Print

Description and Operation

Introduction

This manual covers diagnosis and testing and repair procedures.

It is structured into groups and sections, with specific system sections collected together under their relevant group.

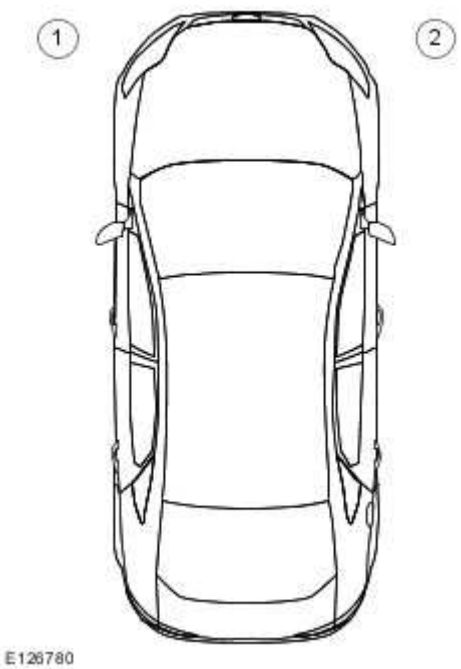
A group covers a specific portion of the vehicle. The manual is divided into five groups, General Information, Chassis, Powertrain, Electrical and Body and Paint. The number of the group is the first number of a section number.

Within Etis, the navigation tree will list the groups. After selecting a group the navigation tree will then list the sections within that group. Each section has a contents list detailing Specifications, Description and Operation, Diagnosis and Testing, General Procedures, Disassembly and Assembly, Removal and Installation.

References to LH (left-hand) and RH (right-hand)

All LH and RH references to the vehicle are taken from a position sitting in the driver seat looking forward.

Vehicle LH and RH definition



Item	Part Number	Description
1	-	LH
2	-	RH

All LH and RH references to the engine are taken from a position at the flywheel looking towards the crankshaft front pulley.

Powertrain LH and RH definition

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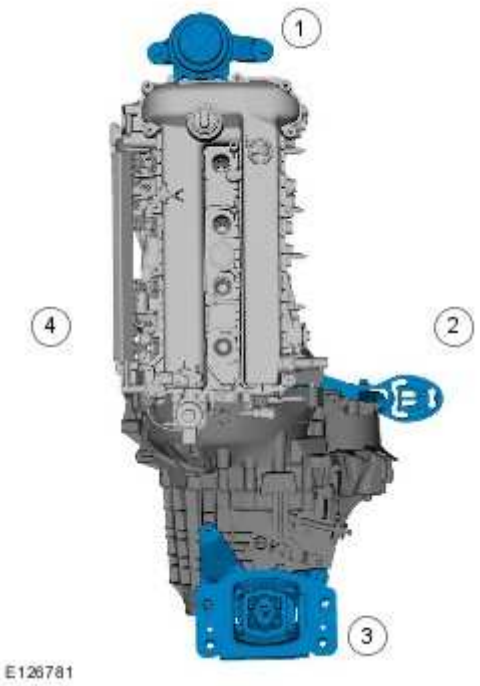

Item	Part Number	Description
1	-	front
2	-	right
3	-	rear
4	-	left

How to use Repair Procedures

This manual has been written in a format that is designed to meet the needs of technicians worldwide. It provides general descriptions for accomplishing repair work with tested and effective techniques.

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

Anyone who departs from the instructions provided in this manual must first establish that personal safety or vehicle integrity is not compromised by the choice of method, tools or components.

Warnings, Cautions and Notes in This Manual

WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.

CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.
NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.
Generic warnings or cautions are in their relevant description and operation procedure within section 100-00. If the generic warnings or cautions are required for a procedure, there will be a referral to the appropriate description and operation procedure.

If a warning, caution or note only applies to one step, it is placed at the beginning of the specific step.

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Trustmark Authoring Standards (TAS) Repair Procedures

NOTE: TAS style procedures can be identified by steps that have no accompanying step text and the magenta color of the electrical connectors and fasteners such as nuts, bolts, clamps or clips.
A TAS removal and installation procedure uses a sequence of color illustrations to indicate the order to be followed when removing/disassembling or installing/assembling a component.

Many of the TAS procedures will have the installation information within the removal steps. These procedures will have the following note at the beginning of the procedure:

NOTE: Removal steps in this procedure may contain installation details.
Reuse of fasteners and seals and gaskets

The following list details the general policy for the reuse of fasteners and seals and gaskets.

Types of self-locking nuts and bolts

NOTE: There are more types of self-locking fasteners available than shown in following illustration.

E126782

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

- All types of seals and gaskets must be discarded and new seals and gaskets installed unless otherwise stated within the procedure.
- Nuts and bolts with a chemical coating for locking and/or sealing and/or antiseize must be discarded unless the procedure advises to reapply the coating with a specified

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material.
- Nuts and bolts with a mechanical locking such as thread inserts, thread deformation or locking washers must be discarded and new nuts and bolts installed unless otherwise stated within the procedure.
- Torque to yield bolts must be discarded and new torque to yield bolts installed unless otherwise stated within the procedure, recognizable by a tightening torque with more than one stage together with a torque angle.

Specification data

Specification procedures will only contain technical data that is not already part of a repair procedure.

Sequence of tasks

If components must be removed or installed in a specific sequence, the sequence will be identified numerically in a graphic and the corresponding text will be numbered accordingly.

Special Tools, Equipment, Materials and Torque Figures

Special tools will be shown with the tool numbers in the illustration. The special tool numbers, general equipment, materials and torque figures used for the procedure step will be shown in the text column.

TAS Graphics

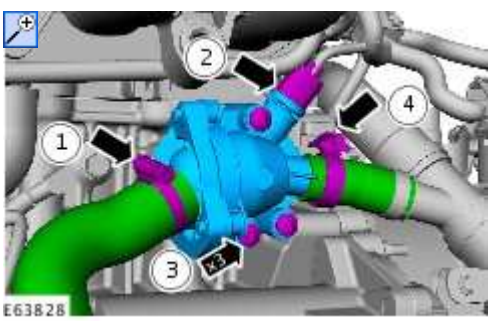
Colors used in the graphic are as follows:

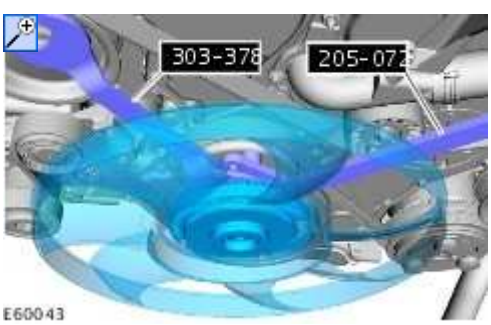
- Blue - Component to be removed/installed or disassembled/assembled.
- Green and Brown - Additional components that need to be removed/installed or disassembled/assembled prior to the target component.
- Yellow - Component that is touched or affected in a way but remains in the vehicle. It may be detached, attached, moved, modified, checked, adjusted etc.
- Magenta - Electrical connectors and fasteners such as nuts, bolts, clamps and clips.
- Pale Blue - Special tool(s) and general equipment.

One illustration may have multiple steps assigned to it.

Numbered pointers are used to indicate the number of electrical connectors and fasteners such as nuts, bolts, clamps and clips.

Items in the illustration can be transparent or use cutouts to show hidden details.





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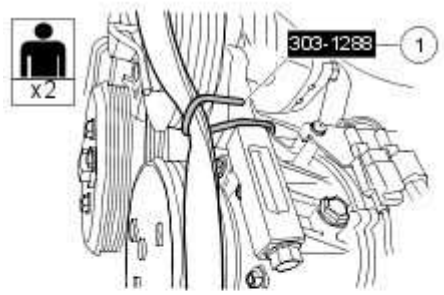

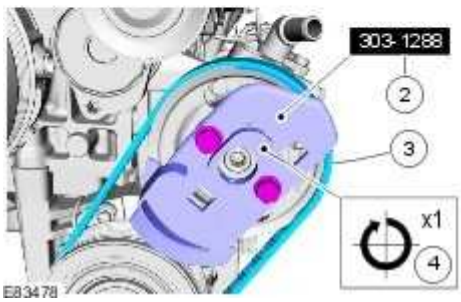

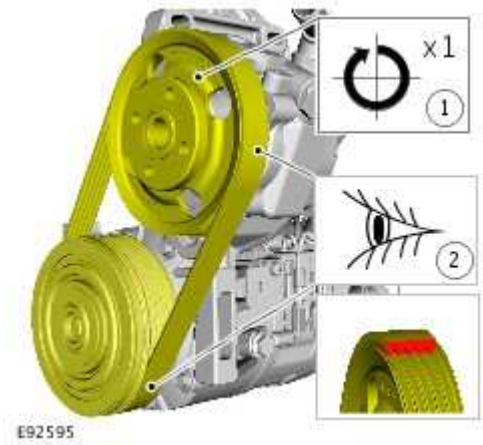

TAS Symbols

Symbols are used inside the graphics and in the text area to enhance the information display. The following paragraphs describe the various types and categories of symbols. For additional information, refer to: Symbols Glossary (100-00 General Information, Description and Operation).

Prohibition symbols advise on prohibited actions to either avoid damage or health and safety related risks. These symbols are

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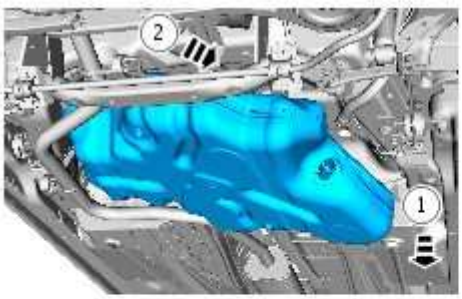
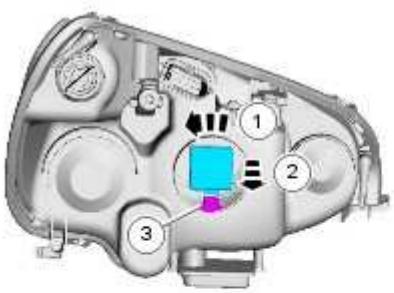


4.

E85026

Health and Safety symbols recommend the use of particular protection equipment to avoid or at least reduce the risk or severity of possible injuries.



2.

E85027

Warning symbols are used to indicate potential risks resulting from a certain component or area.

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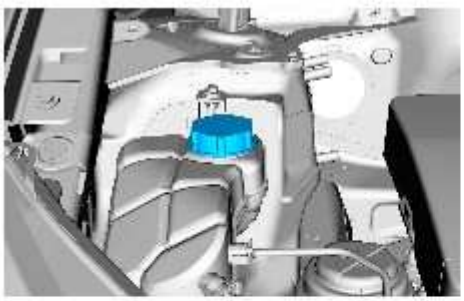

3.

E85028

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

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Location symbols are used to show the location of a component or system within the vehicle.

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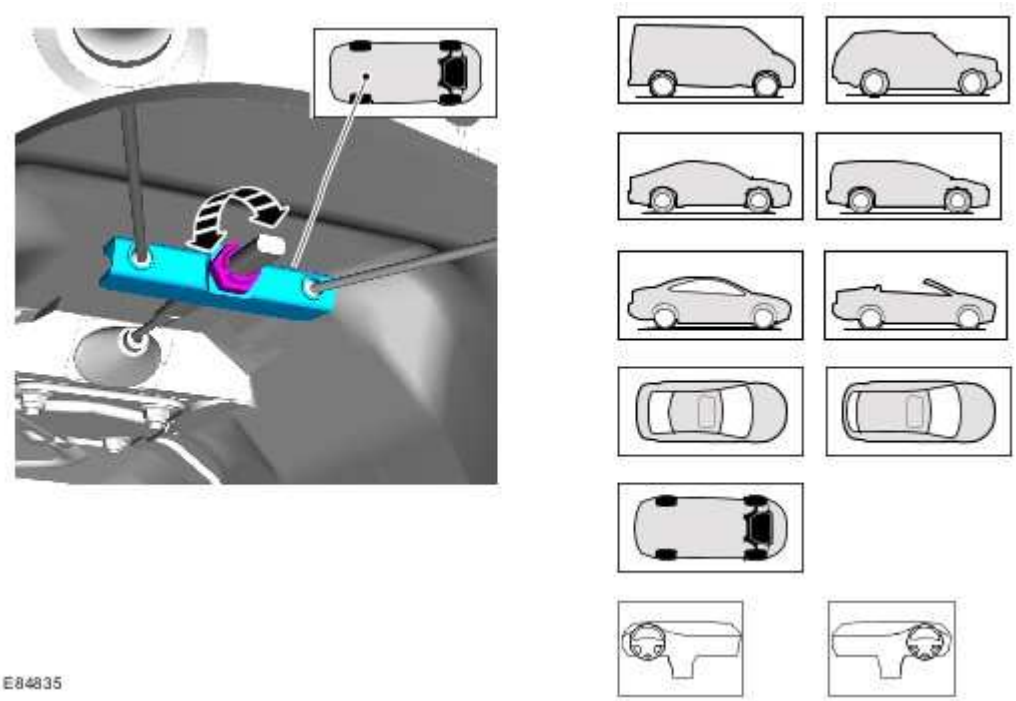
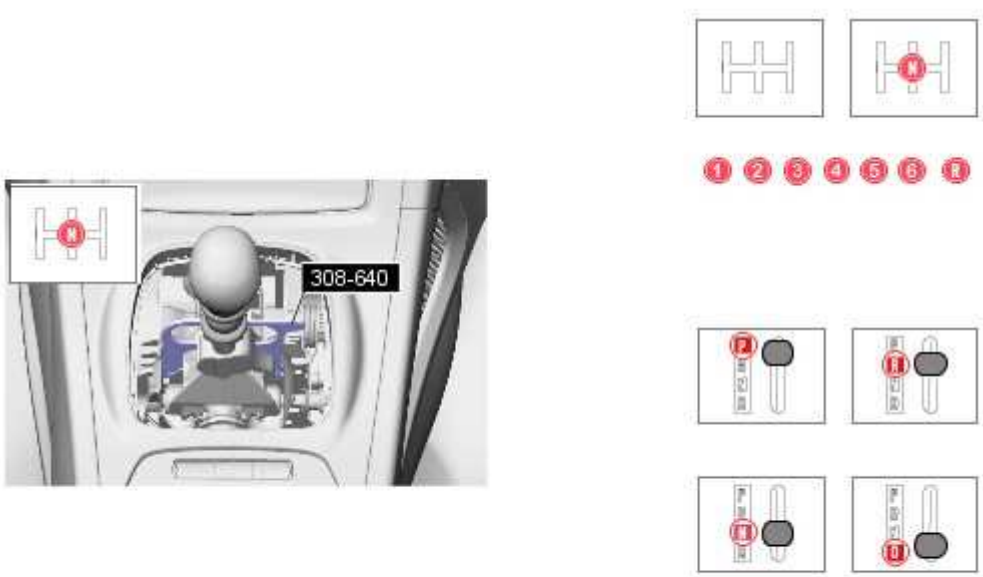


E84835

Gearshift lever or selector lever position symbols are used to show which gearshift lever or selector lever position is to be set.



E84836

Pointer symbols are used to draw attention to components and give special instructions such as a required sequence or number of components. The number of components is reflected by the value inside the luty arrow. A sequence number is located inside the circle. Numbers inside circles are also used to allocate special information such as tightening torques or chemicals to a particular component.

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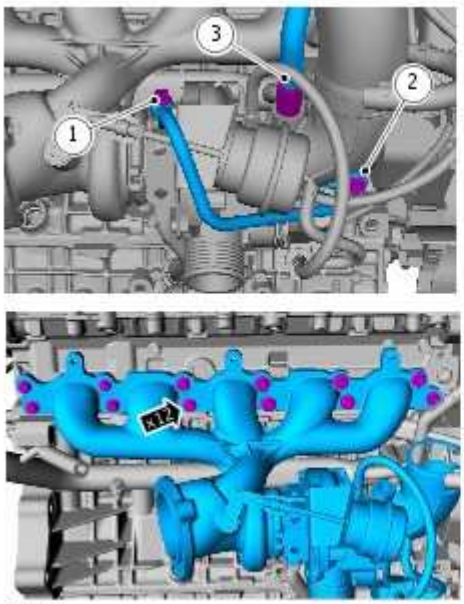
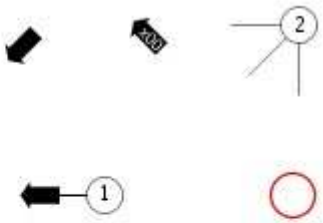
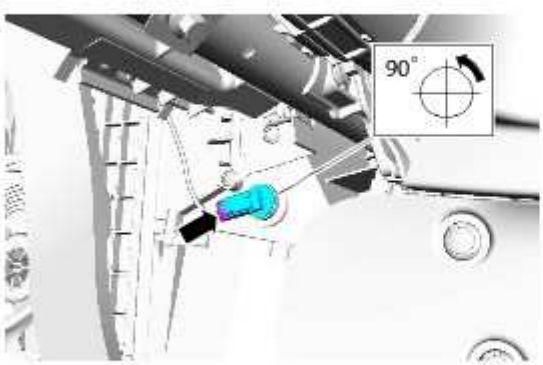
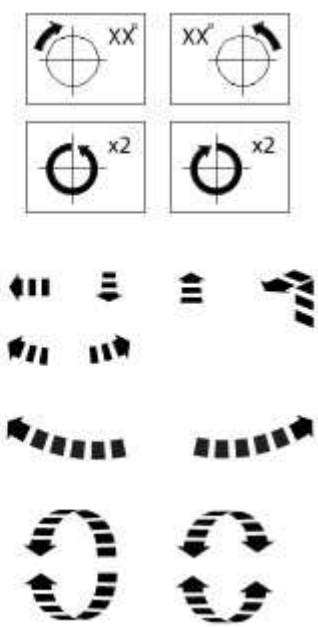




E84837

Movement arrows are used to show three dimensional or rotational movements. These movements can include specific values inside the symbol if required.





E84838

Standard tool symbols recommend the use of certain standard tools. These tools can include dimension values if required.

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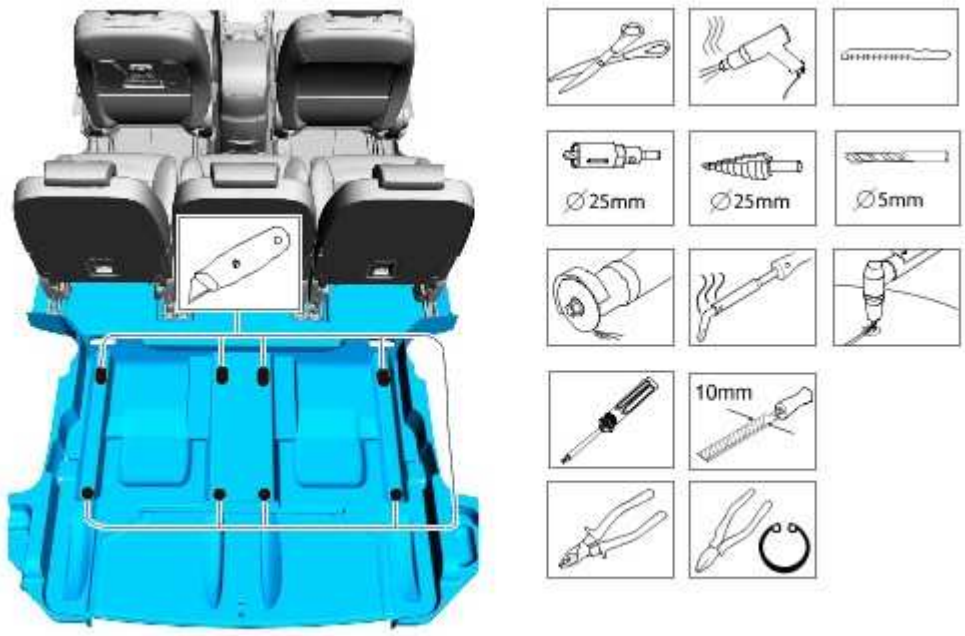
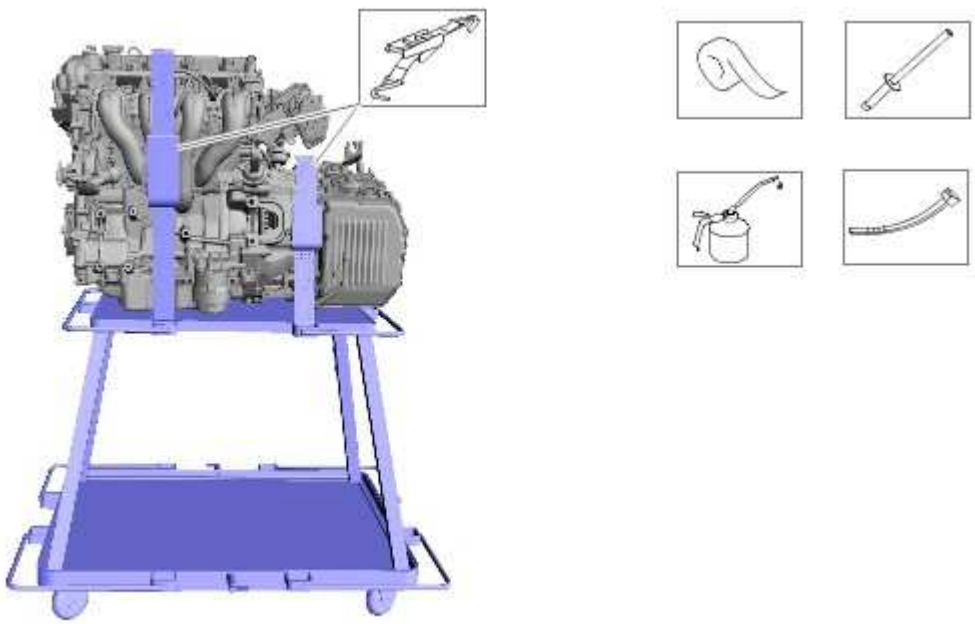


E84839

The following graphic illustrates a set of symbols that are used to provide detailed information on where to apply a material.



E84840

Measurement symbols provide detailed information on where to carry out a specific measurement. These symbols can include specific values if required.

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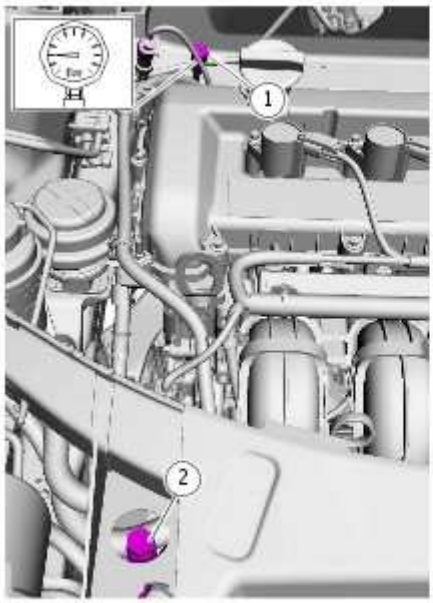

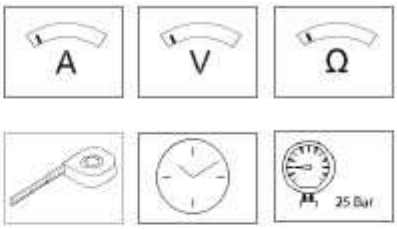

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How to use Diagnosis and Testing procedures

Inspection and Verification

Visual Inspection Charts, Symptom Charts and other information charts (such as diagnostic routines) or supplement test procedures with technical specifications will navigate the user to a specific test procedure.

Symptom Chart

The symptom chart indicates symptoms, sources and actions to address a condition.

Pinpoint Tests

For electrical systems, pinpoint test steps are used to identify the source of a concern in a logical, step-by-step manner. Pinpoint tests have two columns: CONDITIONS and DETAILS/RESULTS/ACTIONS.

The CONDITIONS column is used exclusively for graphics and icons (with or without captions) and the DETAILS/RESULTS/ACTIONS column provides direction to another test step or specific corrective actions.

The boxed numbers indicate the order in which the described action is to be carried out.

Component Tests

A component test is used when a component is tested in multiple pinpoint tests, or if a procedure is too complicated to be formatted within a single page of the pinpoint test.

Graphics

Test graphics show the measurement or test to be carried out in a test step.

A representative tester graphic is used for voltmeters and ohmmeters.

If multiple measurements are made in a single graphic, the test leads are drawn with a solid line until the test lead splits to indicate the multiple measurements, at which point dashed lines are used.

Breakout box type testers are represented by a double circle test pin. Test pins are labeled with the pin number.

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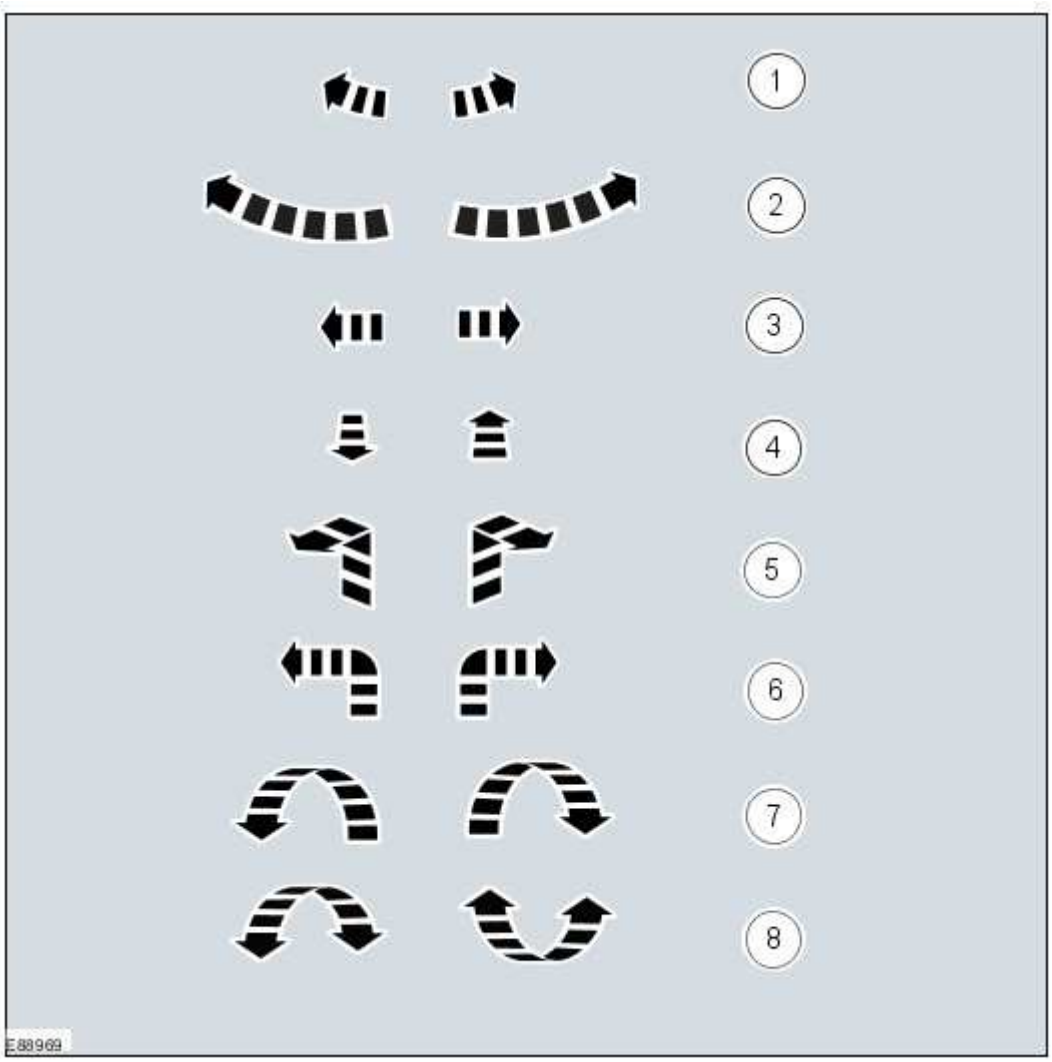
Description and Operation

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

Movement Symbols

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



Item	Part Number	Description
1	-	Minor component movement clockwise/counterclockwise
2	-	Major component movement clockwise/counterclockwise
3	-	Component movement to the left/right/up/down
4	-	Component movement towards/away
5	-	3 dimensional component movement
6	-	2 dimensional component movement
7	-	3 dimensional component rotation
8	-	3 dimensional component cycling

Turn Symbols

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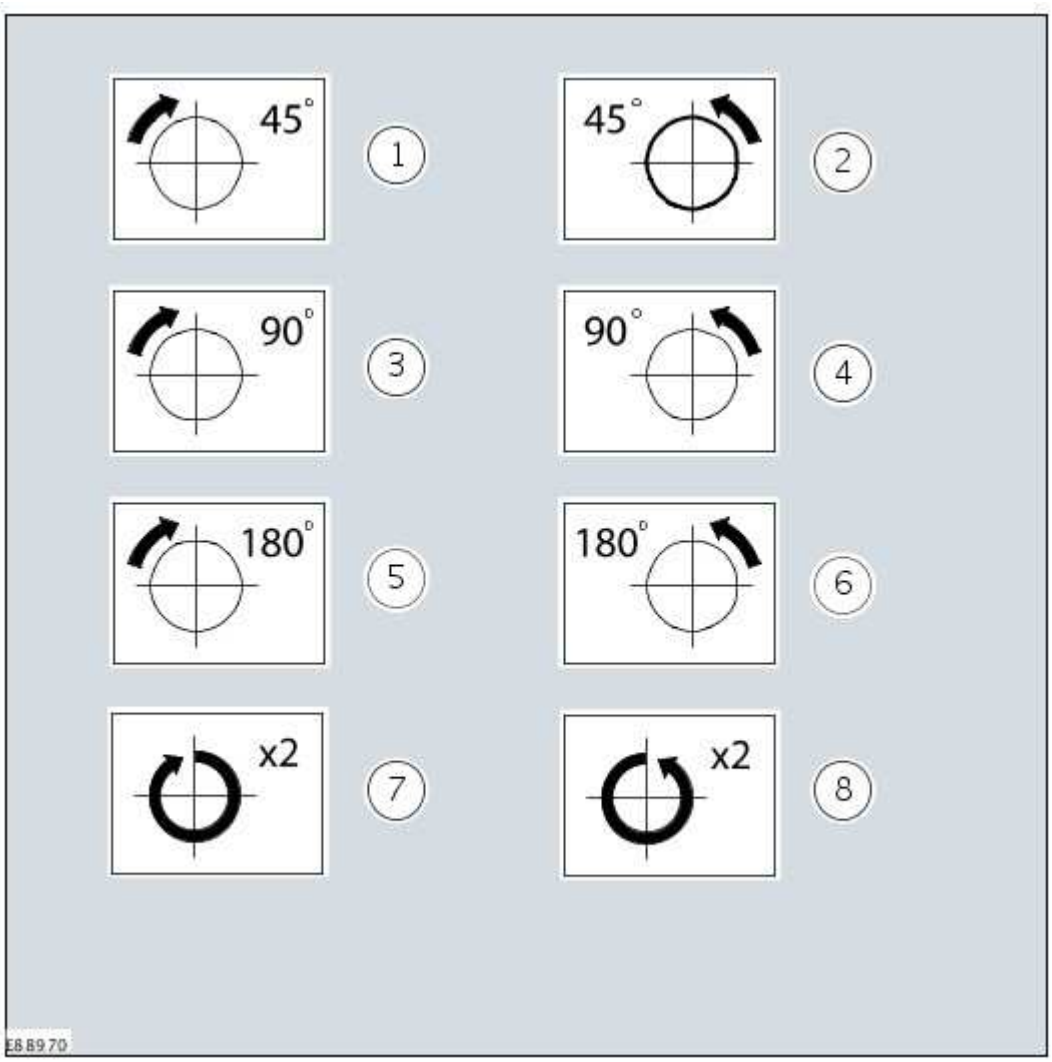
Turn symbols are used to provide further information on the direction or angle of component turns.



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

Steering Wheel Symbols

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

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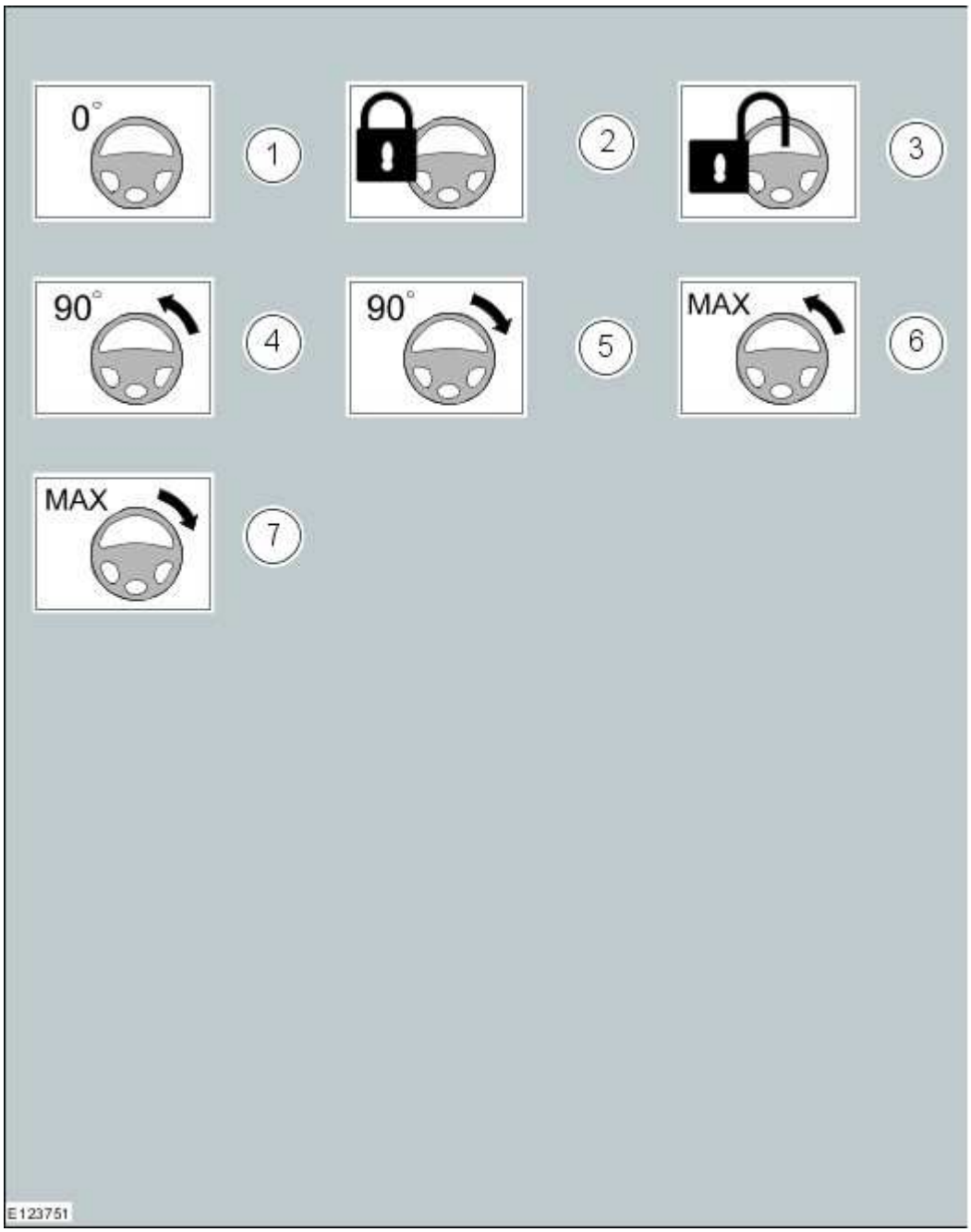

Item	Part Number	Description
1	-	Steering wheel in straight ahead position
2	-	Steering column lock locked
3	-	Steering column lock unlocked
4	-	Turn the steering wheel to the 90° left position
5	-	Turn the steering wheel to the 90° right position
6	-	Turn the steering wheel to the left-hand end position
7	-	Turn the steering wheel to the right-hand end position

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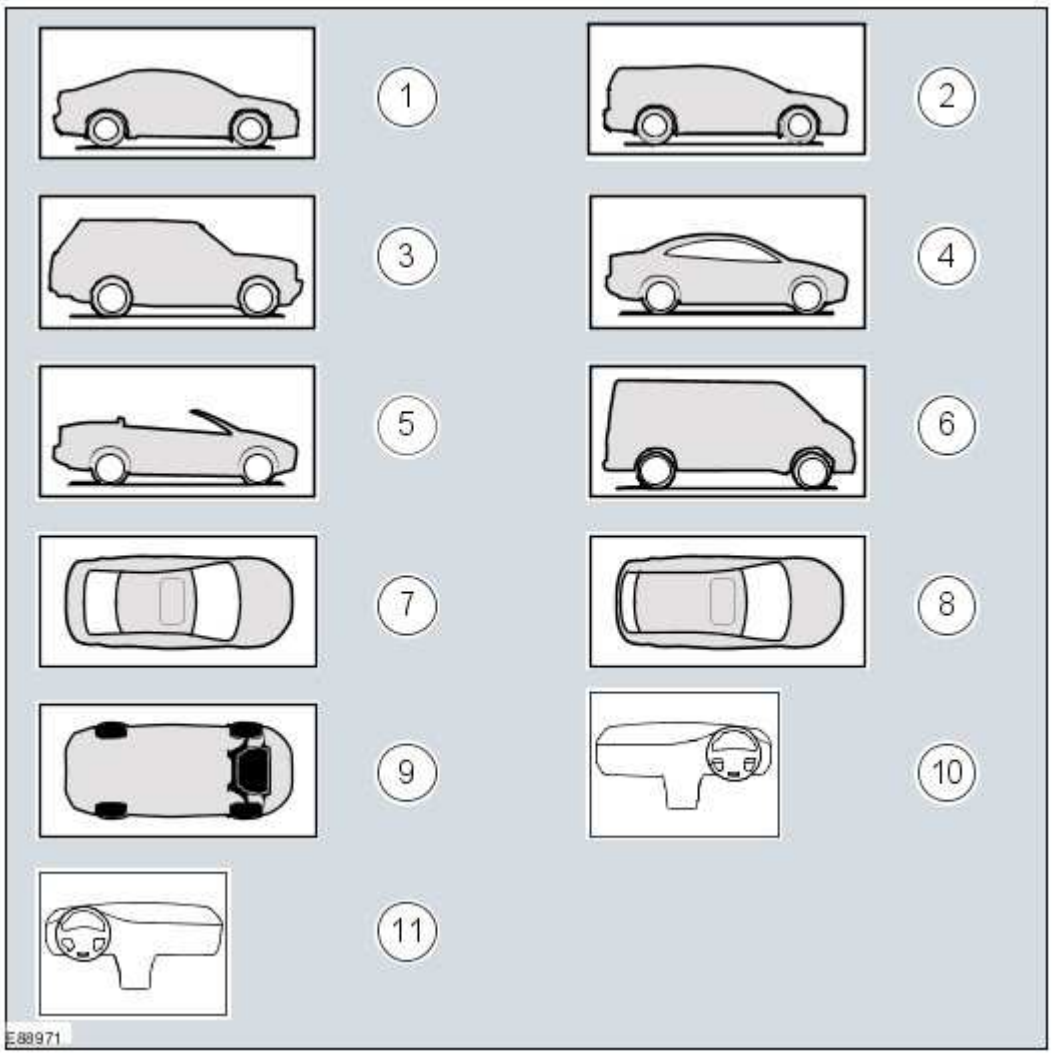

Item	Part Number	Description
1	-	3, 4, 5-door body style
2	-	Wagon body style
3	-	Sports utility vehicle body style
4	-	Coupe body style
5	-	Convertible body style
6	-	Van body style
7	-	3, 4, 5-door body style - Top View
8	-	Wagon body style - Top View
9	-	Underview
10	-	Right-hand drive (RHD) vehicle
11	-	Left-hand drive (LHD) vehicle

Gearshift lever and selector lever position symbols

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

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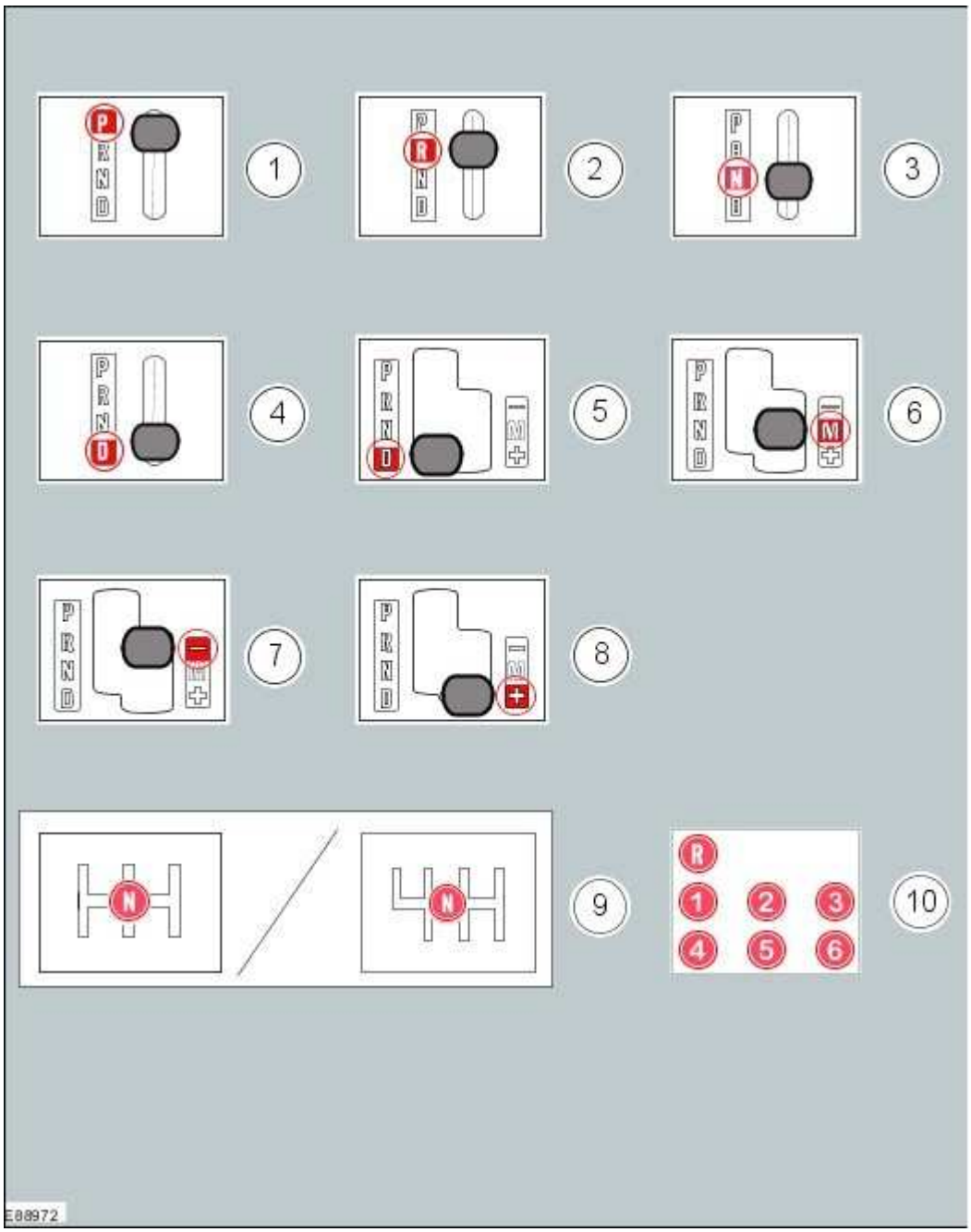

Item	Part Number	Description
1	-	Set the selector lever to the park (P) position
2	-	Set the selector lever to the reverse ®) position
3	-	Set the selector lever to the neutral (N) position
4	-	Set the selector lever to the drive (D) position
5	-	Set the selector lever with manual shift pattern to the park (D) position
6	-	Set the selector lever with manual shift pattern to the manual (M) position
7	-	Set the selector lever with manual shift pattern to the shift down (-) position
8	-	Set the selector lever with manual shift pattern to the shift up (+) position
9	-	Set the gearshift lever to the neutral (N) position
	-	

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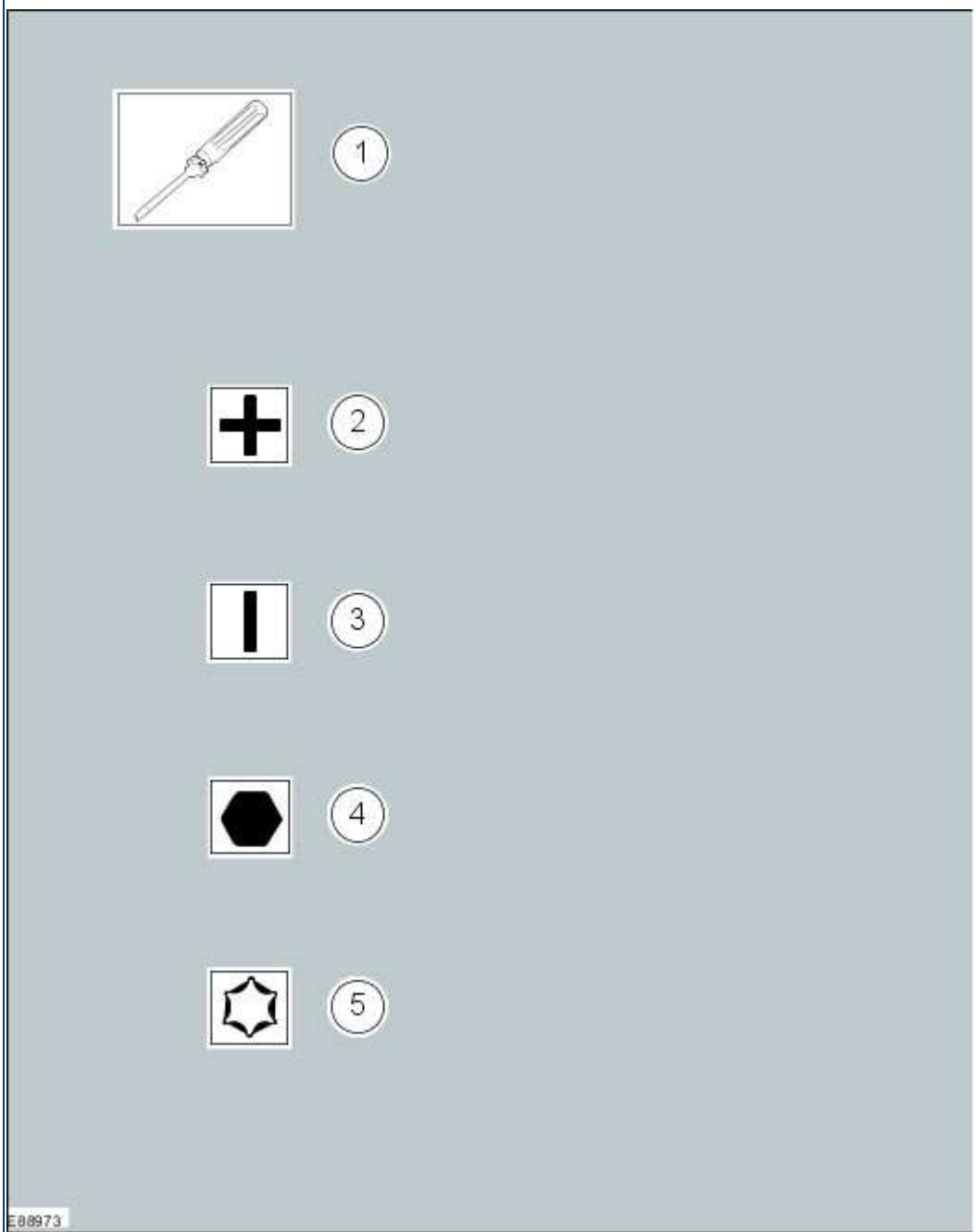
10		Further gearshift lever positions that may appear in illustrations

Screwdriver symbols

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



Item	Part Number	Description
1	-	Screwdriver
2	-	Cross bladed screwdriver
3	-	Flat bladed screwdriver
4	-	Hexagonal screwdriver
5	-	TORX screwdriver

Pliers symbols

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

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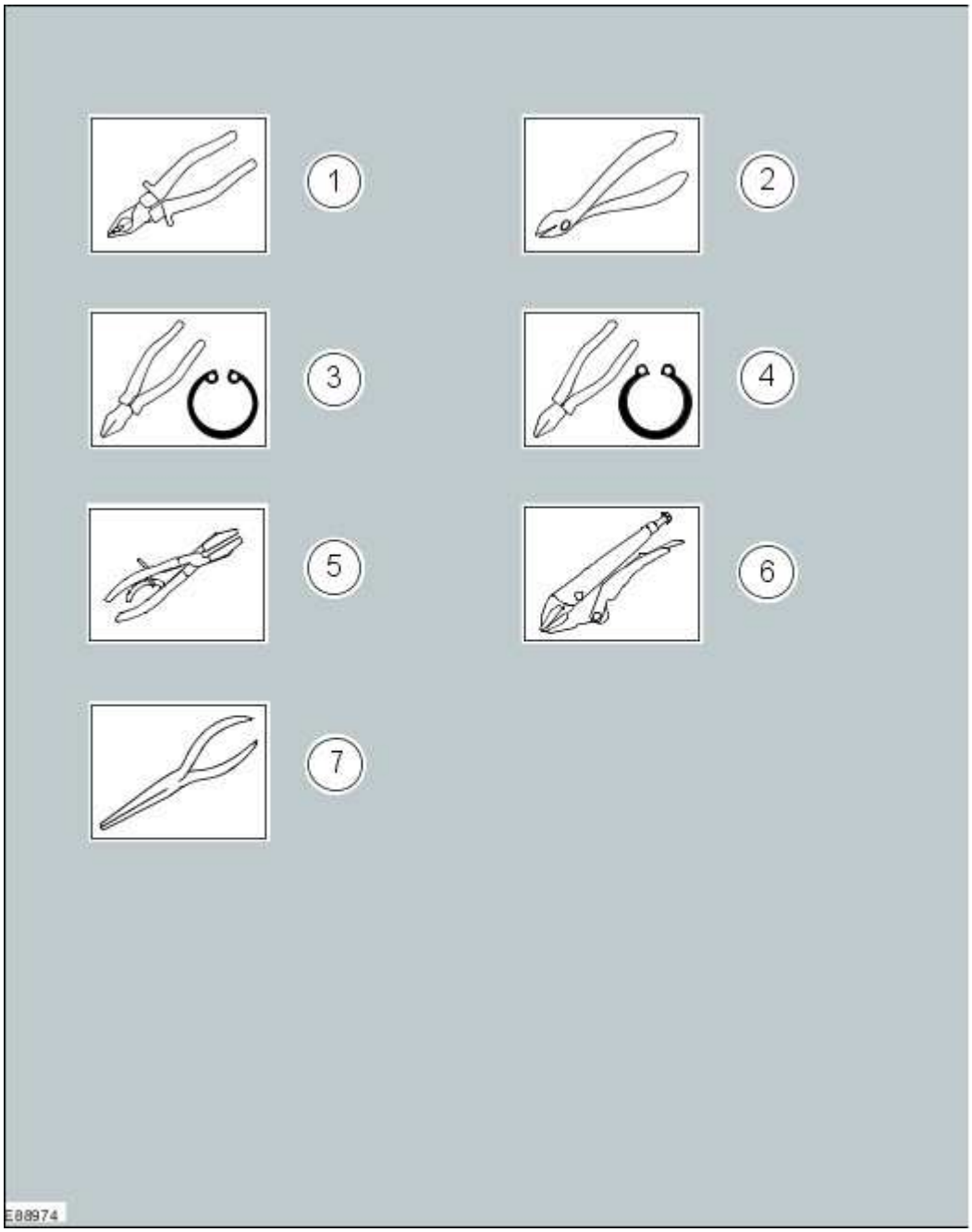

Item	Part Number	Description
1	-	Combination pliers
2	-	Side cutter pliers
3	-	Securing ring pliers - inner
4	-	Securing ring pliers - outer
5	-	Hose clamp pliers
6	-	Locking pliers
7	-	Long nose pliers

Drill symbols

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

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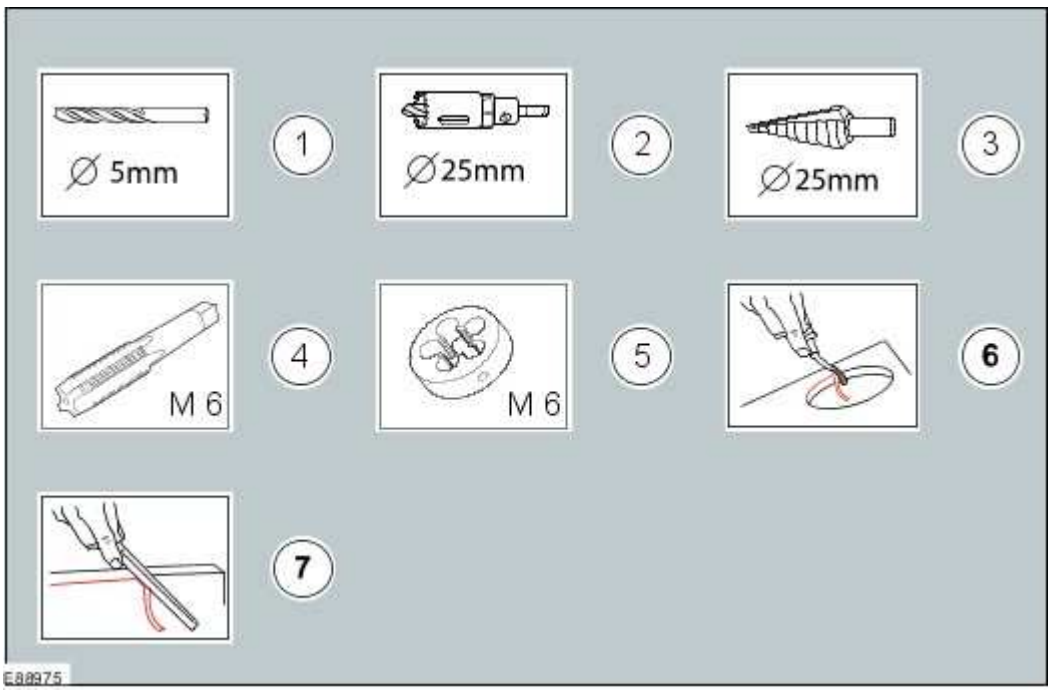

Item	Part Number	Description
1	-	Drill bit with a specified diameter
2	-	Hole saw with a specified diameter
3	-	Stepped drill bit with a specified diameter
4	-	Tap with a specified diameter
5	-	Die with a specified diameter
6	-	Scraper for circular holes
7	-	Scraper for straight edges

Cutting tool symbols

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

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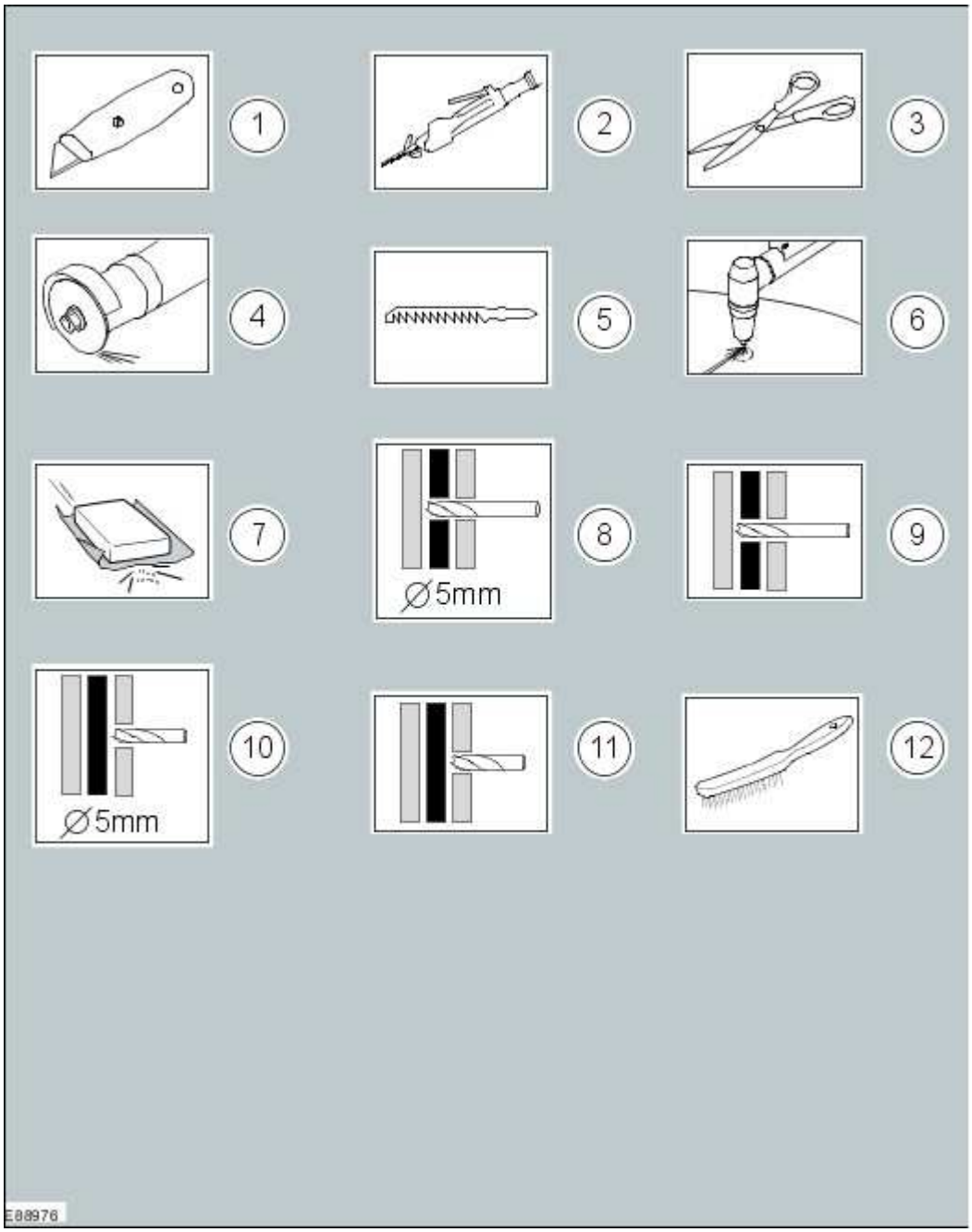

Item	Part Number	Description
1	-	Cutting knife
2	-	Air body saw
3	-	Scissors
4	-	Grinder
5	-	Jig saw
6	-	Plasma cutter
7	-	Sanding Paper
8	-	Drill through the shown number of body panel layers with a specified diameter
9	-	Drill through the shown number of body panel layers with a suitable diameter
10	-	Drill through 1 body panel layer with a specified diameter
	-	

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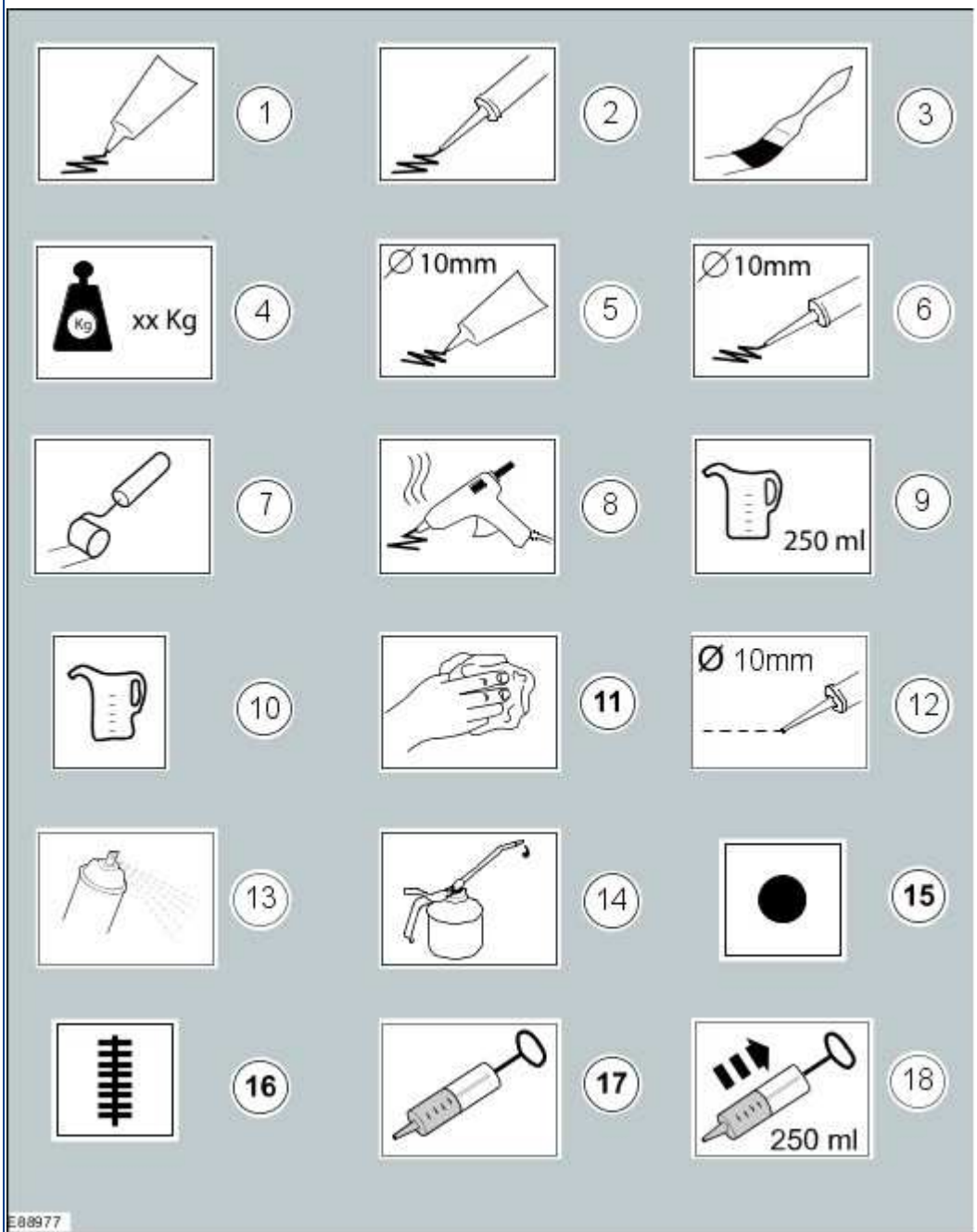
11		Drill through 1 body panel layer with a suitable diameter
	12 -	Wire brush

Apply Chemical or load symbols

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



Item	Part Number	Description
1	-	Apply a bead from the specified tube
2	-	Apply a bead from the specified cartridge
3	-	Apply the specified chemical with a brush
4	-	Apply the specified load to the specified component
5	-	Apply a bead with a specific diameter from the specified tube
6	-	Apply a bead with a specific diameter from the specified cartridge
	-	

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7		Apply the specified chemical with a roller
	8 -	Apply hot glue to the specified component
9	-	Apply the specified amount of fluid from the fluid can
10	-	Apply fluid from the fluid can
11	-	Clean the specified component with the specified material
12	-	Apply a broken bead from the specified tube
13	-	Apply the specified chemical from a spray can
14	-	Apply the specified lubricant to the specified component
15	-	Apply spot welds to the specified component
16	-	Apply a continuous weld to the specified component
17	-	Handle the fluid using a syringe
18	-	Extract the specified amount of fluid using a syringe

Measurement symbols

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

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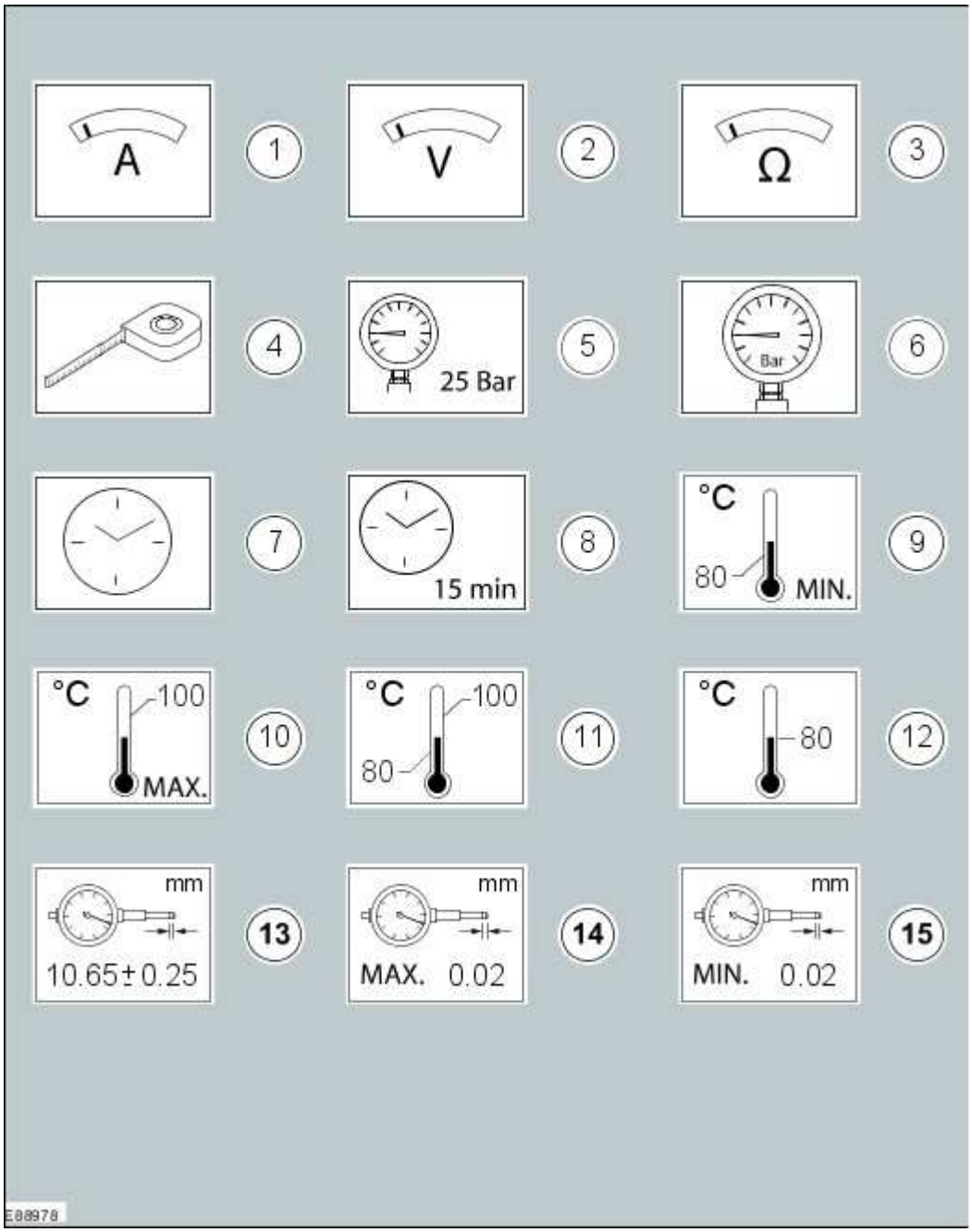

Item	Part Number	Description
1	-	Measure the current using a digital multimeter
2	-	Measure the voltage using a digital multimeter
3	-	Measure the resistance using a digital multimeter
4	-	Measure the length/distance
5	-	Check that the specified pressure is available using a suitable pressure gauge
6	-	Measure the pressure at the specified port using a suitable pressure gauge
7	-	Measure the time using a suitable stopwatch
8	-	Wait for the specified period of time
9	-	The specified task requires the specified minimum temperature
10	-	The specified task requires the specified maximum temperature not to

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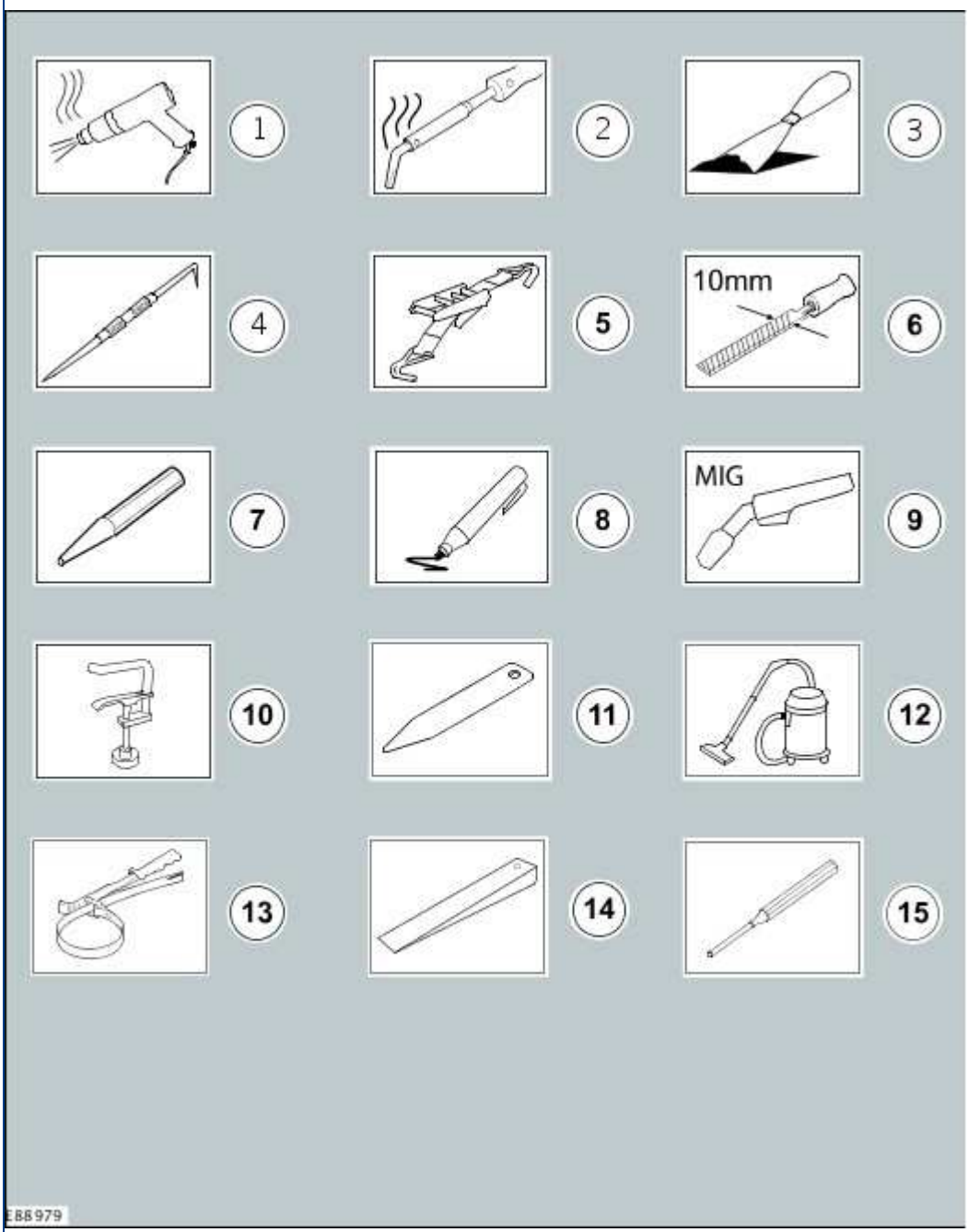
		be exceeded
11	-	The specified task requires the specified temperature range
12	-	The specified task requires the specified temperature
13	-	Measure and check for the specified value using a dial indicator gauge
14	-	Measure and check for the specified MAX value using a dial indicator gauge
15	-	Measure and check for the specified MIN value using a dial indicator gauge

General equipment symbols

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



Item	Part Number	Description
1	-	Hot air gun
	-	

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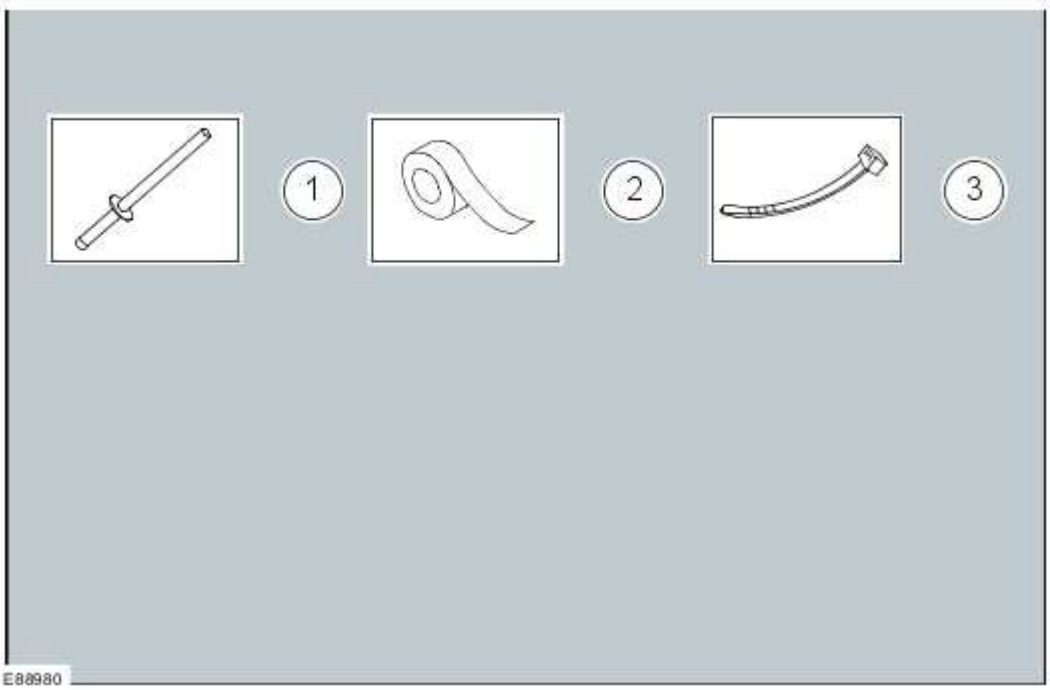
2		Soldering iron
	3 -	Scraper
4	-	Scriber
5	-	Securing strap
6	-	File with a specified size
7	-	Center punch
8	-	Marker
9	-	Metal inert gas (MIG) welding equipment
10	-	Hose clamp
11	-	Interior trim remover
12	-	Vacuum cleaner
13	-	Strap wrench
14	-	Wedge
15	-	Pin Punch

Material symbols

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



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

Miscellaneous symbols

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

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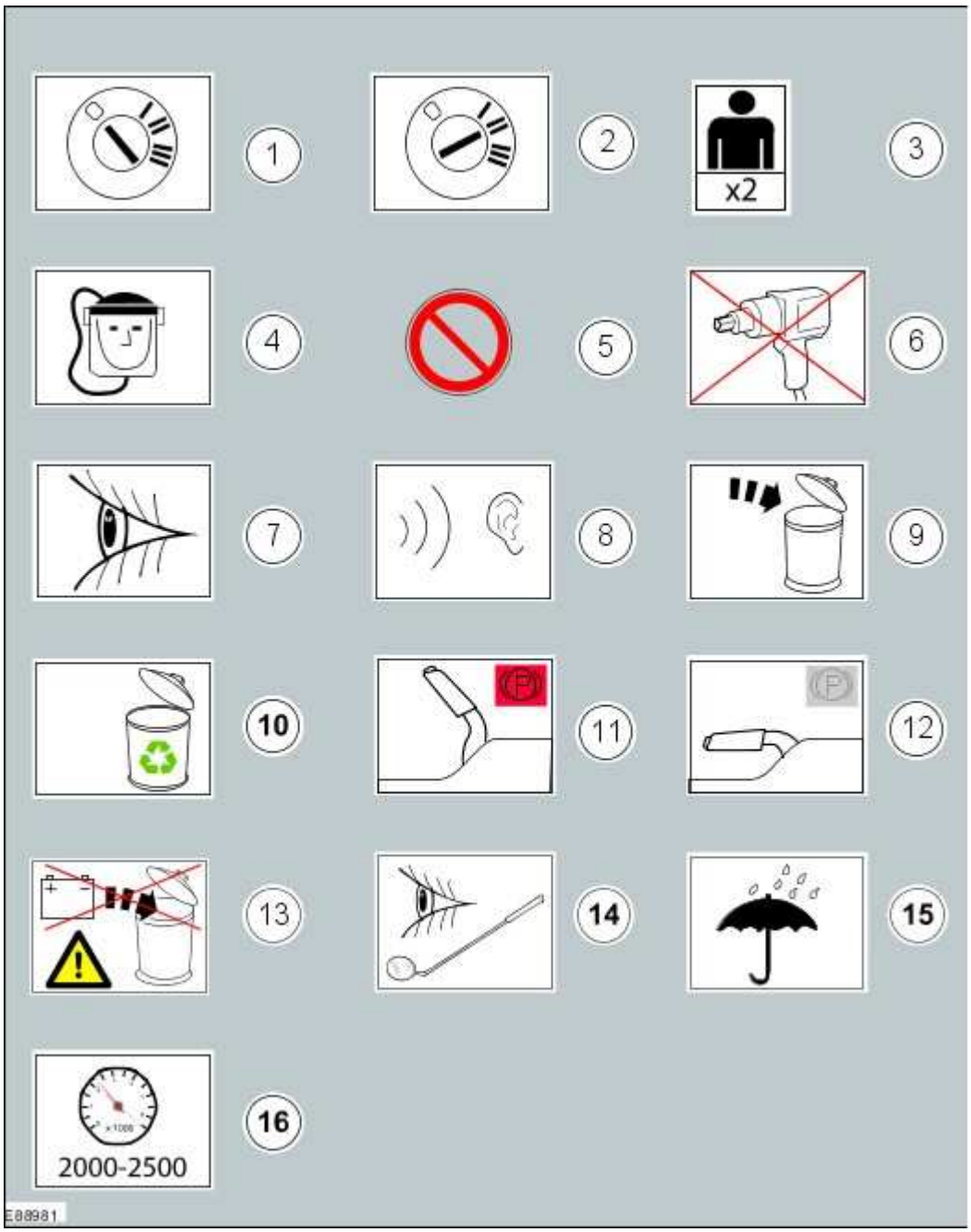

Item	Part Number	Description
1	-	Set the ignition switch to the 0 position
2	-	Set the ignition switch to the II position
3	-	The procedure step requires the aid of the specified number of supporting technicians
4	-	Self contained breathing apparatus
5	-	General prohibition used in combination with another symbol
6	-	Do not use power tools
7	-	Visual check
8	-	Noise check
9	-	Dispose the specified component
10	-	Replaced by item 9 (Dispose the specified component)
11	-	Set the engine speed to the specified value
	-	

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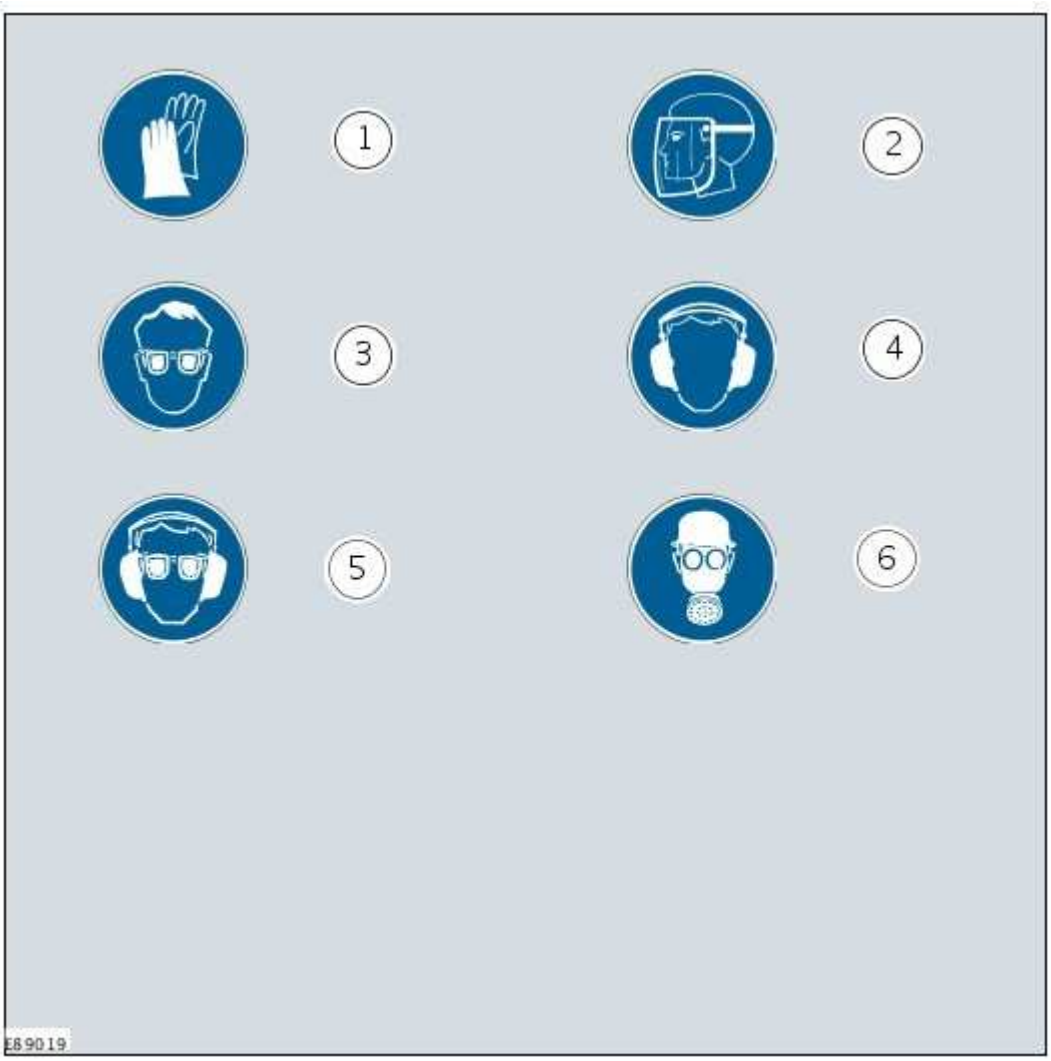
12		Fully apply the parking brake lever
	13 -	Fully release the parking brake lever
14	-	Do not dispose of batteries into the waste bin
15	-	Visual check using a mirror
16	-	Area/component must be dry

Mandatory Protective equipment - Health and safety symbols

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



Item	Part Number	Description
1	-	Wear protective gloves
2	-	Wear face guard
3	-	Wear safety goggles
4	-	Wear ear protectors
5	-	Wear safety goggles and ear protectors
6	-	Wear a respirator

Prohibition - Health and safety symbols and component damage

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

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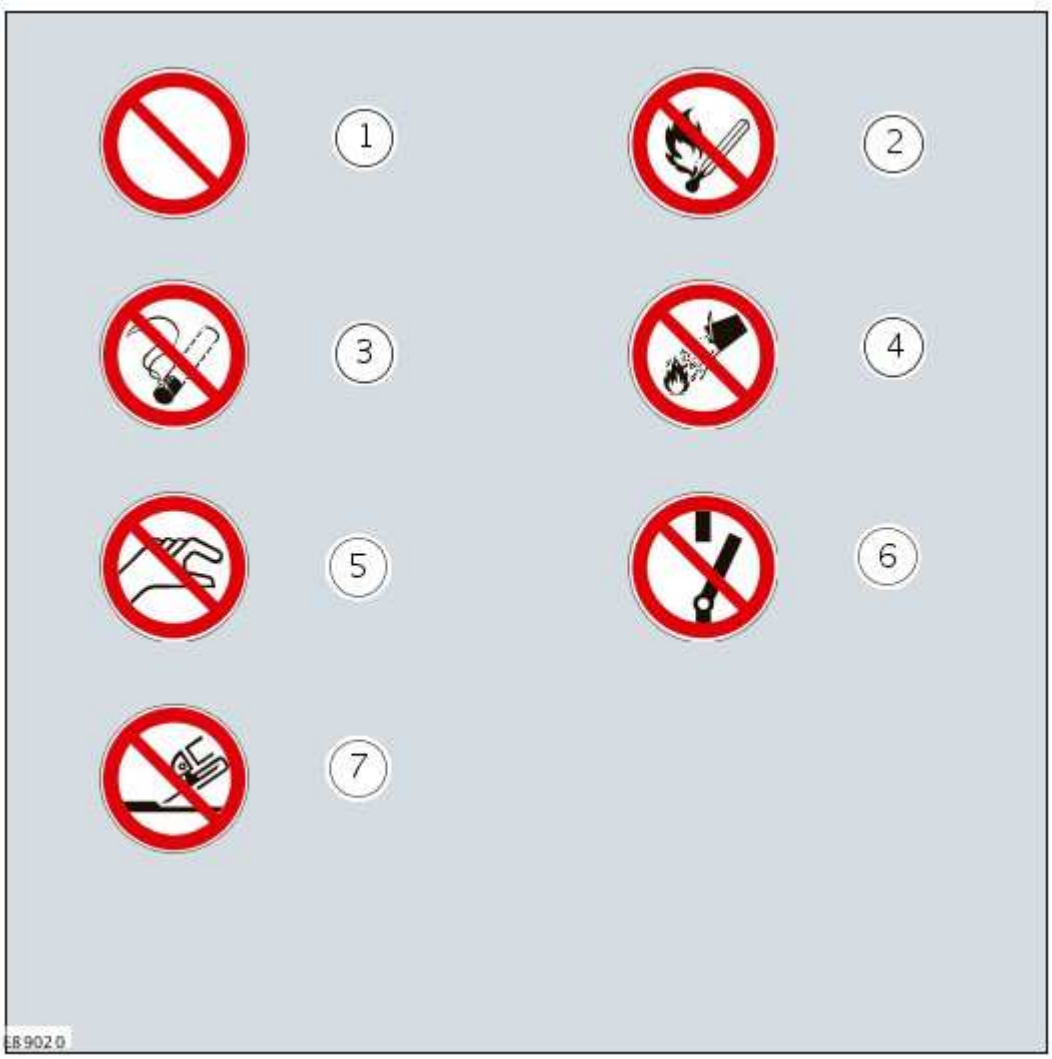

Item	Part Number	Description
1	-	General prohibition symbol
2	-	No naked flames
3	-	No smoking
4	-	No water
5	-	Do not touch
6	-	Do not switch
7	-	No grinding

Warning symbols - Health and safety and component damage

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

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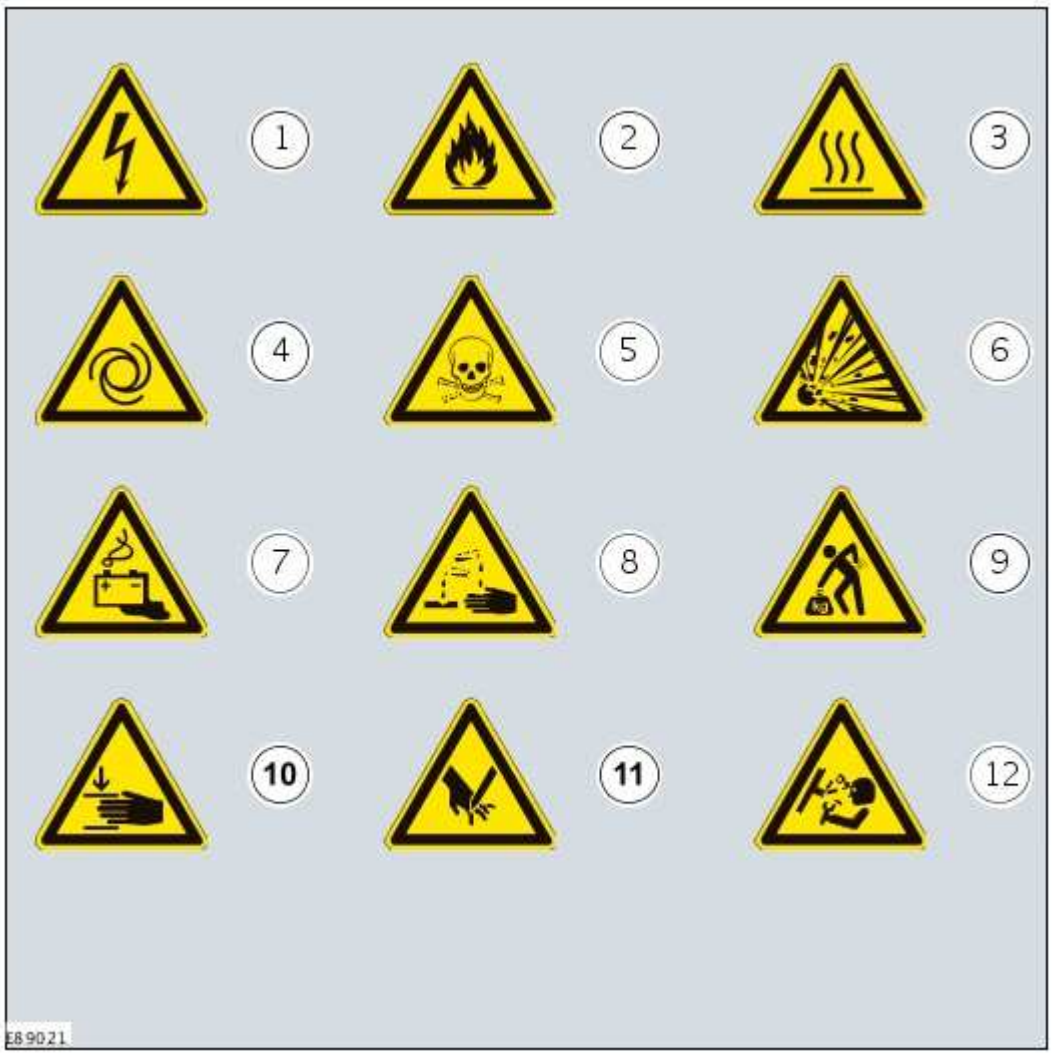

Item	Part Number	Description
1	-	Hazardous voltage/Electrical shock/Electrocution
2	-	Fire Hazard/Highly flammable
3	-	Burn hazard/Hot surface
4	-	Automatic start-up
5	-	Toxic
6	-	Explosive material
7	-	Battery hazard
8	-	Corrosive material
9	-	Lifting hazard
10	-	Hand crush/Force from above
11	-	Cutting of fingers or hand
12	-	Pressure hazard

Control Diagram symbols - Description and Operation procedures

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

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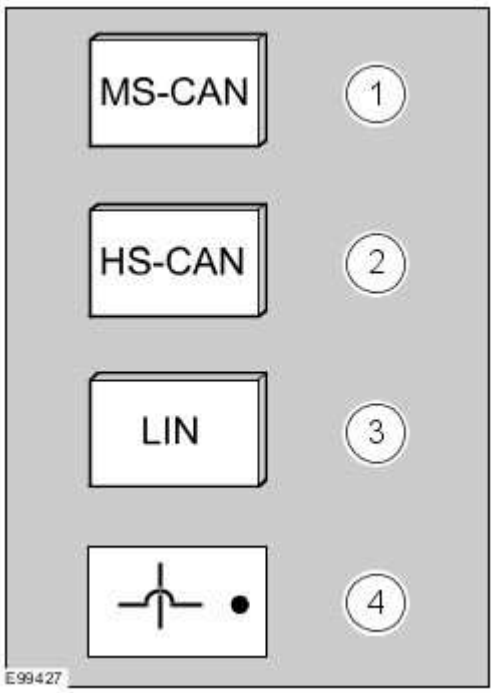

Item	Part Number	Description
1	-	Mid-speed Controller Area Network (CAN)
2	-	High-speed Controller Area Network (CAN)
3	-	Local Interconnect Network (LIN)
4	-	Wires crossing not connected

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Description and Operation

Introduction

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

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

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

Acids and Alkalis

See also Battery Acids.

For example caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

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

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

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

Display Eye Hazard sign.

Air Bags

See also Fire, Chemical Materials.

Highly flammable, explosive – observe No Smoking policy.

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

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

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

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

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

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

Air Conditioning Refrigerant

See also Chlorofluorocarbon, Chemical Materials

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Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

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

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

For additional information, refer to: Air Conditioning (A/C) System Health and Safety Precautions (100-00 General Information, Description and Operation).

Adhesives and Sealers

See also Fire, Chemical Materials.

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

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

Solvent-based Adhesives/Sealers - See Solvents

Follow manufacturers instructions.

Water-based Adhesives/Sealers

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

Hot Melt Adhesives

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

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

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

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

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

Provide adequate ventilation and avoid skin and eye contact.

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

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

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

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

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

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin-based Adhesives.

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

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

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

Splashes entering the eye will cause discomfort and possible damage.

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

Wear appropriate gloves, eye and respiratory protection.

Antifreeze

See also Fire, Solvents.

For example isopropanol, ethylene glycol, methanol.

Highly flammable, flammable, combustible.

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

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

Asbestos

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

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

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

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

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

Battery Acids

See also Acids and Alkalis.

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

Brake and Clutch Linings and Pads

See Asbestos.

Brake Fluids (Polyalkylene Glycols)

See also Fire.

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

Brazing

See Welding.

Chemical Materials

See also Legal Aspects.

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

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

Chemical Materials - Do's

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

Chemical Materials - Do Nots

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

Chlorofluorocarbons (CFC)

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

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

Clutch Fluids

See Brake fluids.

Clutch Linings and Pads

See Asbestos.

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Corrosion Protection Materials

See also Solvents, Fire.

Highly flammable, flammable – observe No Smoking policy.

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

Cutting

See Welding.

Dewaxing

See Solvents and Fuels (Kerosene).

Dusts

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

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

Electric Shock

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

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

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

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

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

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

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

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

In cases of electrocution:

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

Engine Oils

See Lubricants and Grease.

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run

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only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasoline (petrol) engine

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

Diesel engine

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

Fibre Insulation

See also Dusts.

Used in noise and sound insulation.

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

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

Fire

See also Welding, Foams, Legal Aspects.

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

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

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

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

First Aid

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

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

Soiled skin should be washed with soap and water.

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

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

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

Fluoroelastomer

See Viton.

Foams - Polyurethane

See also Fire.

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

Follow manufacturers instructions.

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

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and goggles.

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

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

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

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

Freon

See Air Conditioning Refrigerant.

Fuels

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

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

Gasoline (Petrol)

Highly flammable - observe No Smoking policy.
For additional information, refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

Gas-oil (Diesel Fuel)

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

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - observe No Smoking policy.

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

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

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

Gas Cylinders

See also Fire.

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

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

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

Only trained personnel should undertake work involving gas cylinders.

Gases

See Gas Cylinders.

Gaskets (Fluoroelastomer)

See Viton.

General Workshop Tools and Equipment

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

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

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

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

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

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

High Pressure Air, Lubrication and Oil Test Equipment

See also Lubricants and Greases.

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

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

Halon

See CFCs.

Legal Aspects

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

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

Lubricants and Greases

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

Transmission Fluids

Safety instructions

Certain Transmission and Power Steering fluids supplied to Ford may contain additives which have the potential to cause skin disease (dermatitis) to exposed persons. The dermatitis may be irritant or allergic in nature. Risks are higher where prolonged or

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repeated skin contact with a fluid may occur. These fluids are used for vehicle initial fill and service purposes. This sub-section is to:

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

Control measures

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

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

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

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

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

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

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

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

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

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

Dispose of any waste fluids safely as hazardous waste.

Safety Data Sheets

Safety Data Sheets, which detail specific material handling instructions and precautions are

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available from the respective national sales company, and via internet www.msds.ford.com.

Used Engine Oil

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

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

Environmental Precautions

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

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

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

Noise

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

Noise Insulation Materials

See Foams, Fibre Insulation.

O-Rings (Fluoroelastomer)

See Viton.

Paints

See also Solvents, Chemical Materials.

Highly flammable, flammable - observe No Smoking policy

One Pack

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

Two Pack

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

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

Pressurized Equipment

See High Pressure Air, Lubrication and Oil Test Equipment.

Solder

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

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

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

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

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

Solvents

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

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

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

Some may be highly flammable or flammable.

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

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

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

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

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

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

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

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

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

Sound Insulation

See Fibre Insulation, Foams.

Suspended Loads

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

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

Transmission Brake Bands

See Asbestos.

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Underseal

See Corrosion Protection.

Viton

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

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

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

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

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

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

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

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

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

Welding

See also Fire, Electric Shock, Gas Cylinders.

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

Resistance Welding

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

Arc Welding

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

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

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

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of

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extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

Gas Welding (and Cutting)

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

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

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

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

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

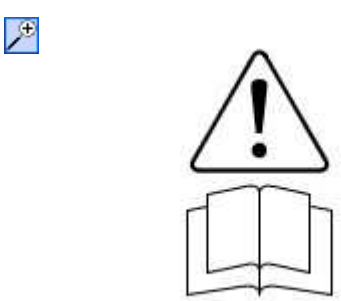
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS, WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

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

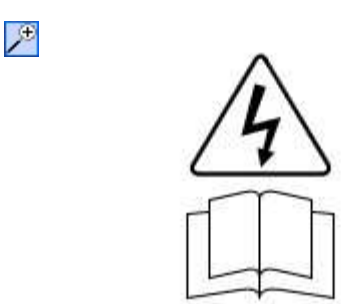
These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

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



TIM0101001

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



TIM0101002

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

TIM0101003

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

TIM0101004

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

TIM0101005

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

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TIM0101006

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

TIM0101008

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

White Spirit

See Solvents.

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Description and Operation

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- the parking brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards.
- the key is removed from key operated hood locks before any work is carried out around the front of the vehicle.
- if the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust fumes.
- there is adequate room to raise the vehicle and remove the wheels, if necessary.
- fender covers are always fitted if any work is to be carried out in the engine compartment.
- the battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is raised.

CAUTION: When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- if using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

Towing the Vehicle

WARNING: When the vehicle is being towed, the ignition switch must be in position II (steering lock released and warning lamps illuminated). Only then will the steering, turn signal lamps, horn and stop lamps be operational. Failure to follow these instructions may result in personal injury.
NOTE: The removable towing eye (if equipped), has a left-hand thread and must be fully tightened before towing can commence.
When towing is necessary, the vehicle towing eyes should be used. The rope must be securely fastened to the towing eyes and must also be attached to the other vehicle such that the rope will not foul the bodywork.

When a vehicle with automatic transmission is towed, the gear selector must be in position N (Neutral). Never tow a vehicle with automatic transmission at a speed greater than 30 mph (50 km/h) or for a distance greater than 30 miles (50 km). If it is necessary to tow the vehicle a greater distance, the drive wheels must be lifted clear off the ground.

Alternatively the vehicle can be transported on a low loader or a trailer.

Connecting a Slave Battery Using Jumper Cables

WARNING: If the slave battery has recently been charged and is gassing, cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should arcing occur when connecting the jumper cables. Failure to follow these instructions may result in personal injury.
CAUTIONS:
A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all normal circuits are switched off. This can cause arcing when the jumper cables are

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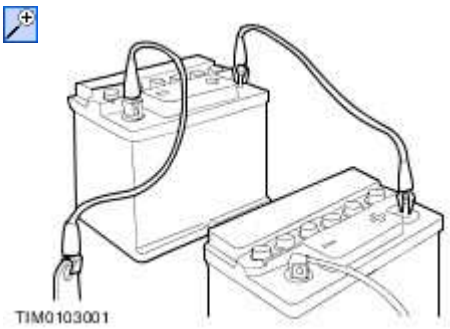
connected.

While it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. In such an instance, the discharged battery must be recharged immediately after jump starting to avoid permanent damage.

- Always make sure that the jumper cables are adequate for the task. Heavy duty cables must be used.
- Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
- Always make sure that switched electric circuits are switched off before connecting jumper cables. This reduces the risk of arcing occurring when the final connection is made.



WARNING: Make sure that the ends of the jumper cables do not touch each other or ground against the vehicle body at any time while the cables are attached to the battery. A fully charged battery, if shorted through jumper cables, can discharge at a rate well above 1000 amps causing violent arcing and very rapid heating of the jumper cables and terminals, and can even cause the battery to explode. Failure to follow these instructions may result in personal injury.
Always connect the jumper cables in the following sequence:

- Slave battery positive first and then vehicle battery positive.
- Slave battery negative next and then vehicle ground at least 12 inches (300 mm) from the battery terminal, for example engine lifting eye.

Always reduce the engine speed to idle before disconnecting the jumper cables.

Before removing the jumper cables from the vehicle that had the discharged battery, switch on the heater blower (high) or the heated rear window, to reduce the voltage peak when the cables are removed.

Always disconnect the jumper cables in the reverse order to the connecting sequence and do not short the ends of the cables.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of eight hours continuous driving with no additional loads placed on the battery.

Component Cleaning

To prevent the ingress of dirt, accumulations of loose dirt and greasy deposits should be removed before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before inspection prior to reassembly.

Cleaning Methods:

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- Dry cleaning.
- Removal of loose dirt with soft or cable brushes.
- Scraping dirt off with a piece of metal or wood.
- Wiping off with a rag.

WARNING: Wear eye protection when cleaning vehicle components with compressed air, a steam cleaner or a power washer. Failure to follow this instruction may result in personal injury.

CAUTIONS:

Compressed air is sometimes 'wet' so use with caution, especially on hydraulic systems.

To prevent damage to the electrical connectors in the engine compartment, do not use a steam cleaner or a power washer to clean the engine compartment.

- Blowing dirt off with compressed air.
- Removal of dry dust using vacuum equipment. This method must always be used to remove friction lining material dust (asbestos particles).
- Steam cleaning.

WARNING: Most solvents require careful handling and some are harmful. Refer to Health and Safety Precautions and to the manufacturers literature for the relevant safety precautions. Failure to follow these instructions may result in personal injury.

Various solvents are available which are suitable for component cleaning. Some components, such as brake hydraulic parts and electrical assemblies should be cleaned only with recommended solvents — refer to Solvents, Sealers and Adhesives or to the section of the manual relevant to the component.

Calibration of Essential Measuring Equipment

WARNING: Equipment, which requires regular calibration, must be calibrated in accordance with the manufacturers instructions. Failure to follow this instruction may result in personal injury or damage to components.

It is of fundamental importance that certain essential equipment, for example torque wrenches, multimeters, exhaust gas analyzers or rolling roads, are regularly calibrated in accordance with the manufacturers instructions.

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Description and Operation

Introduction

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

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

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

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Description and Operation

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

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

Pre-Test Checks

WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.
It is suggested that pre-test checks and functional tests of those systems and circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

With the ignition switched off, check:

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

Starting the Engine

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

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

With the ignition switched on, check:

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

Road or Roller Testing

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

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During the road or roller test, check:

- that the clutch pedal operation is not stiff or heavy.
- that the initial gear engagement is smooth and there is no evidence of clutch drag.
- that the parking brake control operates smoothly and releases quickly and completely.
- that the clutch takes up the drive smoothly, without slip or judder.
- that gear changing is smooth with no abnormal noises or vibrations from the transmission.
- the engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation is not stiff or heavy, and engine speed returns to idle correctly.
- there is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.
- that steering operation, including power steering (if equipped), is smooth, accurate, not excessively heavy or with excessive free play or vibration.
- that the steering does not pull to one side and self centers smoothly after cornering.
- that the speedometer, coolant temperature gauge and tachometer (if equipped) register the correct readings and operate correctly.
- that the switches and controls operate smoothly and positively, warning and indicator lamps operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
- that the heating and ventilation systems operate correctly and effectively.
- the brake operation and efficiency.

Brake Testing

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

CAUTIONS:

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

Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete.
Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

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

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

After completion of the test, check for:

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

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Description and Operation

WARNINGS:

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

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

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

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

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

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

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

Refrigerant is flammable and explosive.

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

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

Make sure that refrigerant bottles are closed properly.

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

Provide adequate ventilation when handling refrigerant.

Never release refrigerant into the atmosphere.

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

Always follow the manufacturer’s instructions for the correct servicing unit operating procedure.

CAUTIONS:

Do not mix refrigerant oils for different types of refrigerant.

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

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

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

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

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

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

If the air conditioning (A/C) system has been opened for a period greater than 2 hours, a new receiver drier must be installed and the evacuating time to be increased by a minimum of 2 hours.
NOTE: New air conditioning (A/C) compressors are delivered prefilled.
NOTE: Refrigerant oil in new air conditioning (A/C) compressors can contain Teflon, visible as white particles, which will not harm the system.

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Description and Operation

WARNINGS:

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

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

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

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

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

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

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

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Description and Operation

WARNINGS:

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

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

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

Only use new specified brake fluid from airtight containers.

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

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Description and Operation

WARNINGS:

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

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

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

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

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

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Description and Operation

WARNINGS:

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

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

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

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

Fuel must not be used as a cleaning agent.

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

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

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

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

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

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

CAUTIONS:

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

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

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Print

Description and Operation

WARNINGS:

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

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

Provide adequate ventilation when working on fuel systems.

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

Fuel must not be used as a cleaning agent.

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

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

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

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

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

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

CAUTIONS:

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

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

Make sure that non-plated tools are used.

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

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

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

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

Make sure to wear non-powdered latex type gloves.

Make sure to protect all electrical components and connectors with lint-free non-flocking material before using the suitable evaporative cleaning agent.
NOTE: Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

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Description and Operation

WARNINGS:

Only qualified technicians are allowed to work on pyrotechnic components.

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

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

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

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

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

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

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

The deployment key must only be accessible to authorized personnel.

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

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

Undeployed pyrotechnic components must not be deployed in the vehicle.

Pyrotechnic components must be deployed following local regulations.

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

Pyrotechnic components must be transported following local regulations.

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

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Pyrotechnic components must not be disassembled.

Pyrotechnic components are not interchangeable between vehicles.

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

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

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

CAUTIONS:

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

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

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Description and Operation

WARNINGS:

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

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

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

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

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

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

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

CAUTIONS:

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

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

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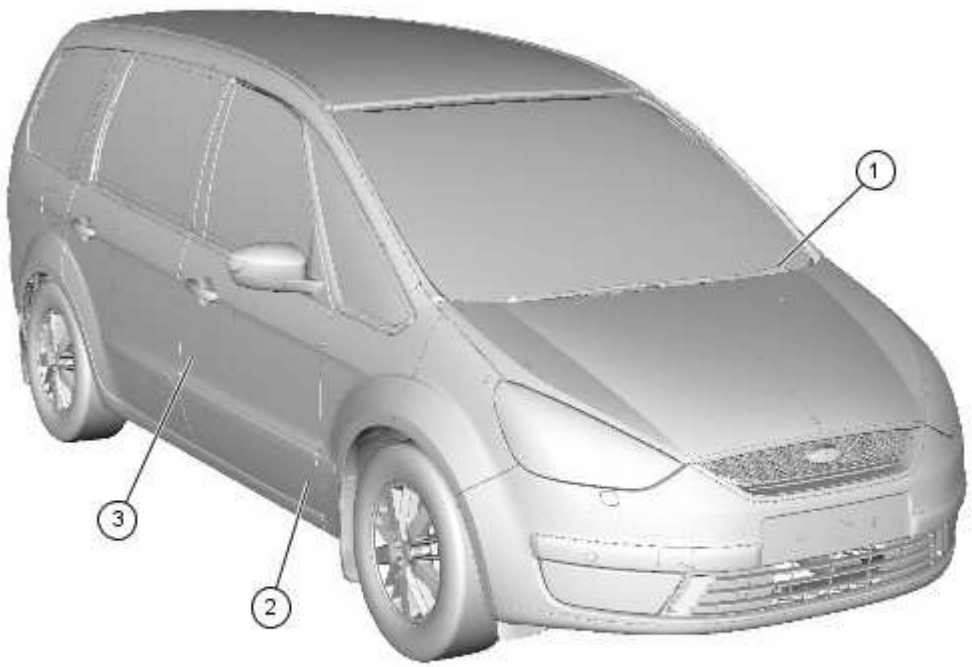
Description and Operation

Identification Codes

The vehicle identification plate (VIN plate) is located on the right-hand B-pillar. The codes stamped or printed on the VIN plate during production enable the precise details of the vehicle build specification to be established. The vehicle identification number (VIN) may also be viewed through the windshield or in the drivers compartment where it is stamped into the floor panel.



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Item	Part Number	Description
1	-	Visible VIN
2	-	VIN on the floor panel
3	-	VIN plate

VIN (an example of VIN shown)

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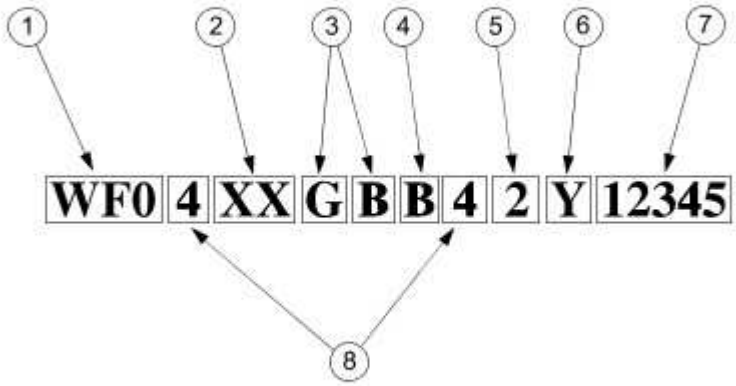

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Item	Part Number	Description
1	-	VIN Position 1, 2 and 3 - World manufacturer identifier
2	-	VIN Position 5 and 6 - Constant X
3	-	VIN Position 7 and 8 - Product source company and assembly plant
4	-	VIN Position 9 - Model
5	-	VIN Position 11 - Year of manufacture
6	-	VIN Position 12 - Month of manufacture
7	-	VIN Positions 13 to 17 - Vehicle serial number
8	-	VIN Position 4 and 10 - Body type

VIN Position 1, 2 and 3 - World Manufacturer Identifier

Code	World Manufacturer
WF0	Ford-Werke GMBH (European vehicles)

VIN Position 4 and 10 - Body Type

Codes	Body Type
M	5 Door (LMV)
S	5 Door (SAV)

VIN Position 5 and 6

Constant X

VIN Position 7 and 8 - Product Source Company and Assembly Plant

Code	Product Source Company and Assembly Plant
GB	Genk/Belgium

VIN Position 9 - Model

Code	Model
W	Galaxy

VIN Position 11 - Year of Manufacture

Code	Year of Manufacture

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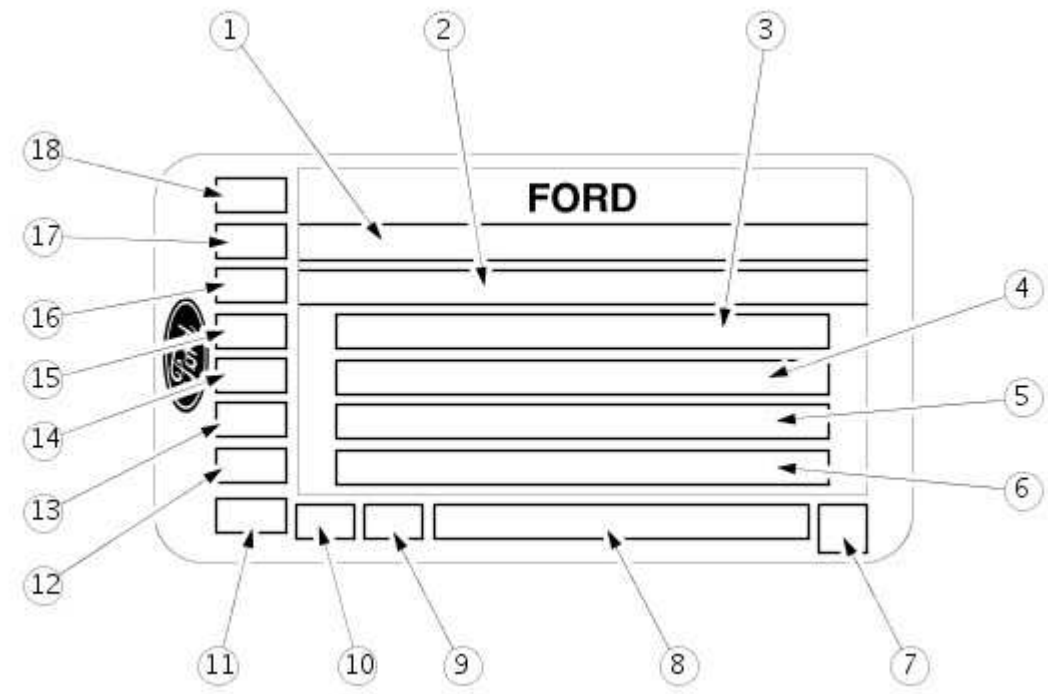
6	2006
7	2007
8	2008
9	2009
A	2010

VIN Position 12 - Month of Manufacture

month	2006	2007	2008	2009	2010
January	L	C	B	J	L
February	Y	K	R	U	Y
March	S	D	A	M	S
April	T	E	G	P	T
May	J	L	C	B	J
June	U	Y	K	R	U
July	M	S	D	A	M
August	P	T	E	G	P
September	B	J	L	C	B
October	R	U	Y	K	R
November	A	M	S	D	A
December	G	P	T	E	G

VIN Positions 13 to 17 - Vehicle Serial Number Five Digit Number

Vehicle Certification Label (Typical) or VIN Plate



Item	Part Number	Description
1	-	National or whole vehicle type approval
2	-	VIN
3	-	Gross vehicle mass (GVM)
4	-	Gross train mass (GTM)
5	-	Maximum permissible front axle mass
6	-	Maximum permissible rear axle mass
	-	

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7		Smoke value (diesel only)
	8 -	Model body or type codes
9	-	Model type code
10	-	Door combination code (Transit only)
11	-	Exhaust emission level codes
12	-	Body color codes
13	-	Interior trim codes
14	-	Transaxle final drive ratio codes
15	-	Transaxle codes
16	-	Engine codes
17	-	Hand of drive
18	-	Axle mounting (Transit only)

Item	Details
Item 1: National or whole vehicle type approval	A unique code required by legislation in certain territories.
Item 2: VIN	Vehicle identification number.
Item 3: GVM	Indicates the maximum legal laden mass, in territories where this is required.
Item 4: GTM	Indicates the maximum combined mass of vehicle and trailer or caravan.
Item 5: Maximum permissible front axle mass	Maximum permissible loading on the front wheels of the vehicle.
Item 6: Maximum permissible rear axle mass	Maximum permissible loading on the rear wheels of the vehicle.

Item 7: Smoke Value (diesel only)

Number	Smoke Value
-	Per meter

Item 8: Model Body or Type Codes

Code	Model Body or Type
WA6	S-MAX/Galaxy

Item 9: Model Type Code

Code	Model Type
-	-

Item 10: Door Combination Code

Code	Model Type
-	-

Item 11: Exhaust Emission Level Codes

Code	Exhaust Emissions
W	Stage IV + Diesel Particulate Filter (DPF)
4	Stage IV (light truck)
7	Stage IV (car)

Item 12: Body Color Codes

Code	Body Color
B	Diamond White
C	Colorado Red
E	Ink Blue

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F	Frozen White
G	Panther Black
V	Deep Navy
W	Kelp (Green)
X	Sea Grey
Y	White Grape (Yellow)
Z	Tango (Orange)
4	Blue Ambition
6	Stardust Silver
7	Machine Silver
8	Tonic (Blue)

For vehicles built in continental plants, the second digit of the paint code, on the VIN label, denotes the original model year of the color's introduction, ('0'=color introduction in 2000 model year).

Item 13: Interior Trim Codes

Code	Interior Trim
AP	Intergate - Generic Orange
BR	Arasia - Infinity Blue
BS	Napoli Perferated - Infinity Blue
BT	Avanette - Infinity Blue
BV	Alcantara - Infinity Blue
CZ	Avanette - Light Denim Blue
DS	Napoli Perferated - Charcoal
EQ	Burlington - Ebony
ER	Arasia - Ebony
EV	Alcantara - Ebony
FS	Napoli Perferated - Alpaca Beige

Item 14: Transaxle Final Drive Ratio Codes

Code	Transaxle Final Drive Ratio
A5	4.067
EV	3.75
H6	4.0
15	3.56
25	3.56
27	3.81/2.77 (a)
3V	3.604
47	3.81/2.77 (a)

a) The 6-speed manual transaxle (MMT6) has two output shafts. First, second, third and fourth gears have the higher final drove ratio. Fifth, sixth and reverse gears have the lower final drive ratio.

Item 15: Transaxle Codes

Code	Transaxle
5	5-Speed Manual Transaxle (MTX-75)
6	6-Speed Manual Transaxle (M66)
7	6-Speed Manual Transaxle (MMT6)
V	6-Speed Automatic Transaxle (AWF21)

Item 16: Engine Codes

Code	Engine
A	2.0L Duratec-HE (MI4) (145 PS)
E	2.3L Duratec-HE (MI4) (160 PS)
H	2.5L Duratec-ST (VI5) (220 PS)

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1	1.8L Duratorq-TDCi (Kent) Diesel (100 PS)
2	1.8L Duratorq-TDCi (Kent) Diesel (125 PS)
3	2.0L Duratorq-TDCi (DW) Diesel (130 PS)
4	2.0L Duratorq-TDCi (DW) Diesel (143 PS)

Item 17: Hand of Drive

Code	Drive
C	Left-hand drive
D	Left-hand drive
3	Right-hand drive
4	Right-hand drive

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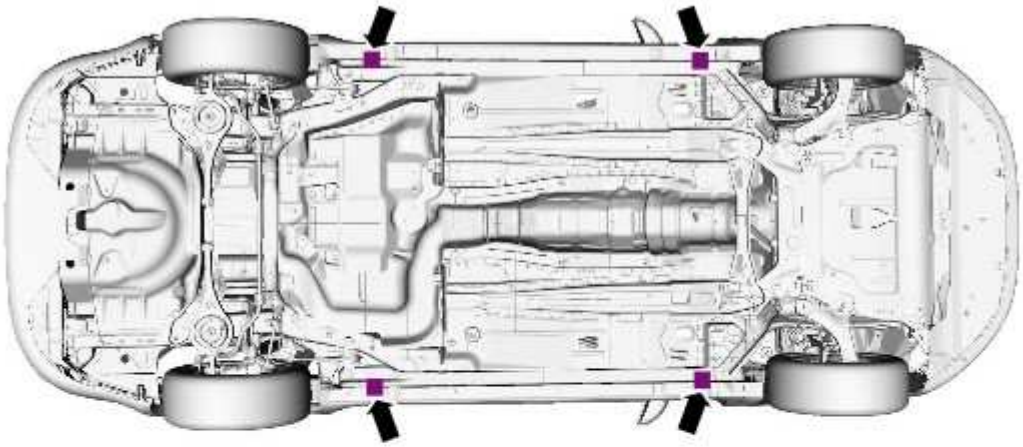
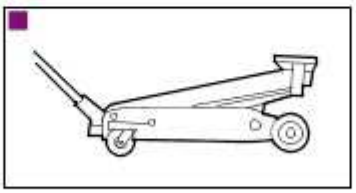
Description and Operation





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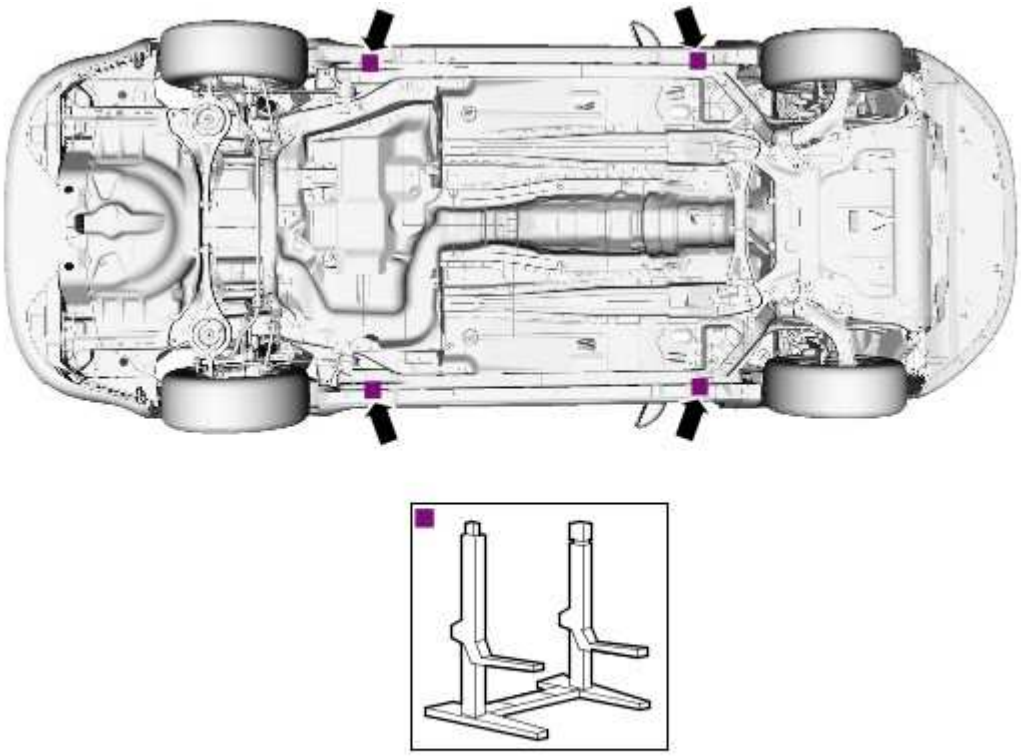
Description and Operation



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Diagnosis and Testing

Inspection and Verification

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

How to Use this Diagnostic Procedure Section

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

Customer Interview

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

Identify the Condition

NVH usually occur in four areas:

- tires
- engine accessories
- suspension
- driveline

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

Noise Diagnostic Procedure

Non-Axle Noise

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

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

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

Noise Conditions

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

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

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

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

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

Vibration Conditions

Vibration at highway speeds may be caused by the following:

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

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

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

Road Test

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

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

1. **1.** Make notes throughout the diagnosis routine. Make sure to write down even the

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smallest bit of information, because it may turn out to be the most important.

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

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

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

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

Road Test Quick Checks

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

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

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

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

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

- worn, damaged or incorrectly installed front wheel bearing.

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- damaged powertrain/drivetrain mounts.

Road Conditions

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

NOTE: Some concerns may be apparent only on smooth asphalt roads.
If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

Vehicle Preparation

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

Power Steering Conditions

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

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

Power Steering Operation Noise Check

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

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

NVH concerns from other components

NVH concerns from other condition (column A to D)					
Noise	Driving Condition	A	B	C	D
Pedal box knocking	Drive off, stop driving and slow cornering over uneven roads	X	X	O	X
Stabilizer bar link knocking	Drive off, driving and cornering	X	O	O	X
Engine support insulator knocking	Drive off, driving, acceleration and deceleration	X		X	
Air conditioning knocking	Engine on, activate switch for air conditioning	X	X	O	O
Suspension knocking (Subframe, Springs)	Drive off, driving, cornering, acceleration and deceleration	X		O	X
Constant velocity (CV) joint	Drive off, driving, cornering, acceleration and	X	O		X

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knocking	deceleration				
Washer bottle	Deceleration, acceleration and single impact	O		X	
Loose suspension bolts	All driving conditions	O		O	X
Instrument panel rattle/squeak	All driving conditions. Engine rpm dependant	X	X	X	X

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

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

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

Steering system NVH concerns

Steering System operation condition (column A to F)							
Noise	Driving condition	A	B	C	D	E	F
Moan	Parking between lock stops, at engine idle and also increased engine speed	X	O				
Whine	Driving, high engine rpm. Must be present from new	O	O	X	X		
Hiss	a) Parking between lock stops. Must be present from new	X	X	O	O		
	b) Holding steering wheel against lock stops. Must be present from new		X				
Lock stop impact knock	a) Parking at lock stop. Must be present from new		X				X
Mechanical knock (power assisted steering (PAS) off)	b) Parking between lock stops, engine OFF. Must be present from new					X	
Mechanical Knock (PAS on)	c) Parking between lock stops, engine ON (ball joint knock)	X					
Hammer knock	d) Parking into lock stop and release (vehicle with hydraulic power assisted steering (HPAS) only, not for vehicles with electro-hydraulic power assisted steering (EHPAS))		X				
Hydraulic knock (clonk)	e) Driving, cobble stones, rough road (clonk). Must be present from new			O	X		
Column knock	f) Parking, driving. cobble stones and rough roads	X	X	O	X	X	X
Column rattle	Mainly driving on rough roads	O		X	X	O	
Toc-toc	Steering left and right at high frequency. Must be present from new	X					
Grinding	When turning steering wheel	X			O	X	
Zip	At engine start, low temperatures below -10°C only	X	O				

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

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

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

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

Symptom Chart

Power Steering Moan Noise

Test Condition

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

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

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

Power Steering Whine Noise

Test Condition

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

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

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

Power Steering Hiss Noise

Test Condition

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

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

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	system hydraulic design.	acceptable, not a safety critical item.
NOTE: Engine speed at idle holding the steering wheel against a steering lock for three seconds. Do not hold for more than five seconds. Power steering system hiss noise – a continuous noise like escaping air occurs while holding the steering against a steering lock stop.	Power steering pump pressure relief valve.	Certain amount of noise level acceptable, not a safety critical item.

Power Steering Lock Stop Impact Knock Noise

Test Condition

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

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

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

Power Steering Mechanical Knock Noise (PAS off)

Test Condition

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

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

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

Power Steering Mechanical Knock Noise (PAS on)

Test Condition

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

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

Symptom	Possible Sources	Action
Power steering system knock	Worn tie-rod ball	REFER to Steering System.

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noise – clear knock noise from steering gear linkage area.	joints (inner and outer ball joints).	REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Power Steering Hammer Knock (Hydraulic) Noise

Test Condition

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

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

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

Power Steering Hydraulic Knock/Clonk Noise

Test Condition

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

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

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

Power Steering Column Knock Noise

Test Condition

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

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

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Symptom	Possible Sources	Action
Power steering system column knock noise – a loose sounding rattle or vibration coming from the column. Noticeable by hearing and touch.	Steering column or steering column shaft.	CHECK the steering column retaining bolts and attachments to the steering column and secure if necessary. REFER to in this section.
		Check steering column and intermediate shaft for free play or loose components. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

Power Steering Toc-Toc Noise

Test Condition

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

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

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

Power Steering Grinding Noise

Test Condition

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

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

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

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	Clockspring.	REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

Power Steering Zip Noise

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

Driveline Noise and Vibration

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

Suspension Noise and Vibration

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

Pinpoint Tests

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

PINPOINT TEST A : SHAKE AND VIBRATION WHILE DRIVING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: NEUTRAL COAST	
	1 Carry out the neutral coast test. Does the vibration disappear during the neutral coast test? **Yes** GO to A2. **No**

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	GO to Pinpoint Test D.
A2: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the mounts OK? **Yes** Vehicle condition corrected. ROAD TEST as necessary. **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST B : TIP-IN MOAN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE AIR CLEANER	
	1 Check the condition of the air cleaner mounts, inlet tube, outlet tube, resonators and all other components associated with the air induction system for correct installation and tightness of all connections.
	Are the components OK? **Yes** GO to B2. **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
B2: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure. REFER to: Exhaust System Neutralizing (100-04 Noise, Vibration and Harshness, General Procedures).
	Is the exhaust system OK? **Yes** GO to B3. **No** REPAIR as necessary. ROAD TEST as necessary.
B3: CHECK THE POWER STEERING	
	1 Remove the accessory drive belt and test for tip-in moan. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05E Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	Is the tip-in moan OK? **Yes** REPAIR the power steering as necessary. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing). **No** GO to B4.
B4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the powertrain/drivetrain mounts OK? **Yes** Vehicle condition corrected. ROAD TEST as necessary. **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as

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	necessary.

PINPOINT TEST C : IDLE BOOM/SHAKE/VIBRATION/SHUDDER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE CABLE/HOSES	
	1 Check the engine compartment for any component that may have a touch condition between the engine and body or chassis. For example: control cable, air conditioning (A/C) hoses, acceleration cable.
	Are the components OK? **Yes** GO to C2. **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C2: CHECK THE ENGINE COOLING RADIATOR	
	1 Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition.
	Is the installation and bushings OK? **Yes** GO to C3. **No** REPAIR or INSTALL new components as necessary. ROAD TEST as necessary.
C3: CHECK THE EXHAUST SYSTEM	
	1 Carry out the exhaust system neutralizing procedure. REFER to: Exhaust System Neutralizing (100-04 Noise, Vibration and Harshness, General Procedures).
	Is the exhaust system OK? **Yes** GO to C4. **No** REPAIR as necessary. ROAD TEST as necessary.
C4: CHECK THE POWERTRAIN/DRIVETRAIN MOUNTS	
	1 Carry out the powertrain/drivetrain mount neutralizing procedure
	Are the powertrain/drivetrain mounts OK? **Yes** Vehicle condition corrected. ROAD TEST as necessary. **No** INSTALL new powertrain/drivetrain mounts as necessary. ROAD TEST as necessary.

PINPOINT TEST D : WHEEL END VIBRATION ANALYSIS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: INSPECT THE WHEELS AND TIRES	
	1 Inspect the wheels and tires. REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
	Are the wheels and tires OK? **Yes** GO to D2. **No** INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation). ROAD TEST as necessary.

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D2: INSPECT THE WHEEL BEARINGS	
	1 Inspect the wheel bearings. REFER to in this section.
	Are the wheel bearings OK? **Yes** GO to D3. **No** INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation), Wheel Knuckle (204-02 Rear Suspension, Removal and Installation). ROAD TEST as necessary.
D3: INSPECT THE WHEEL AND TIRE RUNOUT	
	1 Inspect the wheel and tire runout.
	Is the wheel and tire runout OK? **Yes** Balance the wheels and tires. Refer to the wheel balance equipment manufacturer's instructions. ROAD TEST as necessary. **No** INSTALL new wheels or tires as necessary. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation). ROAD TEST as necessary.

PINPOINT TEST E : NON-AXLE NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: INSPECT THE VEHICLE TRIM	
	1 Check the radiator grille and trim panels to see if they are the source of the noise.
	Are the vehicle trim components causing the noise? **Yes** INSTALL new trim components or REPAIR as necessary. ROAD TEST as necessary. **No** GO to E2.
E2: CHECK THE AIR CONDITIONING (A/C) SYSTEM FOR NOISE	
	1 Ignition switch in position III.
	2 Ignition switch in position II.
	3 Check the A/C system components for noise by turning the A/C system on and off.
	Is the A/C system causing the noise? **Yes** INSPECT the A/C system. REFER to: (412-00 Climate Control System - General Information) Climate Control System (Diagnosis and Testing). ROAD TEST as necessary. **No** GO to E3.
E3: CHECK NON-FACTORY FITTED ACCESSORIES	
	1 Check any non-factory installed accessories for being the source of the noise. For example: touch condition body-to-frame, antennas, deflectors and fog lights.
	Are the accessories the cause of the noise? **Yes** ADJUST, REPAIR, or INSTALL new accessories or fasteners as required. ROAD TEST as necessary. **No**

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	VERIFY the customer concern.

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General Procedures

1. Loosen the muffler inlet pipe and resonator pipe to exhaust manifold fasteners at the flanges and the muffler inlet connection.
2. Place a stand to support the muffler parallel to the vehicle frame with the muffler pipe bracket free of stress.
3. Tighten the muffler connection.
4. Position the exhaust pipes to the manifolds and tighten. Make sure that the catalytic converter and heat shield do not contact the frame rails.
5. With the complete exhaust system tight (and cooled) the rear hanger insulator should be angled forward, to allow the system to expand rearward when heated during normal running.

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Front Wheel Alignment (at curb weight)

Description		Tolerance Range	Setting or Nominal	Maximum Variance Left or Right
Caster angle	Degrees and minutes	4°25' to 2°22'	3°23'	1°00'
	Decimal degrees	4.42° to 2.36°	3.39°	1.00°
Camber angle	Degrees and minutes	0°35' to -1°57'	-0°41'	1°15'
	Decimal degrees	0.59° to -1.95°	-0.68°	1.25°
Total toe	mm	1.4 Toe-in ± 2.5	1.4 Toe-in ± 1.0	-
	Degrees and minutes	0°12' Toe-in ± 0°21'	0°12' Toe-in ± 0°08'	-
	Decimal degrees	0.20° Toe-in ± 0.35°	0.20° Toe-in ± 0.14°	-
Kingpin Angle @ DM	Decimal degrees	-	13.61°	-

Rear Wheel Alignment (at curb weight)

Description		Tolerance Range	Setting or Nominal	Maximum Variance Left or Right
Camber angle	Degrees and minutes	-0°21' to -2°53'	-1°37'	1°15'
	Decimal degrees	-0.35° to -2.89°	-1.62°	1.25°
Total toe	mm	2.8 Toe-in ± 2.5	2.8 Toe-in ± 1.0	-
	Degrees and minutes	0°24' Toe-in ± 0° 21'	0°24' Toe-in ± 0° 08'	-
	Decimal degrees	0.40° Toe-in ± 0.35°	0.40° Toe-in ± 0.14°	-

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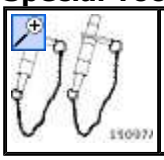
Diagnosis and Testing

Special Tool(s)

	Alignment Pins, Subframe 205-316 (15-097A)

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Tire pressure(s) • Wheels and tires • Wheel knuckles • Tie-rod ends • Front suspension lower arm ball joints • Front suspension lower arm bushings • Front strut and spring assemblies • Front and rear stabilizer bars and connecting links • Rear springs • Shock absorbers • Rear suspension lower arms	• Wiring harness(es). • Electrical connector(s). • Switch(es). • Shock absorber solenoid(s) • vertical acceleration sensor(s) • Height sensor(s) • Adaptive damping module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, connect the Ford approved diagnostic tool to the data link connector (DLC).
5. **5.** Retrieve the Diagnostic Trouble Code (DTC)s and refer to the DTC Index Chart.

DTC Index Chart

DTC	Description/Condition	Possible Source	Action
C110C11	Left front shock absorber solenoid circuit - short to ground	Circuit(s) or solenoid	GO to Pinpoint Test D.
C110C12	Left front shock absorber solenoid circuit - short to power	Circuit(s) or solenoid	GO to Pinpoint Test E.
C110C13	Left front shock absorber solenoid circuit - open circuit	Circuit(s) or solenoid	GO to Pinpoint Test F.
C110C18	Left front shock absorber solenoid circuit - current	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for

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	below threshold		approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110C19	Left front shock absorber solenoid circuit - current above threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110C1D	Left front shock absorber solenoid circuit - current out of range	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110C4B	Left front shock absorber solenoid - over temperature	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110C78	Left front shock absorber solenoid - alignment or adjustment incorrect	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present,

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			INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110D11	Right front shock absorber solenoid circuit - short to ground	Circuit(s) or solenoid	GO to Pinpoint Test D.
C110D12	Right front shock absorber solenoid circuit - short to power	Circuit(s) or solenoid	GO to Pinpoint Test E.
C110D13	Right front shock absorber solenoid circuit - open circuit	Circuit(s) or solenoid	GO to Pinpoint Test F.
C110D18	Right front shock absorber solenoid circuit - current below threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110D19	Right front shock absorber solenoid circuit - current above threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110D1D	Right front shock absorber solenoid circuit - current out of range	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110D4B	Right front shock absorber	Solenoid	Connect the Ford approved diagnostic tool

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	solenoid - over temperature		and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110D78	Right front shock absorber solenoid - alignment or adjustment incorrect	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new front shock absorbers. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly). TEST the system for normal operation.
C110E11	Left rear shock absorber solenoid circuit - short to ground	Circuit(s) or solenoid	GO to Pinpoint Test D.
C110E12	Left rear shock absorber solenoid circuit - short to power	Circuit(s) or solenoid	GO to Pinpoint Test E.
C110E13	Left rear shock absorber solenoid circuit - open circuit	Circuit(s) or solenoid	GO to Pinpoint Test F.
C110E18	Left rear shock absorber solenoid circuit - current below threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110E19	Left rear shock absorber solenoid circuit - current above threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110E1D	Left rear shock absorber solenoid circuit - current out of range	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions.

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			Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110E4B	Left rear shock absorber solenoid - over temperature	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110E78	Left rear shock absorber solenoid - alignment or adjustment incorrect	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110F11	Right rear shock absorber solenoid circuit - short to ground	Circuit(s) or solenoid	GO to Pinpoint Test D.
C110F12	Right rear shock absorber solenoid circuit - short to power	Circuit(s) or solenoid	GO to Pinpoint Test E.
C110F13	Right rear shock absorber solenoid circuit - open circuit	Circuit(s) or solenoid	GO to Pinpoint Test F.
C110F18	Right rear shock absorber solenoid circuit - current below threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110F19	Right rear shock absorber solenoid circuit - current above threshold	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110F1D	Right rear shock absorber solenoid circuit - current out of range	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool

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			CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110F4B	Right front shock absorber solenoid - over temperature	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C110F78	Right front shock absorber solenoid - alignment or adjustment incorrect	Solenoid	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL new rear shock absorbers. REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation.
C111C11	Left front vertical acceleration sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test G.
C111C12	Left front vertical acceleration sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test H.
C111C13	Left front vertical acceleration sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test I.
C111C29	Left front vertical acceleration sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new vertical acceleration sensor. REFER to: Vehicle Front Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C111D11	Right front vertical acceleration sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test G.
C111D12	Right front vertical acceleration sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test H.
C111D13	Right front vertical acceleration sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test I.
C111D29	Right front vertical acceleration sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present,

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			INSTALL a new vertical acceleration sensor. REFER to: Vehicle Front Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C111E11	Left rear vertical acceleration sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test G.
C111E12	Left rear vertical acceleration sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test H.
C111E13	Left rear vertical acceleration sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test I.
C111E29	Left rear vertical acceleration sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new vertical acceleration sensor. REFER to: Vehicle Rear Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C112B94	Suspension system switch - unexpected operation	Switch	INSTALL a new suspension mode selection switch. TEST the system for normal operation.
C112C11	Mode indicator 1 (comfort) circuit - short to ground	Circuit(s) or switch	GO to Pinpoint Test M.
C112C12	Mode indicator 1 (comfort) circuit - short to power	Circuit(s) or switch	GO to Pinpoint Test N.
C112C13	Mode indicator 1 (comfort) circuit - open circuit	Circuit(s) or switch	GO to Pinpoint Test O.
C112D11	Mode indicator 2 (normal) circuit - short to ground	Circuit(s) or switch	GO to Pinpoint Test M.
C112D12	Mode indicator 2 (normal) circuit - short to power	Circuit(s) or switch	GO to Pinpoint Test N.
C112D13	Mode indicator 2 (normal) circuit - open circuit	Circuit(s) or switch	GO to Pinpoint Test O.
C112E11	Mode indicator 3 (sport) circuit - short to ground	Circuit(s) or switch	GO to Pinpoint Test M.
C112E12	Mode indicator 3 (sport) circuit - short to power	Circuit(s) or switch	GO to Pinpoint Test N.
C112E13	Mode indicator 3 (sport) circuit - open circuit	Circuit(s) or switch	GO to Pinpoint Test O.
C1A0311	Left front height sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test J.
C1A0312	Left front height sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test K.
C1A0313	Left front height sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test L.
C1A0329	Left front height sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new front suspension height sensor.

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			REFER to: Front Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C1A0411	Right front height sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test J.
C1A0412	Right front height sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test K.
C1A0413	Right front height sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test L.
C1A0429	Right front height sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new front suspension height sensor. REFER to: Front Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C1A0511	Left rear height sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test J.
C1A0512	Left rear height sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test K.
C1A0513	Left rear height sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test L.
C1A0529	Left rear height sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new rear suspension height sensor. REFER to: Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
C1A0611	Right rear height sensor circuit - short to ground	Circuit(s) or sensor	GO to Pinpoint Test J.
C1A0612	Right rear height sensor circuit - short to power	Circuit(s) or sensor	GO to Pinpoint Test K.
C1A0613	Right rear height sensor circuit - open circuit	Circuit(s) or sensor	GO to Pinpoint Test L.
C1A0629	Right rear height sensor circuit signal invalid	Sensor	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new rear suspension height sensor. REFER to: Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation.
U000100	High speed controller area	CAN	REFER to: Communications Network (418-00

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	network (CAN) communication bus general failure		Module Communications Network, Diagnosis and Testing).
U010000	Lost communication with the powertrain control module (PCM)	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U012100	Lost communication with the braking system control module	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U012600	Lost communication with the steering angle sensor module	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U014000	Lost communication with the generic electronic module (GEM)	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U040168	Invalid data received from the PCM	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U041868	Invalid data received from the braking system control module	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U042268	Invalid data received from the GEM	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U042868	Invalid data received from the steering angle sensor	CAN	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U200A94	Control module internal power - unexpected operation	Adaptive damping module	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200B94	Control module internal power A - unexpected operation	Adaptive damping module	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200C94	Control module internal power B - unexpected operation	Adaptive damping module	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200D11	Control module output power A circuit - short to ground	Circuit(s)	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200D12	Control module output power A circuit - short to power	Circuit(s)	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200E11	Control module output power B circuit - short to ground	Circuit(s)	INSTALL a new adaptive damping module. TEST the system for normal operation.
U200E12	Control module output power B circuit - short to power	Circuit(s)	INSTALL a new adaptive damping module. TEST the system for normal operation.
U201011	Switch illumination circuit - short to ground	Circuit(s) or switch	GO to Pinpoint Test P.
U201012	Switch illumination circuit - short to power	Circuit(s) or switch	GO to Pinpoint Test Q.
U201013	Switch illumination circuit - open circuit	Circuit(s) or switch	GO to Pinpoint Test R.
U201311	Switch circuit - short to ground	Circuit(s) or switch	GO to Pinpoint Test S.
U201312	Switch circuit - short to power	Circuit(s) or switch	GO to Pinpoint Test T.

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U201313	Switch circuit - open circuit	Circuit(s) or switch	GO to Pinpoint Test U.
U201426	Control module signal rate of change below threshold	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201427	Control module signal rate of change above threshold	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201441	Control module general checksum failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201444	Control module data memory failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201647	Control module watchdog failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201648	Control module supervision software failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U20164A	Incorrect control module installed	Adaptive damping module	INSTALL a new adaptive damping module. TEST the system for normal operation.
U201663	Control module component protection time-out	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module.

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			TEST the system for normal operation.
U201667	Control module signal incorrect after event	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201741	Control module general checksum failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U201A41	Control module general checksum failure	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U210000	Control module not configured	Adaptive damping module	Using the Ford approved diagnostic tool, upload the latest level of software to the adaptive damping module. TEST the system for normal operation. If the concern persists, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U210100	Control module configuration not compatible	Adaptive damping module	Using the Ford approved diagnostic tool, upload the latest level of software to the adaptive damping module. TEST the system for normal operation. If the concern persists, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U300016	Control module voltage below threshold	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U300017	Control module voltage above threshold	Adaptive damping module	Connect the Ford approved diagnostic tool and clear the DTC. Carry out a road test for approximately 15 to 20 km (9 to 12 miles) using various road surfaces and conditions. Using the Ford approved diagnostic tool CHECK for the DTC. If the DTC is present, INSTALL a new adaptive damping module. TEST the system for normal operation.
U300062	Battery voltage compare signal failure	Charging system	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

1. **1.** If no DTCs are retrieved or the cause is still evident, refer to the Symptom Chart.

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Symptom Chart

Symptom	Possible Sources	Action
Drift left or right	* Vehicle attitude incorrect (front or rear is high or low).	* Vehicles without load levelling shock absorbers, CHECK for abnormal loading, spring sag or non-standard springs. * Vehicles with load levelling shock absorbers, GO to Pinpoint Test C.
	* Steering gear or linkage worn or damaged.	* CHECK the steering system. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).
	* Brake system.	* CHECK the brake system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications).
	* Incorrect front crossmember alignment.	* Using the special tool, CHECK the front subframe alignment.
	* Worn front wheel bearings.	* CHECK the wheel bearings.
	* Wheel and tires.	* GO to Pinpoint Test A.
Steering wheel off center	* Vehicle attitude incorrect (front or rear is high or low).	* Vehicles without load levelling shock absorbers, CHECK for abnormal loading, spring sag or non-standard springs. * Vehicles with load levelling shock absorbers, GO to Pinpoint Test C.
	* Steering gear or linkage worn or damaged.	* CHECK the steering system. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).
	* Suspension lower arm ball joint.	* CARRY OUT the Ball Joint Inspection Component Test in this procedure.
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications).
Tracks incorrectly	* Incorrect front suspension toe castor or camber angles.	* ADJUST the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications). CHECK and INSTALL new suspension components as necessary.
	* Incorrect rear suspension toe or camber angles.	* CHECK the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications). CHECK and INSTALL new suspension components as necessary.
	* Front or rear suspension damage.	* CHECK and INSTALL new suspension components as necessary.
Rough ride	* Front strut and spring assemblies.	* CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. * CHECK and INSTALL new suspension components as necessary. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly).
	* Front or rear stabilizer bar connecting links or bushings.	* CHECK and INSTALL new suspension components as necessary. REFER to: Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation), Front Stabilizer Bar Link (204-01 Front

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		Suspension, Removal and Installation), Front Stabilizer Bar Bushing (204-01 Front Suspension, Removal and Installation), Rear Stabilizer Bar (204-02 Rear Suspension, Removal and Installation), Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation), Rear Stabilizer Bar Bushing (204-02 Rear Suspension, Removal and Installation).
	* Front suspension lower arm bushings.	* INSTALL a new lower arm. REFER to: Front Lower Arm (204-02 Rear Suspension, Removal and Installation).
	* Rear suspension arm bushings.	* CHECK and INSTALL new components as necessary. REFER to: (204-02 Rear Suspension) Rear Stabilizer Bar (Removal and Installation), Rear Stabilizer Bar Link (Removal and Installation), Rear Stabilizer Bar Bushing (Removal and Installation).
	* Rear shock absorbers.	* CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. * CHECK and INSTALL new suspension components as necessary.
Excessive noise	* Front strut and spring assembly or rear shock absorber and spring upper mounting bolts or nuts loose or broken.	* GO to Pinpoint Test B.
	* Shock absorbers leaking.	* GO to Pinpoint Test B.
	* Shock absorbers performance incorrect.	* GO to Pinpoint Test B.
	* Stabilizer bar components.	* GO to Pinpoint Test B.
	* Strut and spring assembly and springs.	* GO to Pinpoint Test B.
	* Springs moving on springs upper or lower seats.	* GO to Pinpoint Test B.
	* Suspension bushings.	* GO to Pinpoint Test B.
	* Lower arm ball joint.	* GO to Pinpoint Test B.
	* Worn front wheel bearings	* GO to Pinpoint Test B.
	* Wheels and tires.	* GO to Pinpoint Test B.
Incorrect tire wear	* Front or rear suspension damage.	* CHECK and INSTALL new suspension components as necessary.
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications).
Vibration	* Damaged or worn front wheel bearings.	* CHECK the front wheel bearings.
	* Wheels and tires.	* CHECK the tires. BALANCE or INSTALL new tires as necessary.
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: Specifications (211-00 Steering System - General Information, Specifications).
	* Steering gear or linkage worn or damaged.	* CHECK the steering system. REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

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	* Front strut and spring assemblies.	* CARRY OUT the Strut or Shock Absorber Testing component test in this procedure. * CHECK and INSTALL new suspension components as necessary. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly).
	* Damaged front suspension lower arm(s).	* CHECK and INSTALL new suspension components as necessary. REFER to: Lower Arm (204-01 Front Suspension, Removal and Installation).
Vehicle lean	* Load-levelling shock absorbers.	* GO to Pinpoint Test C.

Pinpoint Tests

PINPOINT TEST A : DRIFT LEFT OR RIGHT	
WARNING: To avoid personal injury due to the loss of vehicle control, the inspection should be carried out by two people to maintain safe driving conditions. Adequate grip should always be maintained on the steering wheel. Failure to follow these instructions may result in personal injury.	
NOTE: The following conditions must be met when evaluating the vehicle.	
NOTE: The tire swapping procedures are for bi-directional rotating tires only.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: SWAP THE FRONT WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the front left-hand wheel and tire assembly with the front right-hand wheel and tire assembly. • Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A2. **No** The concern has been corrected.
A2: SWAP THE REAR WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the rear left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. • Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A3. **No** The concern has been corrected.
A3: SWAP THE LEFT-HAND WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the front left-hand wheel and tire assembly with the rear left-hand wheel and tire assembly.

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	• Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A4. **No** The concern has been corrected.
A4: SWAP THE RIGHT-HAND WHEEL AND TIRE ASSEMBLIES	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the front right-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. • Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A5. **No** The concern has been corrected.
A5: SWAP THE FRONT LEFT-HAND WHEEL AND TIRE ASSEMBLY	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the front left-hand wheel and tire assembly with the rear right-hand wheel and tire assembly. • Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A6. **No** The concern has been corrected.
A6: SWAP THE FRONT RIGHT-HAND WHEEL AND TIRE ASSEMBLY	
	1 Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation). • Swap the front right-hand wheel and tire assembly with the rear left-hand wheel and tire assembly. • Road test the vehicle.
	Does the vehicle drift? **Yes** GO to A7. **No** The concern has been corrected.
A7: INSTALL NEW TIRES	
NOTE: Install new tires only once.	
	1 Install new tires to the four road wheels. TEST the system for normal operation.
	Does the vehicle drift? **Yes** Verify possible sources, refer to the Symptom Chart. **No** The concern has been corrected.

PINPOINT TEST B : EXCESSIVE NOISE	
TEST	**DETAILS/RESULTS/ACTIONS**

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CONDITIONS	
B1: INSPECT ALL STRUT AND SPRING ASSEMBLY AND SHOCK ABSORBER MOUNTING BOLTS AND NUTS	
	1 Inspect the strut and spring assembly and shock absorber mounting bolts and nuts.
	Are the mounting bolts or nuts loose or broken? **Yes** TIGHTEN or INSTALL new suspension mounting bolts. **No** GO to B2.
B2: INSPECT THE STRUT AND SPRING ASSEMBLIES AND SHOCK ABSORBERS FOR LEAKS	
	NOTE: Make sure that the oil is not from another source. 1 Inspect the strut and spring assemblies and shock absorbers for signs of oil weepage or leaks. Refer to weepage and leakage conditions in the Strut or Shock Absorber Testing component test in this procedure.
	Are the struts or shock absorbers leaking? **Yes** INSTALL new struts or shock absorbers as necessary. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation), Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). **No** GO to B3.
B3: INSPECT THE SPRINGS AND STABILIZER BAR(S)	
	1 Inspect the springs and stabilizer bar(s) for damage.
	Are the springs or stabilizer bar(s) damaged? **Yes** INSTALL new springs or stabilzer bar(s). REFER to: Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation), Front Stabilizer Bar Link (204-01 Front Suspension, Removal and Installation), Front Stabilizer Bar Bushing (204-01 Front Suspension, Removal and Installation), Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation), Rear Stabilizer Bar (204-02 Rear Suspension, Removal and Installation), Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation), Spring (204-02 Rear Suspension, Removal and Installation). **No** GO to B4.
B4: INSPECT THE SUSPENSION BUSHINGS	
	1 Inspect the suspension bushings for excessive wear or damage.
	Are the bushings worn or damaged? **Yes** INSTALL new components as necessary. REFER to: Lower Arm (204-01 Front Suspension, Removal and Installation), Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation), Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation), Upper Arm (204-02 Rear Suspension, Removal and Installation), Front Lower Arm (204-02 Rear Suspension, Removal and Installation), Rear Lower Arm (204-02 Rear Suspension, Removal and Installation), Rear Stabilizer Bar (204-02 Rear Suspension, Removal and

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	Installation). **No** GO to B5.
B5: INSPECT THE SUSPENSION LOWER ARM BALL JOINTS	
	1 Carry out the Ball Joint Inspection component test in this procedure.
	Is the lower arm ball joint or gaiter damaged? **Yes** INSTALL new lower arm. REFER to: Lower Arm (204-01 Front Suspension, Removal and Installation). TEST the system for normal operation. **No** GO to B6.
B6: INSPECT THE WHEEL BEARINGS	
	1 Check the wheel bearings.
	Are the wheel bearings damaged? **Yes** INSTALL a new wheel hub(s). **No** GO to B7.
B7: INSPECT THE WHEEL AND TIRES	
	1 Inspect the tires for uneven wear.
	Is there uneven wear? **Yes** REFER to the symptom chart. **No** GO to B8.
B8: INSPECT THE STRUT AND SPRING ASSEMBLY AND REAR SUSPENSION SPRING INTERFACE	
	1 Loosen the strut and spring assemblies and shock absorbers top and bottom mounting bolts and nuts. Tighten the mounting bolts and nuts. • Carry out a road test. REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).
	Is the concern still evident? **Yes** GO to B9. **No** Vehicle condition corrected.
B9: INSPECT THE STRUT AND SPRING ASSEMBLIES AND SHOCK ABSORBER COMPONENTS	
	1 Check that the spring is correctly located on the spring seat and has not moved.
	2 Disassemble the strut and spring and assembly and inspect the individual components. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly).
	3 Inspect the shock absorber top mount for wear or damage.
	4 Carry out the Strut or Shock Absorber Testing component test in this procedure.
	Are any of the strut and spring assemblies or shock absorber components damaged? **Yes** INSTALL new components as necessary. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly), Rear Shock Absorber (204-02 Rear Suspension, Removal and

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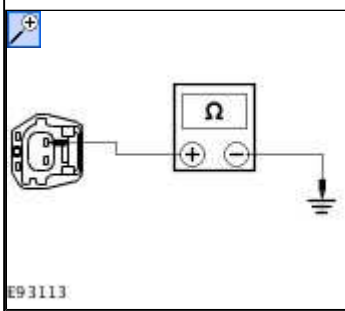
	Installation). **No** REINSTALL the strut and spring assemblies or shock absorbers. GO to B10.
B10: CARRY OUT A ROAD TEST	
	1 Carry out a road test. REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).
	Is the concern still evident? **Yes** REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing). **No** Vehicle condition corrected.

PINPOINT TEST C : VEHICLE LEAN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: VEHICLE LEAN	
	1 Detach the load levelling shock absorbers from the wheel knuckles.
	Does the vehicle lean? **Yes** Install new rear springs. REFER to: Spring (204-02 Rear Suspension, Removal and Installation).TEST the system for normal operation. **No** CARRY OUT the Load-Levelling Shock Absorber Component Test in this section.

PINPOINT TEST D : SHOCK ABSORBER SOLENOID CIRCUIT - SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE SHOCK ABSORBER SOLENOID SIGNAL RETURN CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Shock Absorber Solenoid Connector.
	3 Measure the resistance between the following affected shock absorber solenoid connector pins, harness side and ground: • (Left front) C1CD03 pin 2, circuit RCD03B (VT/BN). • (Right front) C1CD04 pin 2, circuit RCD04B (BU/OG). • (Left rear) C4CD05 pin 2, circuit RCD05A (YE/BU). • (Right rear) C4CD06 pin 2, circuit RCD06A (BU/BN).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL new front or rear shock absorbers as required. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly) / Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

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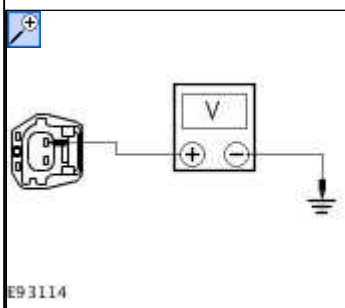
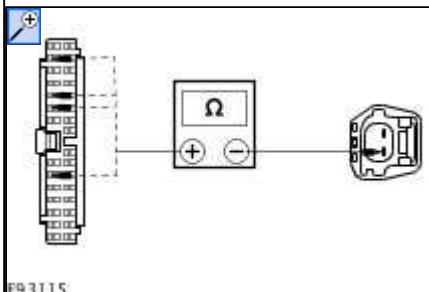
PINPOINT TEST E : SHOCK ABSORBER SOLENOID CIRCUIT - SHORT TO POWER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE SHOCK ABSORBER SOLENOID SIGNAL RETURN CIRCUIT FOR SHORT TO POWER	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Shock Absorber Solenoid Connector.
	3 Ignition switch in position II.
 E93114	4 Measure the voltage between the following affected shock absorber solenoid connector pins, harness side and ground: • (Left front) C1CD03 pin 2, circuit RCD03B (VT/BN). • (Right front) C1CD04 pin 2, circuit RCD04B (BU/OG). • (Left rear) C4CD05 pin 2, circuit RCD05A (YE/BU). • (Right rear) C4CD06 pin 2, circuit RCD06A (BU/BN).
	Is the voltage 0 volts? **Yes** INSTALL new front or rear shock absorbers as required. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly) / Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST F : SHOCK ABSORBER SOLENOID CIRCUIT - OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK THE SHOCK ABSORBER SOLENOID SIGNAL INPUT CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Shock Absorber Solenoid Connector.
 E93115	3 Measure the resistance between the following affected shock absorber solenoid connector pins, harness side and the adaptive damping module C4CD01-B pins, harness side: • (Left front) C1CD03 pin 1, circuit CCD03B (WH/BU) and C4CD01-B pin 6, circuit CCD03C (WH/BU). • (Right front) C1CD04 pin 1, circuit CCD04B (GY/YE) and C4CD01-B pin 9, circuit CCD04C (GY/YE). • (Left rear) C4CD05 pin 1, circuit CCD05A (GN/BU) and C4CD01-B pin 2, circuit CCD05B (GN/BU). • (Right rear) C4CD06 pin 1, circuit CCD06A (VT/GY) and C4CD01-B pin 5, circuit CCD06B (VT/GY).
	Is the resistance less than 1 ohm? **Yes**

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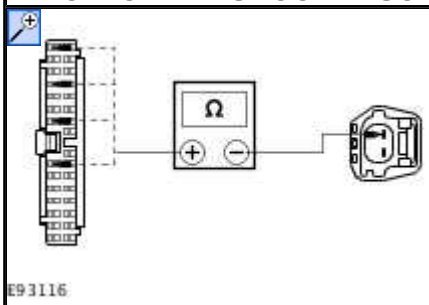
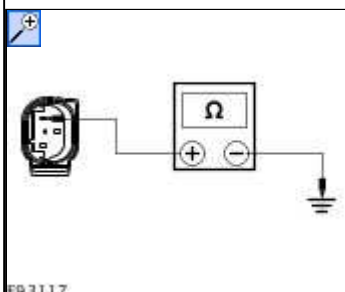
	GO to F2. **No** REPAIR the circuit. TEST the system for normal operation.
F2: CHECK THE SHOCK ABSORBER SOLENOID RETURN CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the following affected shock absorber solenoid connector pins, harness side and the adaptive damping module C4CD01-B pins, harness side: • (Left front) C1CD03 pin 2, circuit RCD03B (VT/BN) and C4CD01-B pin 7, circuit RCD03C (VT/BN). • (Right front) C1CD04 pin 2, circuit RCD04B (BU/OG) and C4CD01-B pin 8, circuit RCD04C (BU/OG). • (Left rear) C4CD05 pin 2, circuit RCD05A (YE/BU) and C4CD01-B pin 1, circuit RCD05B (YE/BU). • (Right rear) C4CD06 pin 2, circuit RCD06A (BU/BN) and C4CD01-B pin 4, circuit RCD06B (BU/BN).
	Is the resistance less than 1 ohm? **Yes** INSTALL new front or rear shock absorbers as required. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation) / Shock Absorber and Spring Assembly (204-01 Front Suspension, Disassembly and Assembly) / Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST G : VERTICAL ACCELERATION SENSOR CIRCUIT - SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE VERTICAL ACCELERATION SENSOR SIGNAL RETURN CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Vertical Acceleration Sensor Connector.
	3 Measure the resistance between the following affected vertical acceleration sensor connector pins, harness side and ground: • (Left front) C1CD07 pin 1, circuit VCD07A (BN/WH). • (Right front) C1CD08 pin 1, circuit VCD08A (BU/GY). • (Left rear) C4CD09 pin 1, circuit VCD09B (YE/VT).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL new vertical acceleration sensors as required. REFER to: Vehicle Front Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Vehicle Rear Vertical Accelerometer (204-05 Vehicle

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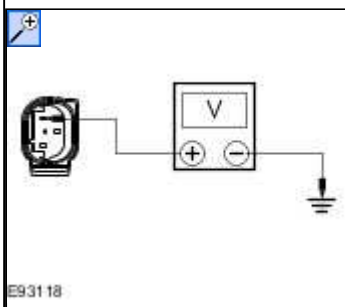
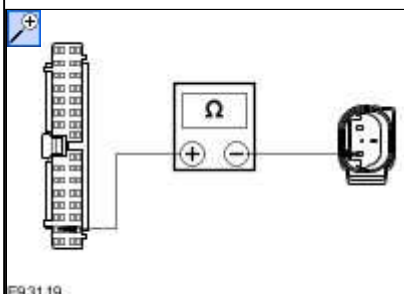
	Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST H : VERTICAL ACCELERATION SENSOR CIRCUIT - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE VERTICAL ACCELERATION SENSOR SIGNAL RETURN CIRCUIT FOR SHORT TO POWER	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Vertical Acceleration Sensor Connector.
	3 Ignition switch in position II.
 E93118	4 Measure the voltage between the following affected vertical acceleration sensor connector pins, harness side and ground: • (Left front) C1CD07 pin 1, circuit VCD07A (BN/WH). • (Right front) C1CD08 pin 1, circuit VCD08A (BU/GY). • (Left rear) C4CD09 pin 1, circuit VCD09B (YE/VT).
	Is the voltage 0 volts? **Yes** INSTALL new vertical acceleration sensors as required. REFER to: Vehicle Front Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Vehicle Rear Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST I : VERTICAL ACCELERATION SENSOR CIRCUIT - OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE VERTICAL ACCELERATION SENSOR SIGNAL INPUT CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Vertical Acceleration Sensor Connector.
 E93119	3 Measure the resistance between the following affected vertical acceleration sensor connector pins, harness side and the adaptive damping module C4CD01-B pin 13, circuit LCD02K (YE/GN): • (Left front) C1CD07 pin 3, circuit LCD02F (YE/GN). • (Right front) C1CD08 pin 3, circuit LCD02E (YE/GN). • (Left rear) C4CD09 pin 3, circuit LCD02J (YE/GN).
	Is the resistance less than 1 ohm? **Yes** GO to I2.

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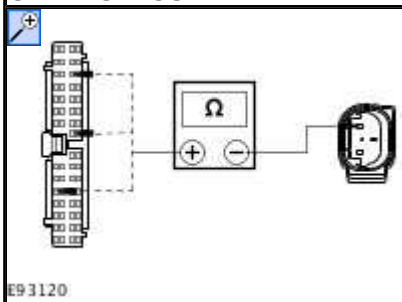
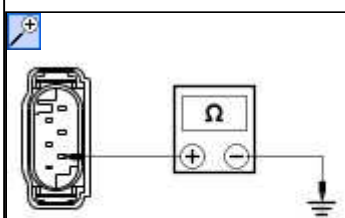
	No REPAIR the circuit. TEST the system for normal operation.
I2: CHECK THE VERTICAL ACCELERATION SENSOR SIGNAL RETURN CIRCUIT FOR OPEN CIRCUIT	
 E93120	1 Measure the resistance between the following affected vertical acceleration sensor connector pins, harness side and the adaptive damping module connector pins, harness side: • (Left front) C1CD07 pin 1, circuit VCD07A (BN/WH) and C4CD01-B pin 10, circuit VCD07B (BN/WH). • (Right front) C1CD08 pin 1, circuit VCD08A (BU/GY) and C4CD01-B pin 22, circuit VCD08B (BU/GY). • (Left rear) C4CD09 pin 1, circuit VCD09B (YE/VT) and C4CD01-B pin 17, circuit VCD09B (YE/VT).
	Is the resistance less than 1 ohm? **Yes** INSTALL new vertical acceleration sensors as required. REFER to: Vehicle Front Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Vehicle Rear Vertical Accelerometer (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST J : SUSPENSION HEIGHT SENSOR CIRCUIT - SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE SUSPENSION HEIGHT SENSOR SIGNAL RETURN CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Suspension Height Sensor Connector.
 E93121	3 Measure the resistance between the following affected suspension height sensor connector pins, harness side and ground: • (Left front) C5CD07 pin 4, circuit VCD10B (BN). • (Right front) C6CD08 pin 4, circuit VCD11B (GY/VT). • (Left rear) C7CD12 pin 4, circuit VCD12B (VT/WH). • (Right rear) C8CD13 pin 4, circuit VCD13B (GN/VT).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL new suspension height sensors as required. REFER to: Front Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal

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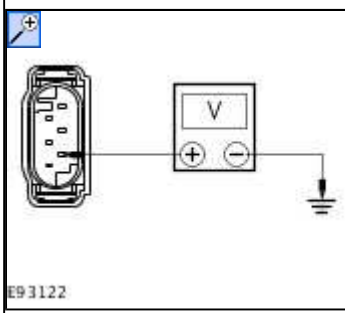
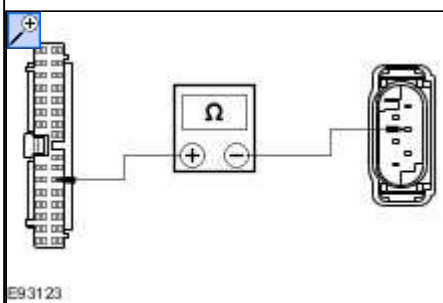
	operation.

PINPOINT TEST K : SUSPENSION HEIGHT SENSOR CIRCUIT - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE SUSPENSION HEIGHT SENSOR SIGNAL RETURN CIRCUIT FOR SHORT TO POWER	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Suspension Height Sensor Connector.
	3 Ignition switch in position II.
 E93122	4 Measure the voltage between the following affected suspension height sensor connector pins, harness side and ground: • (Left front) C5CD07 pin 4, circuit VCD10B (BN). • (Right front) C6CD08 pin 4, circuit VCD11B (GY/VT). • (Left rear) C7CD12 pin 4, circuit VCD12B (VT/WH). • (Right rear) C8CD13 pin 4, circuit VCD13B (GN/VT).
	Is the voltage 0 volts? **Yes** INSTALL new suspension height sensors as required. REFER to: Front Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST L : SUSPENSION HEIGHT SENSOR CIRCUIT - OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE SUSPENSION HEIGHT SENSOR SIGNAL INPUT CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Affected Suspension Height Sensor Connector.
 E93123	3 Measure the resistance between the following affected suspension height sensor connector pins, harness side and the adaptive damping module C4CD01-B pin 25, circuit LCD23E (GN/OG): • (Left front) C5CD07 pin 5, circuit LCD23B (GN/OG). • (Right front) C6CD08 pin 5, circuit LCD02M (YE/GN). • (Left rear) C7CD12 pin 5, circuit LCD23D (GN/OG). • (Right rear) C8CD13 pin 5, circuit LCD02A (YE/GN).
	Is the resistance less than 1 ohm? **Yes** GO to L2. **No** REPAIR the circuit. TEST the system for normal operation.
L2: CHECK THE SUSPENSION HEIGHT SENSOR SIGNAL RETURN CIRCUIT FOR OPEN	

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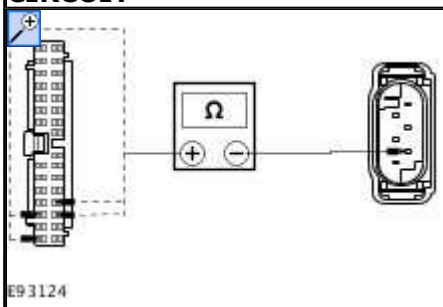
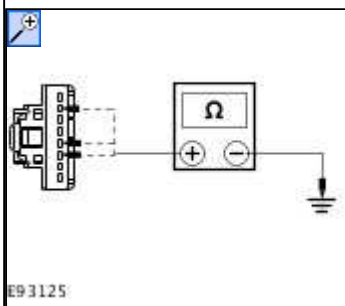
CIRCUIT

	1 Measure the resistance between the following affected suspension height sensor connector pins, harness side and the adaptive damping module connector pins, harness side: • (Left front) C5CD07 pin 4, circuit VCD10B (BN) and C4CD01-B pin 12, circuit VCD10A (BN). • (Right front) C6CD08 pin 4, circuit VCD11B (GY/VT) and C4CD01-B pin 27, circuit VCD11A (GY/VT). • (Left rear) C7CD12 pin 4, circuit VCD12B (VT/WH) and C4CD01-B pin 28, circuit VCD12D (VT/WH). • (Right rear) C8CD13 pin 4, circuit VCD13B (GN/VT) and C4CD01-B pin 14, circuit VCD14A (GN/VT).
	Is the resistance less than 1 ohm? **Yes** INSTALL new suspension height sensors as required. REFER to: Front Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation) / Rear Suspension Height Sensor (204-05 Vehicle Dynamic Suspension, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST M : MODE INDICATOR CIRCUIT - SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE ADAPTIVE DAMPING CONTROL SWITCH TO ADAPTIVE DAMPING MODULE CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Measure the resistance between the following affected adaptive damping control switch connector pins, harness side and ground: • (Comfort) C2CD14 pin 2, circuit CCD18A (BU). • (Normal) C2CD14A pin 6, circuit CCD17A (WH). • (Sport) C2CD14A pin 5, circuit CCD16A (GY/OG).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST N : MODE INDICATOR CIRCUIT - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK THE ADAPTIVE DAMPING CONTROL SWITCH TO ADAPTIVE DAMPING MODULE CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Ignition switch in position II.
	Measure the voltage between the following affected

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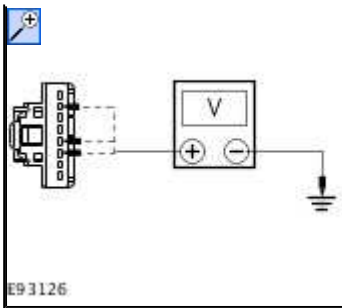
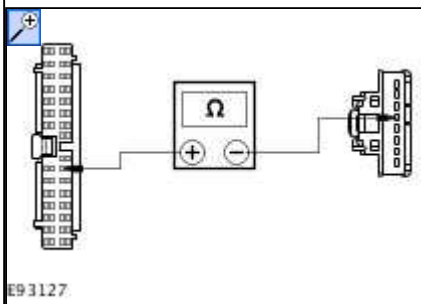
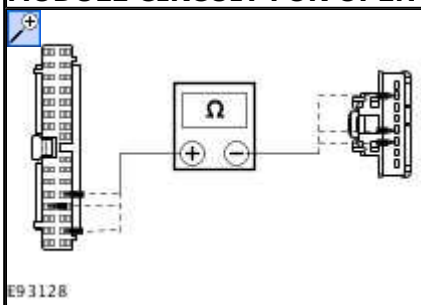
	4 adaptive damping control switch connector pins, harness side and ground: • (Comfort) C2CD14 pin 2, circuit CCD18A (BU). • (Normal) C2CD14A pin 6, circuit CCD17A (WH). • (Sport) C2CD14A pin 5, circuit CCD16A (GY/OG).
	Is the voltage 0 volts? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST O : MODE INDICATOR CIRCUIT - OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK CIRCUITS CCD22A (BN/BU) AND CCD22B (BN/BU) FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Measure the resistance between the adaptive damping module C4CD01-B pin 24, circuit CCD22B (BN/BU), harness side and the adaptive damping control switch C2CD14 pin 4, circuit CCD22A (BN/BU), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to O2. **No** REPAIR the circuit. TEST the system for normal operation.
O2: CHECK THE ADAPTIVE DAMPING CONTROL SWITCH TO ADAPTIVE DAMPING MODULE CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the following affected adaptive damping control switch connector pins, harness side and the adaptive damping module connector pins, harness side: • (Comfort) C2CD14 pin 2, circuit CCD18A (BU) and C4CD01-B pin 26, circuit CCD18B (BU). • (Normal) C2CD14A pin 6, circuit CCD17A (WH) and C4CD01-B pin 11, circuit CCD17B (WH). • (Sport) C2CD14A pin 5, circuit CCD16A (GY/OG) and C4CD01-B pin 29, circuit CCD16B (GY/OG).
	Is the resistance less than 1 ohm? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

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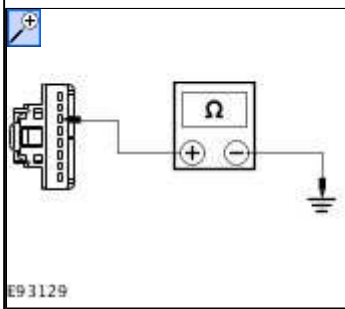
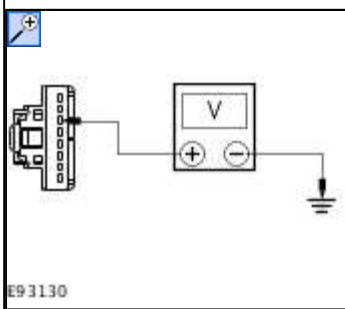
PINPOINT TEST P : SWITCH ILLUMINATION CIRCUIT - SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
P1: CHECK CIRCUITS CCD15A (WH/OG) AND CCD15B (WH/OG) FOR SHORT TO GROUND	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Measure the resistance between the adaptive damping control switch C2CD14 pin 3, circuit CCD15A (WH/OG), harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST Q : SWITCH ILLUMINATION CIRCUIT - SHORT TO POWER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1: CHECK CIRCUITS CCD15A (WH/OG) AND CCD15B (WH/OG) FOR SHORT TO POWER	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Ignition switch in position II.
	4 Measure the voltage between the adaptive damping control switch C2CD14 pin 3, circuit CCD15A (WH/OG), harness side and ground.
	Is the voltage 0 volts? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST R : SWITCH ILLUMINATION CIRCUIT - OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
R1: CHECK CIRCUITS CCD15A (WH/OG) AND CCD15B (WH/OG) FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Measure the resistance between the adaptive damping control switch C2CD14 pin 3, circuit CCD15A (WH/OG), harness side and the adaptive damping module C4CD01-B pin 3, circuit CCD15B (WH/OG), harness

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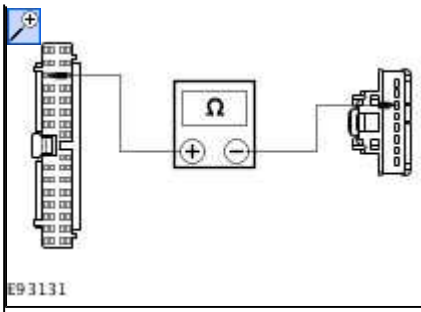
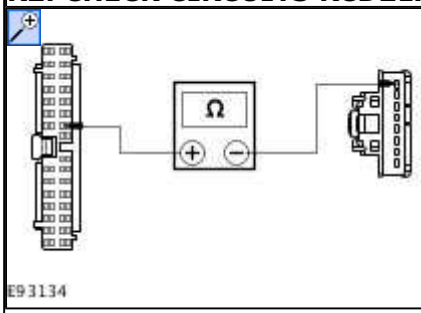
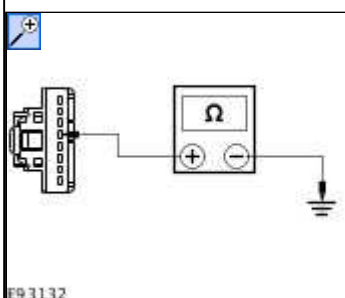
 E93131	side.
	Is the resistance less than 1 ohm? **Yes** GO to R2. **No** REPAIR the circuit. TEST the system for normal operation.
R2: CHECK CIRCUITS RCD21A (VT/OG) AND RCD21B (VT/OG) FOR OPEN CIRCUIT	
 E93134	1 Measure the resistance between the adaptive damping control switch C2CD14 pin 1, circuit RCD21A (VT/OG), harness side and the adaptive damping module C4CD01-B pin 21, circuit RDC21B (VT/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST S : SWITCH CIRCUIT - SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK CIRCUITS CCD22A (BN/BU) AND CCD22B (BN/BU) FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
 E93132	3 Measure the resistance between the adaptive damping control switch C2CD14 pin 4, circuit CCD22A (BN/BU), harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST T : SWITCH CIRCUIT - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

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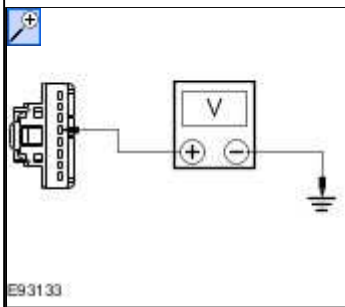
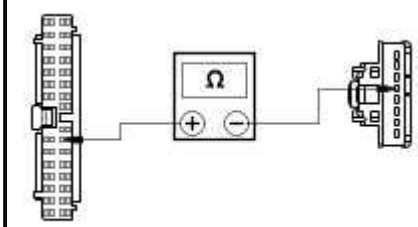
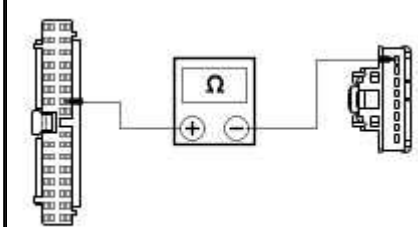
T1: CHECK CIRCUITS CCD22A (BN/BU) AND CCD22B (BN/BU) FOR SHORT TO POWER	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
	3 Ignition switch in position II.
 E93133	4 Measure the voltage between the adaptive damping control switch C2CD14 pin 4, circuit CCD22A (BN/BU), harness side and ground.
	Is the voltage 0 volts? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST U : SWITCH CIRCUIT - OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK CIRCUITS CCD22A (BN/BU) AND CCD22B (BN/BU) FOR OPEN CIRCUIT	
	1 Disconnect Adaptive Damping Module C4CD01-B.
	2 Disconnect Adaptive Damping Control Switch C2CD14.
 E93127	3 Measure the resistance between the adaptive damping control switch C2CD14 pin 4, circuit CCD22A (BN/BU), harness side and the adaptive damping module C4CD01-B pin 24, circuit CCD22B (BN/BU), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to U2. **No** REPAIR the circuit. TEST the system for normal operation.
U2: CHECK CIRCUITS RCD21A (VT/OG) AND RCD21B (VT/OG) FOR OPEN CIRCUIT	
 E93134	1 Measure the resistance between the adaptive damping control switch C2CD14 pin 1, circuit RCD21A (VT/OG), harness side and the adaptive damping module C4CD01-B pin 21, circuit RDC21B (VT/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new adaptive damping control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal

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	operation.

Component Tests

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

Ball Joint Inspection

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

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

3. **3.** If a new lower arm is installed it will be necessary to check and adjust the front wheel alignment.
   REFER to: Specifications (204-00 Suspension System - General Information, Specifications).

Strut or Shock Absorber Inspection

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

Weepage:

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

Leakage:

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

- requires new struts or shock absorbers to be installed.

Strut or Shock Absorber Testing

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

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

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

3. **3.** Compress and release the piston rods. The piston rods should extend equally.

4. **4.** Compress and pull the piston rod in the vertical position. Feel if the resistance force at the point of direction change-over is perceptible without a lag. If a lag is perceptible it is an indication of shock absorber valve damage and new struts or

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shock absorbers must be installed. REFER to:

Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation),
Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).

Load-Levelling Shock Absorber

1. **1.** With the vehicle unladen, measure and note the dimensions between the base of the wheel rim and the top of the rear fender on both sides.
   - The measurements on both sides should be approximately equal.
2. **2.** With a load of 4 average size adults and a 100 kg weight, measure and note the dimensions between the base of the wheel rim and the top of the rear fender on both sides.
3. NOTE: Due to the internal ratchet mechanism of the suspension components, the height of the rear of the vehicle should rise during the road test.
   3. With a load of 4 average size adults and a 100 kg weight, drive the vehicle for 3 km on a road of normal condition.
4. **4.** With a load of 4 average size adults and a 100 kg weight, measure and note the dimensions between the base of the wheel rim and the top of the rear fender on both sides.
5. **5.** If the dimensions on both sides are no longer approximately equal, install new load levelling shock absorbers.
   REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
6. NOTE: Due to the internal ratchet mechanism of the suspension components, the height of the rear of the vehicle should rise during the road test.
   6. If the dimensions are approximately equal, unload the vehicle and drive the vehicle for 3 km on a road of normal condition.
7. **7.** With the vehicle unladen, measure and note the dimensions between the base of the wheel rim and the top of the rear fender on both sides. Check the final dimensions with the original dimensions taken in the unladen condition.
8. **8.** If the final dimensions do not approximately equal the original dimensions, install new load levelling shock absorbers.
   REFER to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
9. **9.** If the final dimensions approximately equal the original dimensions, verify the customer concern.

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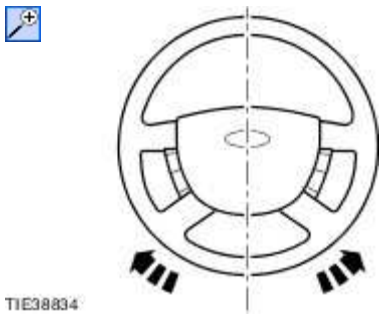
General Procedures

General Equipment

Wheel alignment system

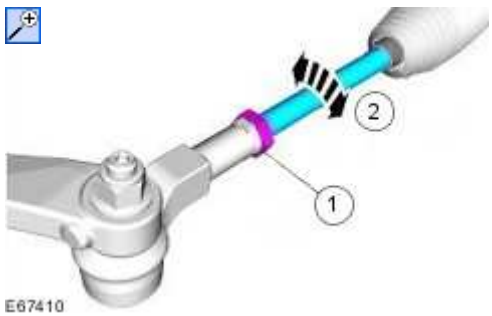
NOTE: Make sure that the vehicle is standing on a level surface.



1. CAUTION: Make sure that the steering wheel lock is engaged.

2. Check the toe setting on both sides.

   General Equipment: Wheel alignment system



3.
   1. Loosen on both sides.
   2. NOTE: Make sure that the boot is correctly located.
      Rotate the tie-rods an equal amount in either a clockwise or a counterclockwise direction to adjust the toe setting on both sides.
      - *Torque:* 90 Nm

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General Procedures

General Equipment

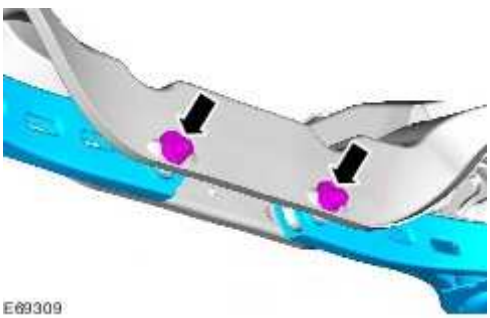
Wheel alignment system

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

1. Check the toe setting.

   Refer to: Specifications (204-00 Suspension System - General Information, Specifications). *General Equipment:* Wheel alignment system
2. Raise and support the vehicle.

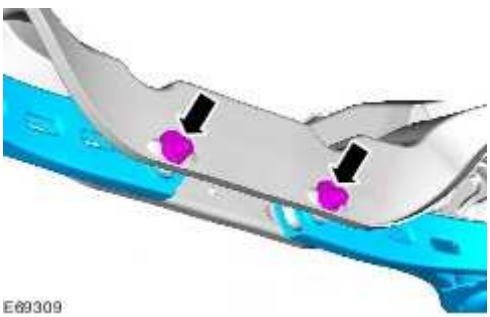
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



3.
   1. Loosen the rear lower arm adjustment cam nut on both sides.
   2. *Torque:* 8 Nm

4. Lower the vehicle.
5. Bounce the vehicle to make sure that the suspension is in its normal resting position.

6. Adjust the toe setting.



7. NOTE: Only tighten the nuts and bolts when the suspension is in the normal drive position.
   Torque: 103 Nm

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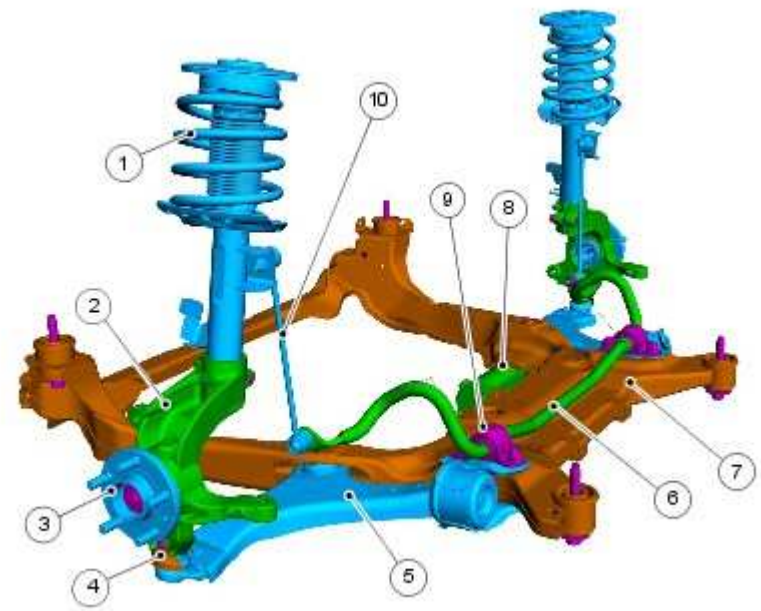
Description and Operation

Vehicles with standard suspension



E91964

Item	Part Number	Description
1	-	Shock absorber and spring assembly
2	-	Wheel knuckle
3	-	Wheel hub
4	-	Heat shield
5	-	Lower arm
6	-	Stabilizer bar
7	-	Front subframe
8	-	Vibration damper (if equipped)
9	-	Stabilizer bar clamp and bushing assembly
10	-	Stabilizer bar link

Item 9 : Stabilizer Bar Clamp

The stabilizer bar clamp retaining bolts are dual purpose. They also act as the lower arm rear retaining bolts.

Vehicles with dynamic suspension

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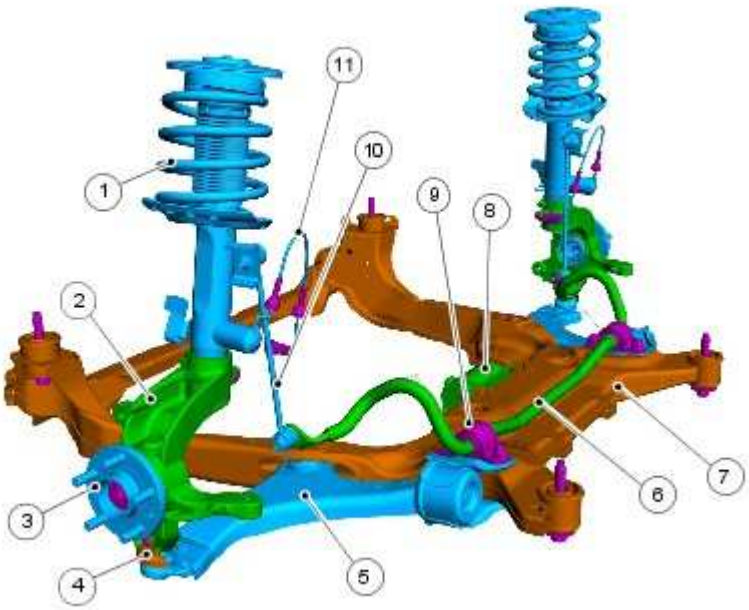

Item	Part Number	Description
1	-	Shock absorber and spring assembly
2	-	Wheel knuckle
3	-	Wheel hub
4	-	Heat shield
5	-	Lower arm
6	-	Stabilizer bar
7	-	Front subframe
8	-	Vibration damper (if equipped)
9	-	Stabilizer bar clamp and bushing assembly
10	-	Stabilizer bar link
11	-	Shock absorber wiring harness

Item 1 : Shock absorber and spring assembly

Continuous damping control shock absorbers provide dynamic front suspension. A continuous damping control shock absorber creates a damping force which depends on the velocity of the vehicle and an electrical current applied to the continuous damping control shock absorber. The electronic stability program (ESP) sensors, acceleration sensors and displacement sensors provide information to the dynamic suspension electronic control unit (ECU), which detects the state of heave, roll, pitch, cornering and acceleration of the vehicle. The ECU then calculates the best damping characteristics for each wheel within 2 ms. The ECU sends an individual electrical current to each shock absorber to control the amount of damping required.

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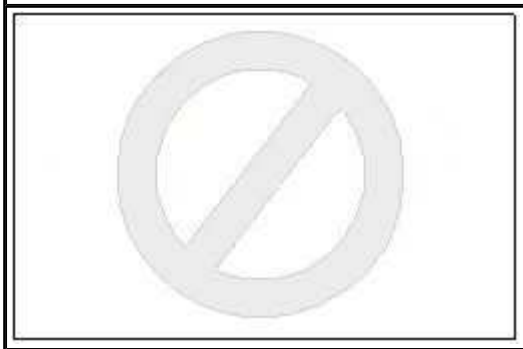
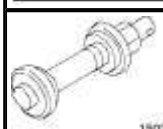
Removal and Installation

Special Tool(s)

E42977	204-348 Remover/Installer, Wheel Hub/Wheel Bearing
	204-348/3 Remover/Installer, Wheel Hub/Wheel Bearing
	204-348-01 Adapter for 204-348
 15035	205-074 Installer, Differential Bearing Cone
15108	205-332 Protector, Axle Shaft

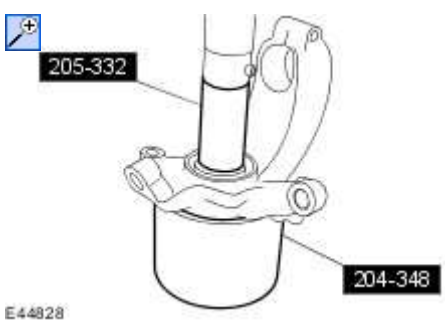
Removal

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

1. Remove the wheel knuckle.

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

2. *Special Tool(s):* 204-348, 205-332



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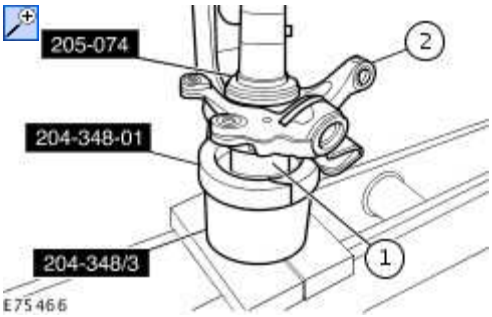
Installation



1. CAUTION: The smaller diameter of the tool 205-074 must be upermost. Check the installation of the wheel bearing. Wheel bearing must be fully home.
    1. Wheel bearing.

       Special Tool(s): 204-348, 204-348-01, 205-074, 204-348/3
    2. Wheel knuckle.
2. To install, reverse the removal procedure.

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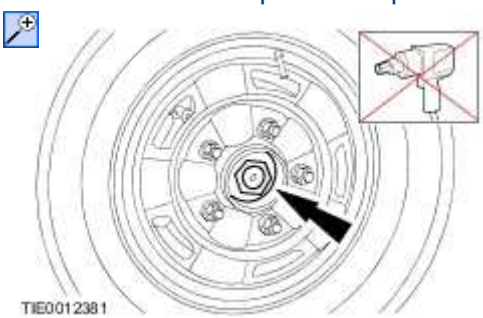
Removal and Installation

Special Tool(s)

	204-159 Lever, Wheel Knuckle
	204-605 Separator, Lower Arm Ball Joint
	204-607 Remover, Ball joint
	204-609 Protection Cap, Ball Joint Gaiter

Removal

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

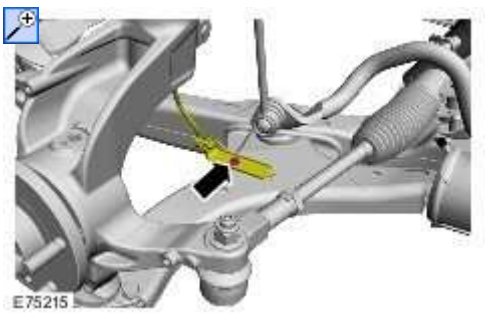


1. Loosen the wheel hub bolt.

2. Remove the wheel and tire.

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

Vehicles with high intensity discharge headlamps



3.

Vehicles with dynamic suspension

4.

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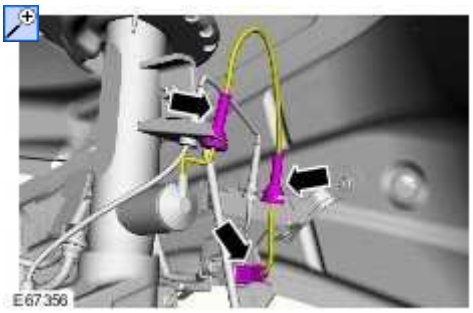
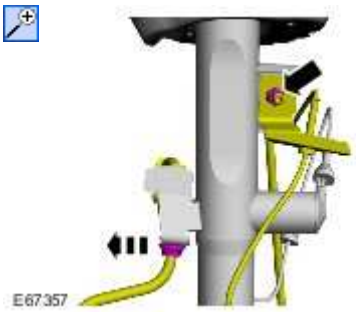
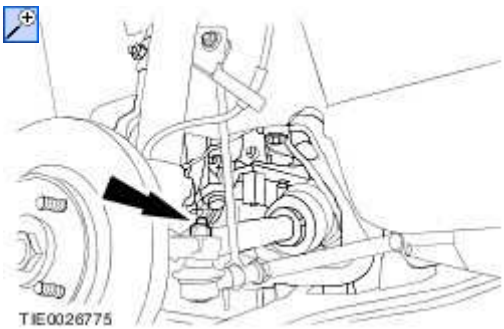


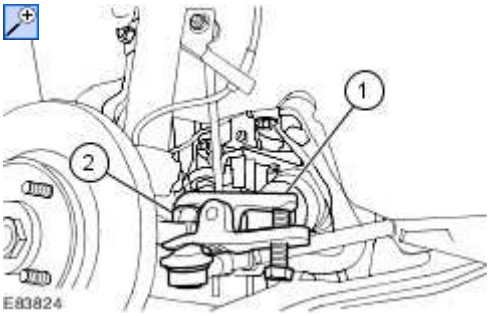
All vehicles



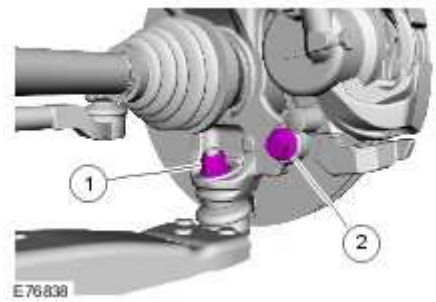
5. *Torque:* 60 Nm



6. CAUTION: Make sure that the ball joint ball does not rotate.
   Loosen the tie-rod end nut.



7. WARNING: Make sure that a new nut is installed.
   CAUTIONS:
   Use suitable packing material to prevent damage to the component.
   Make sure that the ball joint ball does not rotate.
   2. *Torque:* 80 Nm



8. WARNING: Make sure that no load is placed on the brake hose.
   1. Loosen the nut two turns.

      Torque: 100 Nm
   2. *Torque:* 200 Nm

9. *Special Tool(s):* 204-607

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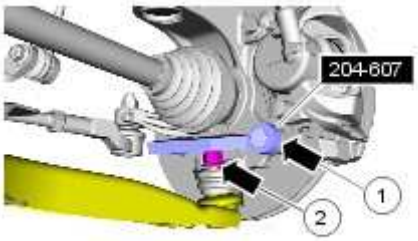
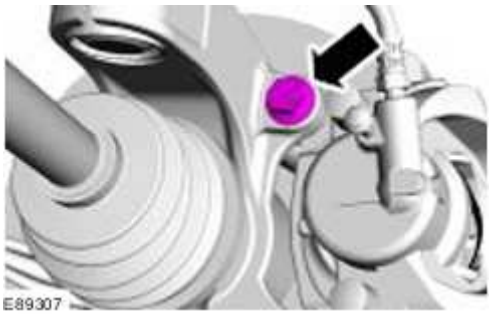
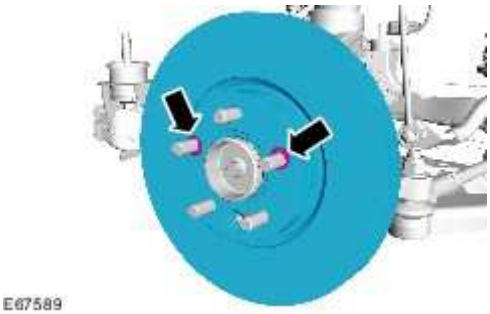


E75216



E89307

10. *Torque:* 200 Nm

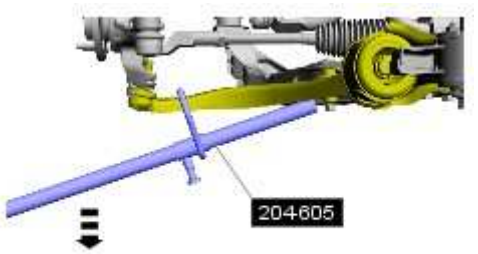


E67589

11.

E67359

12. *Torque:* 10 Nm



E81907

13. *Special Tool(s):* 204-605

14. *Special Tool(s):* 204-609

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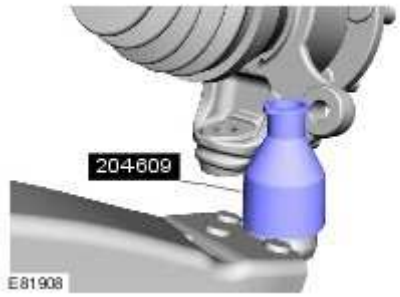
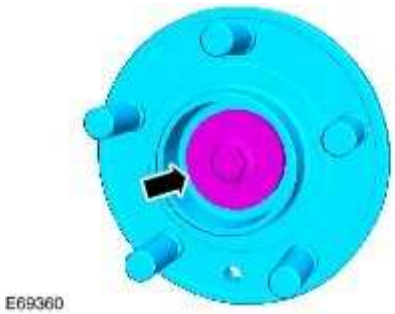
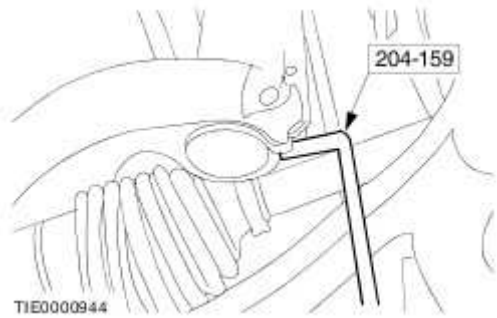




15. CAUTION: If the outer constant velocity (CV) joint boot is damaged a new halfshaft must be installed.
Torque:
Stage 1: 45 Nm
Stage 2: 80°

16. *Torque:* 110 Nm



17. *Special Tool(s):* 204-159

Installation

1. To install, reverse the removal procedure.

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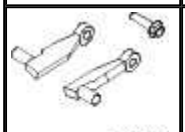
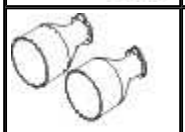
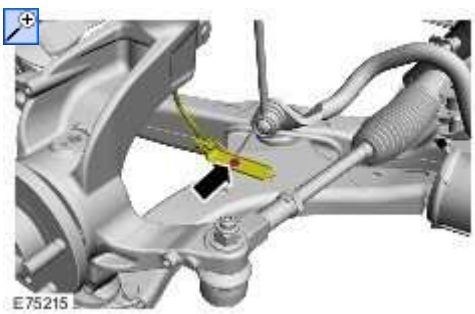
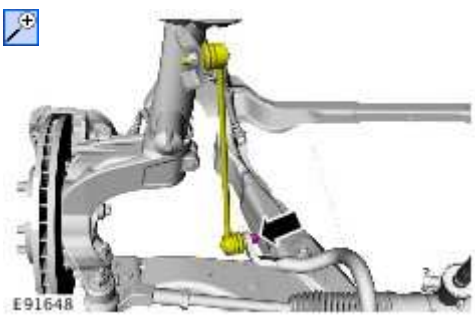
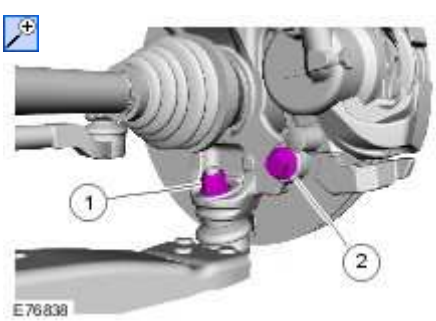
Removal and Installation

Special Tool(s)

E63772	204-605 Separator, Lower Arm Ball Joint
 E63420	204-607 Remover, Ball joint
 E75372	204-609 Protection Cap, Ball Joint Gaiter

Removal

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

1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2.  E75215
3.  E91648
   CAUTION: Make sure that the ball joint ball does not rotate.
   Torque: 70 Nm
4.  E76838
   1. *Loosen:* 2 turn(s)
   2. WARNING: Make sure that no load is placed on the brake hose.
      Torque: 200 Nm
5. 1. *Special Tool(s):* 204-607
   2. *Torque:* 100 Nm

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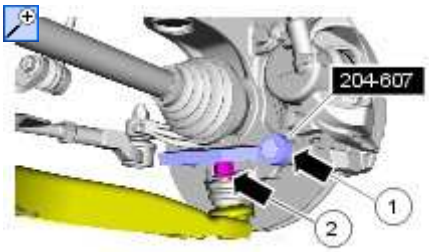
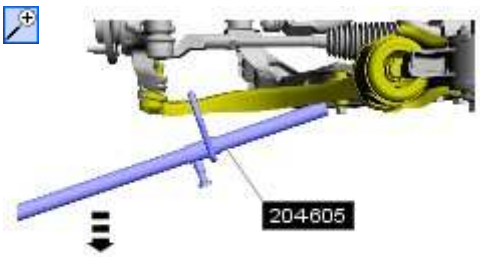
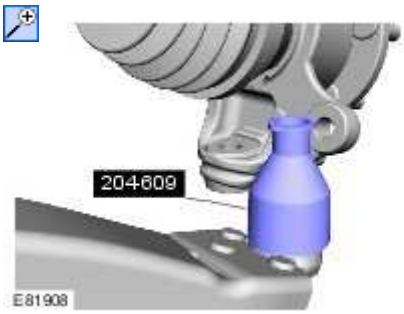


E75216



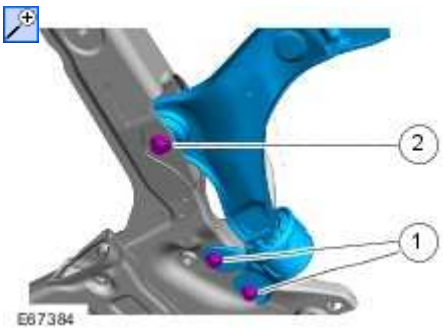
E81907

6. *Special Tool(s):* 204-605



E81908

7. *Special Tool(s):* 204-609



E67384

8. CAUTION: Make sure that new bolts are installed.
   1. *Torque:*
      Stage 1: 140 Nm
      Stage 2: 45°
   2. *Torque:*
      Stage 1: 80 Nm
      Stage 2: 120°

Installation

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

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Removal and Installation

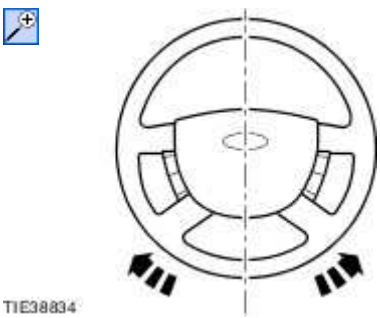
Special Tool(s)

	205-316A Alignment Pins, Subframe
	307-242 Remover, Transmission Fluid Cooler
	308-440 Disconnect Tool, Hydraulic Line

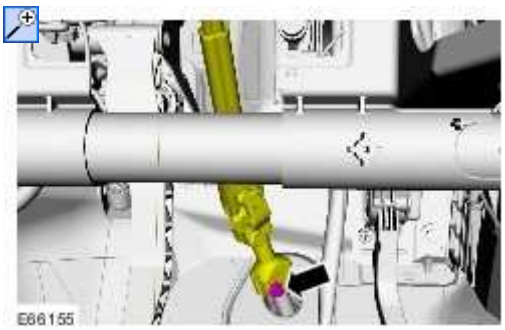
General Equipment

Hydraulic press
Transmission jack

Removal


TIE38834

1. CAUTION: Make sure that the steering wheel lock is engaged.
   NOTE: Make sure that the road wheels are in the straight ahead position.


E66155

2.

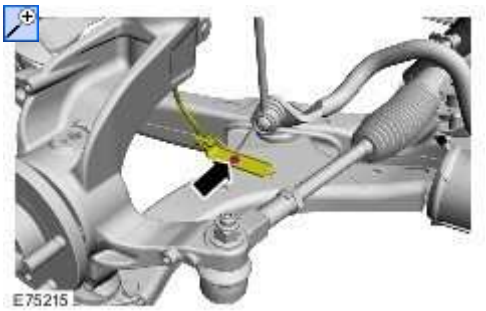
3. Remove the wheel and tire on both sides.

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

Vehicles with high intensity discharge headlamps

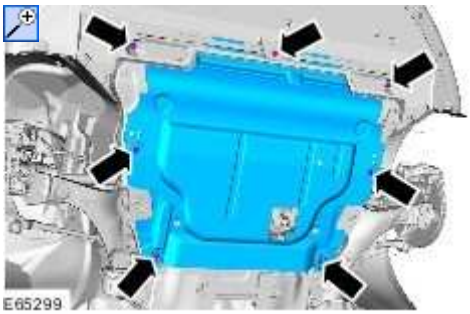
4.

http://vnx.su



All vehicles

5.



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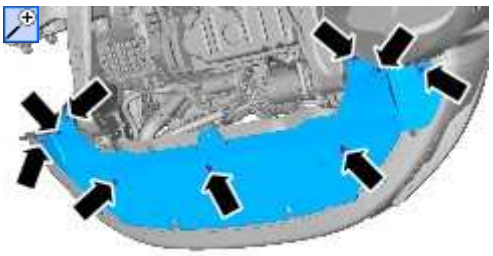
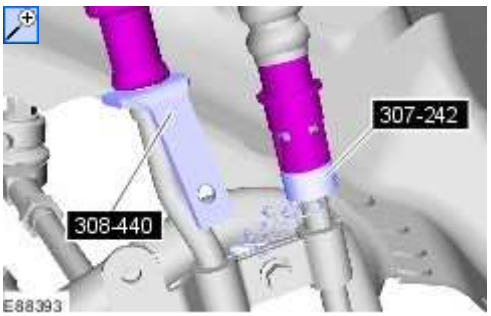
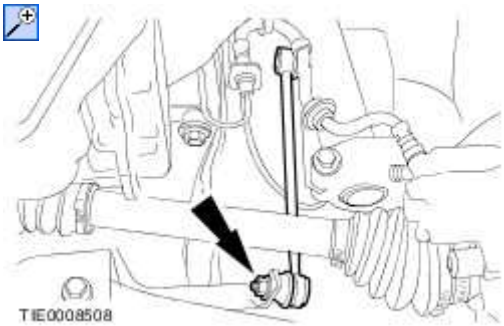




7. WARNING: Be prepared to collect escaping fluids.

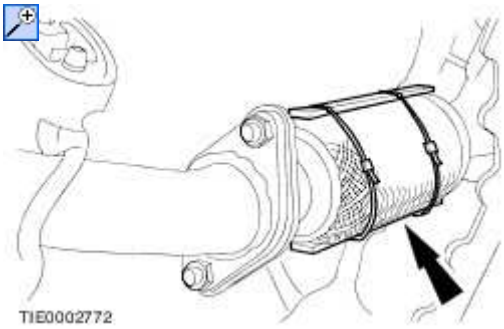
CAUTION: Make sure that all openings are sealed.
Special Tool(s): 307-242, 308-440



8. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

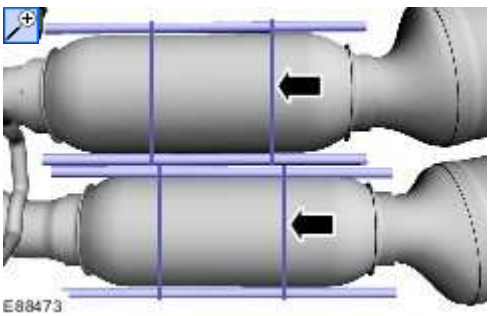
9. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

http://vnx.su



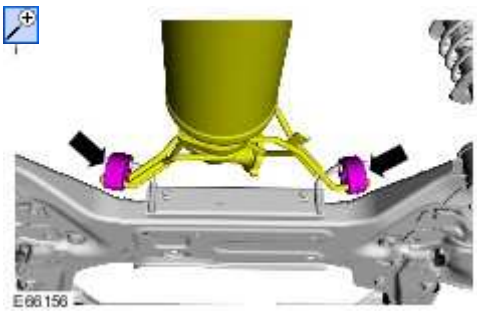
Vehicles with 1.6L engine

10.



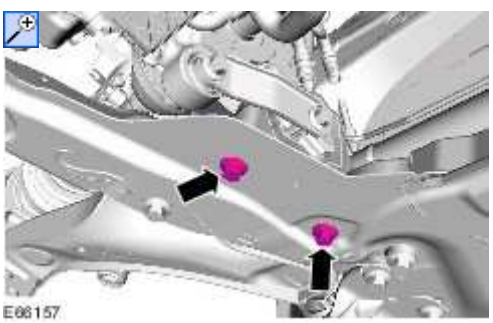
All vehicles

11.



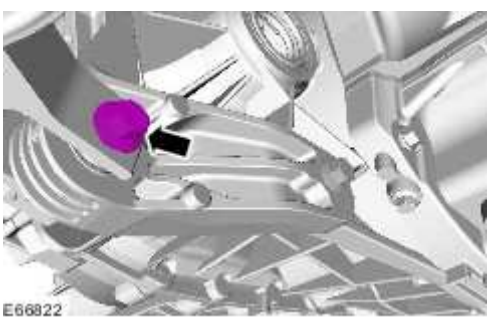
Vehicles with 2.5L engine

12.



Vehicles with 2.0L or diesel engine

13.



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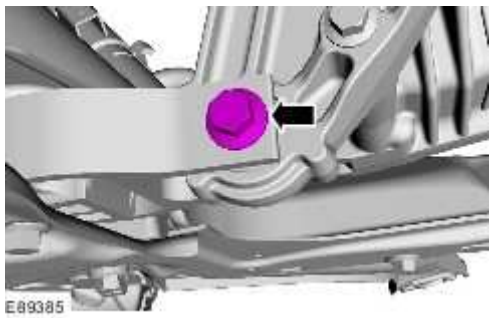
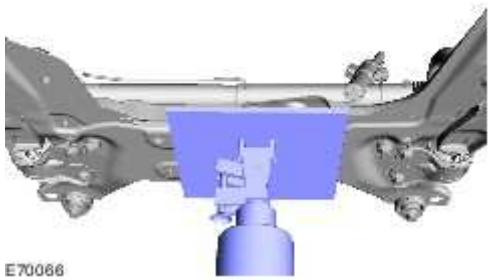
Vehicles with 1.6L engine

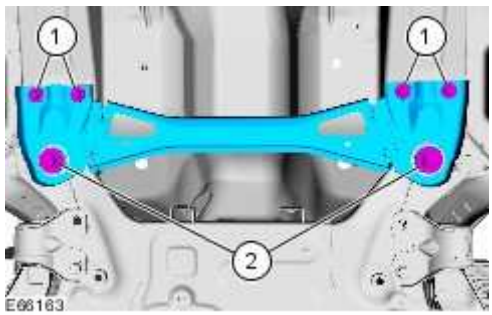

E89385

14.

All vehicles

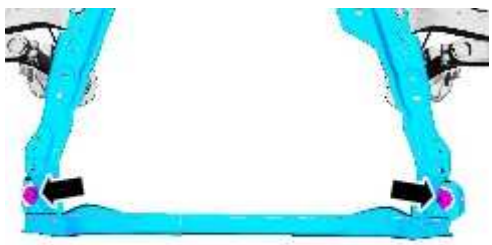
15. *General Equipment:* Transmission jack


E70066

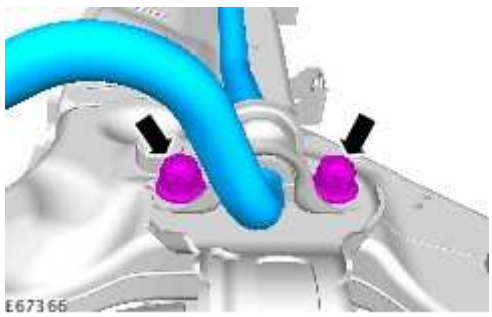


E68163

16.


E68164

17. WARNING: This step requires the aid of another technician.
Lower the front subframe to gain access to the stabilizer bar bolts.


E67365

18. Remove the stabilizer bar nuts on both sides. Do not remove the stabilizer bar bolts at this stage.

19. NOTE: Note the position of each component before removal.

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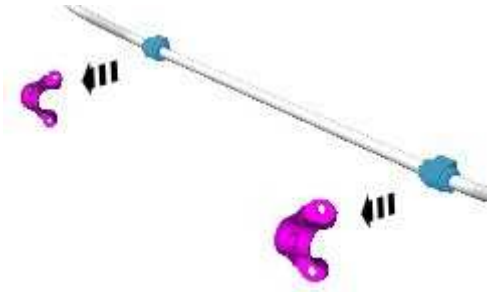
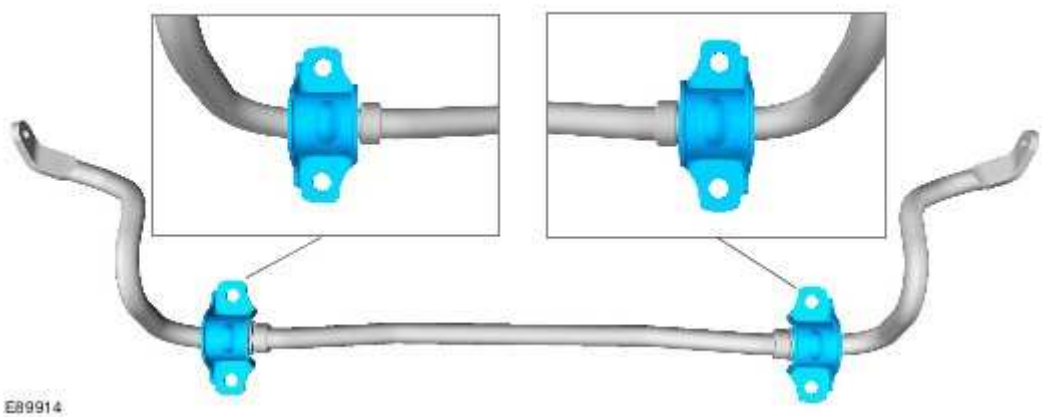

E68087

Installation

All vehicles

E67369

1. Install the stabilizer bar bushings with no lubricant. Make sure the bushing nipple is on the right-hand side.

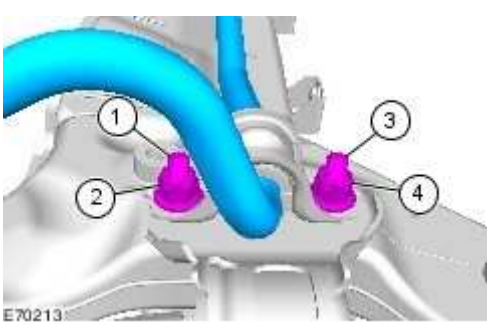

E89914

2. NOTE: Make sure that the clamp is installed to the same orientation as when removed.
On both sides.

E69763

3. NOTE: Apply water to the stabilizer bar clamp to assist installation.
On both sides.

General Equipment: Hydraulic press



E70213

4. Install new nuts and bolts, on both sides.

Torque:
Stage 1: 140 Nm
Stage 2: 45°

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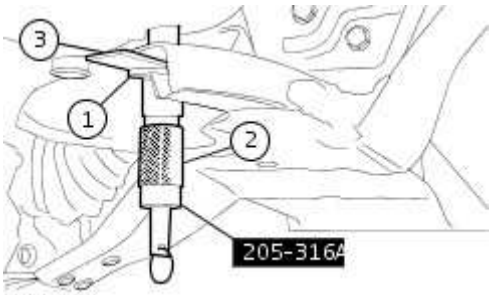
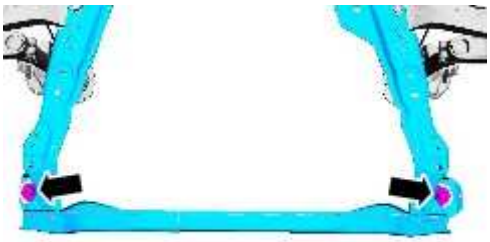


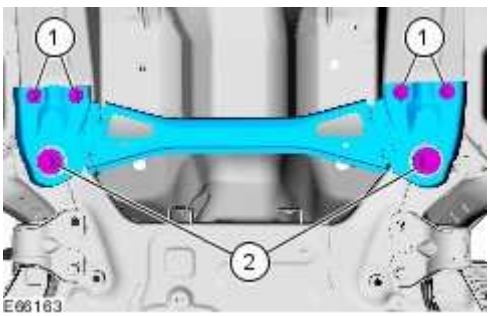
E002 1863

5.
1. Insert the washer, with inside diameter 22 mn outside diameter 44 mm and height 5 mm, int the front subframe above the alignment hole.
2. Insert the alignment pin through the front subframe alignment holes and the washer.

Special Tool(s): 205-316A
3. Slide the locking plates on top of the washer a into the groove of the special tool and tighten the alignment pin sleeve.


E68164

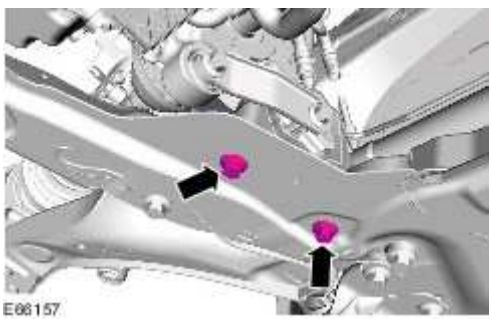
6. *Torque:*
Stage 1: 150 Nm
Stage 2: 90°



E68163

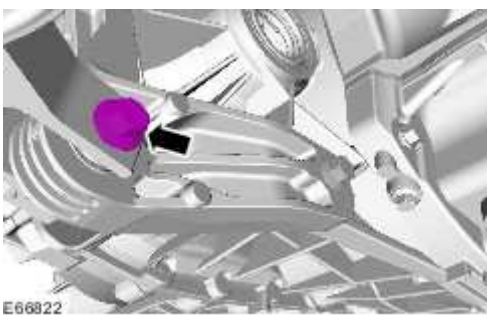
7.
1. *Torque:* 30 Nm
2. *Torque:*
Stage 1: 150 Nm
Stage 2: 90°

Vehicles with 2.5L engine


E68157

8. *Torque:* 110 Nm

Vehicles with 2.0L or diesel engine


E66822

9. *Torque:* 80 Nm

Vehicles with 1.6L engine

10. *Torque:* 80 Nm

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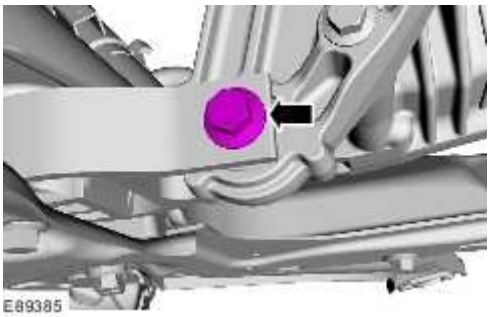
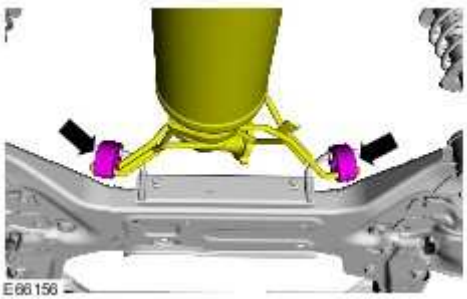


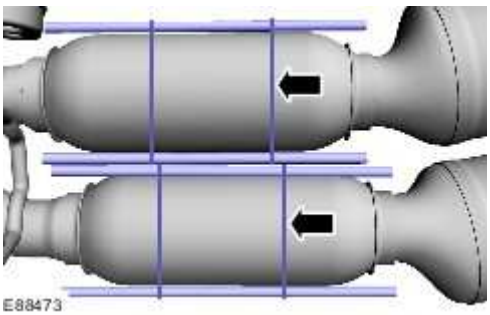
All vehicles

11.

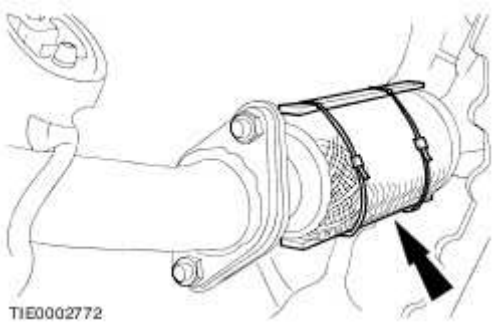


Vehicles with 1.6L engine

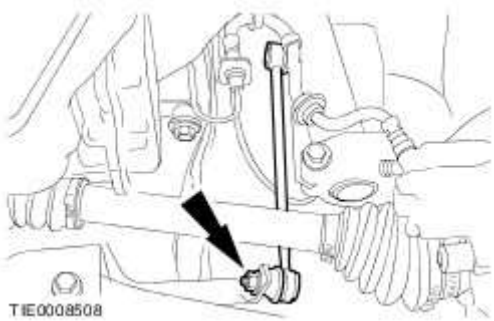
12.



All vehicles



13. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



14. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

Torque: 70 Nm

15. *Special Tool(s):* 307-242, 308-440

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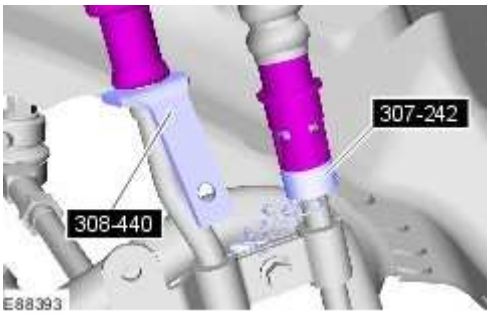
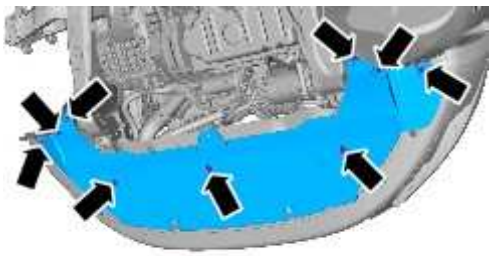
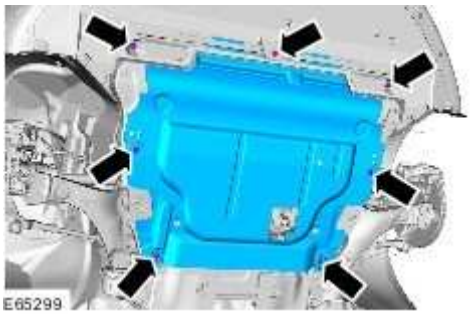


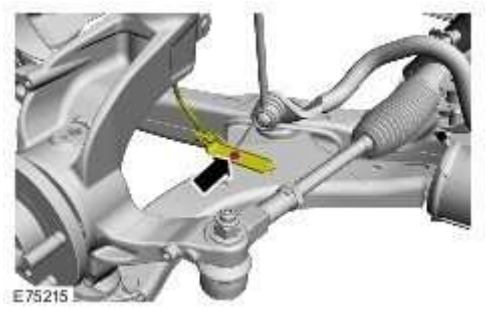

E68962

16.


E65299

17.

Vehicles with high intensity discharge headlamps


E75215

18. *Torque:* 8 Nm

All vehicles

19. Install the wheel and tire on both sides.

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

20. WARNING: Make sure a new steering column flexible coupling bolt is installed.
    Torque: 30 Nm

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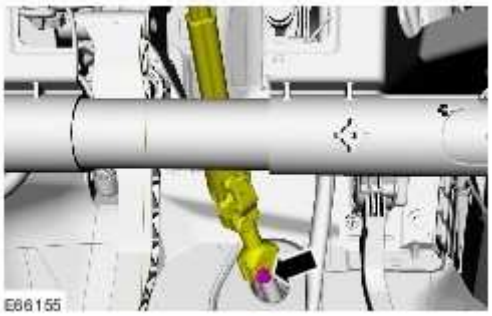

21. Fill the power steering system.

    Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

22. Bleed the power steering system.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

23. Check the toe setting and adjust as necessary on bo sides.

    Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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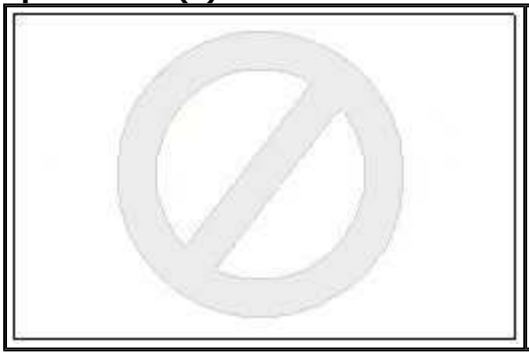
Removal and Installation

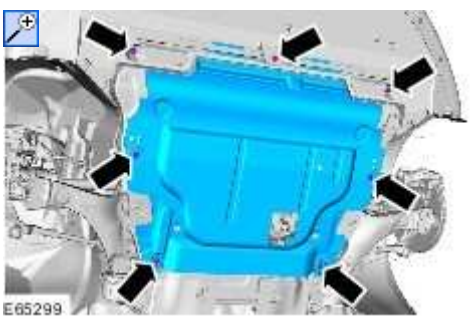
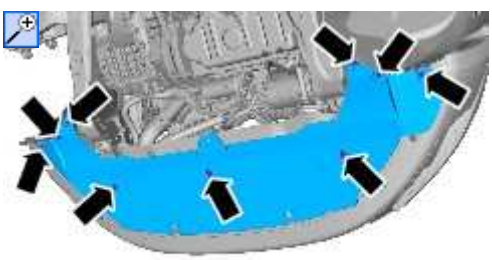
Special Tool(s)

	205-316A Alignment Pins, Subframe

General Equipment

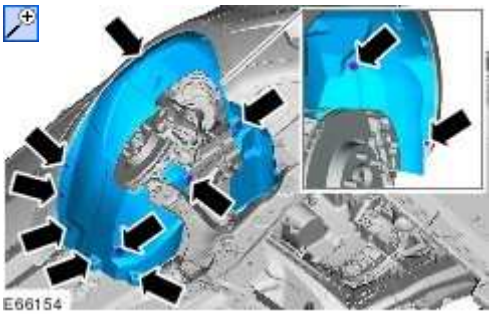
Hydraulic press
Transmission jack

Removal

1. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).
2. 
E65299
3. 
E68962
4. If equipped.

E97506
5.

http://vnx.su



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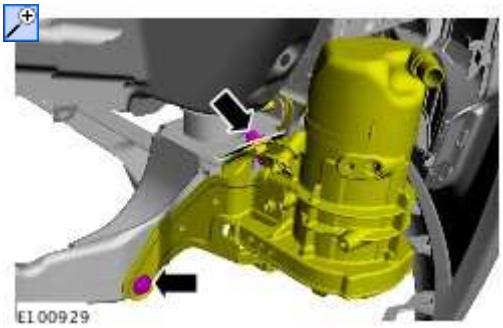

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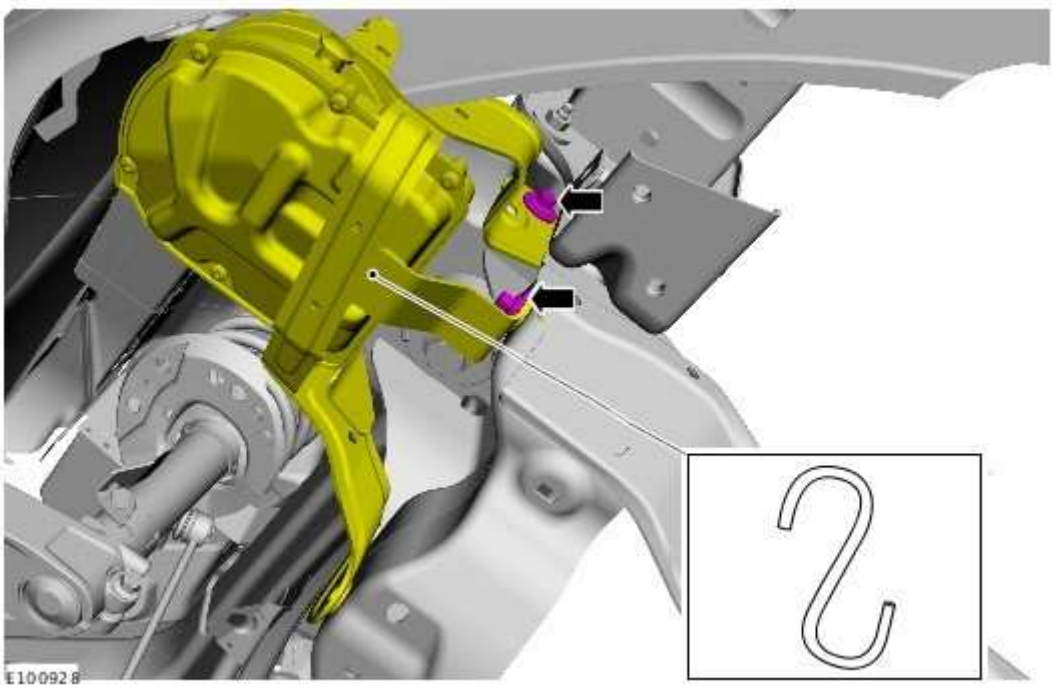

8.

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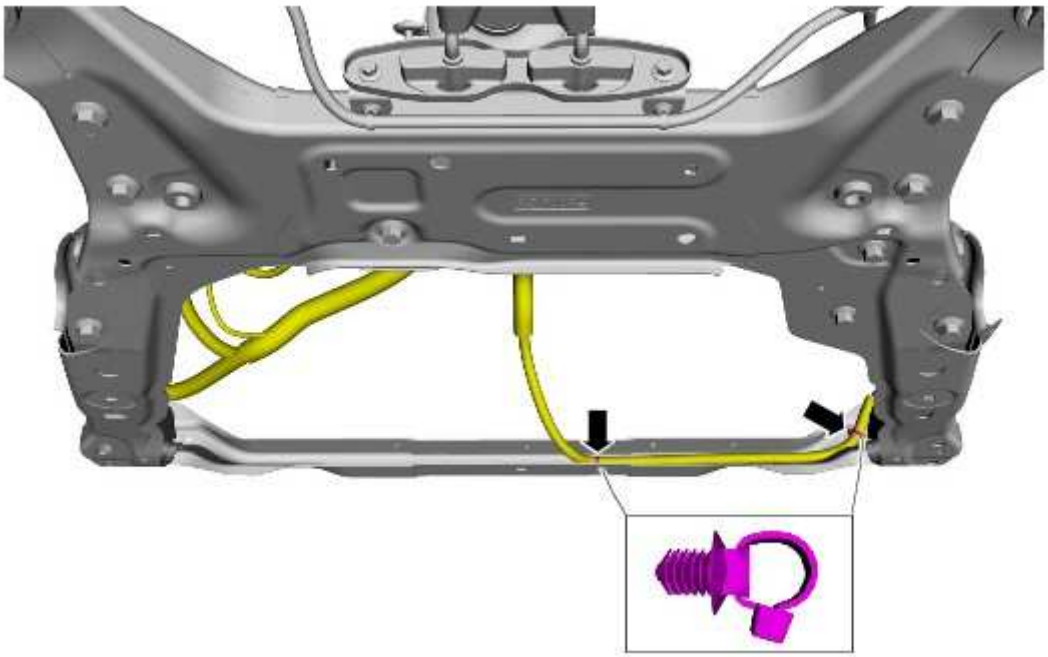
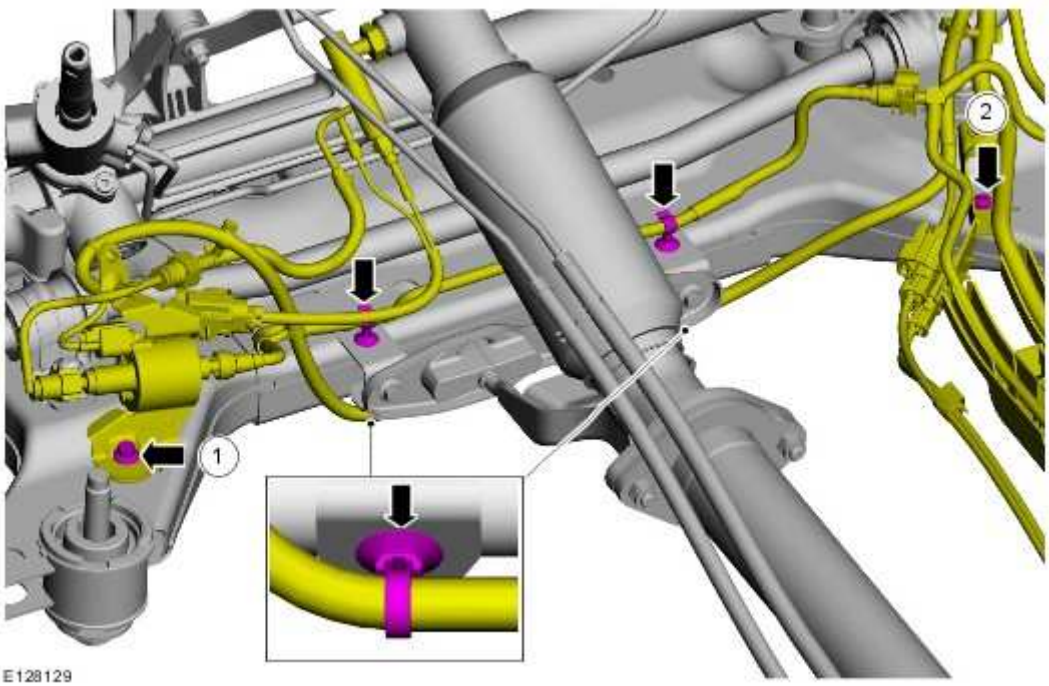
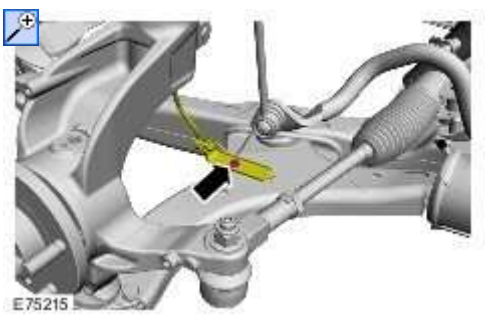


E128177

9.



E128129



E75215

10. If equipped. On both sides.

11. CAUTION: Make sure that the ball joint ball do not rotate.
On both sides.

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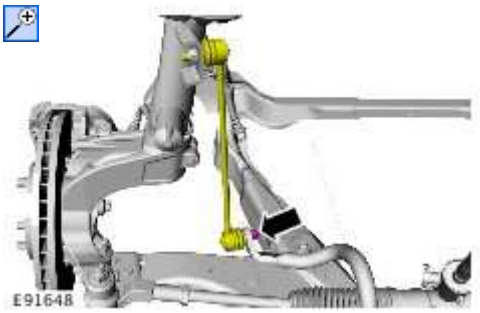
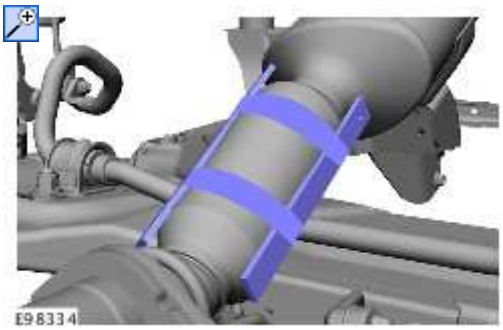
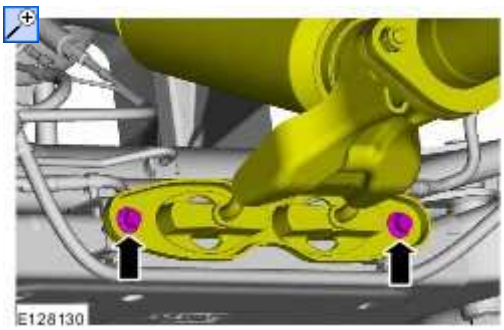


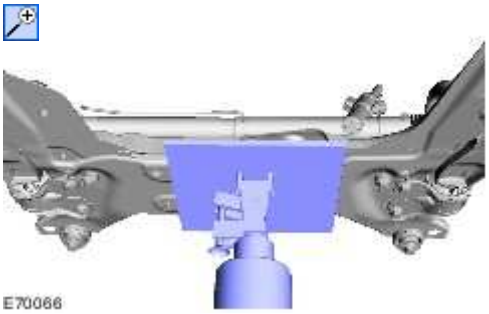


12. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



13.

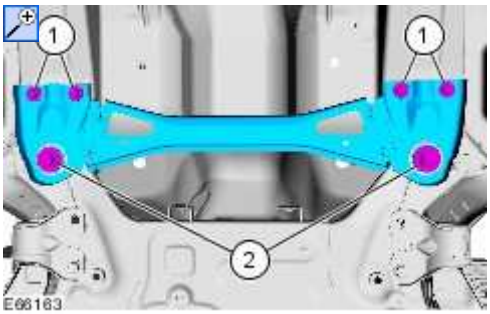
14.



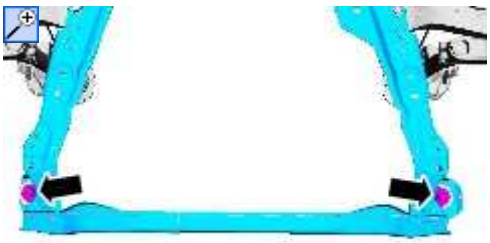
15. *General Equipment:* Transmission jack

16.

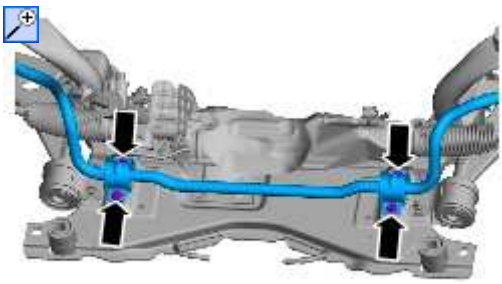
http://vnx.su



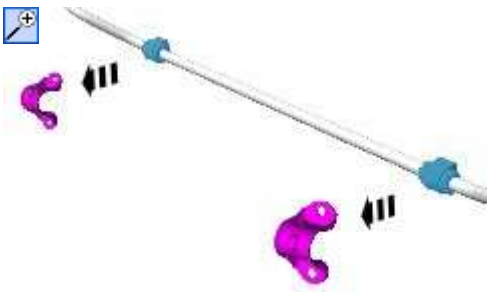
E68163


E68164

17. WARNING: This step requires the aid of anoth technician.
Lower the front subframe to gain access to the stabi bar bolts.


E99063

18.


E68087

19. NOTE: Note the position of each component before removal.

Installation

E67369

1. NOTE: Make sure that the component is installed t the position noted before removal.
On both sides.

2. NOTE: Ma sure that clamp is installed t the same

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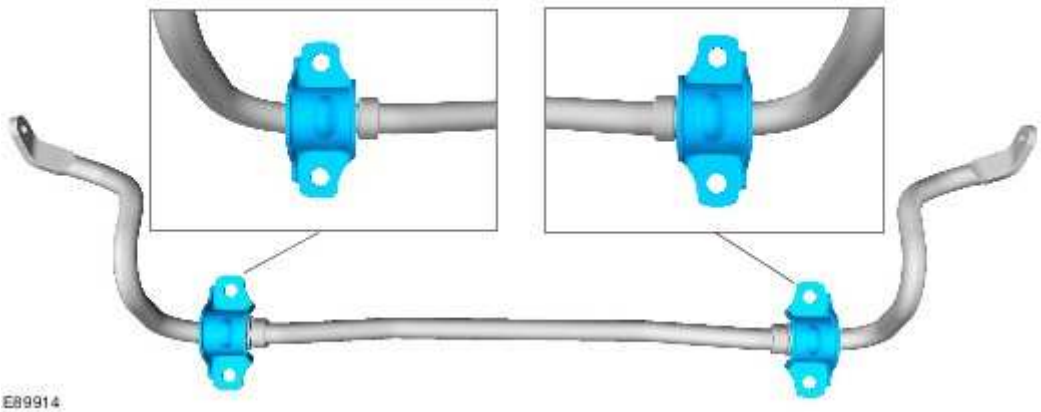
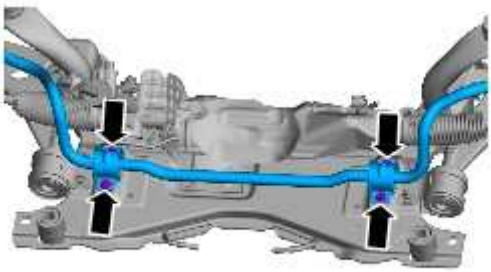
orientatio
as when
removed.
NOTE: Ap
water to t
stabilizer
clamp to
assist
installatio
General
Equipment
Hydraulic

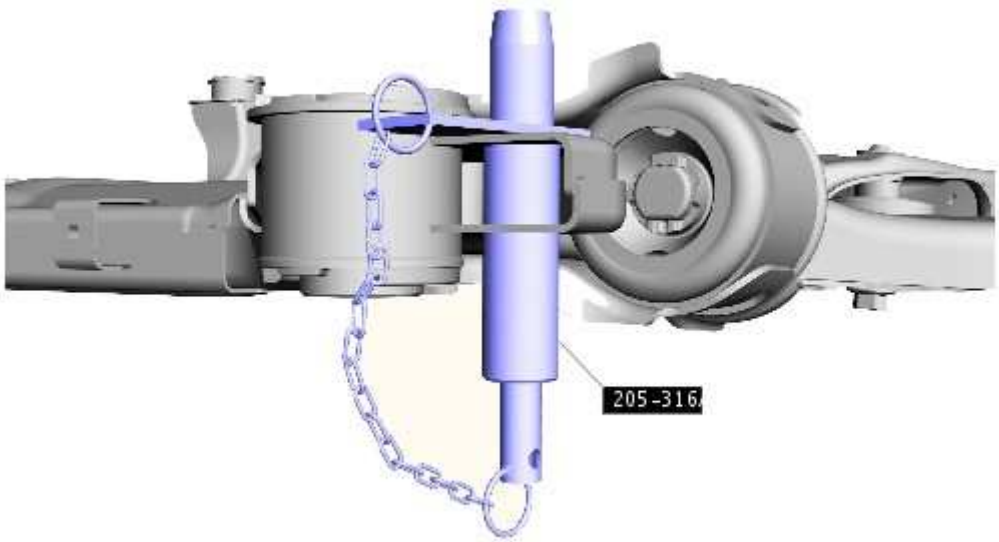

E89914


E99063

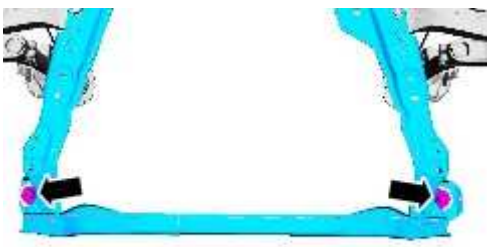
3. *Torque:*
   Stage 1: 140 Nm
   Stage 2: 45°

4. On both side

Special Tool(
205-316A



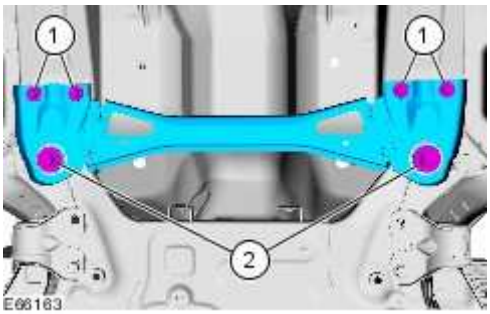
E93352


E68164

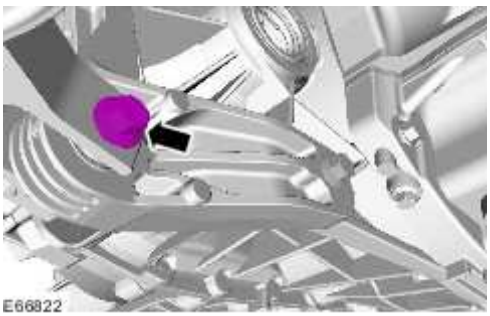
5. *Torque:*
   Stage 1: 150 Nm
   Stage 2: 90°

6.
   1. *Torque:* 30 Nm

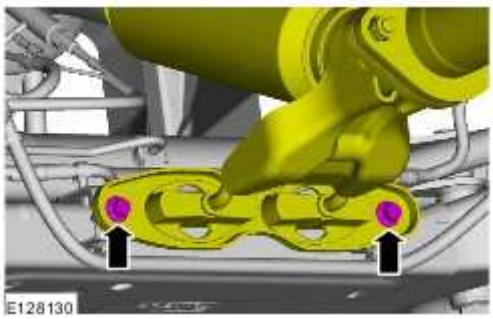
http://vnx.su



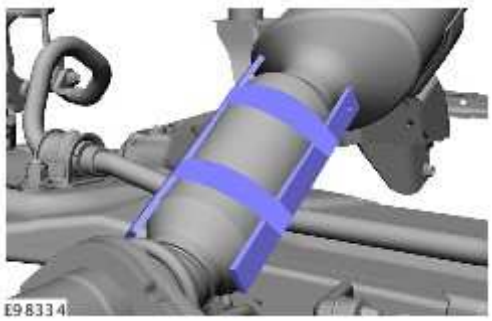
2. *Torque:*
   Stage 1: 150 Nm
   Stage 2: 90°



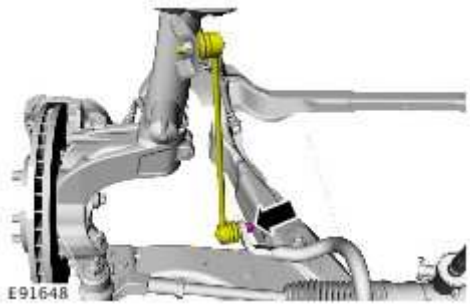
7. *Torque:* 80 Nm



8. *Torque:* 24 Nm



9. CAUTION: Make sure that the exhaust flexibl pipe is not forcibly bent.



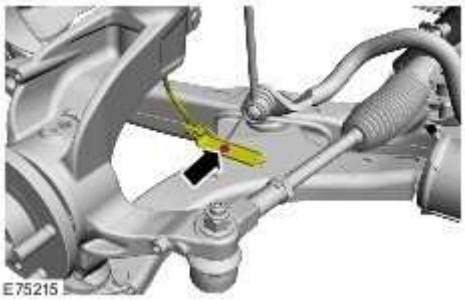
10. CAUTION: Make sure that the ball joint ball dc not rotate.
    On both sides.

    Torque: 70 Nm

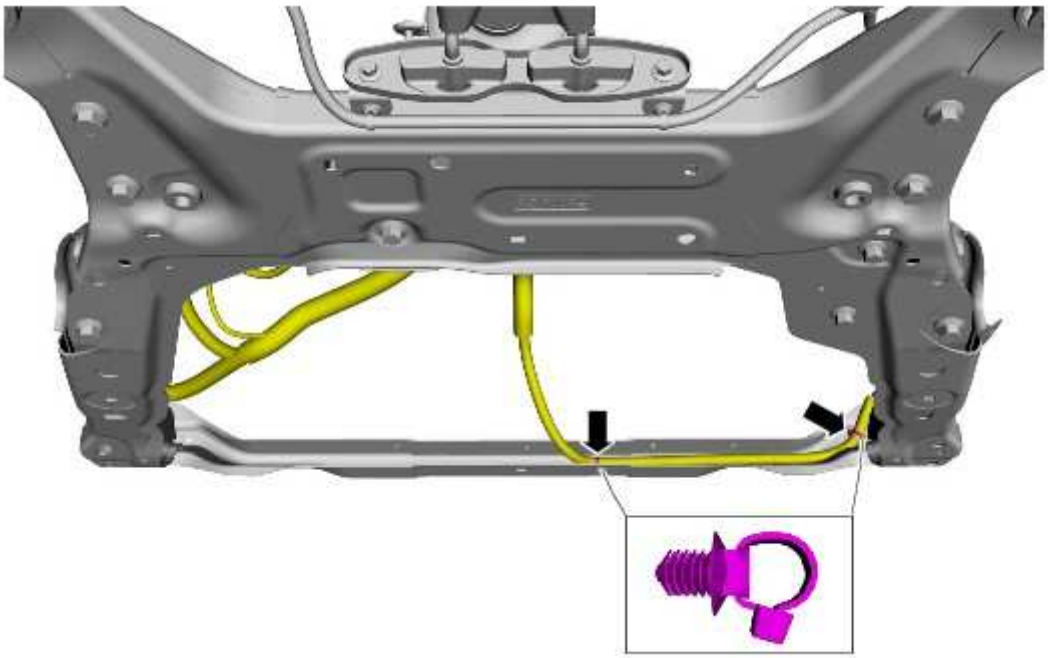
11. If equipped. On both sides.

    Torque: 8 Nm

http://vnx.su

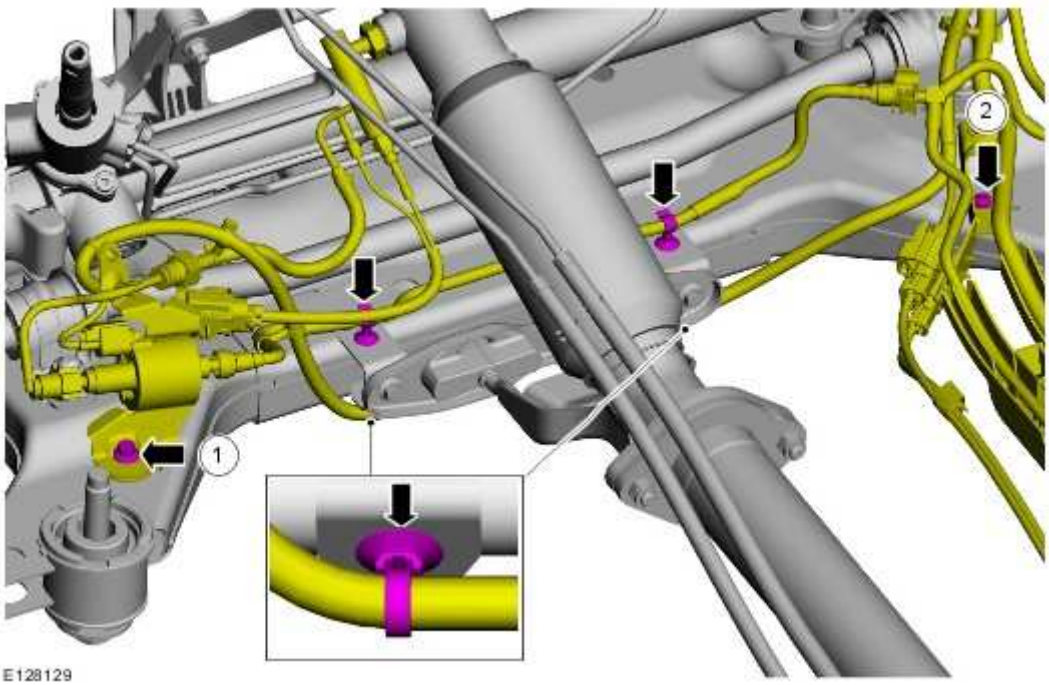

E75215

12.


E128177

13.

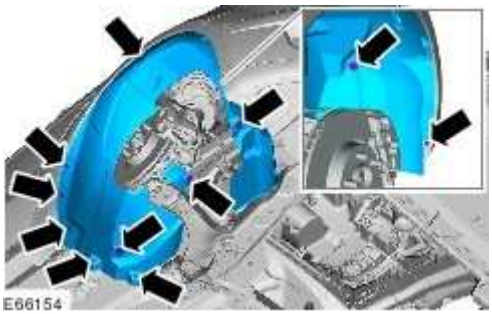
1. *To* 25
2. *To* 10



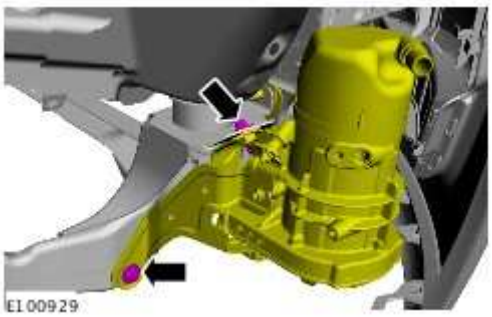
E128129

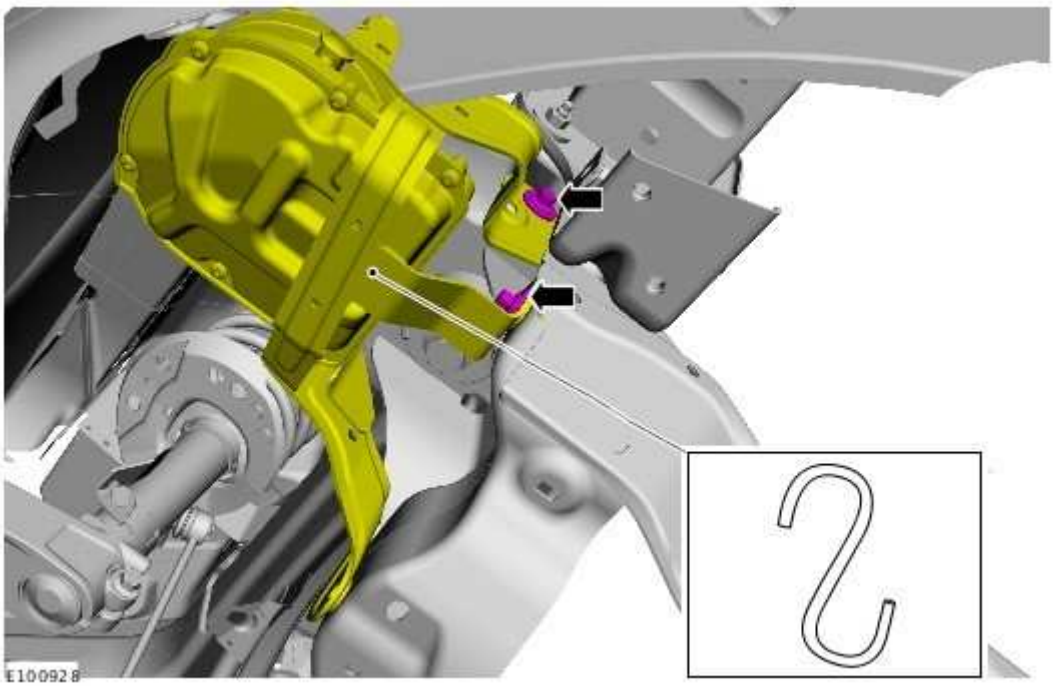
14.

http://vnx.su

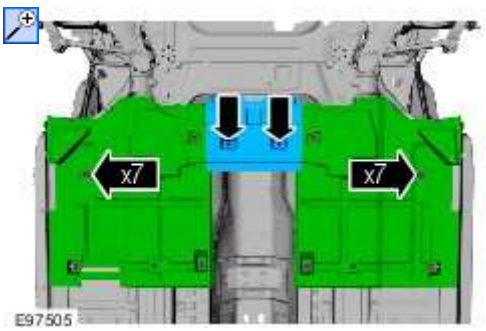


15. *Torque:* 25 Nm





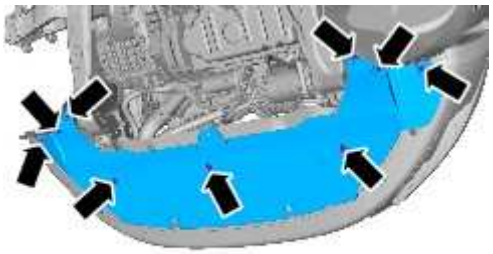
16. *Torque:* Nm



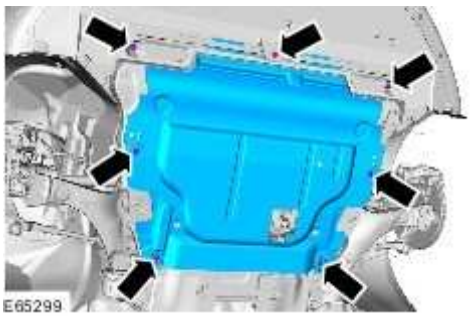
17. If equipped.

18.

http://vnx.su



E68962



E65299

19.

20. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

21. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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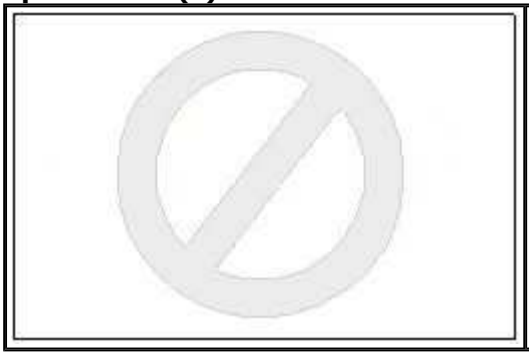
Removal and Installation

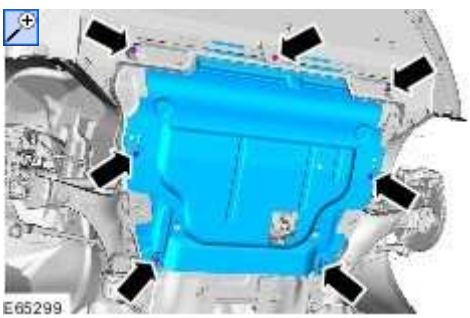
Special Tool(s)

	205-316A Alignment Pins, Subframe

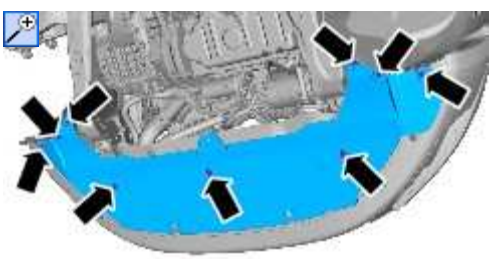
General Equipment

Cable ties
Hydraulic press
Transmission jack

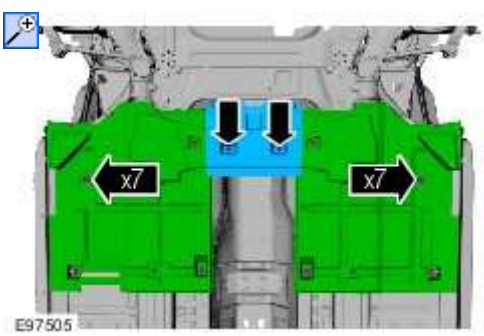
Removal


E65299

1.


E68962

2.



E97505

3. If equipped.

4.

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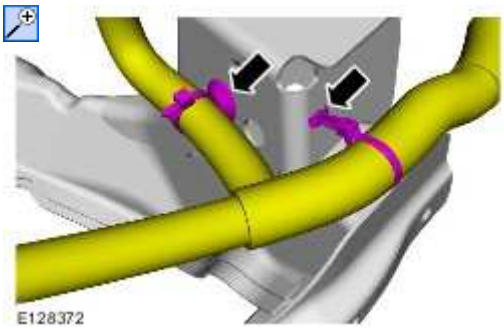
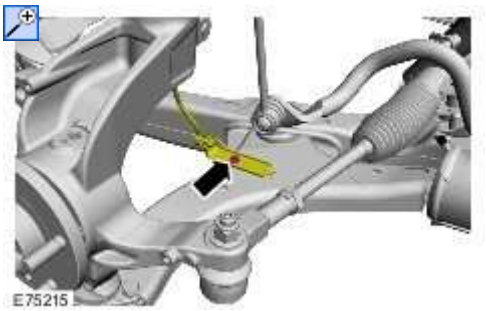
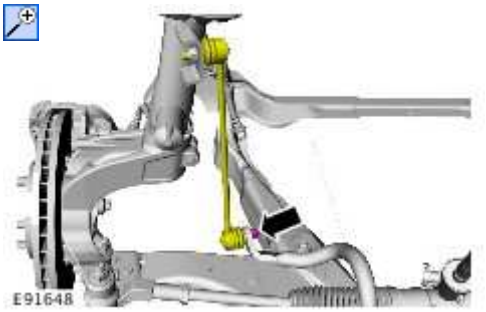
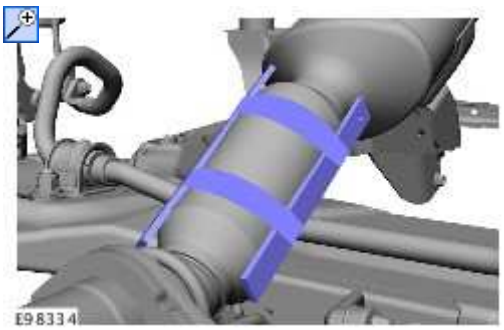




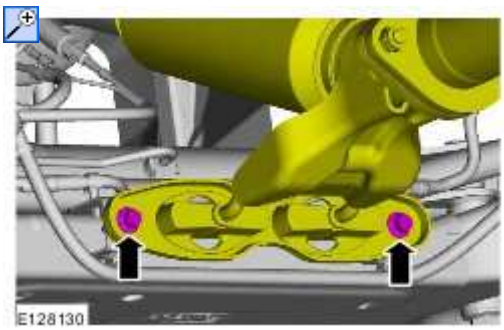
5. If equipped. On both sides.



6. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.



7. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



8.

9.

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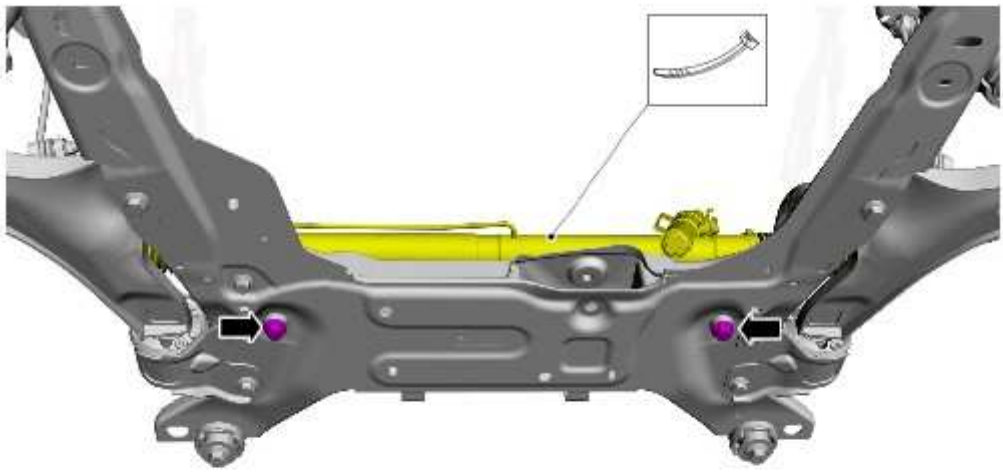
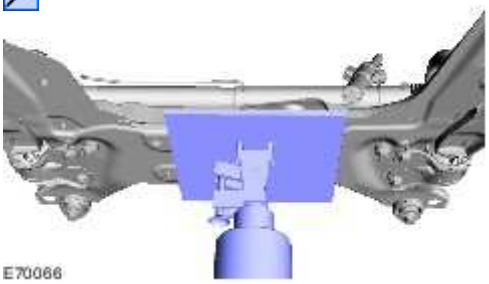
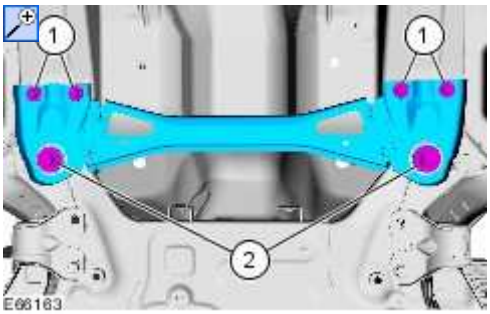


10. *General Equipment:* Cable ties



11. *General Equipment:* Transmission jack



12.

13. WARNING: This step requires the aid of another technician.
Lower the front subframe to gain access to the stabilizer bar bolts.

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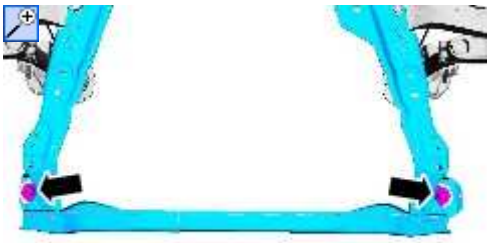
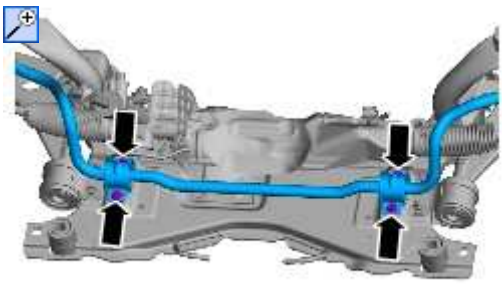
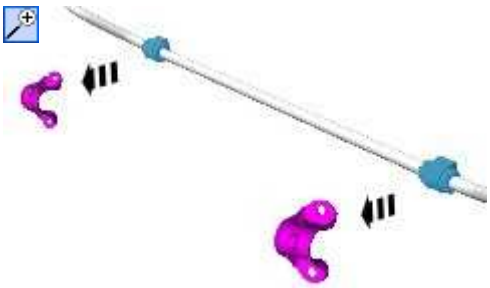


E68164



E99063

14.



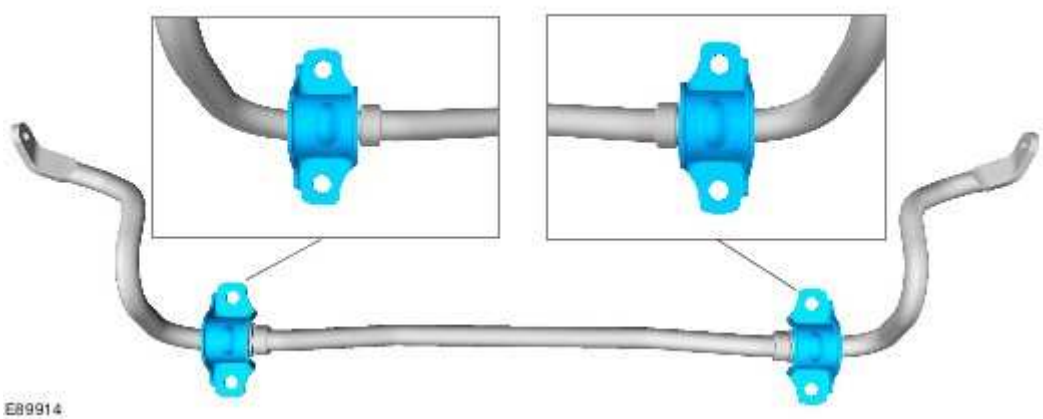
E68087

15. NOTE: Note the position of each component before removal.

Installation

E67369

1. NOTE: Make sure that the component is installed t the position noted before removal.
   On both sides.



E89914

2. NOTE: Make sure that the clamp is installed t the same orientatio as when removed.
   NOTE: Apply water to the stabilizer bar clamp

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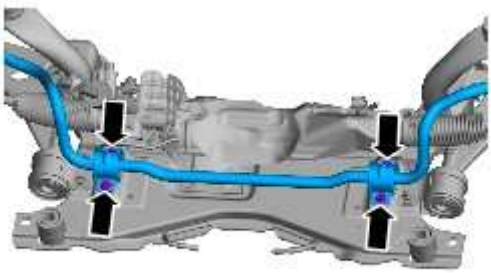
to assist
installatio
General
Equipment
Hydraulic
press

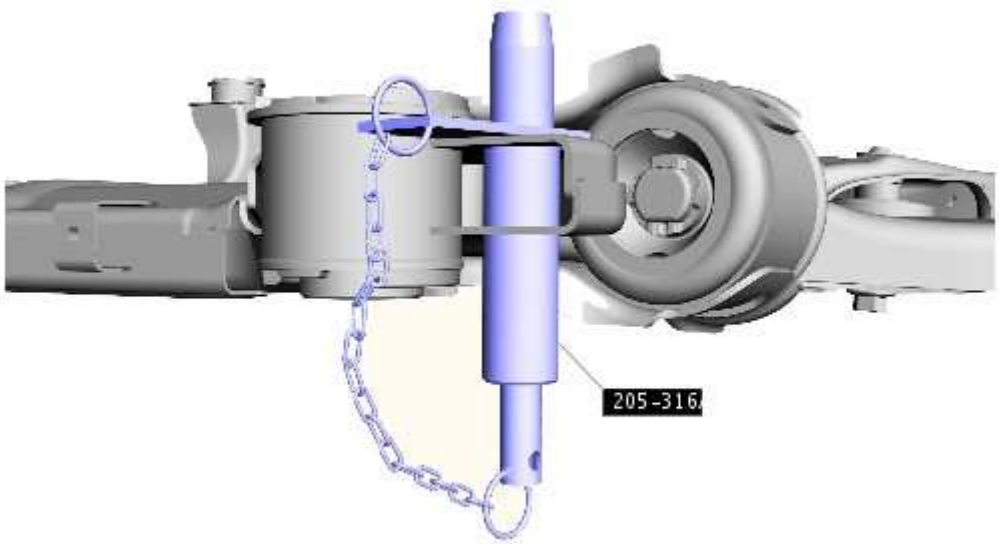


E99063

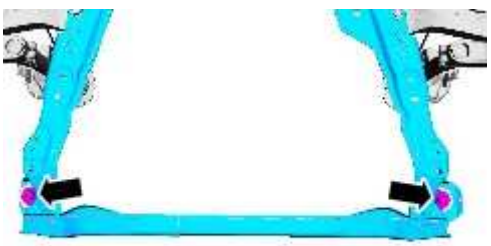
3. *Torque:*
   Stage 1: 140 Nm
   Stage 2: 45°

4. On both sides

Special Tool(s
205-316A

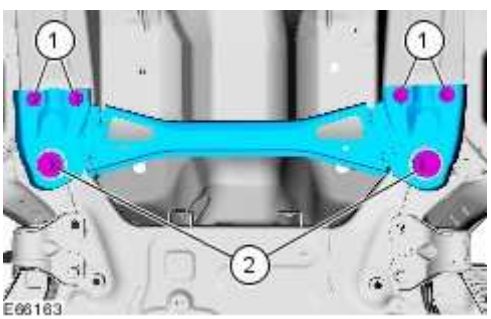


E93352



E68164

5. *Torque:*
   Stage 1: 150 Nm
   Stage 2: 90°



E68163

6.
   1. *Torque:* 30 Nm
   2. *Torque:*
      Stage 1: 150 Nm
      Stage 2: 90°

7. *Torque:* 120

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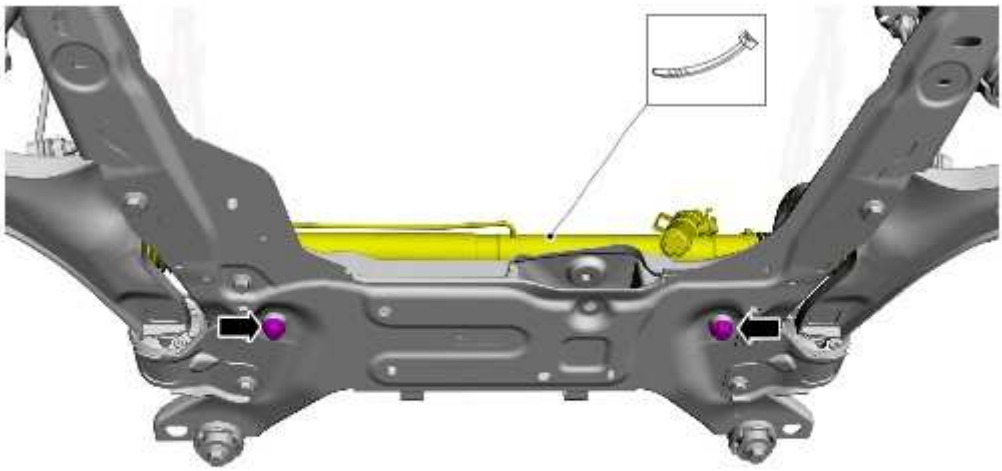
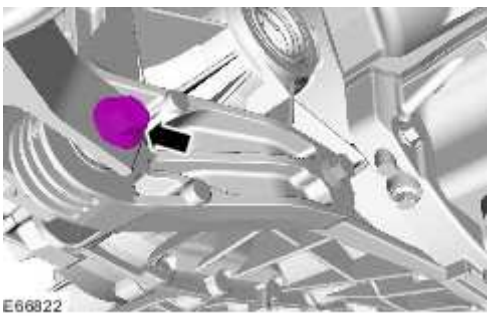
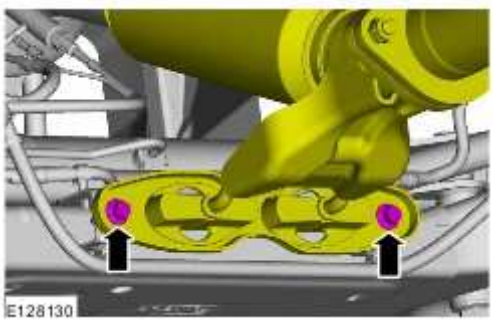


E93354



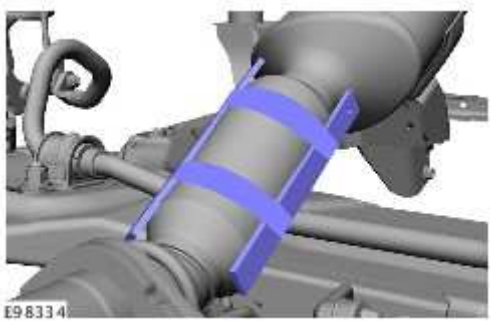
E66822

8. *Torque:* 80 Nm



E128130

9. *Torque:* 24 Nm



E98334

10. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

11. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

Torque: 70 Nm

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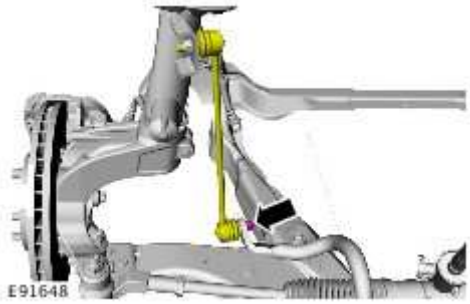
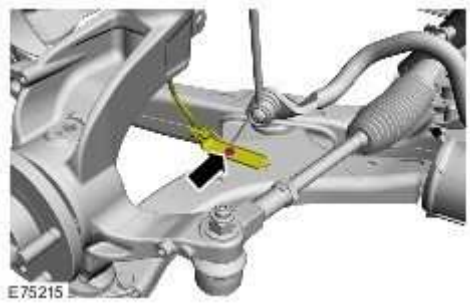
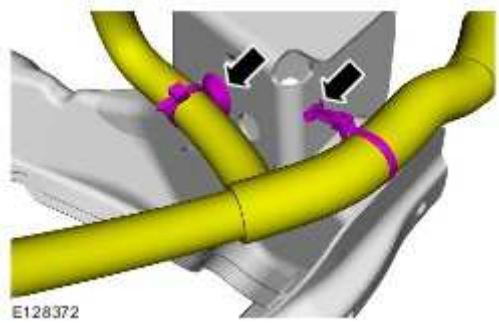




12. If equipped. On both sides.

    Torque: 8 Nm



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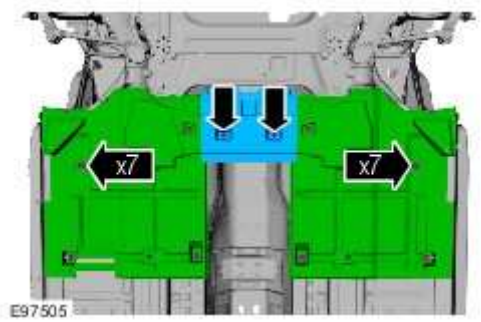
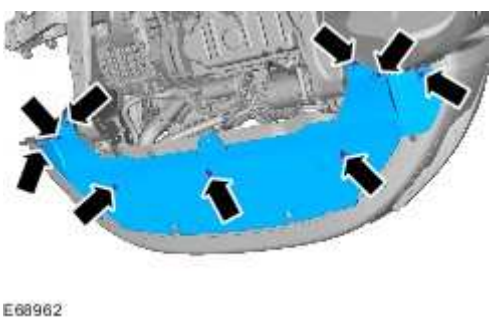


14. If equipped.



15.

16.

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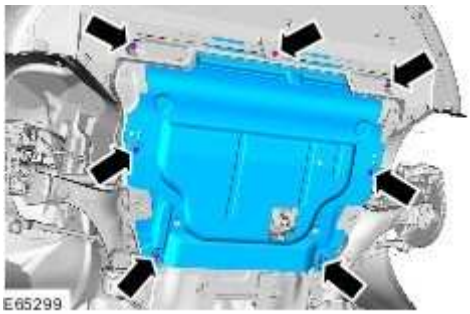

17. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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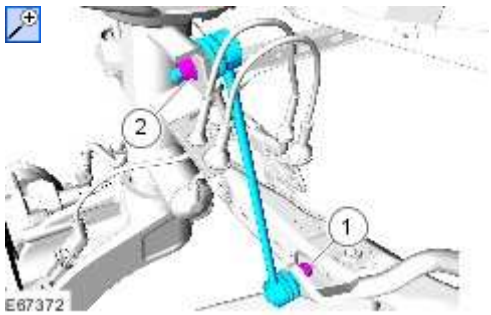
Removal and Installation

Removal



1. Remove the wheel and tire.

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

2. CAUTION: Make sure that the ball joint ball does not rotate.
   1. *Torque:* 70 Nm
   2. *Torque:* 60 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal and Installation

1. Refer to: Front Stabilizer Bar (204-01 Front Suspension, Removal and Installation).

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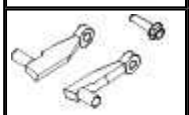
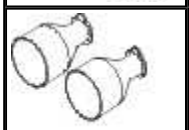
Removal and Installation

Special Tool(s)

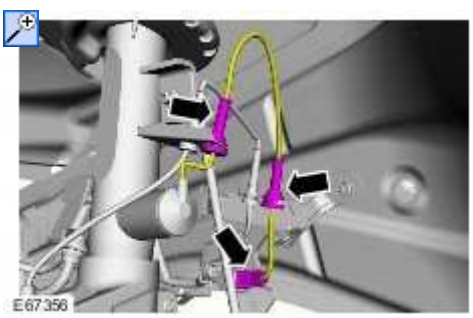
	204-159 Lever, Wheel Knuckle
	204-605 Separator, Lower Arm Ball Joint
	204-607 Remover, Ball joint
	204-609 Protection Cap, Ball Joint Gaiter

Removal

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

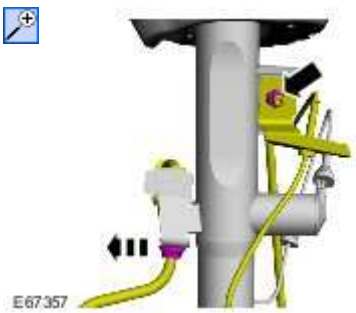
1. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Vehicles with dynamic suspension



3.

All vehicles



4. *Torque:* 60 Nm

5.

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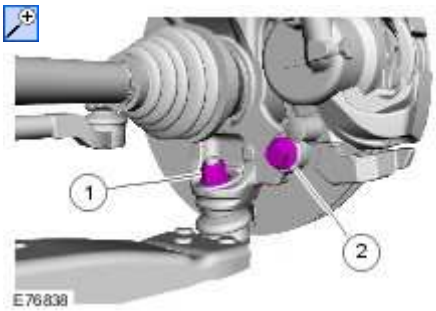
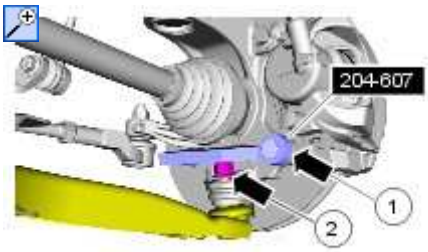
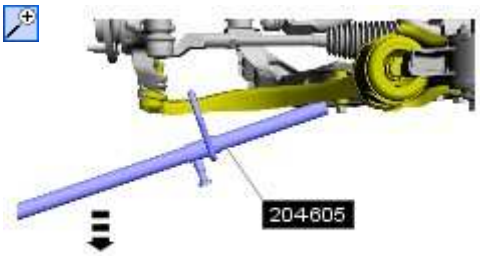


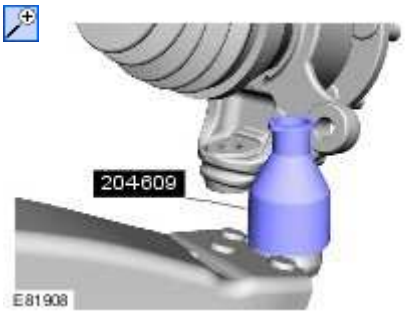
1. *Loosen:* 2 turn(s)
2. WARNING: Make sure that no load is placed on the brake hose.
   Torque: 200 Nm



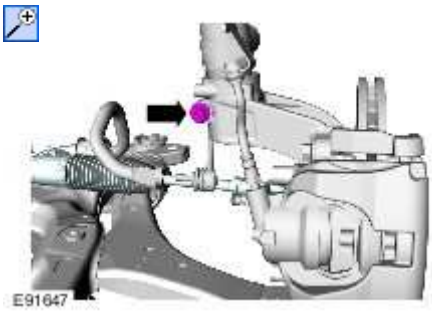
6. *Special Tool(s):* 204-607
   Torque: 100 Nm



7. *Special Tool(s):* 204-605



8. *Special Tool(s):* 204-609



9. *Torque:* 110 Nm

10. *Special Tool(s):* 204-159

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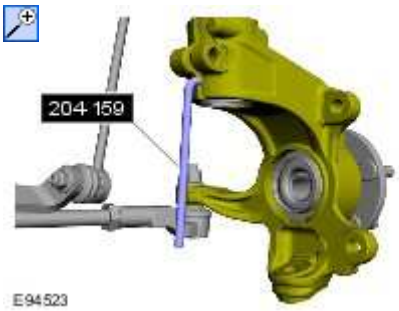

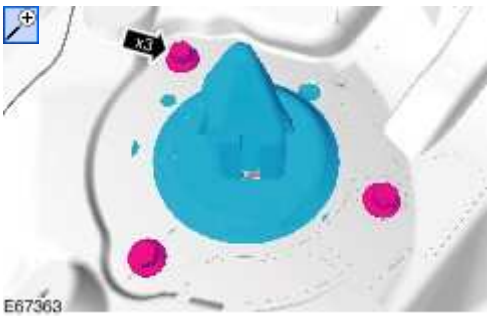

11. WARNING: This step requires the aid of another technician.
Torque: 35 Nm

Installation

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

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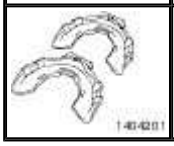
Disassembly and Assembly

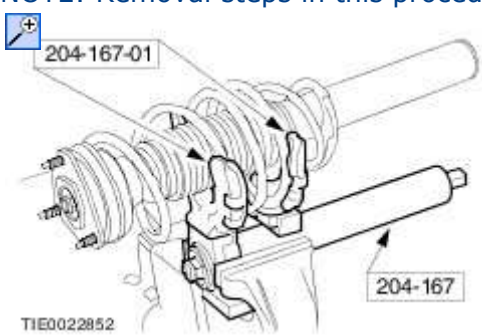
Special Tool(s)

	204-167 Compressor, Coil Spring
	204-167-01 Adapter for 204-167

Disassembly

All vehicles

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



1. WARNING: Take extra care when handling the compressed spring.
   Compress the spring.

   Special Tool(s): 204-167, 204-167-01

Vehicles with dynamic suspension

2.

All vehicles

3.

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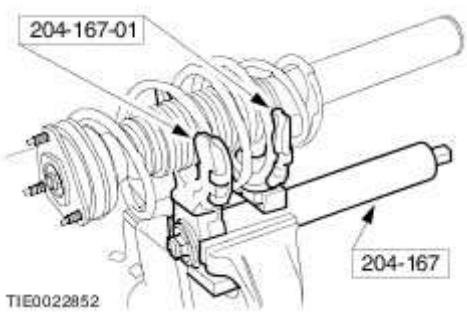
E71736

Assembly



TIE0022852

4. NOTE: Only tighten the nut finger tight at this stage.
   To assemble, reverse the disassembly procedure.

5. WARNING: Take extra care when handling the compressed spring.
   NOTE: Make sure that the spring is correctly located in the lower spring seat.
   Special Tool(s): 204-167, 204-167-01

E89915

6. Align the top mount with the shock absorber as shown.

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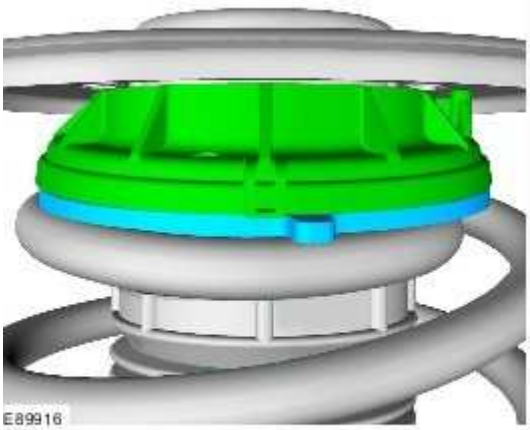

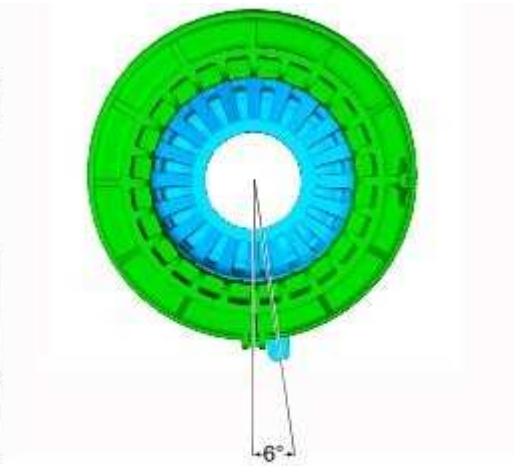

7. Align the lower bearing race with the upper bearing race as shown.

8. Tighten the nut.

   Torque: 58 Nm

9. Remove the special tools.

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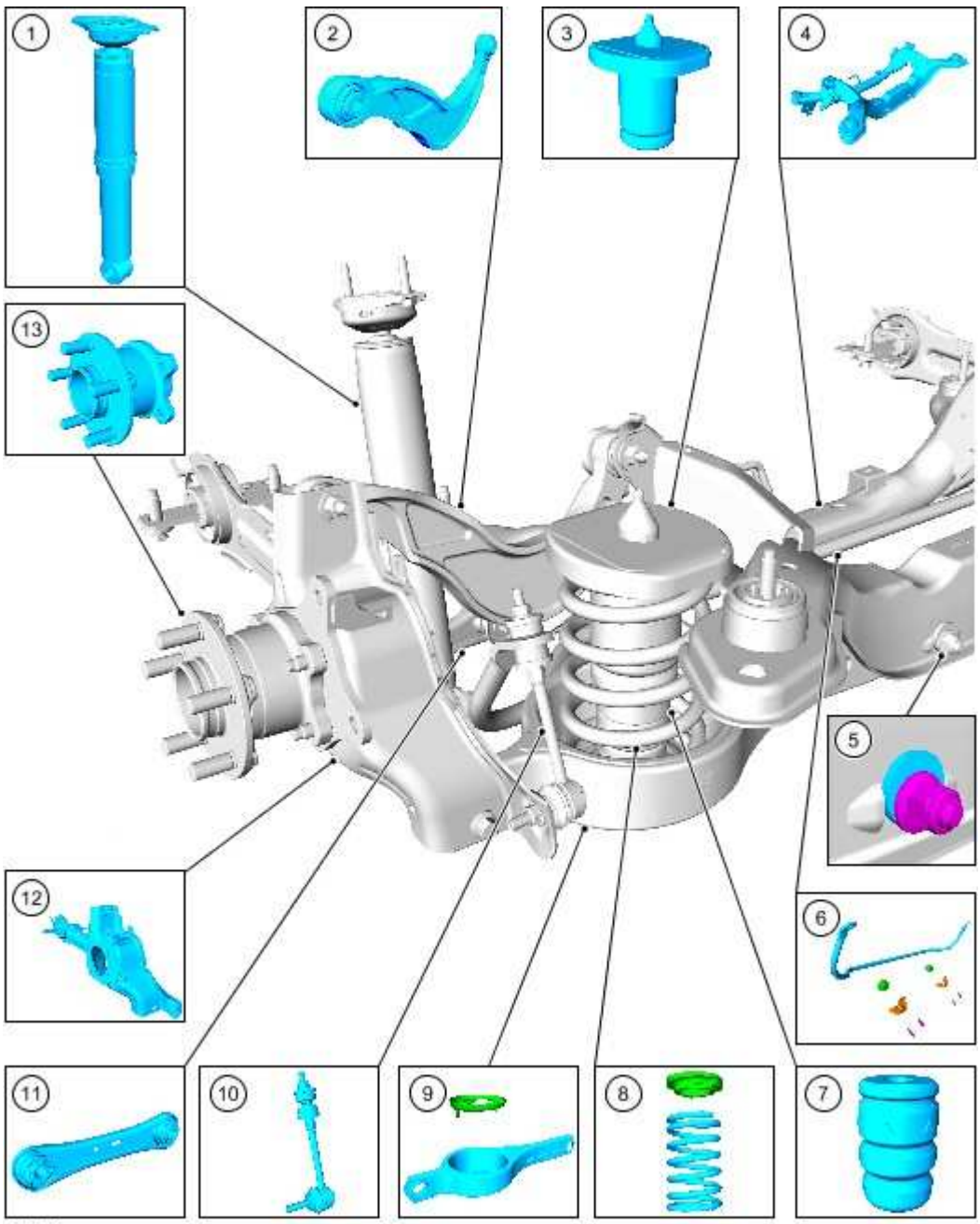
Description and Operation

Vehicles with standard suspension



Item	Part Number	Description
1	-	Standard shock absorber
2	-	Upper arm
3	-	Spring seat
4	-	Rear subframe
5	-	Rear lower arm adjustment cam nut
6	-	Stabilizer bar, bushings and clamps
7	-	Bump stop
	-	

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8			Spring and spring upper pad
	9	-	Rear lower arm and spring lower pad
10		-	Stabilizer bar link
11		-	Front lower arm
12		-	Wheel knuckle
13		-	Wheel hub

Item 1: Shock Absorber

The shock absorber includes a unique upper mount damper to provide additional noise reduction.

Item 10 : Stabilizer Bar Link

The stabilizer bar link is a combination link. This consists of a solid link attached to the stabilizer bar with a retaining nut and a ball joint link attached to the wheel knuckle with a retaining nut. The ball joint link provides a quicker response to suspension movement. This enables the stabilizer bar to respond more directly to wheelstation movement.

Vehicles with load-leveling shock absorbers

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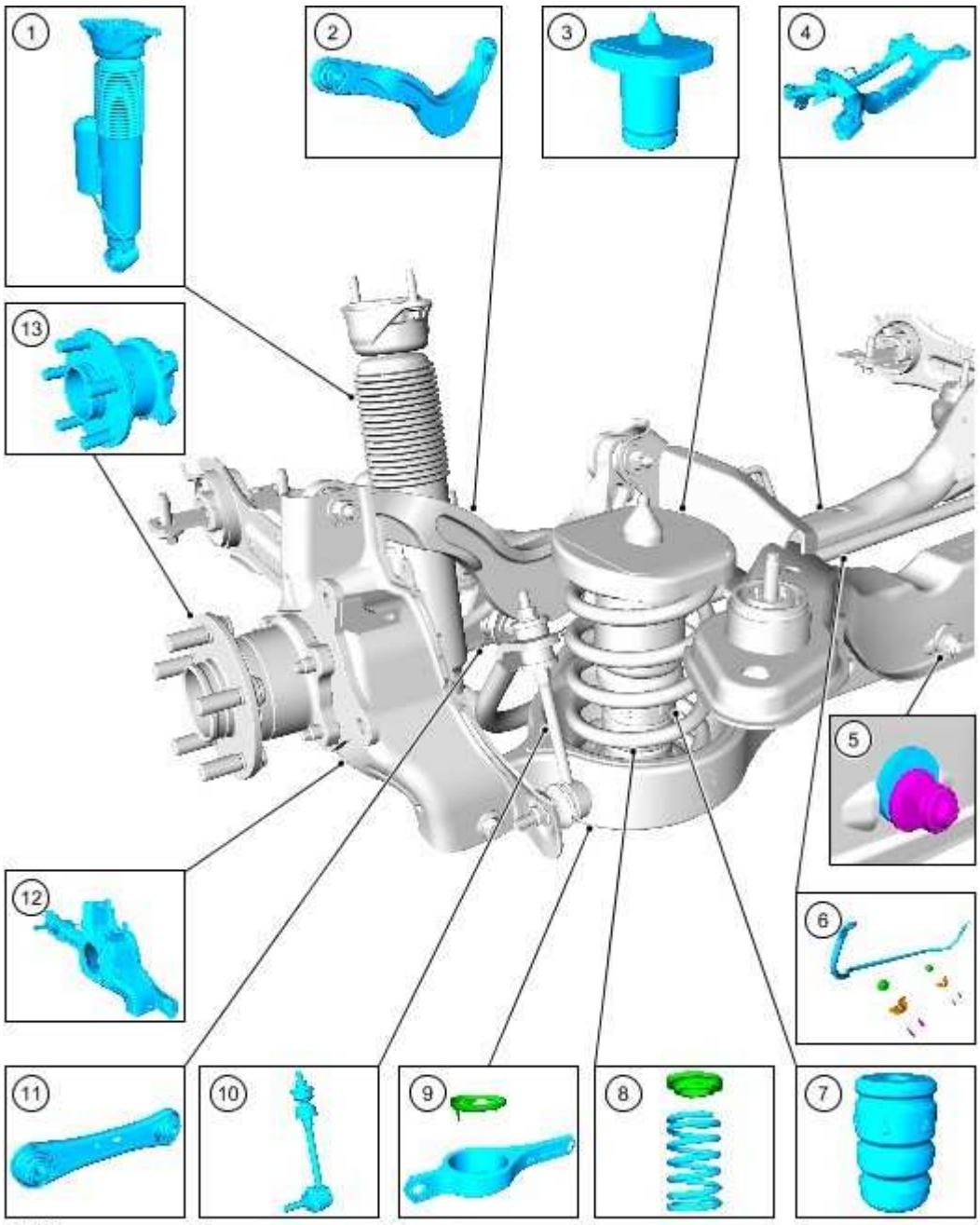

Item	Part Number	Description
1	-	Nivomat shock absorber
2	-	Upper arm
3	-	Spring seat
4	-	Rear subframe
5	-	Rear lower arm adjustment cam nut
6	-	Stabilizer bar, bushings and clamps
7	-	Bump stop
8	-	Spring and spring upper pad
9	-	Rear lower arm and spring lower pad
10	-	Stabilizer bar link
11	-	Front lower arm
	-	

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12		Wheel knuckle
	13 -	Wheel hub

Item 1: Shock Absorber

Nivomat shock absorbers (if equipped) provide load-leveling rear suspension.

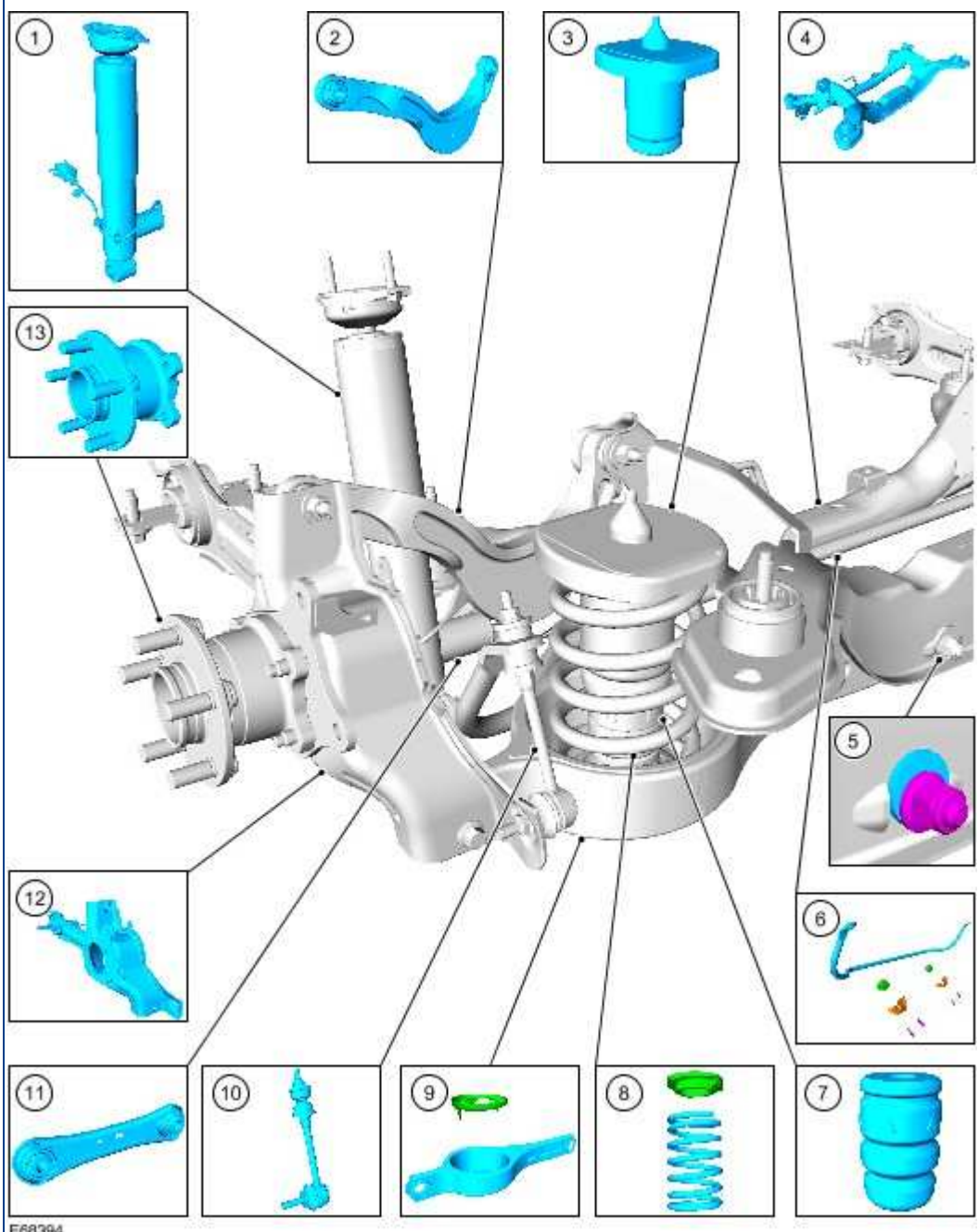
Item 2: Upper Arm

The upper arm is a different shape to the standard suspension upper arm to allow clearance of the shock absorber.

Item 10 : Stabilizer Bar Link

The stabilizer bar link is a combination link. This consists of a solid link attached to the stabilizer bar with a retaining nut and a ball joint link attached to the wheel knuckle with a retaining nut. The ball joint link provides a quicker response to suspension movement. This enables the stabilizer bar to respond more directly to wheelstation movement.

Vehicles with dynamic suspension



Part Number

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Item	Part Number	Description
1	-	Continuous damping control shock absorber
2	-	Upper arm
3	-	Spring seat
4	-	Rear subframe
5	-	Rear lower arm adjustment cam nut
6	-	Stabilizer bar, bushings and clamps
7	-	Bump stop
8	-	Spring and spring upper pad
9	-	Rear lower arm and spring lower pad
10	-	Stabilizer bar link
11	-	Front lower arm
12	-	Wheel knuckle
13	-	Wheel hub

Item 1: Shock Absorber

Continuous damping control shock absorbers (if equipped) provide dynamic front suspension. A continuous damping control shock absorber creates a damping force which depends on the velocity of the vehicle and an electrical current applied to the continuous damping control shock absorber. The electronic stability program (ESP) sensors, acceleration sensors and displacement sensors provide information to the dynamic suspension electronic control unit (ECU), which detects the state of heave, roll, pitch, cornering and acceleration of the vehicle. The ECU then calculates the best damping characteristics for each wheel within 2 ms. The ECU sends an individual electrical current to each shock absorber to control the amount of damping required.

Item 2: Upper Arm

The upper arm is a different shape to the standard suspension upper arm to allow clearance of the shock absorber.

Item 10 : Stabilizer Bar Link

The stabilizer bar link is a combination link. This consists of a solid link attached to the stabilizer bar with a retaining nut and a ball joint link attached to the wheel knuckle with a retaining nut. The ball joint link provides a quicker response to suspension movement. This enables the stabilizer bar to respond more directly to wheelstation movement.

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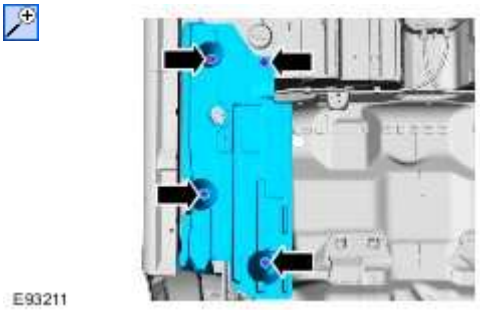
Removal and Installation

Removal

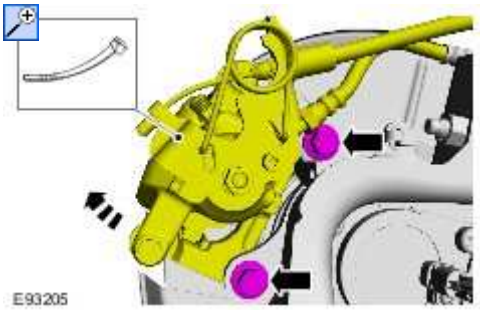
1. Refer to: Spring (204-02 Rear Suspension, Removal and Installation).


E93211

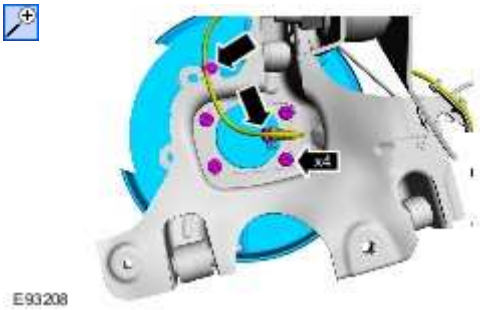
2. NOTE: This step is only necessary when installing a new component to the left-hand side.

E93212

3. NOTE: This step is only necessary when installing a new component to the right-hand side.


E93205

4.


E93208

5.

6.

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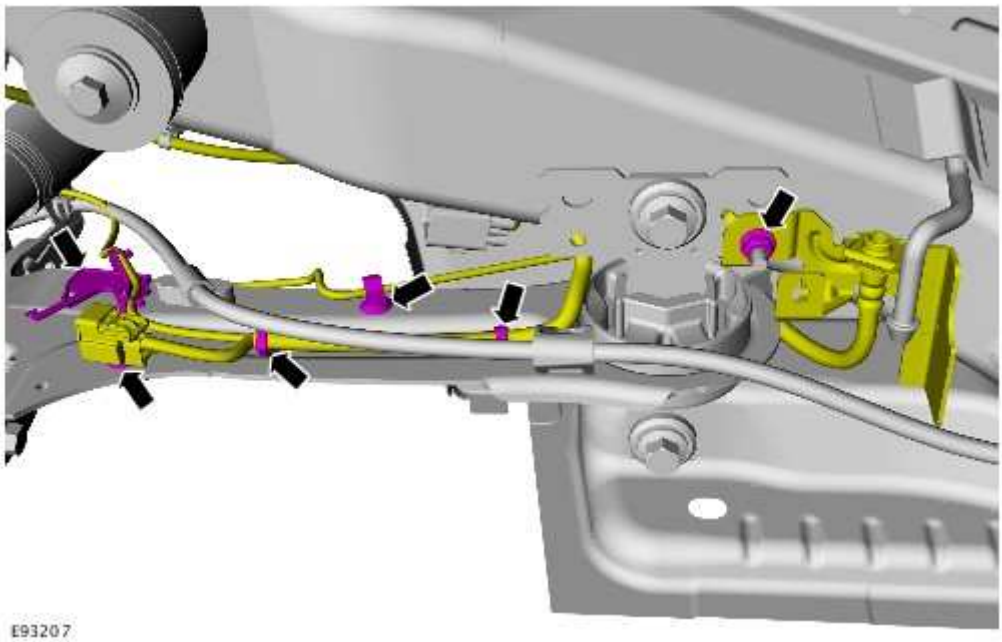

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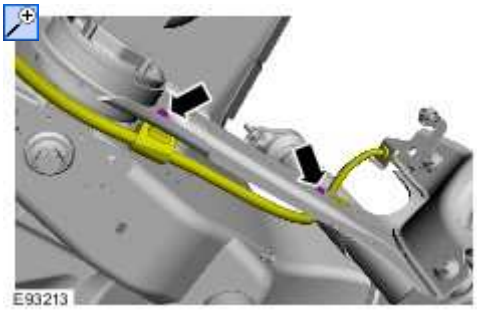

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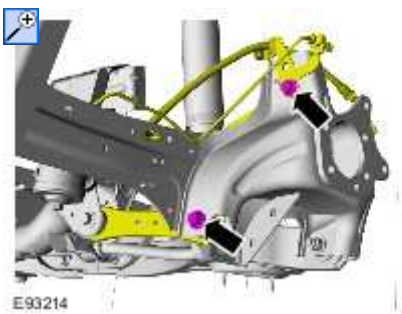

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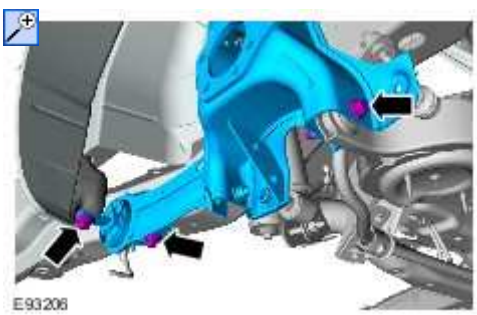

Installation

1. Fabricate a spacer.

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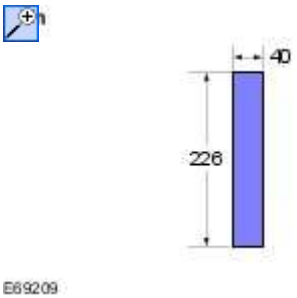
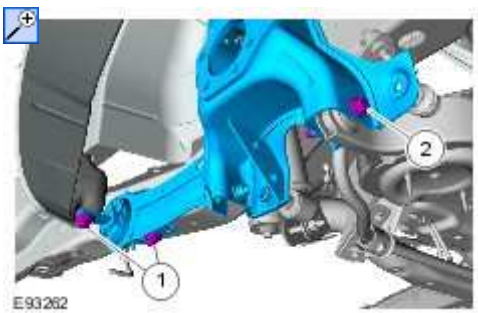
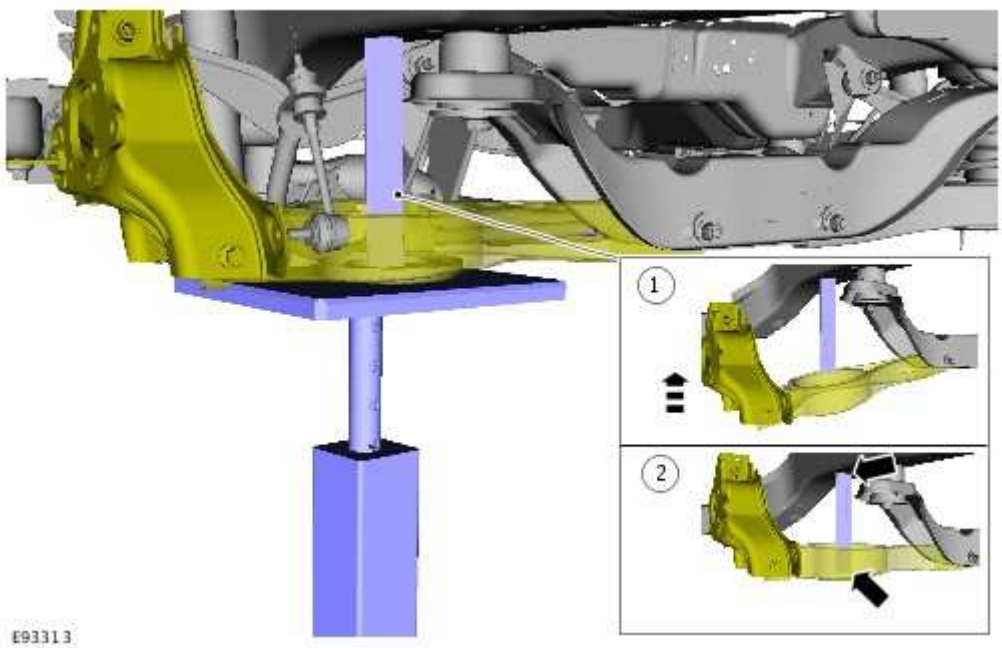


E69209



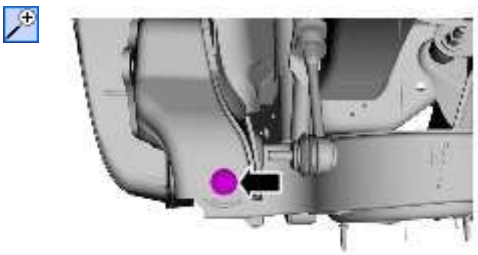
E93262

2.
   1. *Torque:* 180 Nm
   2. NOTE: Only tighten the bolt finger tight at this stage.



E93313

3. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting.



E94368

4. *Torque:* 120 Nm

5. *Torque:* 130 Nm

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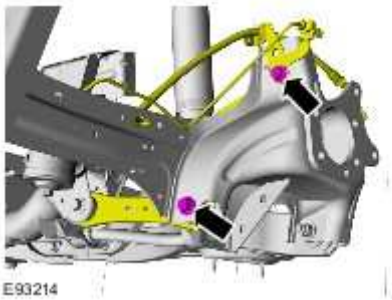
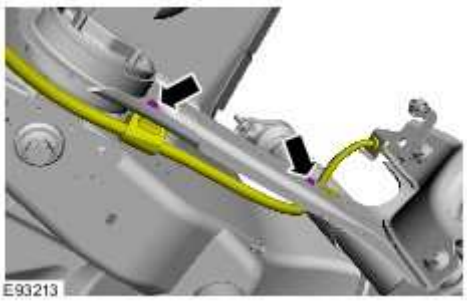
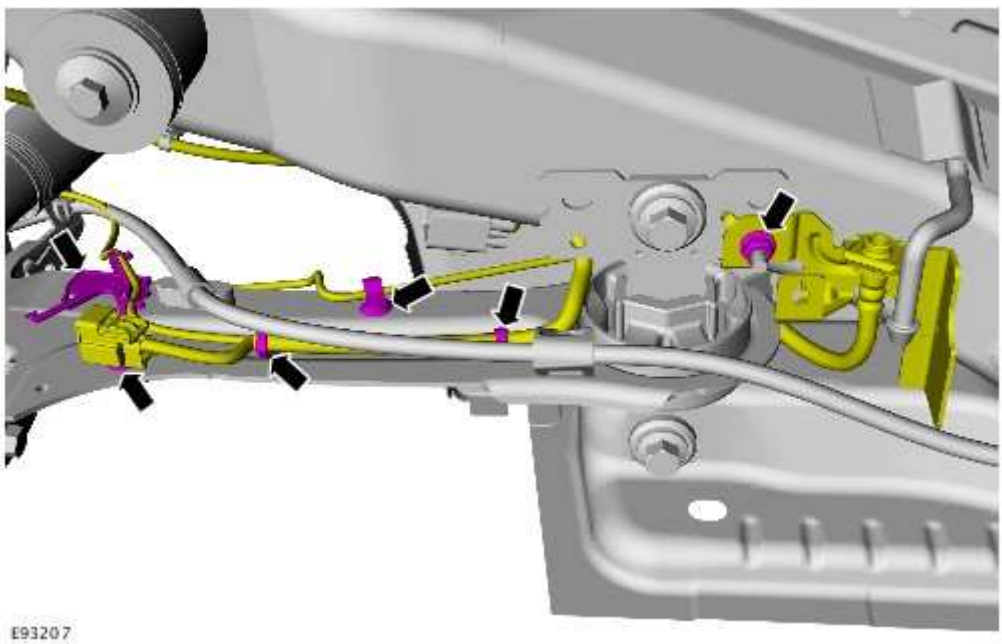


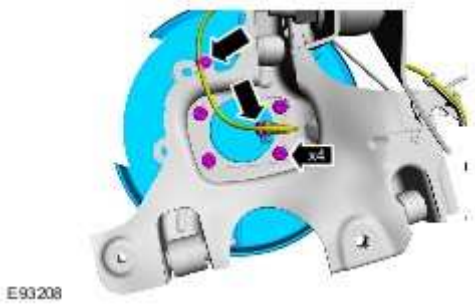
6. *Torque:* 2.8 Nm



7. *Torque:* 20 Nm

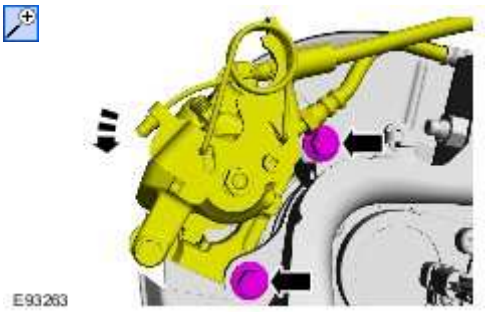


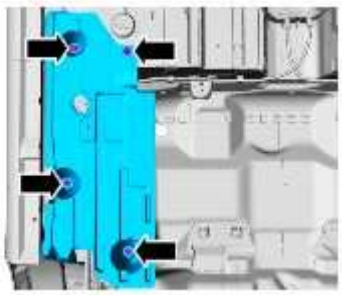
8. *Torque:* 110 Nm



9. *Torque:* 110 Nm

http://vnx.su


E93263


E93211

10. NOTE: This step is only necessary when installing a new component to the left-hand side.
Torque: 10 Nm

E93212

11. NOTE: This step is only necessary when installing a new component to the right-hand side.
Torque: 10 Nm

12. Refer to: Spring (204-02 Rear Suspension, Removal and Installation).
13. Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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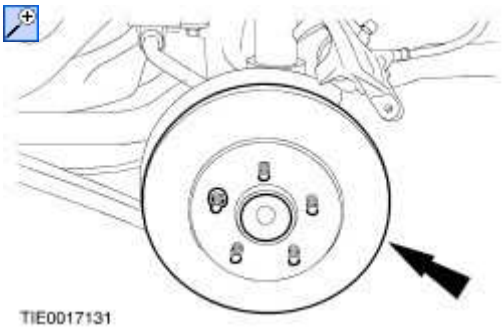
Removal and Installation

Removal

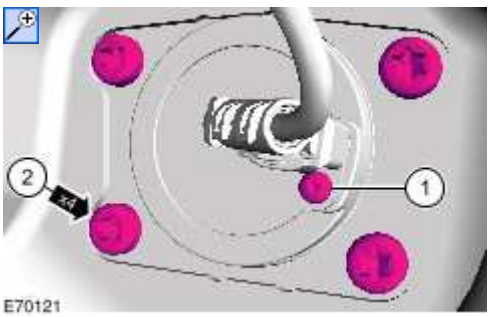
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the brake caliper.

   Refer to: Brake Caliper (206-04 Rear Disc Brake, Removal and Installation).



2.



3.
   1. *Torque:* 5 Nm
   2. *Torque:* 110 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

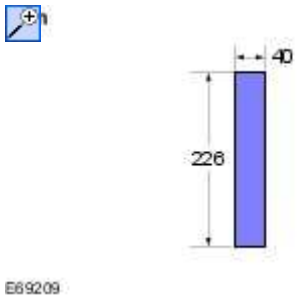
General Equipment

Transmission jack

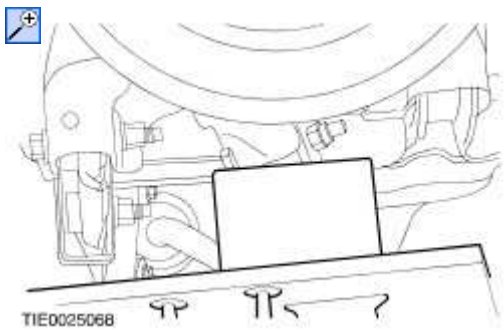
Removal

1. Remove the spring.

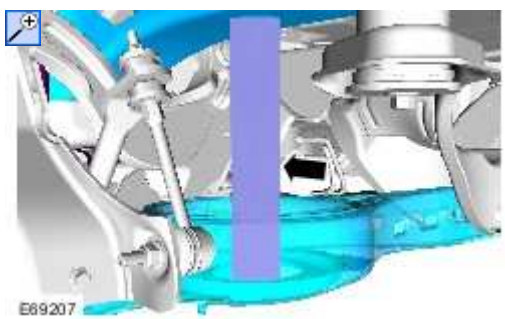
   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).



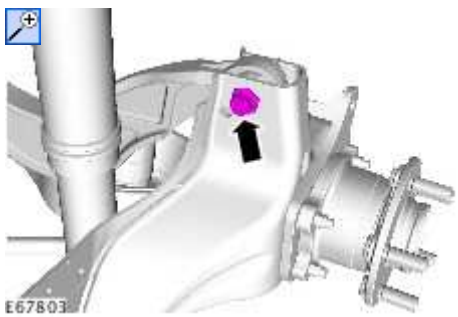
2. Fabricate a spacer.



3. *General Equipment:* Transmission jack



4. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting.



5.

6.

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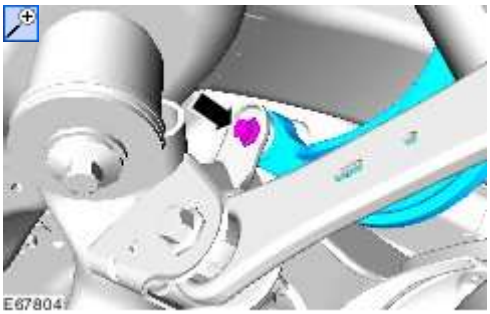
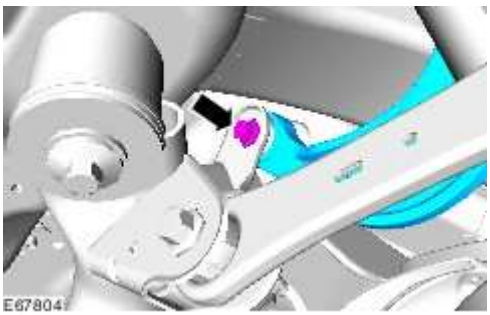
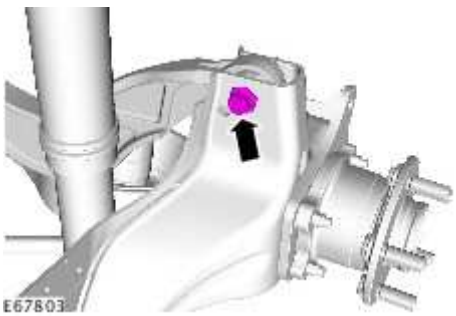


Installation



1. *Torque:* 130 Nm



2. *Torque:* 130 Nm

3. Install the spring.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

4. Check the toe setting and adjust as necessary.

   Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
   Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

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Removal and Installation

General Equipment

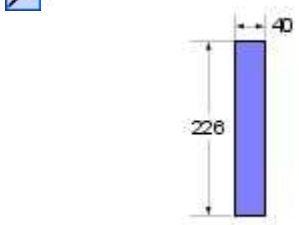
Transmission jack

Removal

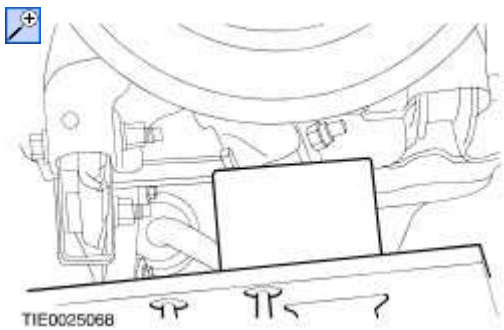
1. Remove the spring.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

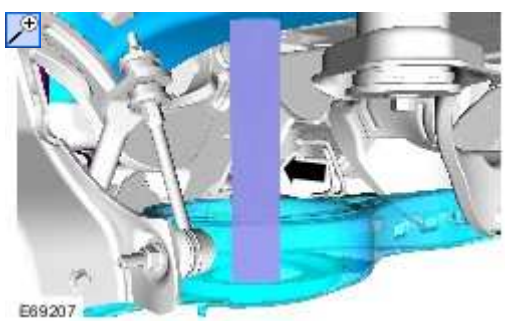
2. Fabricate a spacer.



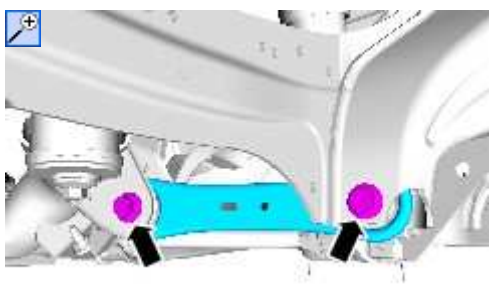
E69209


TIE0025068

3. *General Equipment:* Transmission jack


E69207

4. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting.


E67810

5.

Installation

1. *Torque:* 130 Nm

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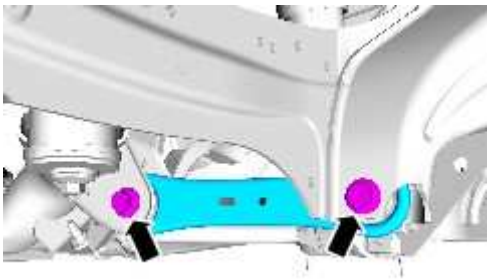

E67810

2. Install the spring.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

3. Check the toe setting and adjust as necessary.

   Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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Removal and Installation

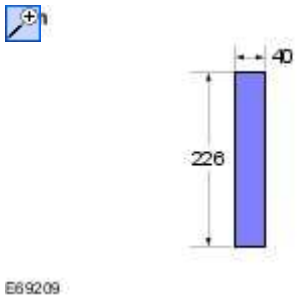
General Equipment

Transmission jack

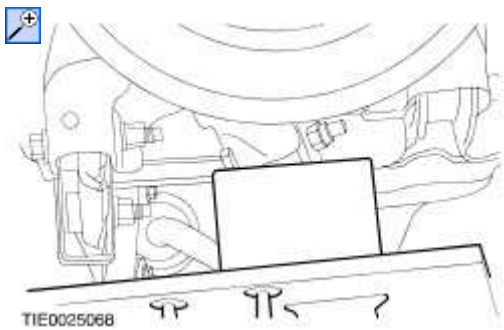
Removal

1. Remove the spring.

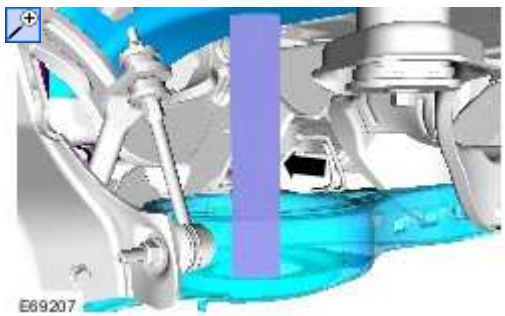
   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).



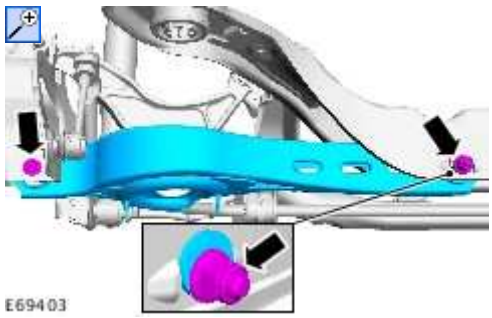
2. Fabricate a spacer.



3. *General Equipment:* Transmission jack



4. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting.



5.

Installation

1. NOTE: Only tighten the nut and bolts finger tight at this stage.

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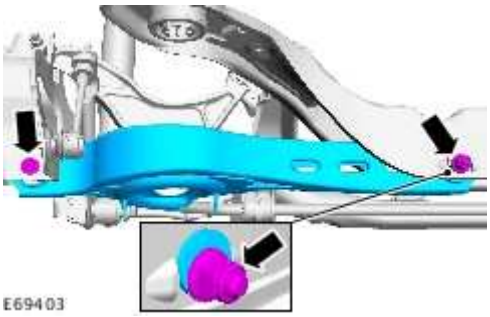
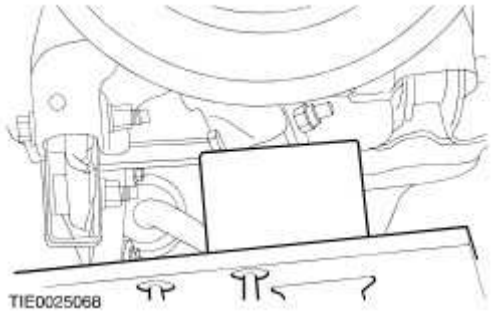
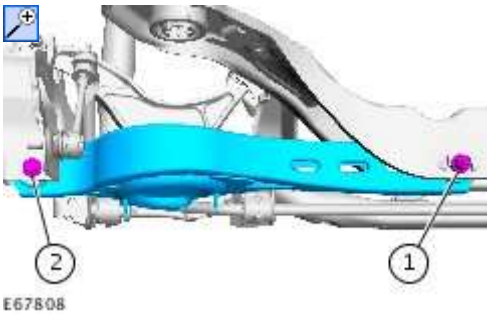


2. *General Equipment:* Transmission jack



3. Install the spacer between the rear lower arm and the body side rail. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting.

4.
   1. *Torque:* 8 Nm
   2. *Torque:* 120 Nm



5. Install the spring.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

6. Check the toe setting and adjust as necessary.

   Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
   Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

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Removal and Installation

General Equipment

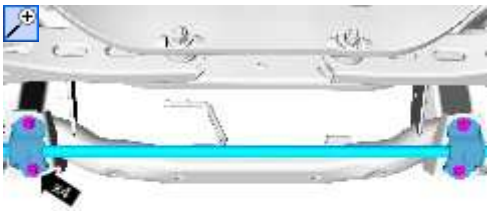
Hydraulic press

Removal

1. Remove the stabilizer bar link.

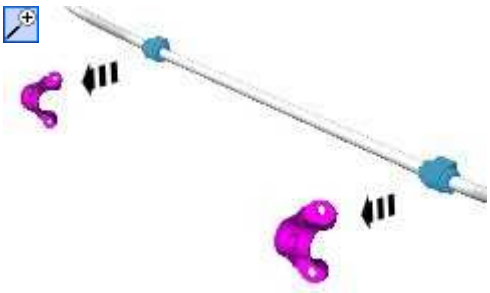
   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).

2.



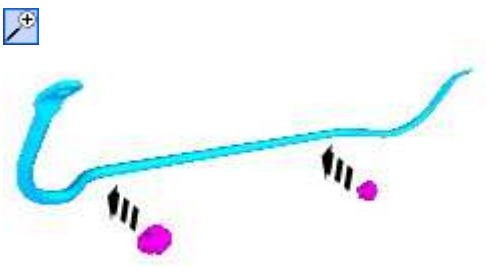
E67812

3.



E68087

Installation



E69762

1. Install the stabilizer bar bushings with no lubricant. Make sure the bushing nipple is on the right-hand side.

E69763

2. NOTE: Apply water to the stabilizer bar clamp to assist installation.
   General Equipment: Hydraulic press

3. *Torque:* 48 Nm

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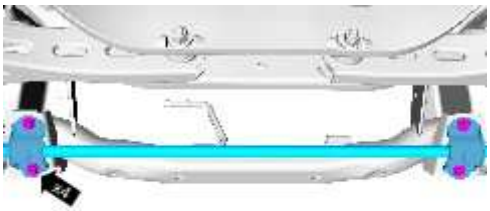

E67812

4. Install the stabilizer bar link.

   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).

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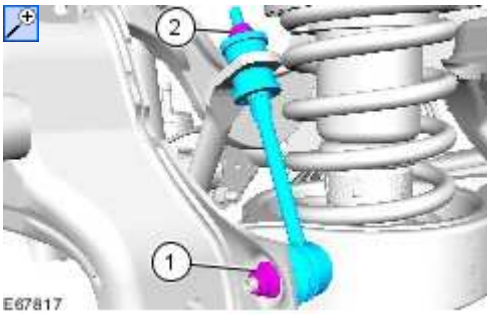
Removal and Installation

Removal

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



1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2. CAUTION: Make sure that the ball joint ball does not rotate.
   1. *Torque:* 60 Nm
   2. *Torque:* 15 Nm

Installation

1. To install, reverse the removal procedure.

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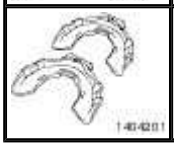
Removal and Installation

Special Tool(s)

	204-167 Compressor, Coil Spring
	204-167-01 Adapter for 204-167

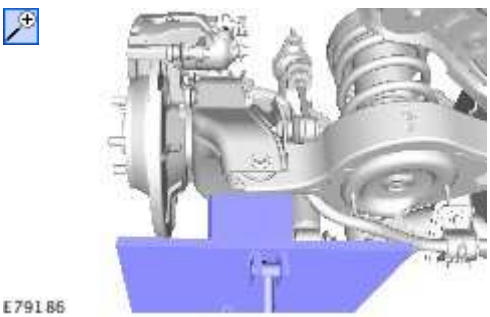
General Equipment

Trolley jack

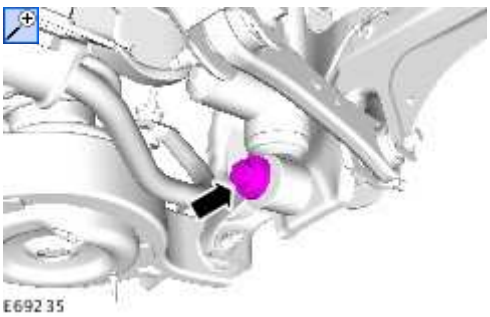
Removal

1. Remove the wheel and tire.

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


E79186

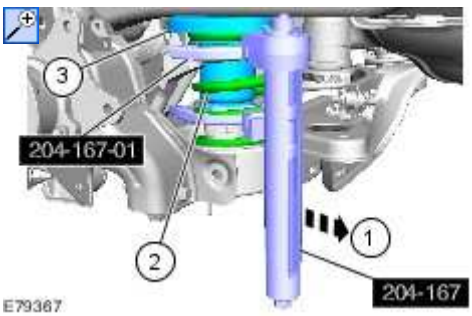
2. *General Equipment:* Trolley jack


E69235

3.

4. Remove the rear stabilizer bar link.

   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).



E79367

5. *Special Tool(s):* 204-167, 204-167-01

6.

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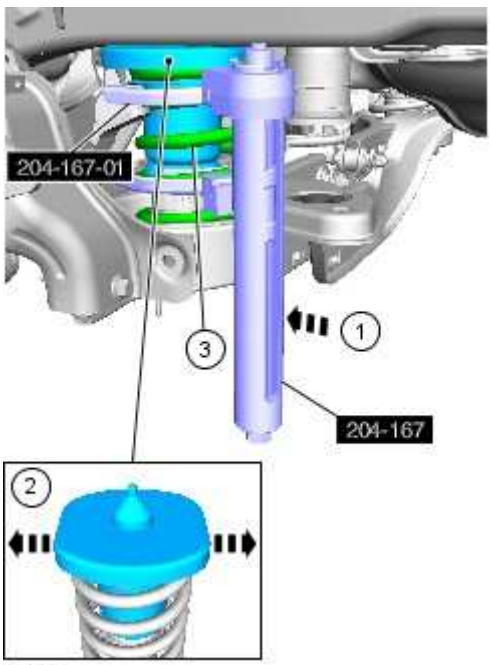
E79369

Installation

E79369

1.

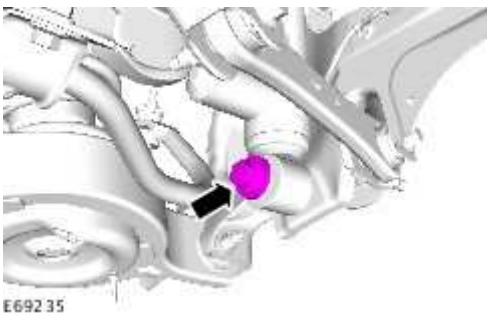


E79368

2. NOTE: Make sure that the spring is correctly located in the lower spring seat.
Special Tool(s): 204-167, 204-167-01

3. Install the rear stabilizer bar link.

   Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).



E69235

4. *Torque:* 175 Nm

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E69693

Vehicles with load-leveling shock absorbers

5. *Torque:* 280 Nm

All vehicles

6. Remove the trolley jack.
7. Install the wheel and tire.

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

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Removal and Installation

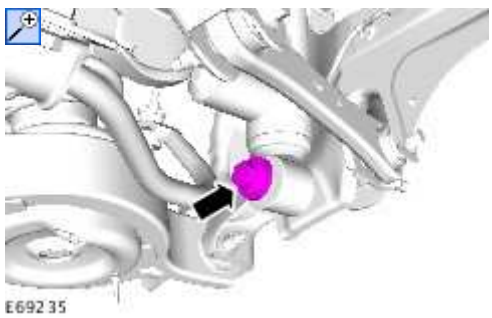
General Equipment

Transmission jack

Removal

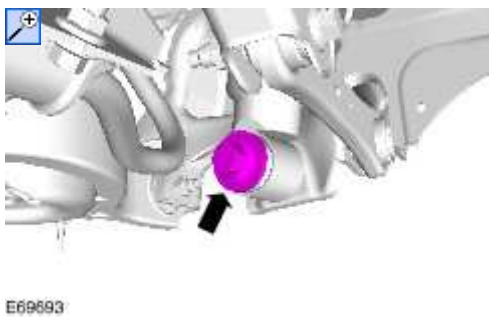
NOTE: Removal steps in this procedure may contain installation details.

1. *General Equipment:* Transmission jack



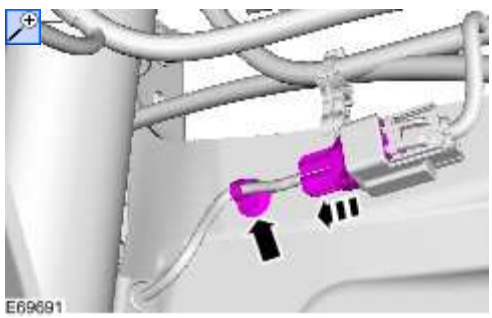
2. *Torque:* 175 Nm

Vehicles with load-leveling shock absorbers



3. *Torque:* 280 Nm

Vehicles with dynamic suspension



4.

All vehicles

5. *Torque:* 30 Nm

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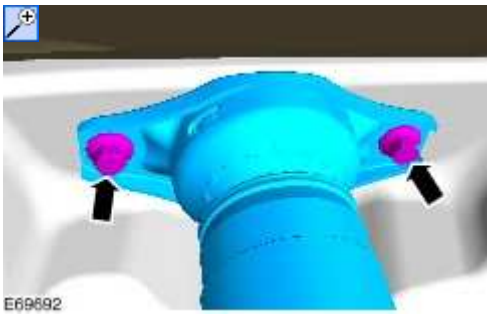

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal and Installation

1. Refer to: Rear Stabilizer Bar (204-02 Rear Suspension, Removal and Installation).

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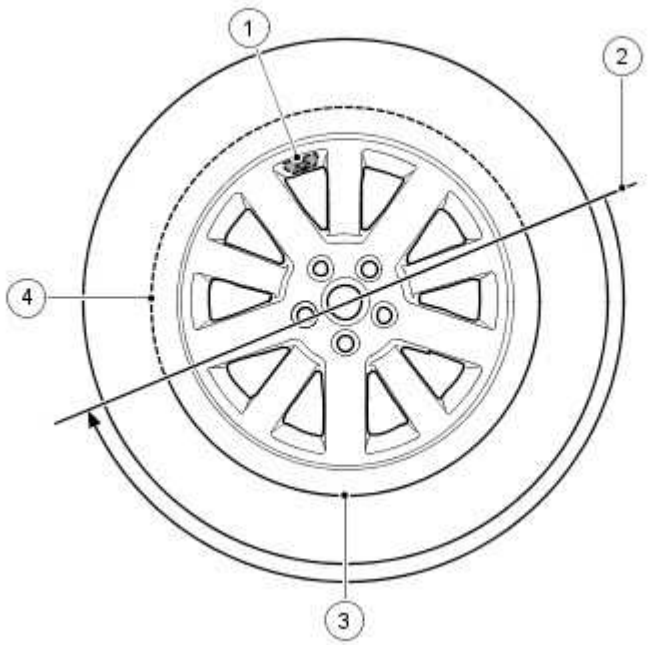
Description and Operation

Vehicles equipped with a tire pressure sensor

Care must be taken when removing and installing tires to make sure that the tire pressure sensor is not damaged.

CAUTION: To avoid contact with the track rod end, only adhesive weights may be used on the inside of 17 inch aluminium wheels.



Item	Part Number	Description
1	-	Tire valve and pressure sensor
2	-	Tire removal/install tool starting position
3	-	Tire and bead high tension area
4	-	Tire and bead low tension area

When removing the tire, the bead breaker must not be used within 90 degrees of the tire valve in each direction.

When using the tire removal machine, the fitting arm start position must be as shown. The wheel can then be rotated through 180 degrees in a counterclockwise direction. This will release the high tension from the tire bead allowing the remaining 180 degrees of the tire to be manually released from the wheel rim.

When installing the tire, position the fitting arm as shown. Rotate the tire in a clockwise direction taking care that the bead on the side of the tire experiencing low tension does not damage the sensor.

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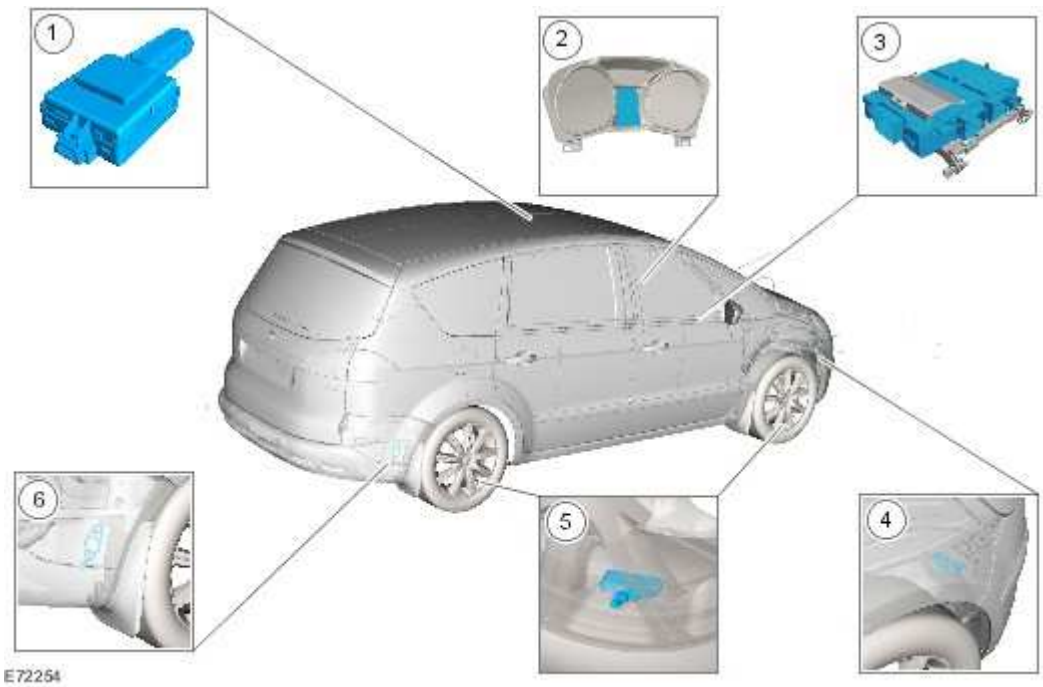
Description and Operation

Tire Pressure Monitoring System

Wheels fitted with the tire low pressure sensor can be visually identified by a grey valve dust cap. All Ford non-tire pressure monitoring system wheels have a black valve dust cap.

The tire pressure monitoring system monitors pressure in each tire in a road wheel position. The tire pressure monitoring system monitors the pressure in each tire on the vehicle and provides the pressure information from all wheels to the driver through the instrument cluster menu.

General Overview



Item	Part Number	Description
1	-	Radio frequency (RF) receiver
2	-	Instrument cluster
3	-	Central junction box (CJB)
4	-	Tire pressure monitoring system front antenna
5	-	Tire low pressure sensor(s)
6	-	Tire pressure monitoring system rear antenna

CAUTION: When removing or installing a new tire care must be taken to make sure that the tire low pressure sensor is not damaged. Make sure the tire bead is broken from the wheel rim 180 degrees from the tire low pressure sensor.

The purpose of the tire pressure monitoring system is to assist the driver in maintaining the vehicles tire pressures at the optimum level in order to:

- Improve fuel consumption
- Maintain ride and handling characteristics
- Reduce the risk of tire failure – which may be caused by under-inflated tires
- Comply with legislation in relevant markets
- Aid the driver during the use of run-flat tires

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During a blow-out, very rapid tire pressure is experienced. The tire pressure monitoring system is not intended to warn the driver of a blow-out, since it is not possible to give the driver sufficient warning that such an event is occurring, due to its short duration. The design of the tire pressure monitoring system is to assist the driver in keeping the tires at the correct pressure, which may reduce the likelihood of a tire blow-out occurring.

Principles of Operation

On driving off at a speed of more than 20 kph (12.5 mph) the central junction box (CJB) sends a low-frequency (LF) signal to each tire pressure monitoring system antenna in turn. Each antenna initiates its specific tire low pressure sensor. The corresponding tire low pressure sensor responds after detecting its LF signal by sending a radio frequency (RF) (315 MHz or 433 MHz depending on market) signal. These signals contain data which corresponds to tire low pressure sensor identification, tire pressure, tire temperature and vehicle acceleration information.

As each wheel responds to the LF signal from the CJB, it is assigned a position on the vehicle and is monitored for the remainder of that drive cycle in that position.

The tire pressure monitoring system antennas operate in turn for 15 seconds in the following order:

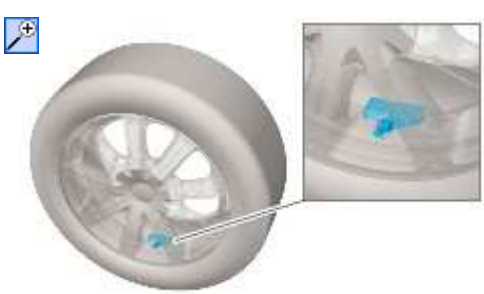
- Left-hand front
- Right-hand front
- Right-hand rear
- Left-hand rear

Each tire low pressure sensor responds in turn so that the CJB can establish the tire low pressure sensor positions at the start of the drive cycle. This process is repeated up to 3 times but less if the tire low pressure sensor positions are already known in the CJB. This process takes 3 to 4 minutes to complete. During this period the tire low pressure sensors transmit at regular intervals once every 15 seconds. For the remainder of the drive cycle the tire low pressure sensors transmit once every 60 seconds or if a change in tire pressure is sensed until the vehicle stops and the tire pressure monitoring system returns to park mode.

The low tire pressure warning occurs at 25% + 35% deflation and consists of amber and red warning lamp indicators and an appropriate message displayed in the information and message center. The information and message center will also display additional information about the position of the affected tire(s).

The tire pressure monitoring system enters the park mode after the vehicle speed has been less than 20 km/h (12.5 mph) for 15 minutes. In park mode the tire low pressure sensors transmit a coded signal to the CJB once every 13 hours. If the tire pressure decreases by more than 0.06 bar (1 lbf/in²) within the 13 hours, the tire low pressure sensor will transmit more often as the tire pressure is lost.

Tire Low Pressure Sensor



E72255

The tire pressure monitoring system uses active tire low pressure sensors which are mounted on each wheel, inside the tire cavity. The tire low pressure sensor is retained in position by the tire valve nut to the wheel. The tire low pressure sensors transmit their RF

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signals at either 315 MHz or 433 MHz dependent on market requirements.

The tire low pressure sensors periodically measure the tire pressure and temperature of the air inside the respective tires. Pressure and temperature measurements are transmitted periodically to the RF receiver on the vehicle.

The tire low pressure sensors are self-contained units.

The safety points detailed in tire changing must be followed to avoid damage to the tire low pressure sensor. If the tire low pressure sensor is removed, the nut, valve core, cap, seal and washer must also be installed and the tire low pressure sensor tightened to the correct torque value.

It is strongly recommended that the valve seal and steel washer is replaced each time a tire is changed to avoid a seal failure. The seal and washer must be replaced if the sensor is removed. Removal of the sensor retaining nut must be regarded as sensor removal. The valve cap must always be in place except when inflating, releasing pressure or checking pressure.

The RF transmission from the tire low pressure sensor contains a unique identification code in its transmission data so that the CJB can identify the tire on the vehicle. If a new tire low pressure sensor is installed on a road wheel, the new tire low pressure sensor identification will be learnt when the vehicle is first driven at a speed of more than 20 km/h (12.5 mph) for 15 minutes.

It is strongly recommended that the valve seal and steel washer is replaced each time a tire is changed to avoid a seal failure. The seal and washer must be replaced if the sensor is removed. Removal of the sensor retaining nut must be regarded as sensor removal. The valve cap must always be in place except when inflating, releasing pressure or checking pressure.

Tire Pressure Monitoring System Antenna(s)

E72304

The tire pressure monitoring system has four tire pressure monitoring system antennas. The tire pressure monitoring front antennas are located on top of the fender splash shield. The tire pressure monitoring rear antennas are located on the rear bumper bracket. Each tire pressure monitoring system antenna has a connector which connects with the body wiring harness.

The tire pressure monitoring antenna is a passive, LF transmitter. Each tire pressure monitoring system antenna is controlled by the CJB and provides an auto-location feature to identify tire positions on the vehicle.

The CJB energizes each tire pressure monitoring antenna in turn using LF drivers. The corresponding tire low pressure sensor detects the resulting LF transmission and modifies the mode status within the RF transmission. This data is received by the CJB through the RF receiver. The CJB can then determine which tire low pressure sensor is transmitting and its location on the vehicle.

CJB

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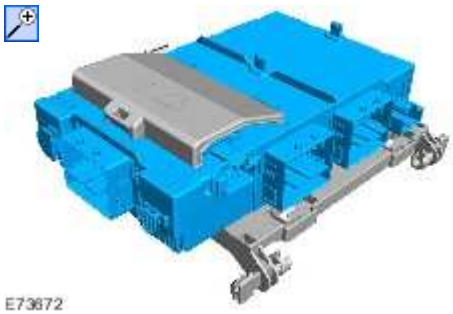

E73672

The function of the CJB with the tire pressure monitoring system is to detect the following:

- The tire pressure is below the recommended low tolerance value – under-inflated tire
- The position of the tire on the vehicle.

The CJB communicates with the vehicle instrument cluster to provide the driver with appropriate warnings and also indicates the status/failure of tire pressure monitoring system components.

Tire Location

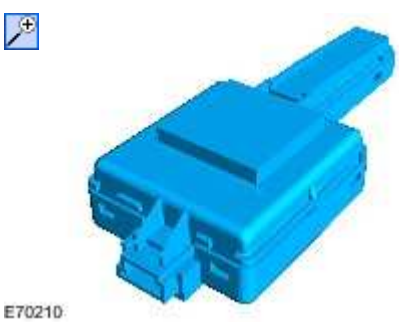
Because of the requirement for different pressure targets and thresholds for the front and rear tires, the CJB needs to identify the position of the tires on the vehicle and assign a received tire low pressure sensor identification to a specific position on the vehicle (left-hand front (FL), right-hand front (FR), left-hand rear (RL) or right-hand rear (RR)).

Tire location is carried out automatically by the CJB using an auto-location function. The CJB automatically learns the position of tires on the vehicle if the tire low pressure sensors or their positions are changed on the vehicle.

The CJB automatically detects, under normal conditions, the following:

- One or more new tire low pressure sensors have been installed
- One or more tire low pressure sensor has stopped transmitting
- Signals from tire low pressure sensors that do not belong to the vehicle.

RF receiver


E70210

The RF receiver is part of the central locking system and is located above the headliner in the vicinity of the overhead console.

The RF receiver receives tire pressure, temperature and vehicle acceleration information from each tire low pressure sensor and interfaces with the CJB. The CJB then transmits the appropriate messages to the instrument cluster through the controller area network (CAN) bus.

The RF receiver also receives further information from each tire low pressure sensor concerning wheel identification, mode status and the condition of the tire low pressure sensor.

Instrument Cluster

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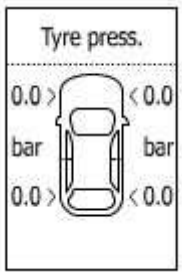
E71685



E70535

The tire pressures on all 4 tires are displayed in the message center of the instrument cluster, after being relayed by the CJB. Warnings are also visually displayed by the amber and red warning indicators and a message is displayed in the information and message center.

The warning indicators are driven by CAN messages from the CJB.

Tire Pressure Monitoring System Load Setting

The tire pressure monitoring system load setting switch is used by the driver to set the required load conditions of the vehicle, normal load or high load.

Using the button located on the steering wheel right-hand side switch, select the Information/Tires menu (located in the instrument cluster information and message center).

E70520

To set the tire pressure monitoring system load setting required, select Set up/Tires menu.

The tire pressure monitoring system load setting can now be selected:

· Low load

· High load

To confirm the setting select OK.

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Diagnosis and Testing

Inspection and Verification

Visual Inspection Chart

Mechanical
Wheel(s)
Tire(s)
Tire pressure(s) *
Wheel nuts
Wheel studs
* Vehicles equipped with a tire pressure monitoring system must be inspected for correct operation using the diagnostic tool.

To maximize tire performance, inspect the tires for signs of incorrect inflation and uneven wear which may indicate a need for balancing, rotation or suspension alignment. Tires should also be checked frequently for cuts, stone bruises, abrasions, blisters and for objects that may have become embedded in the tread. More frequent inspections are recommended when rapid or extreme temperature changes occur or when road surfaces are rough or occasionally littered with foreign material.

As a further visible check of tire condition, tread wear indicators are molded into the bottom of the tread grooves. When these indicator bands become visible, new tires must be installed.

Tire Wear Diagnosis

Uneven wear is usually caused by either excessive camber or excessive toe on tires.

Sometimes incorrect toe settings or worn struts will cause severe `cupping' or `scalloped' tire wear on non-driven wheels.

Severely incorrect toe settings will also cause other unusual wear patterns.

Tire Vibration Diagnosis

A tire vibration diagnostic procedure always begins with a road test. The road test and customer interview (if available) will provide much of the information needed to find the source of a vibration.

During the road test, drive the vehicle on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

- the speed at which the vibration occurs.
- what type of vibration occurs in each speed range.
  - mechanical or audible
- how the vibration is affected by changes in the following:
  - engine torque
  - vehicle speed
  - engine speed
- type of vibration - sensitivity:
  - torque sensitive
  - vehicle speed sensitive
  - engine speed sensitive

The following explanations help isolate the source of the vibration.

Torque Sensitive

This means that the condition can be improved or made worse by accelerating, decelerating, coasting, maintaining a steady vehicle speed or applying engine torque.

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Vehicle Speed Sensitive

This means that the vibration always occurs at the same vehicle speed and is not affected by engine torque, engine speed or the transmission gear selected.

Engine Speed Sensitive

This means that the vibration occurs at varying vehicle speeds when a different transmission gear is selected. It can sometimes be isolated by increasing or decreasing engine speed with the transmission in NEUTRAL or by stall testing with the transmission in gear. If the condition is engine speed sensitive, the cause is probably not related to the tires.

If the road test indicates that there is tire whine, but no shake or vibration, the noise originates with the contact between the tire and the road surface.

A thumping noise usually means that the tire is flat or has soft spots making a noise as they slap the roadway. Tire whine can be distinguished from axle noise. Tire whine remains the same over a range of speeds.

A complete road test procedure is described in Section 100-04. REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

Symptom Chart

Symptom	Possible Sources	Action
Tire(s) show excess wear on edge of tread	* Tire(s) under-inflated.	* ADJUST the tire pressure(s).
	* Vehicle overloaded.	* CORRECT as necessary.
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: (204-00 Suspension System - General Information) Specifications (Specifications), Front Toe Adjustment (General Procedures).
Tire(s) show excess wear in center of tread	* Tire(s) over-inflated.	* ADJUST the tire pressure(s).
Other excessive tire wear concerns	* Incorrect tire pressure(s).	* ADJUST the tire pressure(s).
	* Wheel and tire assemblies need rotating.	* ROTATE the wheel and tire assemblies.
	* Incorrect wheel alignment.	* ADJUST the wheel alignment. REFER to: (204-00 Suspension System - General Information) Specifications (Specifications), Front Toe Adjustment (General Procedures).
	* Vehicle overloaded.	* CORRECT as necessary.
	* Loose or leaking front strut and spring assembly.	* TIGHTEN or INSTALL new suspension components as necessary. REFER to: Shock Absorber and Spring Assembly (204-01 Front Suspension, Removal and Installation).
	* Wheel bearings worn.	* INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation), Rear Wheel Bearing (204-02 Rear Suspension, Removal and Installation).
	* Suspension components, bushings and ball joints.	* CHECK or INSTALL new suspension components as necessary.
	* Excessive lateral	* BALANCE the wheel and tire assemblies. Using a

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	or radial runout of wheel or tire.	suitable dial indicator gauge and holding fixture, CHECK lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Wheel and Tire (Removal and Installation).
Wobble or shimmy affecting wheel runout	* Damaged wheel.	* INSPECT the wheel rims for damage. BALANCE the wheel and tire assemblies. Using a suitable dial indicator gauge and holding fixture, CHECK lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Wheel and Tire (Removal and Installation).
	* Front wheel bearing.	* CHECK or INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
Excessive vehicle vibration, rough steering	* Suspension components.	* CHECK or INSTALL new suspension components as necessary.
Vehicle vibrations from wheels and tires	* Incorrect tire pressure(s).	* ADJUST the tire pressure(s).
	* Wheel or tire imbalance.	* BALANCE the wheel and tire assemblies.
	* Uneven tire wear.	* INSTALL a new tire(s) as necessary. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	* Brake disc imbalance.	* CHECK the brake disc for foreign material.
	* Water in tire(s).	* REMOVE the water.
	* Bent wheel.	* INSTALL a new wheel and tire assembly. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	* Incorrectly seated tire bead.	* SPIN the wheel on the vehicle. EXAMINE the area where the tire and the wheel meet. If that section of the tire appears to waver while being rotated, the tire bead may not be correctly seated on the wheel. REMOVE the tire and CLEAN the bead seat areas on both wheel and tire.
	* Excessive lateral or radial runout of wheel or tire.	* BALANCE the wheel and tire assemblies. Using a suitable dial indicator gauge and holding fixture, CHECK the lateral and radial runout of the wheel and tire assemblies. INSTALL new wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Wheel and Tire (Removal and Installation).
	* Foreign material between wheel mounting face and hub mounting surface.	* CLEAN mounting surfaces.
	* Front wheel bearing.	* CHECK or INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
Rust streaks from the wheel stud holes in the wheel	* Wheel nuts.	* REMOVE the wheel and tire assembly. Inspect the wheel nuts and wheel and tire assembly for damage. INSTALL new wheel nuts and wheel and tire assemblies as necessary. REFER to: (204-04 Wheels and Tires) Wheel and Tire (Removal and Installation).

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Seized wheel nuts	* Corrosion.	* CAUTION: Do not permit lubricant to get on cone sets of stud holes or on cone angle of wheel nuts. If corrosion is slight, wire brush away. If corrosion is excessive, INSTALL new wheel studs and nuts. REFER to: (204-04 Wheels and Tires) Wheel and Tire (Removal and Installation). If the condition persists, LUBRICATE the first three threads of each wheel stud with a graphite-based lubricant.
	* Vehicle overloaded	* CORRECT as necessary.

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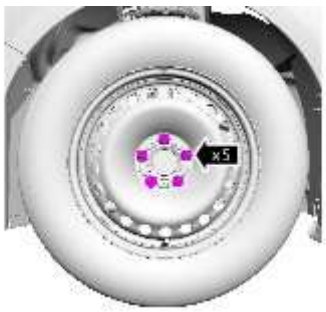
Removal and Installation

Removal

CAUTIONS:

Do not use heat to loosen a seized wheel nut.

Do not use power tools on locking wheel nuts.



E74933

1. Loosen the wheel nuts.

2. Raise and support the vehicle.

   Refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

E74934

3.

Installation

E74934

1. WARNING: Make sure that the mating faces are clean and free of corrosion and foreign material
   NOTE: Only tighten the nuts finger tight at this stage.

2. Lower the vehicle.
3. Tighten the wheel nuts in the sequence shown.

   Torque:
   Steel wheel nut M12 silver 140 Nm
   2-piece alloy wheel nut M12 with conical washer 140 Nm
   2-piece alloy wheel locking nut M12 with conical washer 110 Nm

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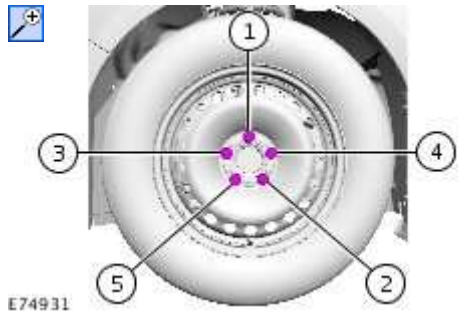

1-piece alloy wheel locking nut M12 140 Nm
All nuts M14 including locking nuts 170 Nm

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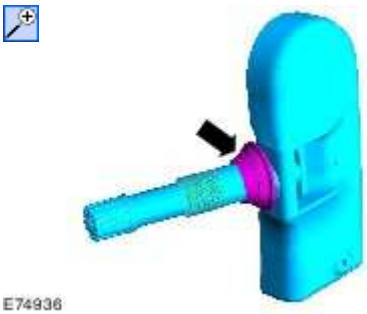
Removal and Installation

Removal

1. Remove the wheel and tire.

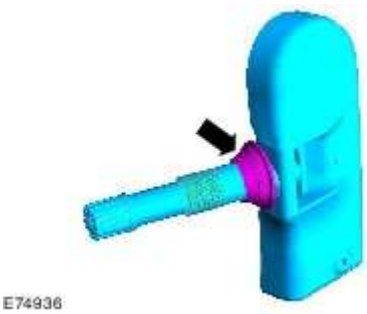
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2. Remove the tire from the wheel, release the tire bead from the rim 180 degrees from the valve.

3.

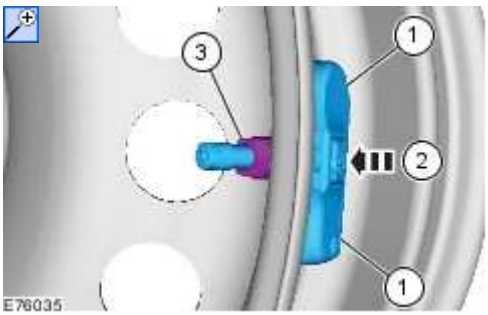


4.

Installation



1. NOTE: Make sure that the seal is correctly located.
   Install a new washer and seal, making sure the valve remains pressed fully onto its seat.



2. WARNINGS:

   Make sure that any corrosion or dirt is removed from the mating faces.

   Make sure that a new nut is installed.

   CAUTION: Use lint free cloth.
   1. NOTE: Only tighten the nut finger tight at this stage.
      Install the tire low pressure sensor and support the sensor body in position.

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2. Support the back of the valve stem in order to prevent rotation and damage to the tire low pressure sensor body.
3. CAUTION: Only use moderate force when installing the sensor.
   Gently push the nut towards the center of the wheel. Tighten the nut.

   Torque: 8.0 Nm

3. Install the tire and balance the wheel.
4. Install the wheel and tire.

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

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Removal and Installation

Removal and Installation

1. Refer to: Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Removal and Installation).

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Removal and Installation

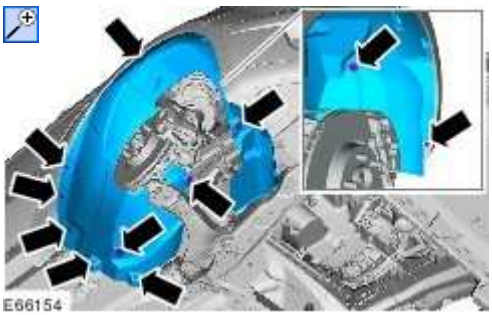
General Equipment

Ford diagnostic equipment

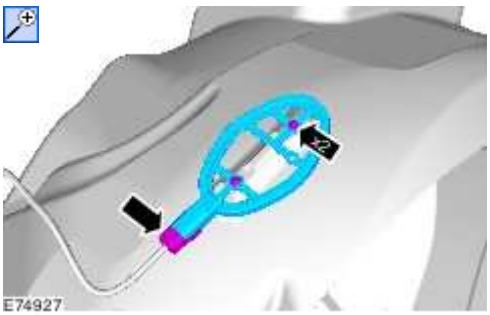
Removal

1. Remove the front wheel and tire.

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



2.



3. *Torque:* 8 Nm

Installation

1. To install, reverse the removal procedure.
2. Configure the tire pressure monitoring system front antenna.

   General Equipment: Ford diagnostic equipment

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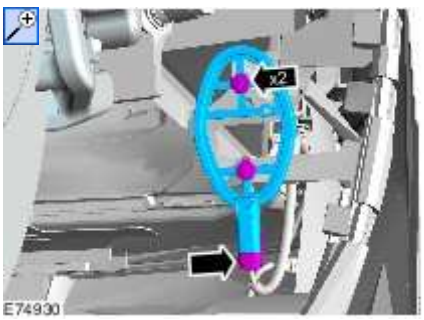
Removal and Installation

General Equipment

Ford diagnostic equipment

Removal



1. *Torque:* 8 Nm

Installation

1. To install, reverse the removal procedure.
2. Configure the tire pressure monitoring system rear antenna.

   General Equipment: Ford diagnostic equipment

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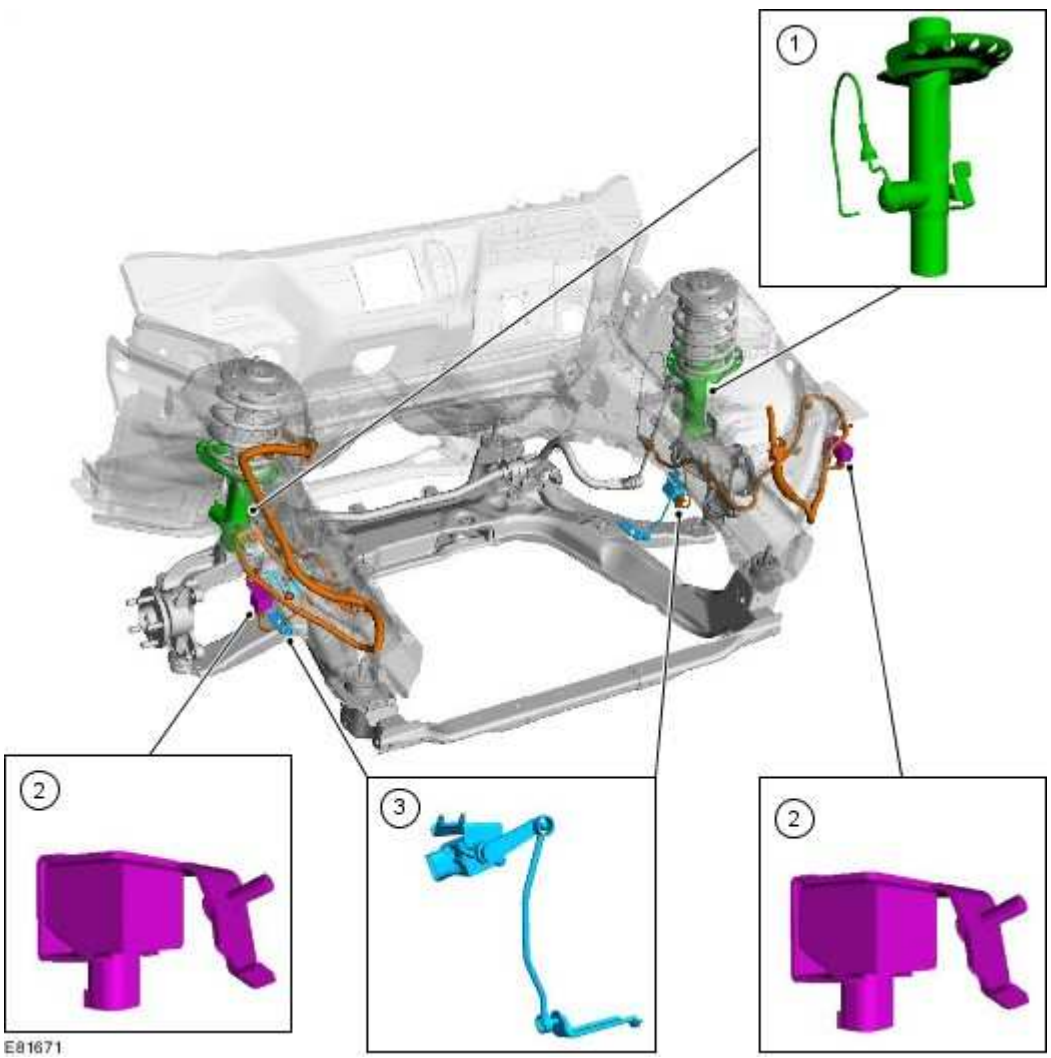
Description and Operation

System overview



Item	Part Number	Description
1	-	Front adaptive shock absorbers
2	-	Front vertical acceleration sensors
3	-	Front suspension height sensors

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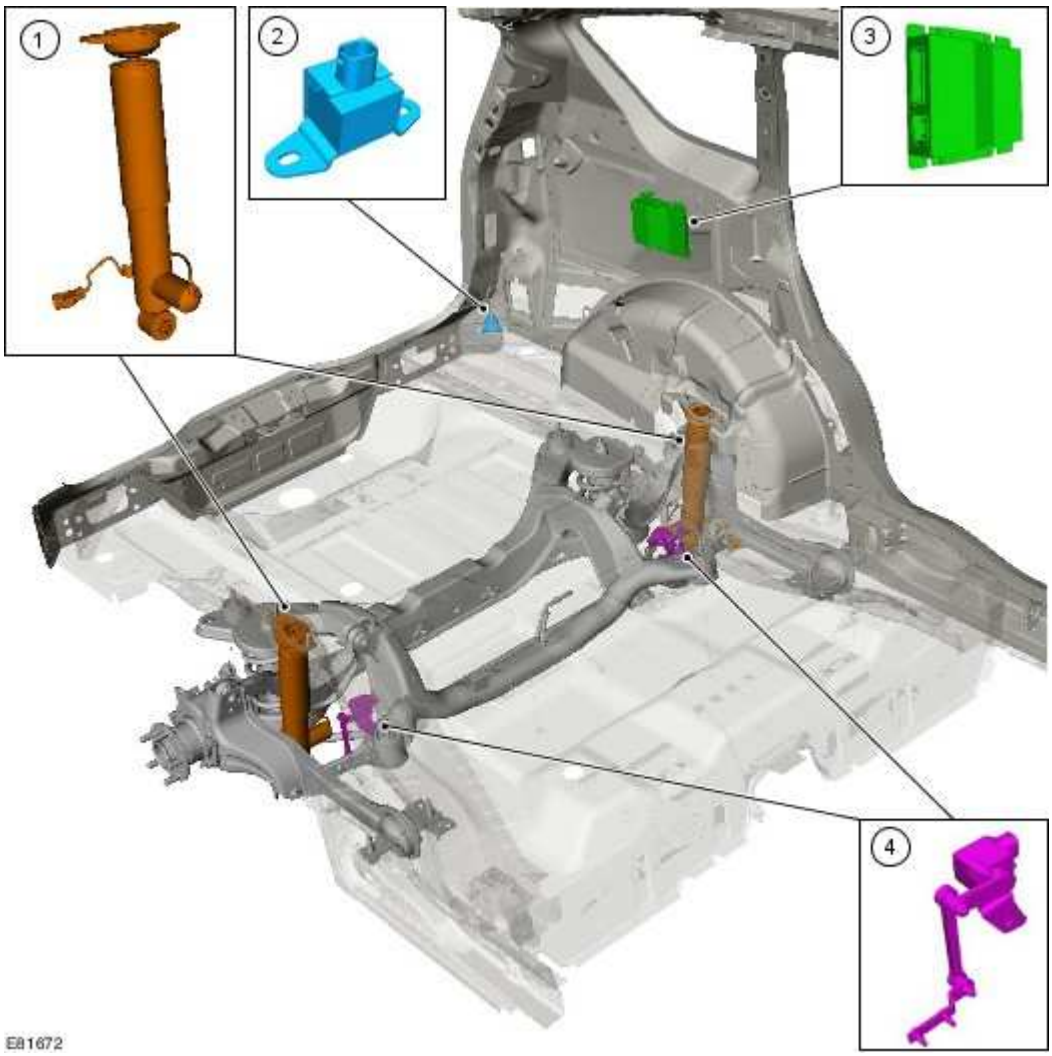
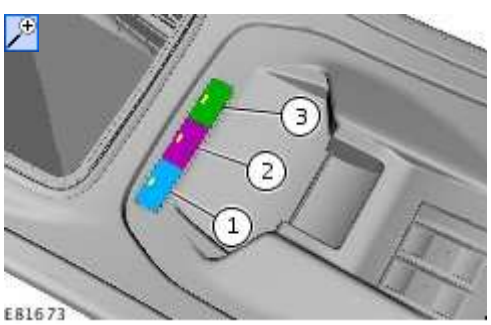


Item	Part Number	Description
1	-	Rear adaptive shock absorbers
2	-	Rear vertical acceleration sensor
3	-	Adaptive damping module
4	-	Rear suspension height sensors

The active suspension provides improved handling, comfort and stability by continuously adjusting the adaptive shock absorber properties to the current road and driving conditions. In conjunction with the anti-lock brake system (ABS) the system offers the benefit of potentially shorter stopping distances on rough road surfaces.



Item	Part Number	Description
1	-	Comfort
2	-	Normal

-

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3		Sport

Located in the floor console is the switch for the driver to choose one of the following suspension modes, comfort, normal and sport. The indicator in the switch will be illuminated and a text message, indicating the chosen suspension mode, will also appear in the instrument cluster for a few seconds.

E81674

The suspension system will be set to a fail safe mode if the adaptive module detects a concern in the system. The malfunction indicator lamp (MIL) will illuminate and a message will appear in the instrument cluster.

Basic operation

The adaptive damping module is connected to the high speed controller area network (HS-CAN) to communicate with the electronic stability programme (ESP), the anti-lock brake system (ABS), powertrain control modue (PCM) and other systems.

The adaptive damping module also receives information from the front and rear vertical acceleration sensors and the front and rear suspension height sensors.

With the information received the adaptive damper module monitors the heave, roll, pitch, cornering, braking and acceleration of the vehicle. Then, depending on the suspension mode selected by the driver, the module calculates the best action for each adaptive shock absorber within 2 ms.

Depending on the suspension mode selected, the adaptive damping module will send an electrical current to each damper in a range between 0.29A for comfort and 1.6A for sport.

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Removal and Installation

General Equipment

Ford diagnostic equipment

Removal

1. Remove the front suspension height sensor

   Refer to: Headlamp Leveling Front Sensor (417-01 Exterior Lighting, Removal and Installation).

Installation

1. Configure the adaptive damping module.

   General Equipment: Ford diagnostic equipment

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Removal and Installation

General Equipment

Ford diagnostic equipment

Removal

1. Remove the rear suspension height sensor.

   Refer to: Headlamp Leveling Rear Sensor (417-01 Exterior Lighting, Removal and Installation).

Installation

1. Configure the adaptive damping module.

   General Equipment: Ford diagnostic equipment

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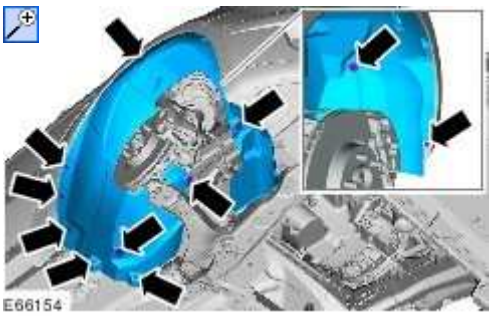
Removal and Installation

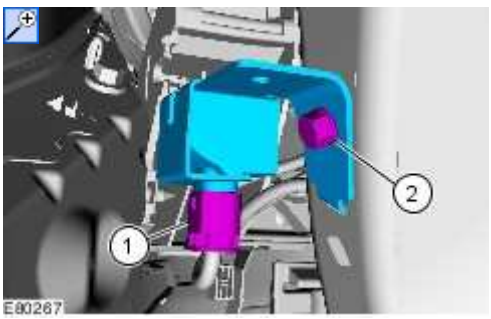
Removal

1. Remove the wheel and tire.

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



2.



3.
   2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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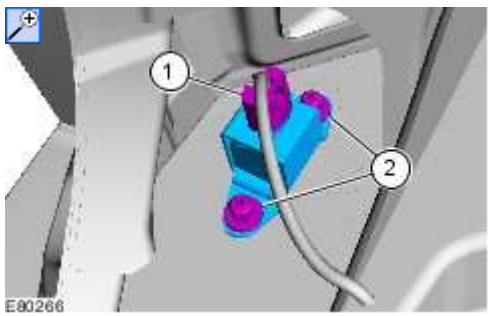
Removal and Installation

Removal



1. Remove the left-hand loadspace trim panel.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

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Lubricants, Fluids, Sealers and Adhesives

	Specifications
Outer Constant Velocity Joint Grease	WSS-M1C259-A1

Capacity

Description	Driveshaft Joint Grease Fill Capacity	
	Inner (Grams)	Outer (Grams)
2.0L engine with manual transaxle	180	150
2.5L engine with manual transaxle	100	150
1.8L diesel engine with manual transaxle	180	150
2.0L diesel engine with manual transaxle	180	150

Torque Specifications

Item	Nm	lb-ft	lb-in
Intermediate shaft center bearing bracket to engine block bolts (M8)	25	18	-
Intermediate shaft center bearing bracket to engine block bolts (M10)	48	35	-

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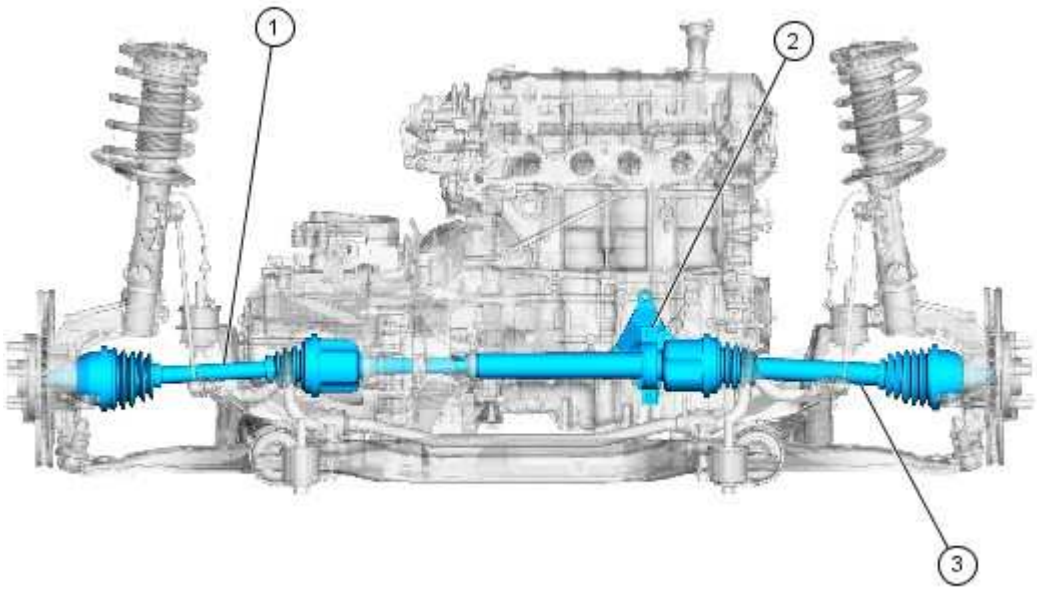
Description and Operation

- The halfshafts have constant velocity (CV) joints at both ends to provide smooth drive to the road wheels.
- The inner CV joints are sliding joints.
- The outer CV joints are fixed ball joints.
- The left-hand halfshaft CV joint is secured in the differential with a snap ring.
- The intermediate shaft (right-hand side) is secured in the differential by the intermediate shaft center bearing assembly.
- The outer CV joints are attached to the wheel hubs.



E77091

Item	Part Number	Description
1	-	Halfshaft LH
2	-	Intermediate shaft center bearing assembly
3	-	Halfshaft RH

Authoring Template

Working principle of the halfshafts

- The halfshafts transmit torque from the engine to the wheels.
- In order to allow vertical movement of the wheels and engine, the halfshafts operate at varying lengths and angles.
- The tripode joints allow for changes in halfshaft length during axial movements.

Handling halfshafts

CAUTION: The inner constant velocity (CV) joint must not be bent at more than 18 degrees, the outer CV joint must not be bent at more than 45 degrees.
NOTE: Do not place the tripode joint under tension.
If removing/installing and disassembling/assembling the halfshafts, the following points should be observed:

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- Check polished surfaces and splines for damage.
- Do not allow the boots and the clamps to come into contact with sharp edges, the engine or the exhaust system.
- Do not drop the halfshaft as this can damage the inside of the CV joint boots without showing any signs of damage on the outside.
- Do not use halfshafts as levering tools for the installation of other components. The halfshafts must always hang freely.
- The tripode joint can be damaged by impact from outside the joint housing.

Wheel balancing, front

CAUTION: Using a portable wheel balancing unit when the vehicle is lifted completely off the ground will result in damage to the tripode joints or boots, as the joint is bent at a greater angle than its normal operating range. This results in overheating of the joint.
To use a portable balancing unit position a trolley jack under the suspension arm opposite the wheel which is being balanced. This prevents the joint from being bent too much when the vehicle is raised.

Where possible, wheels should be removed for balancing, and balanced using a stationary wheel balancing unit.

Raising the vehicle

CAUTION: Never use the CV joints or halfshafts as jacking points.

Towing the vehicle

NOTE: Do not attach the tow rope to the halfshaft.

Underbody protection and corrosion prevention

NOTE: The boots should be covered during application of underbody protection or corrosion prevention.
Foreign matter on the boots can cause premature ageing of the material. Foreign matter on the halfshafts can cause imbalance.

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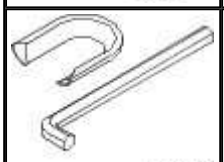
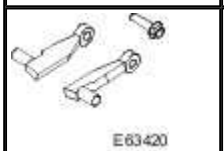
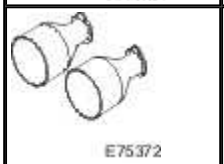
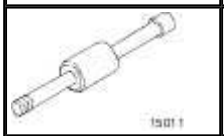
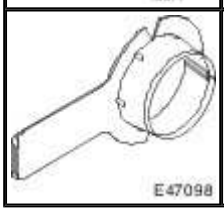
Print

Removal and Installation

Special Tool(s)

	204-226 Remover, Halfshaft
	204-226-01 Adapter for 204-266
	204-349 Protector Set, Ball Joint Gaiter
	204-605 Separator, Lower Arm Ball Joint
	204-607 Remover, Ball joint
	204-609 Protection Cap, Ball Joint Gaiter
	205-047 Slide Hammer
	205-775 Protector Halfshaft Seal

Removal

All vehicles

1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2.

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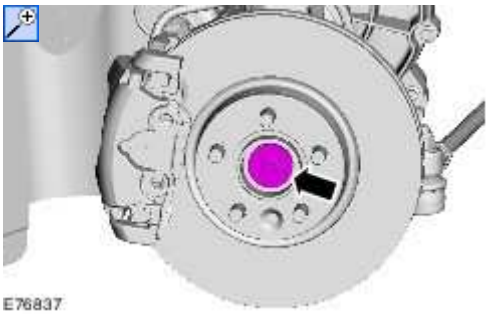
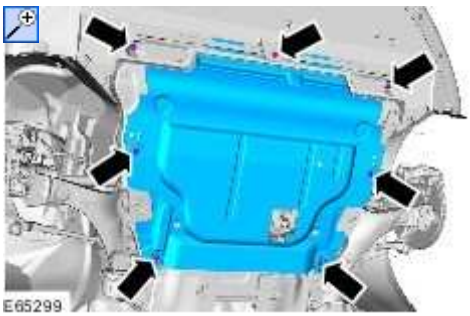
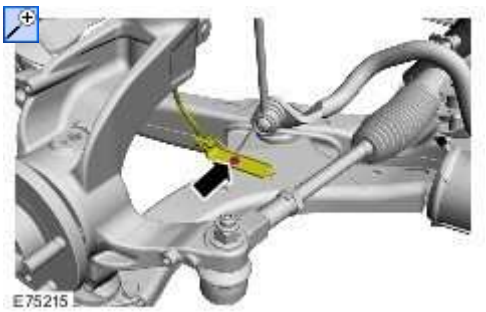

E76837


E65299

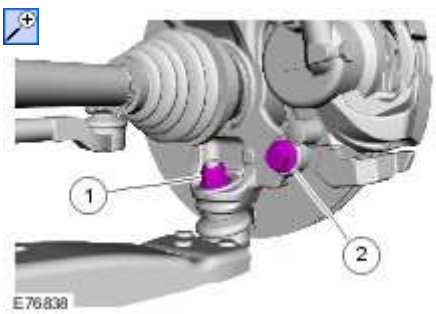
3. If equipped.

Vehicles with high intensity discharge headlamps


E75215

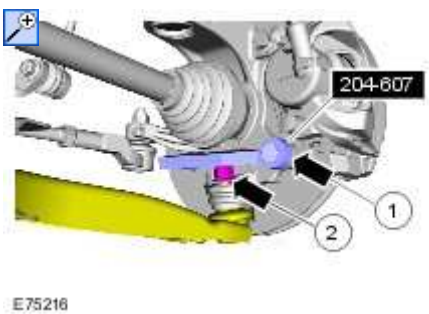
4.

All vehicles



E76838

5.
1. Loosen the nut two turns.



E75216

6. *Special Tool(s):* 204-607

7. *Special Tool(s):* 204-605

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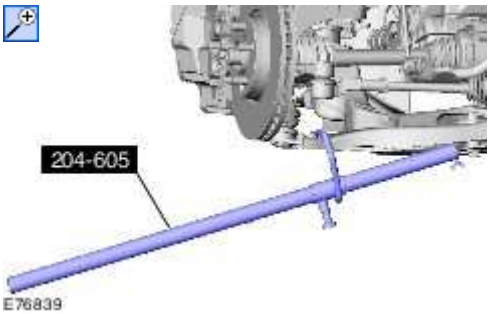
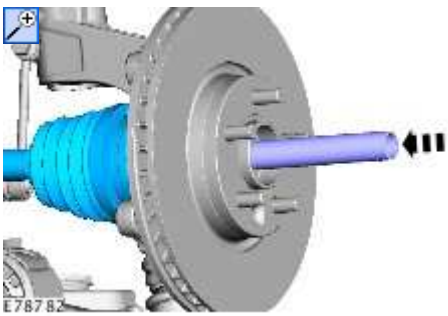


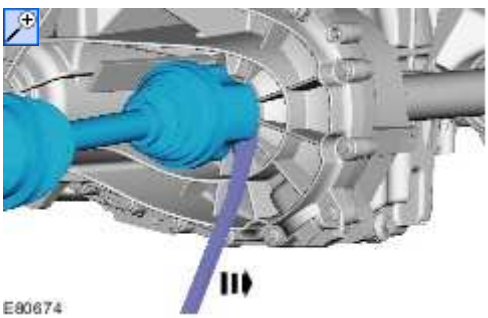
8. *Special Tool(s):* 204-609

9.



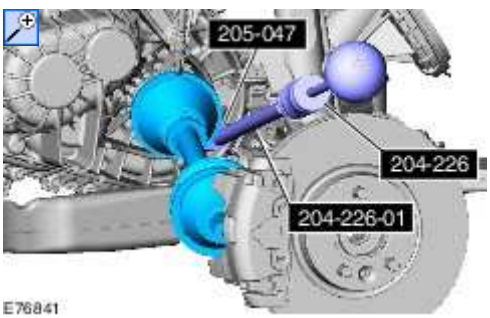
Vehicles with 1.8L or 2.0L engine

10.



Vehicles with 2.5L engine

11. *Special Tool(s):* 205-047, 204-226, 204-226-01



Installation

All vehicles

1. NOTE: Make sure that a new component is installed.

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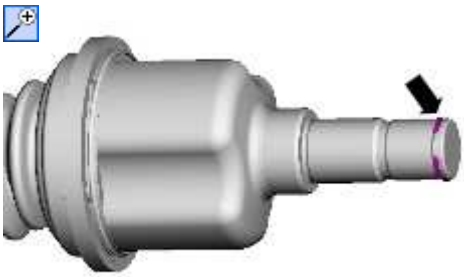
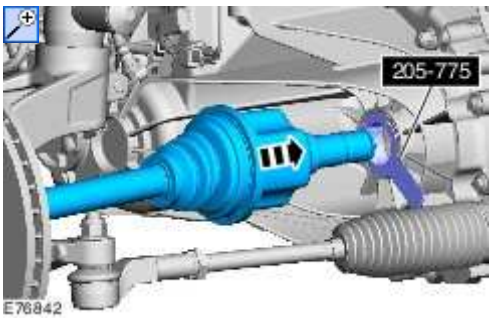


E78783



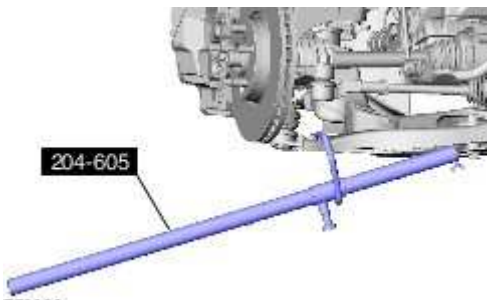
E76842

2. Remove the special tool before completely installing the halfshaft.

   Special Tool(s): 205-775

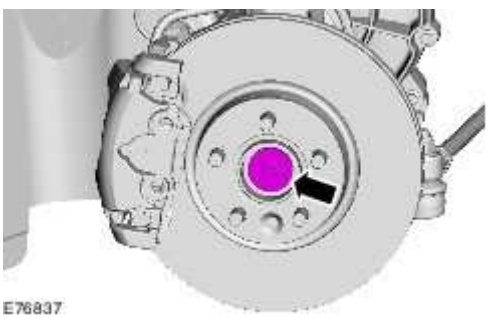
E76840

3. *Special Tool(s):* 204-609



E76839

4. *Special Tool(s):* 204-605



E76837

5. WARNING: Make sure that a new bolt is installed.
   Using the halfshaft bolt, connect the halfshaft to the wheel hub.

   Torque: 20 Nm

6. *Special Tool(s):* 204-349
   Torque: 100 Nm

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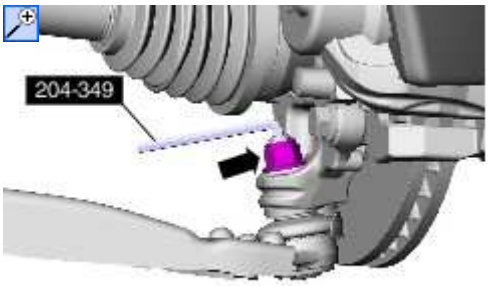
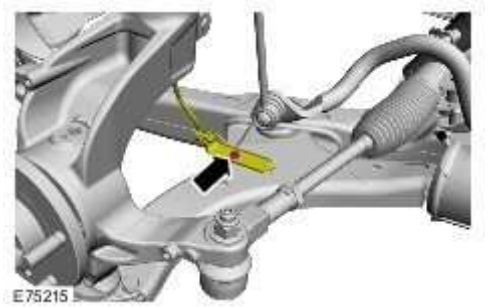


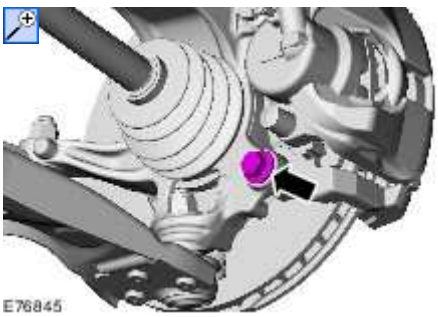
E77293

Vehicles with high intensity discharge headlamps

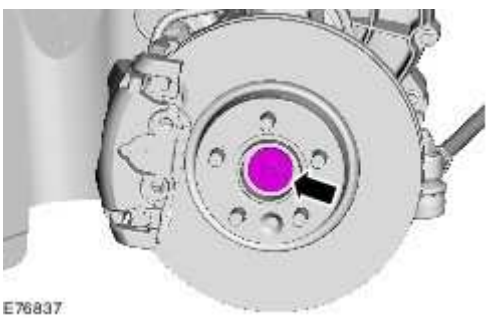

E75215

7. *Torque:* 8 Nm

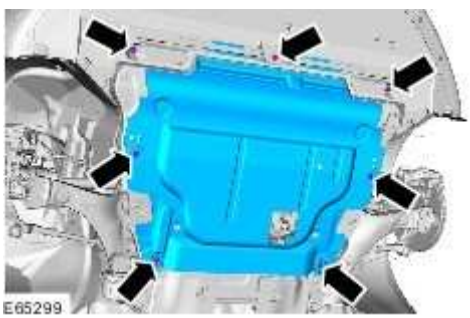
All vehicles


E76845

8. *Torque:* 200 Nm


E76837

9. *Torque:*
   Stage 1: 45 Nm
   Stage 2: 80°


E65299

10. If equipped.

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

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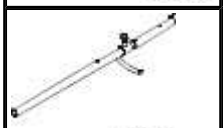
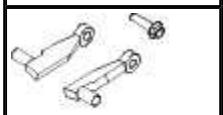
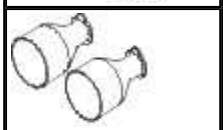
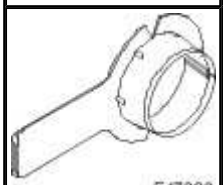
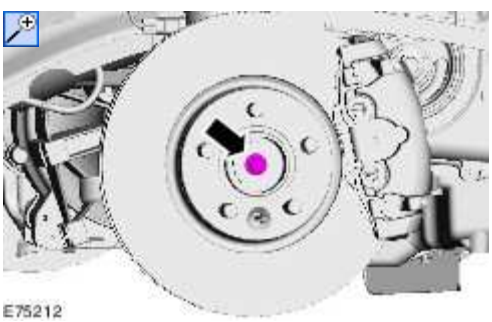
Removal and Installation

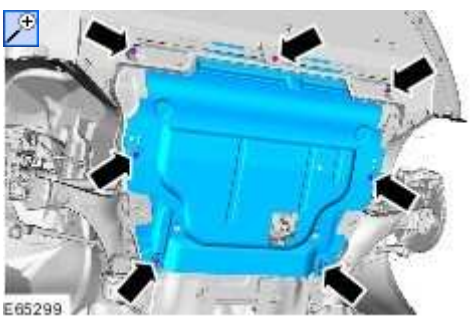
Special Tool(s)

E42949	204-349 Protector Set, Ball Joint Gaiter
 E63772	204-605 Separator, Lower Arm Ball Joint
 E63420	204-607 Remover, Ball joint
 E75372	204-609 Protection Cap, Ball Joint Gaiter
 E47098	205-775 Protector Halfshaft Seal

Removal

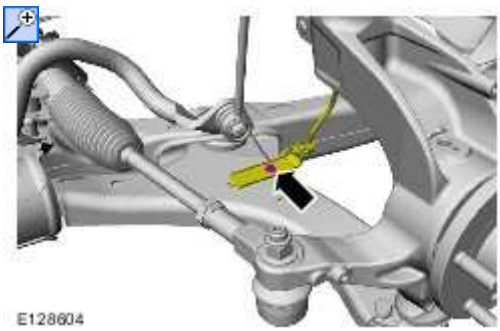
All vehicles

1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2.  E75212
3. If equipped.

 E65299

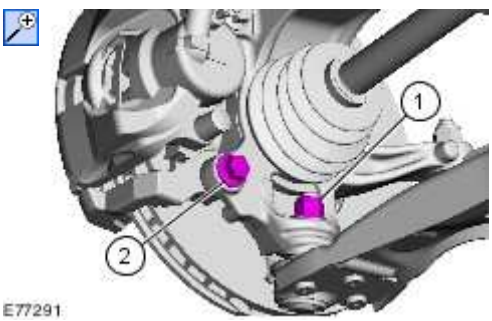
http://vnx.su

Vehicles with high intensity discharge headlamps


E128604

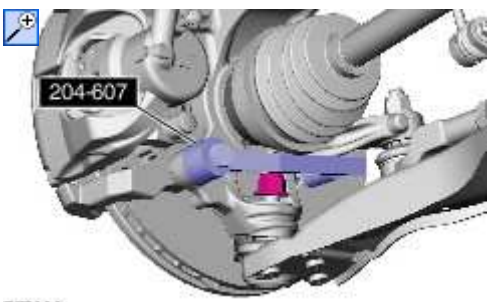
4. If equipped.

All vehicles



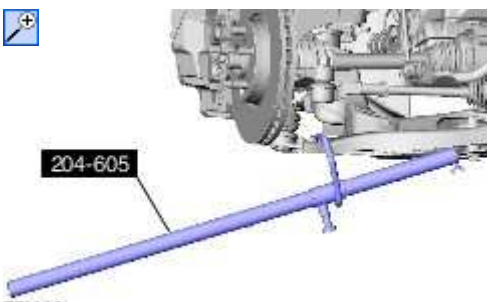
E77291

5.
   1. Loosen the nut two turns.



E77292

6. *Special Tool(s):* 204-607



E76839

7. *Special Tool(s):* 204-605

E76840

8. *Special Tool(s):* 204-609

9.

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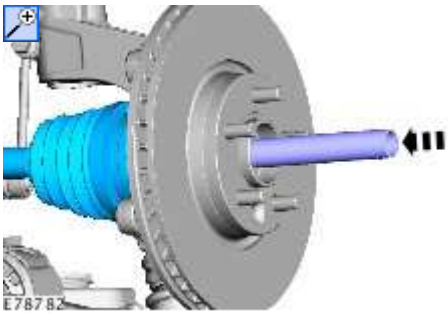
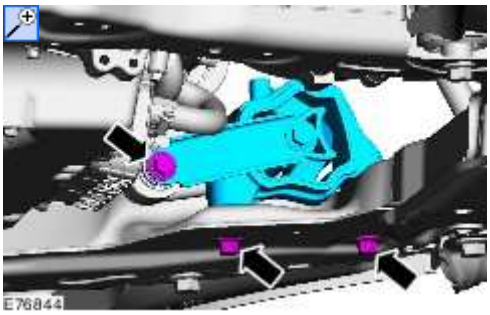
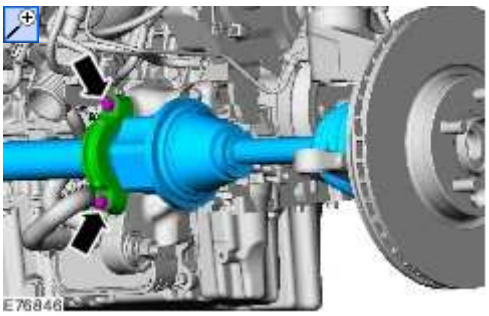


Vehicles with 2.5L engine

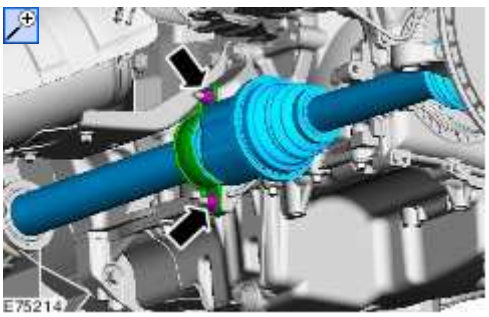


10.



11.

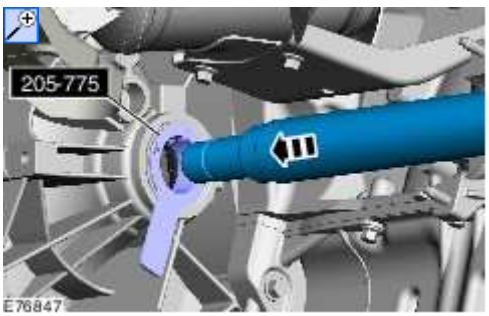
Vehicles with 2.0L engine, 1.8L or 2.0L diesel engine



12.

Installation

All vehicles



1. Remove the special tool before completely installing the halfshaft.

   Special Tool(s): 205-775

Vehicles with 2.0L engine, 1.8L or 2.0L diesel engine

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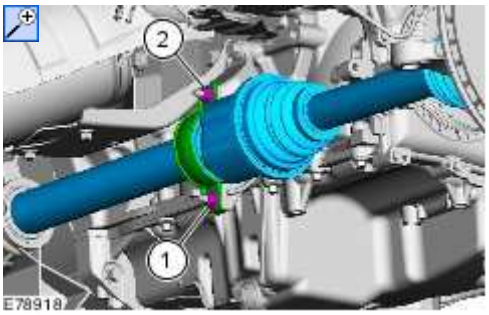
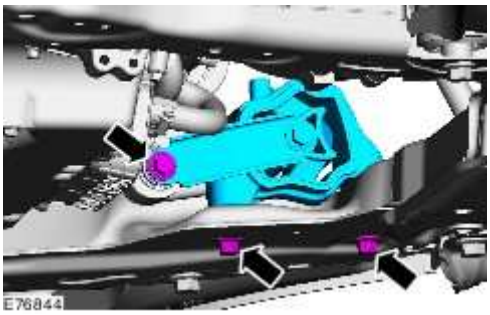
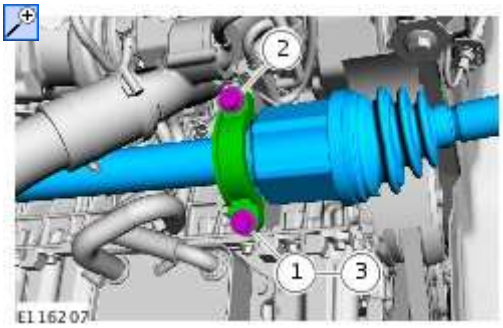


2. NOTE: Make sure that new components are installed.
   Torque:
   Stage 1: 6 Nm
   Stage 2: 25 Nm

Vehicles with 2.5L engine



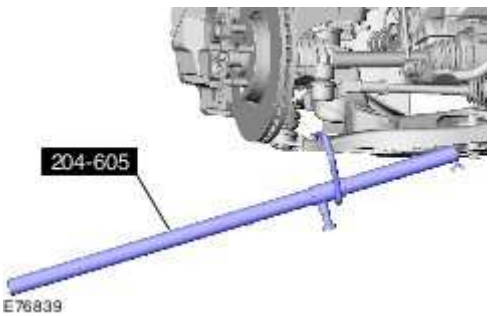
3. *Torque:* 40 Nm



4.
   1. *Torque:* 10 Nm
   2. *Torque:* 25 Nm
   3. *Torque:* 25 Nm

All vehicles

5. *Special Tool(s):* 204-609



6. *Special Tool(s):* 204-605

7. WARNING: Make sure that a new bolt is installed.
   Using the halfshaft bolt, connect the halfshaft to

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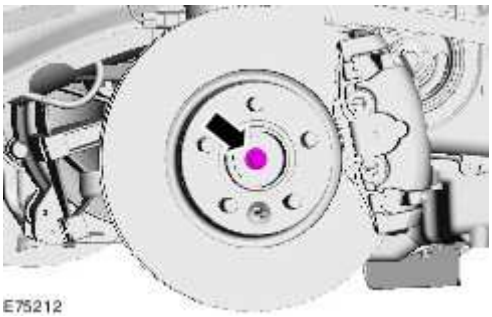
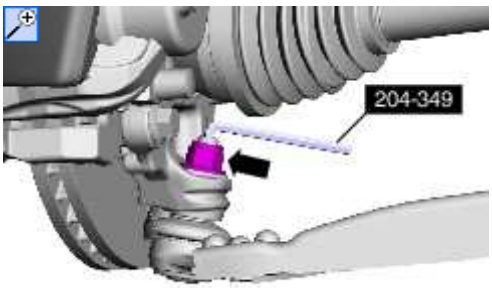

E75212

the wheel hub.

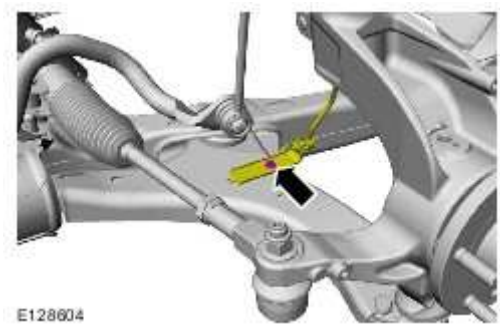
Torque: 20 Nm



E75213

8. *Special Tool(s):* 204-349
   Torque: 100 Nm

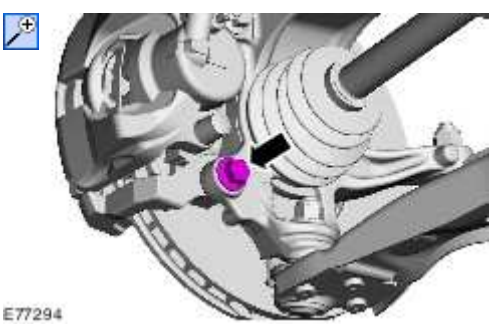
Vehicles with high intensity discharge headlamps


E128604

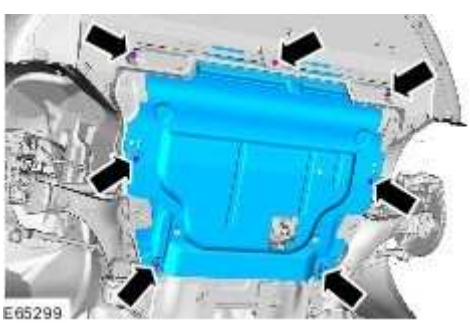
9. If equipped.

   Torque: 8 Nm

All vehicles


E77294

10. *Torque:* 200 Nm


E65299

11. If equipped.

12. *Torque:*
    Stage 1: 45 Nm
    Stage 2: 80°

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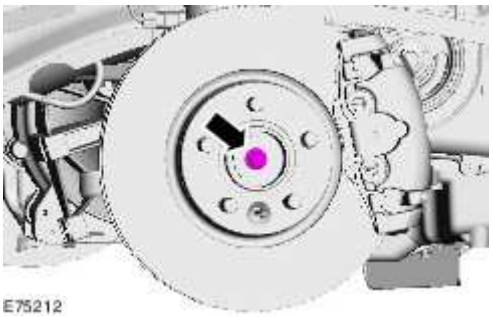
E75212

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

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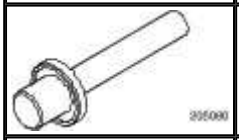
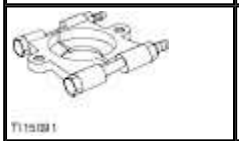
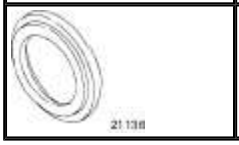
Removal and Installation

Special Tool(s)

	204-169 Clamping Tool, Boot Retaining Clamp
	205-080 Installer, Differential Bearing
	205-310 Remover, Bearing/Gear
	303-255 Installer, Timing Cover Seal

Materials

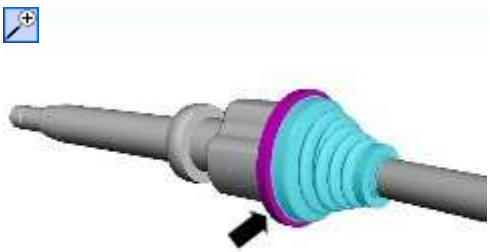
Name	Specification
Grease FD-R	WSS-M1C259-A1 / 3M5J-M1C259-AA

General Equipment

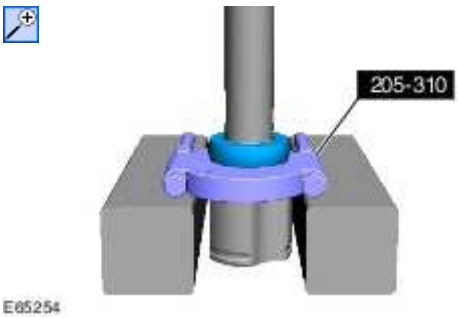
Hydraulic press

Removal

1. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
2. Discard the constant velocity (CV) joint boot.



E73018



E65254

3. NOTE: Note the position of the component before removal.
   Special Tool(s): 205-310
   General Equipment: Hydraulic press

Installation

1. NOTE: Make sure that this component is

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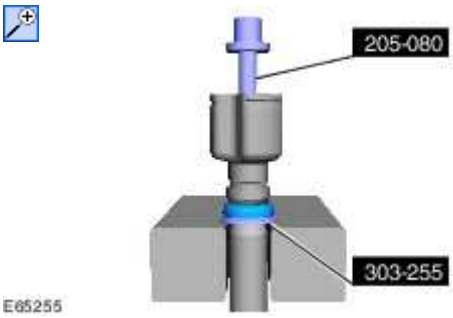
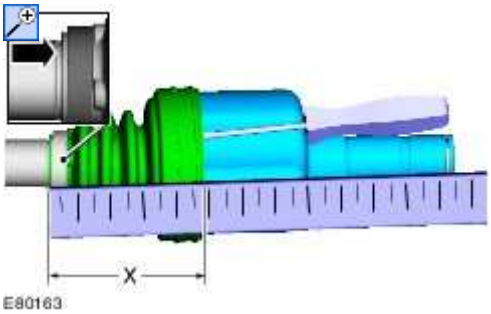
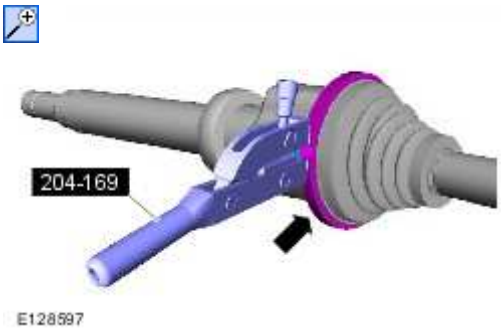


installed to the noted removal position.
Special Tool(s): 205-080, 303-255
General Equipment: Hydraulic press



2.
- Fill the CV joint with grease.

  Material: Grease FD-R (WSS-M1C259-A1 / 3M5J-M1C259-AA)
- Insert a small screwdriver under the boot seat to allow the air to escape.
- Push on the tripode housing to stop, then pull it back 25 mm (x = 95 Nm).
- Remove the screwdriver.



3. CAUTION: Make sure that a new inner constant velocity (CV) joint boot is installed.
Special Tool(s): 204-169
Torque: 21 Nm

4. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

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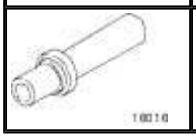
Removal and Installation

Special Tool(s)

	204-169 Clamping Tool, Boot Retaining Clamp
	308-046 Installer, Transmission Extension Housing Bushing/Seal

Materials

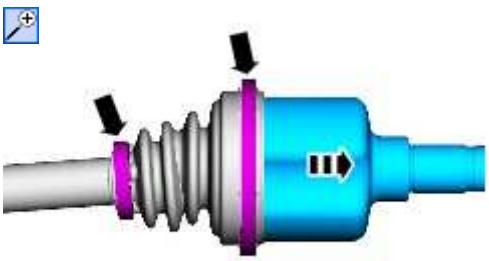
Name	Specification
Grease FD-R	WSS-M1C259-A1 / 3M5J-M1C259-AA

General Equipment

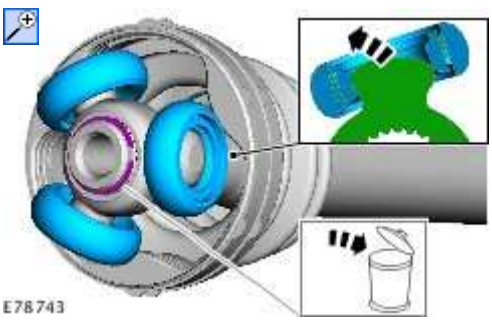
Puller

Removal

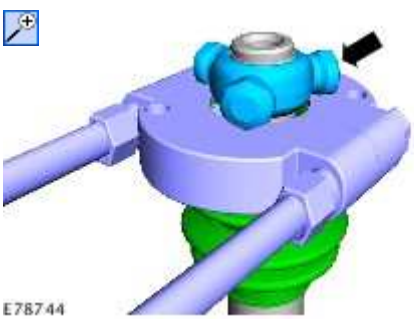
1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).


E77183

2. Discard the grease.


E78743

3.


E78744

4. *General Equipment:* Puller

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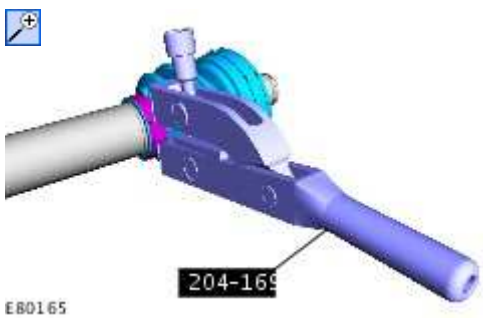
E78781

5.

Installation

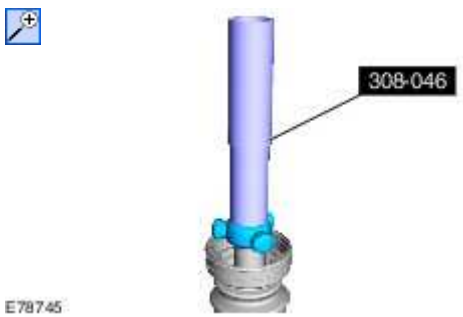
E78781

1.



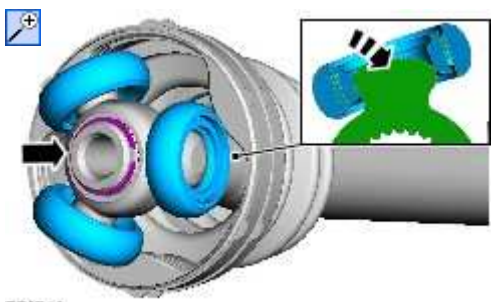
E80165

2. *Special Tool(s):* 204-169
Torque: 21 Nm



E78745

3. *Special Tool(s):* 308-046



E78746

4. NOTE: Make sure that a new component is installed.

5.

- Fill the CV joint with grease.

  Material: Grease FD-R (WSS-M1C259-A1 / 3M5J-M1C259-AA)
- Insert a small screwdriver under the boot

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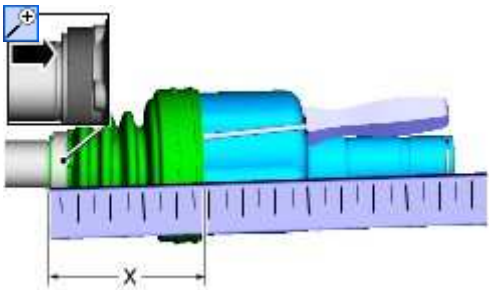
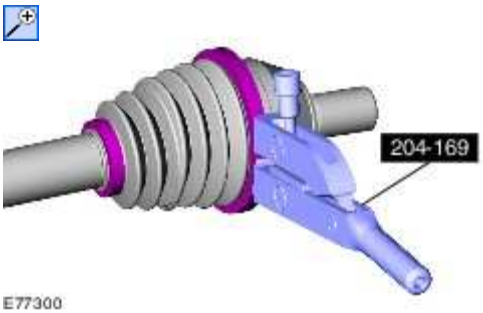


E80163

seat to allow the air to escape.
- Push on the tripode housing to stop, then pull it back 25 mm (x = 95 mm).
- Remove the screwdriver.



E77300

6. *Special Tool(s):* 204-169
Torque: 21 Nm

7. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

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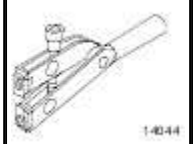
Removal and Installation

Special Tool(s)

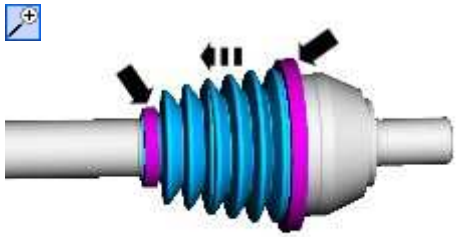
	204-169 Clamping Tool, Boot Retaining Clamp

Removal

1. Remove the inner CV joint boot.

   Refer to: Inner Constant Velocity (CV) Joint Boot (205-04 Front Drive Halfshafts, Removal and Installation).

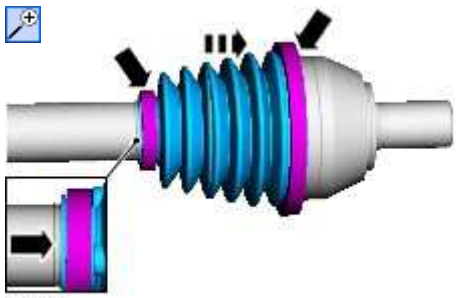
2.



E77185

Installation

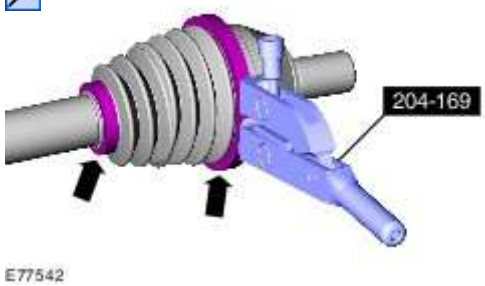
1.



E77333

- Fill the CV joint with grease.
- Insert a small screwdriver under the boot seat to allow the air to escape.

2. *Special Tool(s):* 204-169
   Torque: 21 Nm



E77542

3. Install the inner CV joint boot.

   Refer to: Inner Constant Velocity (CV) Joint Boot (205-04 Front Drive Halfshafts, Removal and Installation).

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Description and Operation

The braking system is of a diagonally split, dual circuit design featuring front and rear disc brakes.

The hydraulic system has separate circuits for each pair of diagonally opposed wheels (left front, right rear and right front, left rear). The front brake caliper is of a single sliding piston design which makes sure that equal effort is applied through both brake pads.

The parking brake control operates the rear brakes through a cable system. There is also an electronic parking brake (EPB) system available.

The brake master cylinder is of a tandem design and is linked to a brake booster which reduces the brake pedal effort. The tandem design will make sure that in the event of one brake circuit failing the other will remain fully operational.

The brake booster vacuum on vehicles with diesel engine is provide by a camshaft driven vacuum pump.

The anti-lock brake system (ABS) is controlled by the hydraulic control unit (HCU), incorporated within the hydraulic system, and only operates when the wheel speed sensors detect the onset of wheel lock up.

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Diagnosis and Testing

Principles of Operation

The brake system operates by transferring effort applied to the brake pedal by the driver to the brakes at each wheel.

The braking effort is distributed to each wheel, using an hydraulic system. The system is assisted using a vacuum brake booster that reduces pedal effort and increases hydraulic pressure. The parking brake operates on the rear wheels and is applied using a hand operated control.

Inspection and Verification

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

Visual Inspection Chart

Mechanical
• Tire pressure • Wheels and tires • Fluid leak from brake line(s) • Fluid level • Fluid contamination

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparison and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while other will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

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Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, isolation) occurs only with the parking brake, the concern is in the rear brake system.

Avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency. A heavily braked and turning wheel will stop the vehicle in a shorter distance than locked brakes.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

Symptom Chart

Symptom	Possible Sources	Action
The brakes pull or drift	* Wheel alignment angles.	* CHECK the wheel alignment angles. REFER to Section 204-00 Suspension System - General Information.
	* Brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake disc.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake caliper.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
The red brake warning indicator is always on	* Brake fluid level sensor.	* REFER to WDS.
	* Parking brake control.	* RELEASE and ADJUST the parking brake. REFER to Section 206-05 Parking Brake and Actuation.
	* Excessively worn brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake master cylinder primary piston cup.	* INSTALL a new brake master cylinder. REFER to Section 206-06 Hydraulic Brake Actuation.
Vibration when brakes are applied	* Brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake caliper.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake disc.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
The pedal goes down fast	* Air in system.	* BLEED the system. REFER to Section 206-00 Brake System - General Information.
	* Brake master cylinder	* Carry out the brake master cylinder component test in this section.
	* Brake disc.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake pads.	* CHECK and INSTALL new components as

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		necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
The pedal eases down slowly	* Brake caliper	* CHECK and INSTALL new components as necessary. CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake master cylinder.	* Carry out the brake master cylinder component test in this section.
The pedal is low or feels spongy	* Air in system.	* Bleed the system. REFER to Section 206-00 Brake System - General Information.
	* Brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake booster	* CARRY out the brake booster component test in this section.
Brake lockup during light brake pedal force	* Brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake disc.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake booster.	* CARRY out the brake booster component test in this section.
Excessive/erratic brake pedal travel	* Insufficient grease on sliding parts.	* APPLY grease where necessary.
	* Brake pads.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Brake disc.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Wheel bearing.	* CHECK or INSTALL a new wheel bearing. REFER to Section 204-01 Front Suspension.
	* Brake pedal.	* GO to Pinpoint Test A.
Brake drag	* Brake booster.	* Carry out the brake booster component test in this section.
	* Brake caliper.	* CHECK and INSTALL new components as necessary. REFER to Section 206-03 Front Disc Brake / 206-04 Rear Disc Brake.
	* Stability assist system (if equipped)	* REFER to WDS.
	* Brake pedal.	* GO to Pinpoint Test B.
Slow or incomplete brake pedal return	* Stability assist system (if equipped)	* REFER to WDS.
	* Brake master cylinder.	* Carry out the brake master cylinder component test in this section.
	* Brake pedal.	* GO to Pinpoint Test C.

Pinpoint Tests

PINPOINT TEST A : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR BRAKE PEDAL RETURN	

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	1 Run the engine at fast idle whilst making several brake applications.
	2 Pull the brake pedal upwards.
	3 Release the brake pedal and measure the distance from the rubber to the floor.
	4 Make a hard brake application.
	5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? **Yes** Vehicle is OK. **No** GO to A2.
A2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely.
	Is the brake pedal operating freely? **Yes** INSTALL a new brake booster. REFER to Section 206-07 Power Brake Actuation. TEST the system for normal operation. **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

PINPOINT TEST B : BRAKES DRAG	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast idle whilst making several brake applications
	2 Pull the brake pedal upwards.
	3 Release the brake pedal and measure the distance from the rubber to the floor.
	4 Make a hard brake application.
	5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? **Yes** Vehicle is OK. **No** GO to B2.
B2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely.
	Is the brake pedal operating freely? **Yes** INSTALL a new brake booster. REFER to Section 206-07 Power Brake Actuation. TEST the system for normal operation. **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

PINPOINT TEST C : SLOW OR INCOMPLETE BRAKE PEDAL RETURN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast idle whilst making several brake applications.
	2 Pull the brake pedal upwards.
	3 Release the brake pedal and measure the distance from the rubber to the floor.

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	4 Make a hard brake application.
	5 Release the brake pedal and measure the distance from brake pedal rubber to the floor. The brake pedal should return to its original position.
	Does the brake pedal return to its original position? **Yes** Vehicle is OK. **No** GO to C2.
C2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely.
	Is the brake pedal operating freely? **Yes** INSTALL a new brake booster. REFER to Section 206-07 Power Brake Actuation. TEST the system for normal operation. **No** REPAIR or INSTALL new brake pedal and bracket. TEST the system for normal operation.

Component Tests

Brake Booster

1. **1.** Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the brake booster check valve for damage.

2. **2.** Check the hydraulic brake system for leaks or low fluid.

3. **3.** With the transmission in PARK (automatic transmission), stop the engine and operate the parking brake. Operate the brake pedal several times to exhaust all vacuum in the system.

4. **4.** With the engine turned OFF and all vacuum in the system exhausted operate the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.

5. **5.** Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the transmission in PARK or NEUTRAL. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, the vacuum booster system is not functioning.

6. **6.** Run the engine for a minimum of 10 seconds at fast idle. Stop the engine and let the vehicle stand for 10 minutes. Then, operate the brake pedal with approximately 98N (20 lb) of force. The pedal feel (brake applications) should be the same as noted with the engine running. If the brake pedal feels hard (no power assist), install a new check valve and then repeat the testing. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system. Refer to General Procedures.

Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check

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brake pedal feel as evidence of a brake concern.

Check for brake warning indicator illumination and the brake fluid level in the brake fluid reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

1. **1.** New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts of another vehicle, same model and year.

2. **2.** During normal operation of the brake master cylinder, the brake fluid level in the reservoir will rise during brake application and fall during release. The net brake fluid level (after brake application and release) will remain unchanged.

3. **3.** A trace of brake fluid exists on the brake booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.

4. **4.** Brake fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques are brake pedal feel, brake warning indicator illumination and low brake fluid level as indicators in diagnosing brake system concerns. The following condition are considered abnormal and indicate that the brake master cylinder is in need of repair.

1. **1.** Brake pedal goes down fast. This could be caused by an external or internal leak.

2. **2.** Brake pedal eases down slowly. This could be caused by an external or internal leak.

3. **3.** Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder reservoir, brake fluid reservoir cap vent holes blocked or air in the hydraulic system.

4. **4.** Brake pedal effort is excessive. This may be caused by a bind or obstruction in pedal or linkage, blocked fluid control valve or insufficient brake booster vacuum.

5. **5.** Rear brakes lock up during light pedal force. This may be caused by grease or fluid on brake pads, damaged brake pads and linings, incorrectly adjusted parking brakes, damaged or contaminated brake pressure control valve.

6. **6.** Brake pedal effort is erratic. This condition could be caused by the brake booster being in operative, extreme brake caliper piston knock back or incorrectly installed brake pads.

7. **7.** Brake warning indicators is always ON. This may be caused by low fluid level, ignition wire routing too close to the fluid level indicator, or float assembly damage.

Bypass Condition Test

1. **1.** Check the brake fluid level in the brake fluid reservoir. Fill the brake fluid reservoir

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to the MAX mark if low or empty.

2. **2.** Observe the brake fluid level in the brake fluid reservoir. If after several brake applications, the brake fluid level remains the same, measure the wheel turning torque required to rotate the wheels with rearward with brakes applied as follows:

Place the transmission in NEUTRAL and raise and support the vehicle. REFER to Section 100-02 Jacking and Lifting.

With the aid of another technician, operate the brakes with a minimum of 445N (100 lb) and hold for approximately 15 seconds. With the brakes still applied, exert torque on the front wheels to 10.1 Nm (75 lbf.ft). If either wheel rotates, install a new brake master cylinder.

Non-Pressure Leaks

Any empty brake fluid reservoir condition may be the result of two types of non-pressure external leaks.

Type 1: An external leak may occur at the brake fluid reservoir cap because of incorrect positioning of the gasket and cap.

Reposition the gasket and cap.

Type 2: An external leak may occur at the brake fluid reservoir mounting seals. Repair such a leak by installing new seals.

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General Procedures

General Equipment

Worldwide Diagnostic System (WDS)

Bleeding

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.
NOTE: Make sure that the vehicle is standing on a level surface.
NOTE: The system consists of separate circuits for each front and diagonally opposite rear wheel. Each circuit can be bled independently.

1. CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.
   Install the bleed tube to the bleed nipple.
2. Immerse the end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.
3. Position the bleed jar base at least 300 mm above the bleed nipple to maintain fluid pressure and prevent air leaking past the threads of the bleed nipple.
4. Loosen the bleed nipple by one-half turn.
5. Operate the brake pedal fully (pumping brake fluid and air into the bleed jar) and allow the brake pedal to return to the rest position.
6. Fill the brake fluid reservoir to the MAX mark.
7. Continue operating the brake pedal until air-free fluid is being pumped into the bleed jar.
8. With the brake pedal fully depressed tighten the bleed nipple.
9. CAUTION: Make sure that the bleed nipple cap is installed after bleeding the brake line(s). This will prevent corrosion to the bleed nipple. Failure to follow this instruction may result in the bleed nipple becoming seized.
   Repeat the procedure for the remaining brake lines.

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General Procedures

General Equipment

Worldwide Diagnostic System (WDS)
Brake/clutch system pressure bleeder/filler

Bleeding

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with the eyes. Wash hands thoroughly after handling. If brake fluid contacts the eyes, flush the eyes for 15 minutes with cold running water. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately. Failure to follow these instructions may result in personal injury.

CAUTION: If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.
NOTE: Make sure that the vehicle is standing on a level surface.
NOTE: The system consists of separate circuits for each front and diagonally opposite rear wheel. Each circuit can be bled independently.

1. Fill the brake fluid reservoir to the MAX mark.
2. CAUTIONS:

   Make sure that the pressure within the brake system does not exceed 1 bar.

   Make sure that the pressure bleeding equipment is filled with new brake fluid to the correct specification.
   Using the brake/clutch system pressure bleeder/filler, pressure bleed the system in accordance with the manufacturer's instructions.
3. CAUTION: Make sure that the bleed nipple cap is installed after bleeding the brake line(s). This will prevent corrosion to the bleed nipple. Failure to follow this instruction may result in the bleed nipple becoming seized.
   Fill the brake fluid reservoir to the MAX mark as necessary.

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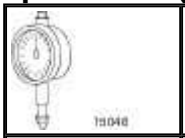
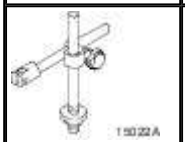
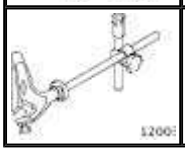
General Procedures

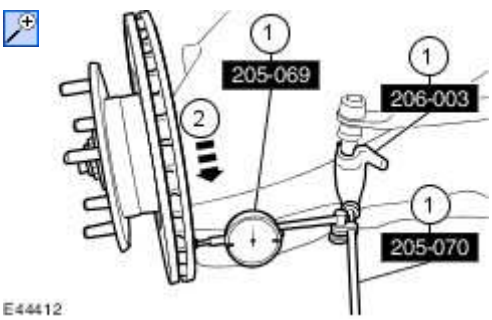
Special Tool(s)

	205-069 Dial Indicator Gauge (Metric)
	205-070 Holding Fixture, Dial Indicator Gauge
	206-003 Holding Fixture, Dial Indicator Gauge (Disc Brake)

1. Remove the following items:
   1. Wheel and tire.

      Refer to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
   2. Brake pads.

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



E44412

2.
   1. Position the dial indicator gauge so that it contacts the brake disc face approximately 10 mm from the outer edge (inner face measurement shown).

      Special Tool(s): 205-069, 205-070, 206-003
   2. Slowly rotate the brake disc and note the readings.
   3. Repeat sub-steps 1 and 2 on the brake disc outer face.
   4. If any of the measurements exceed the brake disc runout specification, a new brake disc must be installed and the brake disc runout re-checked.

      Refer to: Specifications (206-03 Front Disc Brake, Specifications).

E44414

3.
   1. Measure the brake disc thickness at eight positions, 45 degrees apart and approximately 15 mm from the outer edge of the brake disc.
   2. If any of the measurements exceed the brake disc thickness variation specification, a new brake disc must be installed and the brake disc runout re-checked.

      Refer to: Specifications (206-03 Front Disc

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Brake, Specifications).

4. If all the brake disc runout measurements and the thickness variation are within the specifications, check the wheel balance.

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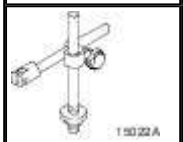
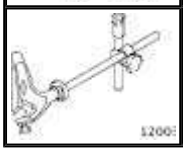
General Procedures

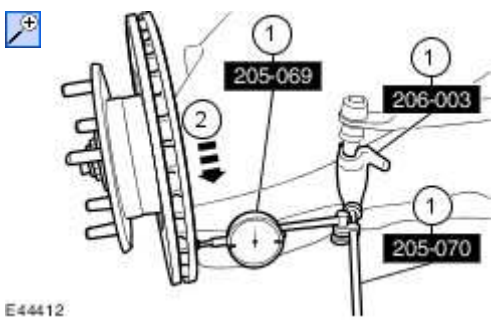
Special Tool(s)

	205-069 Dial Indicator Gauge (Metric)
	205-070 Holding Fixture, Dial Indicator Gauge
	206-003 Holding Fixture, Dial Indicator Gauge (Disc Brake)

1. Remove the following items:
   1. Wheel and tire.

      Refer to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
   2. Brake pads.

      Refer to: Brake Pads (206-04 Rear Disc Brake, Removal and Installation).
      Refer to: Brake Pads - Vehicles With: Electronic Parking Brake (EPB) (206-04 Rear Disc Brake, Removal and Installation).



2.
   1. Position the dial indicator gauge so that it contacts the brake disc face approximately 10 mm from the outer edge (inner face measurement shown).

      Special Tool(s): 205-069, 205-070, 206-003
   2. Slowly rotate the brake disc and note the readings.
   3. Repeat sub-steps 1 and 2 on the brake disc outer face.
   4. If any of the measurements exceed the brake disc runout specification, a new brake disc must be installed and the brake disc runout re-checked.

      Refer to: Specifications (206-04 Rear Disc Brake, Specifications).

3.
   1. Measure the brake disc thickness at eight positions, 45 degrees apart and approximately 15 mm from the outer edge of the brake disc.
   2. If any of the measurements exceed the brake disc thickness variation specification, a new brake disc must be installed and the

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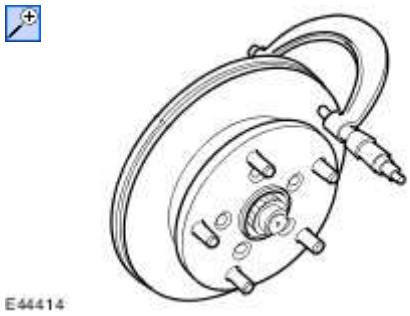
E44414

brake disc runout re-checked.

Refer to: Specifications (206-04 Rear Disc Brake, Specifications).

4. If all the brake disc runout measurements and the thickness variation are within the specifications, check the wheel balance.

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Front Disc Brake Specification

Description
Brake disc diameter - All except vehicles with 2.5L engine or 2.2L diesel engine
Brake disc diameter - Vehicles with 2.5L engine or 2.2L diesel engine
New brake disc nominal thickness
Worn brake disc discard thickness *
Maximum brake disc thickness variation
Worn brake pad discard thickness**
Maximum brake disc runout (installed)

*** When the discard thickness has been reached, install a new brake disc and brake p**
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal a

**** When the discard thickness has been reached, install new brake pads.**
For additional information, refer to: Brake Pads (206-03 Front Disc Brake, Removal a

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Diagnosis and Testing

1. **1.** REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).

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Removal and Installation

Special Tool(s)

	206-005 Retractor, Brake Caliper Piston

Materials

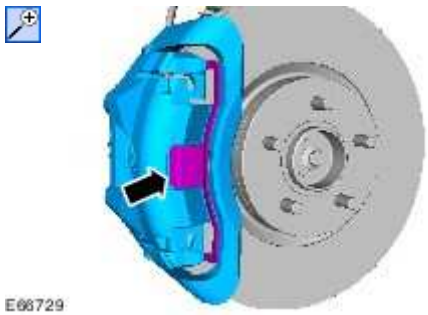
Name	Specification
Brake Fluid - Super DOT4	WSS-M6C57-A2

Removal

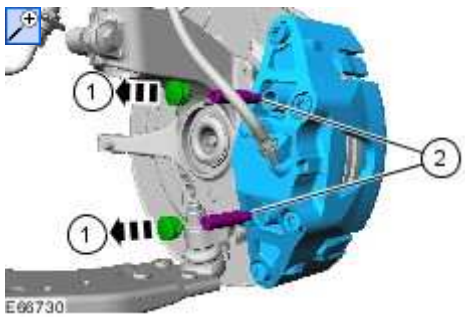
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

Vehicles with 2.5L engine or 2.2L diesel engine


E68729

3.

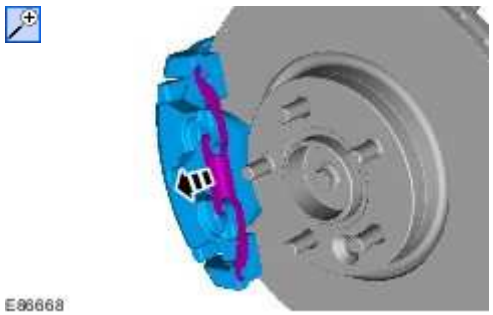


E68730

4. WARNING: The brake caliper housing Torx bolts must not be removed.

   CAUTION: Make sure that no load is placed on the brake hose.
   Torque: 28 Nm

All except vehicles with 2.5L engine or 2.2L diesel engine


E98668

5.

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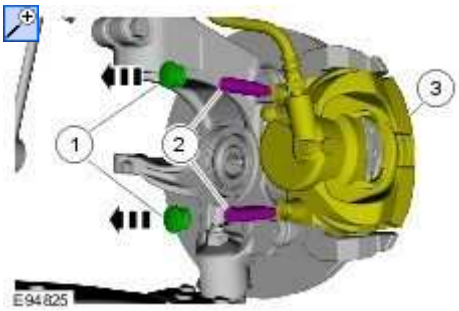
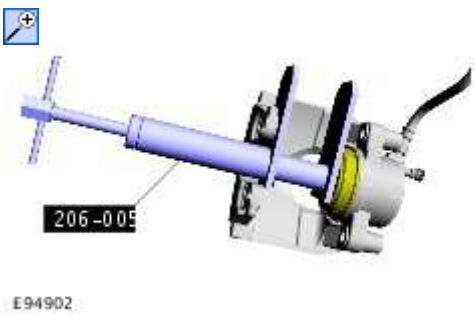


6. CAUTION: Make sure that no load is placed on the brake hose.
   Torque: 28 Nm

All vehicles

7. NOTE: Note the position of the brake pads to aid installation.



8. *Special Tool(s):* 206-005

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material and that no grease is applied to the brake pad guides.
   To install, reverse the removal procedure.

All except vehicles with 2.5L engine or 2.2L diesel engine

2.

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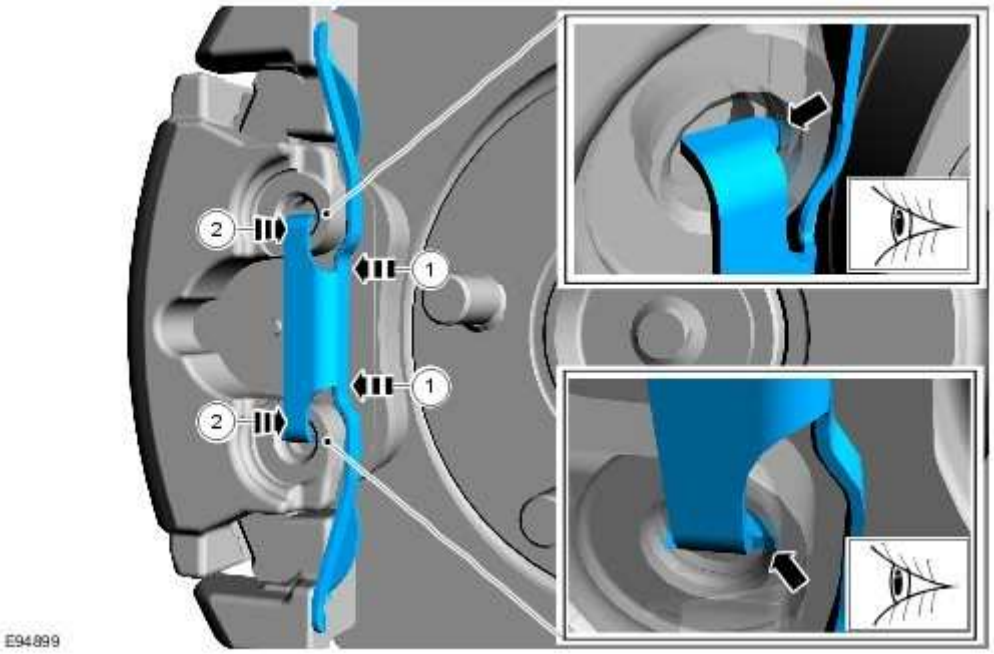

All vehicles

3. Depress the brake pedal, check the brake fluid level in the brake fluid reservoir and top up as necessary with brake fluid.

   Material: Brake Fluid - Super DOT4 (WSS-M6C57-A2)

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Removal and Installation

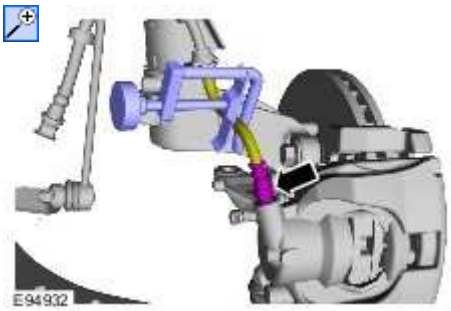
General Equipment

Hose clamp(s)

Removal

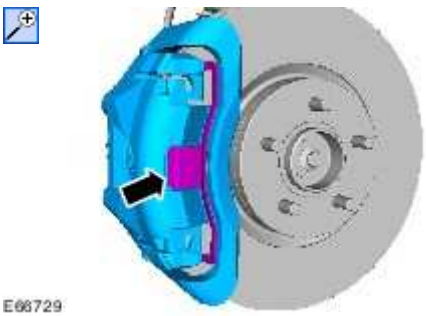
NOTE: Removal steps in this procedure may contain installation details.

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

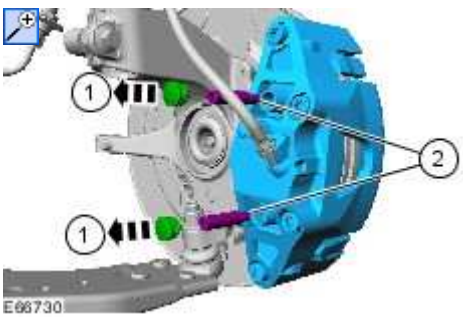


3. CAUTION: Make sure that all openings are sealed.
   General Equipment: Hose clamp(s)
   Loosen: 90°

Vehicles with 2.5L engine or 2.2L diesel engine



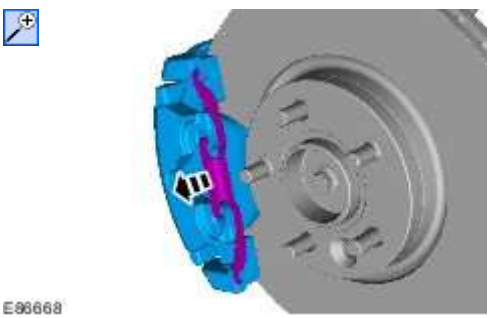
4.



5. WARNING: The brake caliper housing Torx bolts must not be removed.

   CAUTION: Make sure that no load is placed on the brake hose.
   Torque: 28 Nm

All except vehicles with 2.5L engine or 2.2L diesel engine



6.

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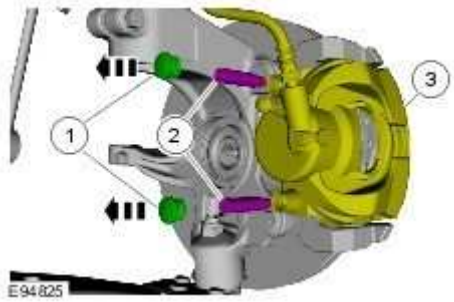
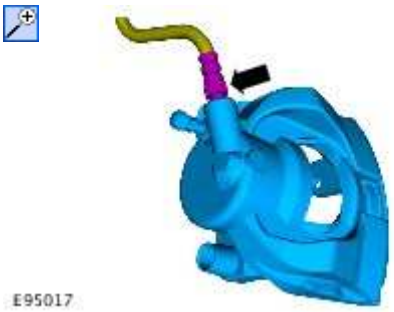


7. CAUTION: Make sure that no load is placed on the brake hose.
   Torque: 28 Nm

All vehicles

8. NOTE: Note the position of the brake pads to aid installation.



9. *Torque:* 18 Nm

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material and that no grease is applied to the brake pad guides.
   To install, reverse the removal procedure.

All except vehicles with 2.5L engine or 2.2L diesel engine

2.

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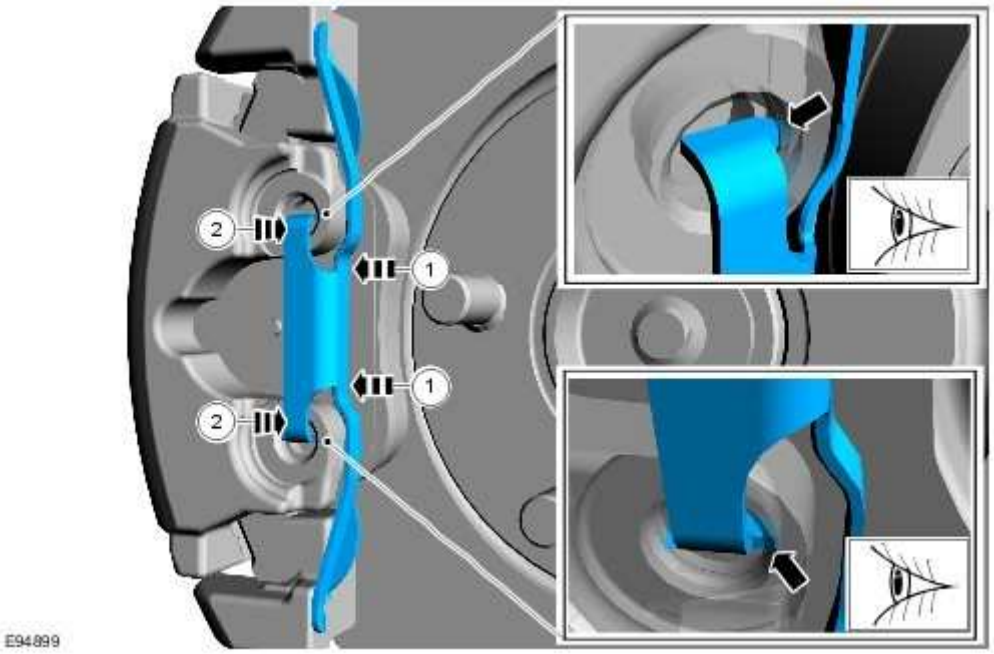

All vehicles

3. Refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

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Rear Disc Brake Specification

Description
Brake disc diameter
New brake disc nominal thickness
Worn brake disc discard thickness *
Maximum brake disc thickness variation
Worn brake pad discard thickness**
Maximum brake disc runout (installed)

*** When the discard thickness has been reached, install a new brake disc and brake p**
For additional information, refer to: Brake Pads (206-04 Rear Disc Brake, Removal a

**** When the discard thickness has been reached, install new brake pads.**
For additional information, refer to: Brake Pads (206-04 Rear Disc Brake, Removal a

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Diagnosis and Testing

REFER to Section 206-00 Brake System - General Information.

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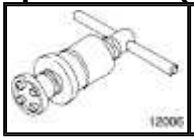
Removal and Installation

Special Tool(s)

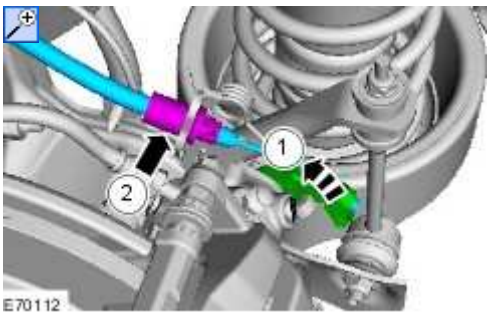
	206-012 Retractor, Rear Brake Caliper Piston

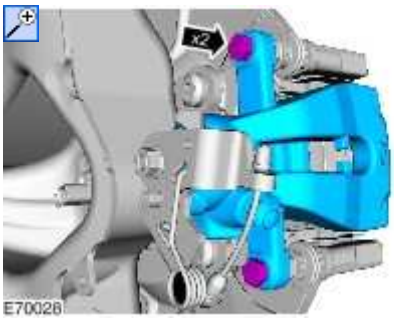
Materials

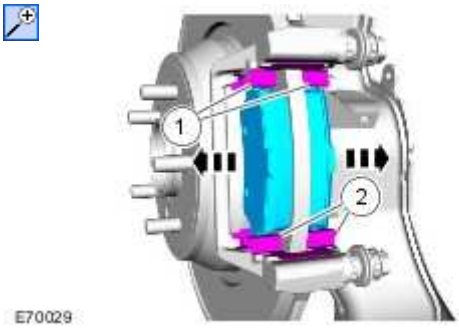
Name	Specification
Brake Fluid - Super DOT4	WSS-M6C57-A2

Removal

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

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

4. 

WARNING: Make sure that no load is placed on the brake hose.
Torque: 35 Nm
5. 

NOTE: Note the position of each component before removal.
    1. Brake pad locating spring (rubber coated).
    2. Brake pad locating spring.
6. *Special Tool(s):* 206-012

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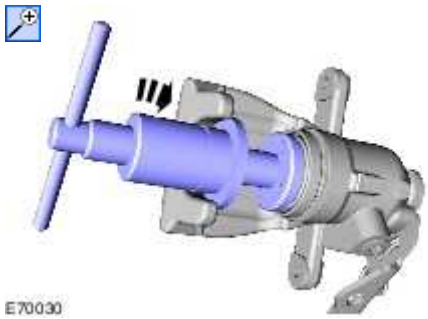
E70030

Installation

E56190

1. CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the clips are correctly located.

   Make sure that the component is not bent.

   Remove the adhesive foil from the rear of the outer brake pad.
2. To install, reverse the removal procedure.
3. Depress and release the brake pedal 3 times, check the brake fluid level in the brake fluid reservoir and top up as necessary with brake fluid.

   Material: Brake Fluid - Super DOT4 (WSS-M6C57-A2)

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Removal and Installation

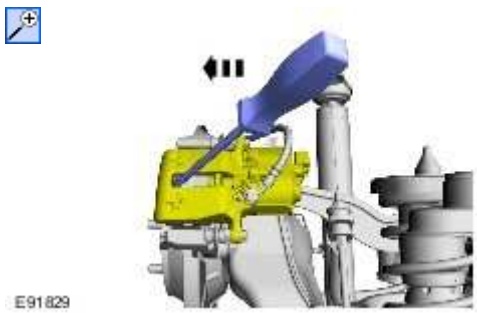
Materials

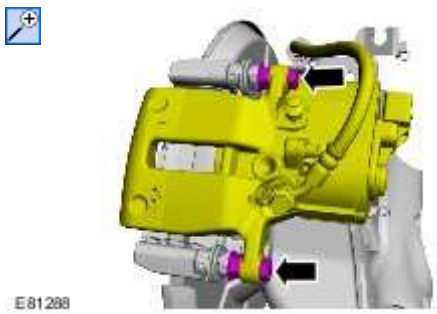
Name	Specification
Brake Fluid - Super DOT4	WSS-M6C57-A2

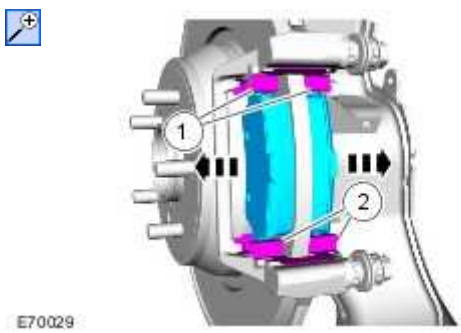
Removal

CAUTION: Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2. Activate the electronic parking brake caliper actuator service mode.

   Refer to: Electronic Parking Brake (EPB) Release Using the Vehicle Systems (206-05 Parking Brake and Actuation, General Procedures).
3. 

4. WARNING: Make sure that no load is placed on the brake hose.
   Torque: 35 Nm


5. NOTE: Note the position of each component before removal.


Installation

1. CAUTIONS:

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Make sure that the mating faces are clean and free of foreign material.

Make sure that the clips are correctly located.

Make sure that the component is not bent.

Remove the adhesive foil from the rear of the outer brake pad.

2. To install, reverse the removal procedure.
3. Deactivate the electronic parking brake caliper actuator service mode.

   Refer to: Electronic Parking Brake (EPB) Release Using the Vehicle Systems (206-05 Parking Brake and Actuation, General Procedures).
4. Depress and release the brake pedal 3 times, check the brake fluid level in the brake fluid reservoir and top up as necessary with brake fluid.

   Material: Brake Fluid - Super DOT4 (WSS-M6C57-A2)

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Removal and Installation

Materials

Name	Specification
Brake Fluid - Super DOT4	WSS-M6C57-A2

General Equipment

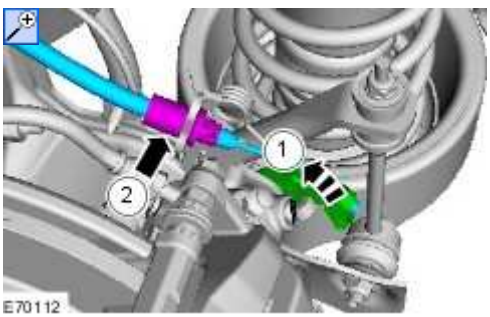
Hose clamp(s)

Removal

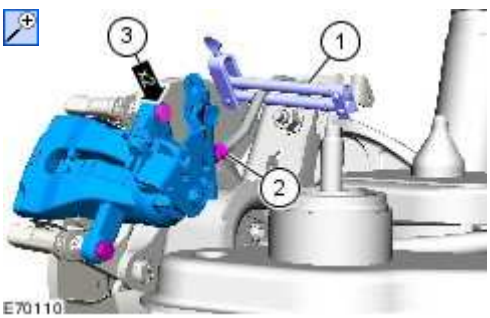
CAUTION: Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the wheel and tire.

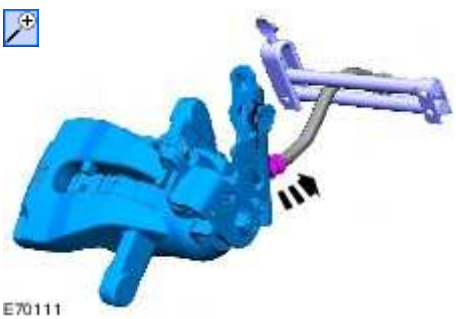
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



2.



3.
   1. *General Equipment:* Hose clamp(s)
   2. *Torque:* 18 Nm
   3. *Torque:* 35 Nm



4. CAUTION: Make sure that all openings are sealed.

5. NOTE: Note the position of the brake pads to aid installation.

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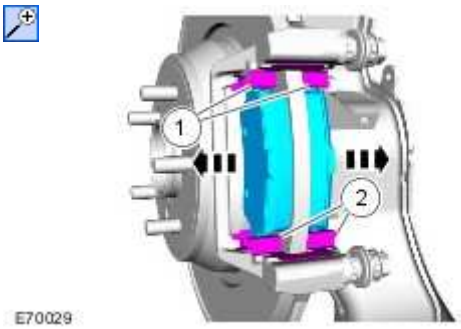

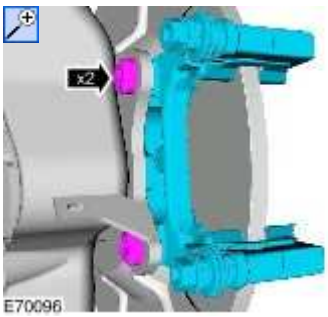

6. *Torque:* 110 Nm

Installation

1. CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that the clips are correctly located.

   Make sure that the component is not bent.

   To install, reverse the removal procedure.
2. Depress and release the brake pedal 3 times, check the brake fluid level in the brake fluid reservoir and top up as necessary with brake fluid.

   Material: Brake Fluid - Super DOT4 (WSS-M6C57-A2)

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Description and Operation

Manual parking brake

A conventional parking brake system is used with a twin A-frame parking brake control lever which is located in the floor console.

Only the parking brake control is visible, the parking brake control lever is hidden by the floor console.

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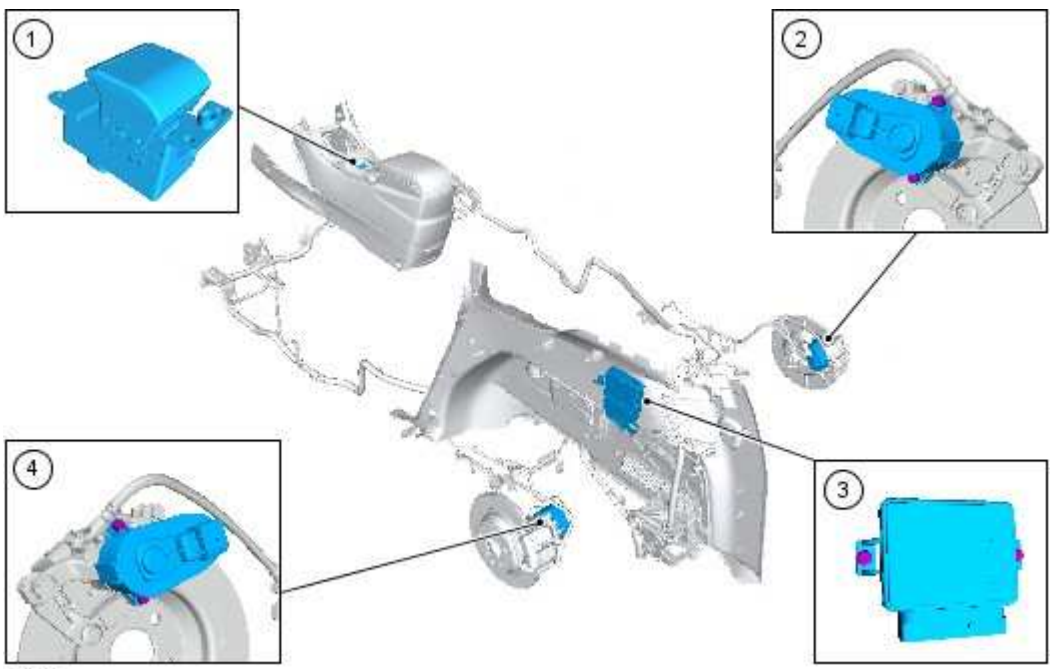
Electronic parking brake (EPB)



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Item	Part Number	Description
1	-	EPB switch
2	-	Right-hand rear EPB actuator
3	-	EPB module
4	-	Left-hand rear EPB actuator

An EPB is available as an option for the vehicle. In comparison to a conventional parking brake, the EPB offers the following advantages:

* Ease of operation, due to low operating forces. This is achieved by the use of an electrical switch instead of a lever and the parking brake cables are replaced by electrical cables.

* The EPB is always applied firmly, giving maximum parking brake power in all operating

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conditions.

* Safety, the vehicle can be slowed down with the EPB if the hydraulics of the brake system fail while driving. The system is automatically coordinated with the ABS system to prevent the braked wheels from locking.

The system comprises the following components:

* EPB module: This is located in the rear stowage area, behind the left-hand rear quarter trim panel. The module is the system control unit and operates the rear brake calipers as required using information from the EPB switch, the ignition key and various system data from the high-speed CAN Bus.

* EPB Switch: This is a push-pull type switch and is located in the floor console. To release the EPB, push the EPB switch down. To engage the EPB, pull the EPB switch up.

* EPB Actuators: These are attached to the left and right-hand rear brake caliper housings. They use an electric motor to operate the calipers by turning a threaded spindle within a pressure nut that presses against the brake caliper piston.

Modes of Operation:

Static Mode (vehicle stationary): Full application and release of the rear brakes is possible. The parking brake will only release if the brake pedal or clutch pedal is depressed at the same time as releasing the EPB switch, or when the vehicle is driven away.

Key Out Apply: The parking brake is automatically applied (auto clamp) when the ignition key is removed from the ignition switch.

Dynamic Mode (vehicle in motion): The parking brake is gradually activated when the EPB switch is applied and released when the EPB switch is released.

Drive Away Assist: This system enables the driver to drive away on an incline without the vehicle rolling back unintentionally. After stopping the vehicle on an incline or a descent and the parking brake is applied, it will be released when operating the accelerator pedal without any further driver intervention.

Disc Temperature Mode: If after bringing the vehicle to a halt the rear brake discs temperature exceeds 300°C, the parking brake will be activated and will not release until the brake discs have sufficiently cooled.

Stall Apply: If the engine is stalled the parking brake is automatically applied.

Service mode activation and deactivation

On vehicles with Electronic Parking Brake (EPB) it is required to activate the service mode before any work is started. Also the deactivation of the service mode is required after the repair. The Service mode can be activated either using the vehicle system or using the Ford diagnostic system. For additional information, refer to 206-05 Parking Brake and Actuation, General Procedures.

A separate procedure is available if the vehicle is without power. For additional information, refer to 206-05 Parking Brake and Actuation, General Procedures.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 206-05, for schematic and connector information.

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Parking brake switch • Clutch pedal switch • Caliper • Brake disc • Brake pad	• Parking brake switch • Clutch pedal switch • Fuse(s) • Electrical connector(s) • Circuit(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Poor drive away release	* Reversing lamp switch stuck on.	* Check the operation of the reversing lamps. REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
	* Clutch changed and not re-learned.	* Carry out several drive aways with manual operation of the EPB switch.
Drive away release not possible	* Clutch pedal position switch not depressed fully.	* Check the correct clutch pedal position switch is fitted. Advise the customer that the clutch must be fully depressed to activate drive away release.
	* Accelerator pedal not depressed sufficiently.	* Advise the customer that the accelerator pedal must be depressed at least 10% to activate drive away release.
	* Drive away release option configured out.	* Connect WDS and check the configuration. REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
Automatic 'key out' EPB activation not possible	* Automatic 'key out' EPB activation	* Connect WDS and check the configuration.

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	option configured out.	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
DTC C2005.09: Right actuator fault	* Parking brake release actuator.	* GO to Pinpoint Test A.
DTC C2005.71: Right actuator fault	* Parking brake release actuator.	* GO to Pinpoint Test A.
DTC C2005.77: Right actuator fault	* Battery. * Charging system. * Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test B.
DTC C2005.95: Right actuator fault	* Parking brake release actuator.	* REPEAT the self-test, CLEAR the DTCs. Apply and release the parking brake. If the DTC remains, GO to Pinpoint Test C.
DTC C2006.09: Left actuator fault	* Parking brake release actuator.	* GO to Pinpoint Test D.
DTC C2006.71: Left actuator fault	* Parking brake release actuator.	* GO to Pinpoint Test D.
DTC C2006.77: Left actuator fault	* Battery. * Charging system. * Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test E.
DTC C2006.95: Left actuator fault	* Parking brake release actuator.	* REPEAT the self-test, CLEAR the DTCs. Apply and release the parking brake. If the DTC remains, GO to Pinpoint Test F.
DTC C2007.01: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test G.
DTC C2007.11: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test H.
DTC C2007.12: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test I.
DTC C2007.13: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test J.
DTC C2007.16: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test K.
DTC C2007.17: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test L.
DTC C2007.18: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test G.
DTC C2007.19: Right motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test M.
DTC C2007.1D: Right motor fault	* Parking brake release actuator.	* GO to Pinpoint Test N.
DTC C2008.01: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test O.

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DTC C2008.11: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test P.
DTC C2008.12: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test Q.
DTC C2008.13: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test R.
DTC C2008.16: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test S.
DTC C2008.17: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test T.
DTC C2008.18: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test O.
DTC C2008.19: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test U.
DTC C2008.1D: Left motor fault	* Parking brake release actuator. * Circuit(s).	* GO to Pinpoint Test V.
DTC P061E.67: Internal control module brake signal performance	* Brake pedal switch. * Central junction box. * Circuit(s).	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * GO to Pinpoint Test W.
DTC U0001.00: High speed CAN bus	* CAN bus.	* GO to Pinpoint Test X.
DTC U0100.00: Lost communications with engine control module (ECM)	* ECM.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0101.00: Lost communications with transmission control module (TCM) - Automatic vehicles only	* TCM.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0121.00: Lost communications with ABS	* ABS Module.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0140.00: Lost communications with central junction box (CJB)	* CJB.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * REFER to: Communications Network

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		(418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0300.00: Internal control module software incompatibility	* Electronic Parking Brake (EPB) Module software version.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. NOTE: Make sure that the most up-to-date software version is installed in WDS. * Update the EPB module software, REFER to WDS. Configure the module. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). REPEAT the self-test, CLEAR the DTCs.
	* Electronic Parking Brake (EPB) Module configuration.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * REFER to: Module Configuration (418-01 Module Configuration, General Procedures). REPEAT the self-test, CLEAR the DTCs.
	* CJB.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0401.68: Control module	* Powertrain Control Module (PCM).	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * Check the PCM DTCs, REFER to WDS. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0418.68: Invalid data received from brake system control module	* ABS Module. * Circuit(s).	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * Check the ABS module DTCs, REFER to WDS. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U0422.68: Invalid data received from central junction box (CJB)	* CJB.	NOTE: Do not replace Parking Brake Module or Parking Brake Release Actuators. * Check the CJB DTCs, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
	* GEM.	* Check the GEM DTCs,

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		REFER to: Generic Electronic Module (GEM) (419-10, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U2002.62: EPB Switch fault	* EPB Switch. * Circuit(s).	* GO to Pinpoint Test Y.
DTC U2002.64: EPB Switch fault	* EPB Switch.	* Check the EPB switch is not stuck ON. REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB switch. REFER to: Parking Brake Switch - Vehicles With: Electronic Parking Brake (EPB) (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC U2002.92: EPB Switch fault	* EPB Switch. * Circuit(s).	* GO to Pinpoint Test Y.
DTC U2016.05: Control module main software	* EPB Module. * Battery.	* GO to Pinpoint Test Z.
DTC U2100.00: Control module	* EPB Module.	NOTE: Make sure that the most up-to-date software version is installed in WDS. * CONFIGURE the EPB module. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). REPEAT the self-test, CLEAR the DTCs.
	* CJB.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U2100.54: Initial configuration not complete	* Electronic parking brake (EPB) module.	* CHECK the EPB module mounting. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). NOTE: Make sure that the most up-to-date software version is installed in WDS. * CONFIGURE the EPB module. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). NOTE: Make sure that the most up-to-date software version is installed in WDS. * Release the parking brake. Carry out the Assembly Check, REFER to WDS. * Calibrate the longitudinal acceleration sensor. REFER to WDS. REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation).

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DTC U2101.00: Control module configuration incompatible	* Electronic parking brake (EPB) module.	NOTE: Make sure that the most up-to-date software version is installed in WDS. * CONFIGURE the EPB module. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). NOTE: Make sure that the most up-to-date software version is installed in WDS. * Update the EPB module software with WDS. REPEAT the self-test, CLEAR the DTCs.
	* CJB.	* CONFIGURE the CJB. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). REPEAT the self-test, CLEAR the DTCs. * CHECK the CAN bus. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC U3000.00: Control module	* Electronic parking brake (EPB) module.	* REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC U3000.13: Control module	* Battery.	* Check the battery. If necessary, REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
	* Electronic parking brake (EPB) module. * Circuit(s).	* GO to Pinpoint Test AA.
DTC U3000.29: Control module	* Electronic parking brake (EPB) module.	* CHECK the EPB module mounting. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. NOTE: Make sure that the most up-to-date software version is installed in WDS. * CONFIGURE the EPB module. REFER to: Module Configuration (418-01 Module Configuration, General Procedures). * Calibrate the longitudinal acceleration sensor. REFER to WDS. REPEAT the self-test, CLEAR the DTCs. If the DTC

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		remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation).
DTC U3000.48: Control module	* Electronic parking brake (EPB) module.	* REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC U3003.62: Battery voltage	* Circuit(s).	* GO to Pinpoint Test AB.
DTC U3006.16: Battery voltage (Low or high)	* Battery. * Charging system. * Circuit(s).	* GO to Pinpoint Test AB.
DTC U300A.62: Ignition cross check fault	* Circuit(s).	* GO to Pinpoint Test AC.
DTC U300A.86: Ignition cross check fault	* Circuit(s).	* GO to Pinpoint Test AD.

Pinpoint Tests

PINPOINT TEST A : DTC C2005.09/71: RIGHT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST B : DTC C2005.77: RIGHT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** GO to B2. **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and

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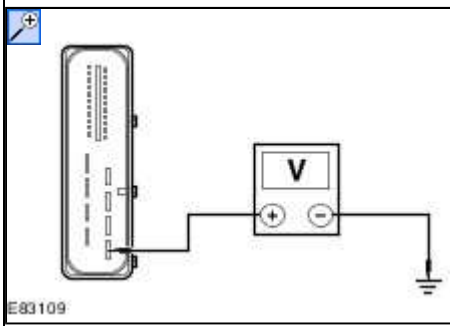
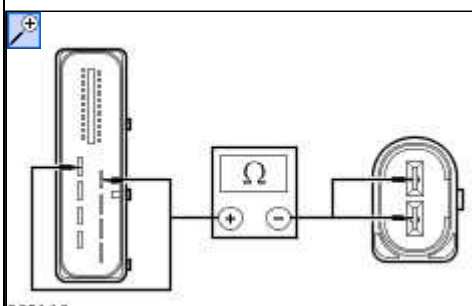
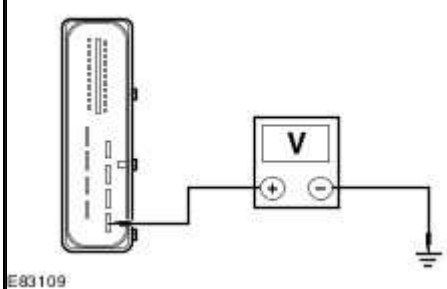
	Installation).
B2: CHECK THE EPB MODULE SUPPLY VOLTAGE	
	1 Disconnect EPB Module C4CB01.
	2 Ignition switch in position II.
	3 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to B3. **No** GO to B4.
B3: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Ignition switch in position 0.
	2 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	3 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the parking brake release actuator C4CB07 pin 1, circuit CCB18A (YE/GY), harness side. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and the parking brake release actuator C4CB07 pin 2, circuit CCB19B (GN/BN), harness side.
	Are the resistances less than 2 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.
B4: CHECK FOR VOLTAGE TO THE EPB MODULE	
	1 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.

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	Is any voltage present? **Yes** Check the charging system. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST C : DTC C2005.95: RIGHT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST D : DTC C2006.09/71: LEFT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST E : DTC C2006.77: LEFT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.

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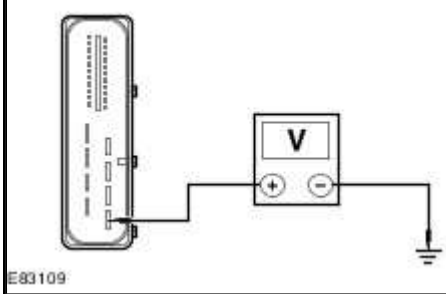
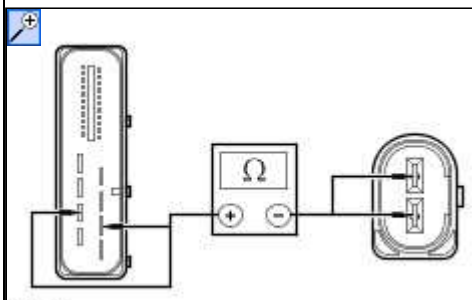
	Are the brake disc and brake pads OK? **Yes** GO to E2. **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).
E2: CHECK THE EPB MODULE SUPPLY VOLTAGE	
	1 Disconnect EPB Module C4CB01.
	2 Ignition switch in position II.
 E83109	3 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to E3. **No** GO to E4.
E3: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Ignition switch in position 0.
	2 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
 E83111	3 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the parking brake release actuator C4CB06 pin 1, circuit CCB16A (WH/VT), harness side. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and the parking brake release actuator C4CB06 pin 2, circuit CCB17B (BU/GN), harness side.
	Are the resistances less than 2 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.
E4: CHECK FOR VOLTAGE TO THE EPB MODULE	
	1 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground.

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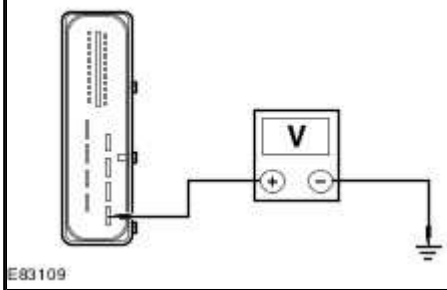


- EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.

Is any voltage present?

Yes

Check the charging system.
REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
REPEAT the self-test, CLEAR the DTCs.

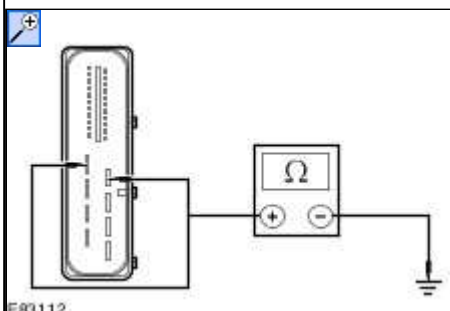
No

REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST F : DTC C2006.95: LEFT ACTUATOR FAULT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST G : DTC C2007.01/18: RIGHT MOTOR FAULT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side
	Is the resistance greater than 10,000 ohms? **Yes** GO to G2. **No**

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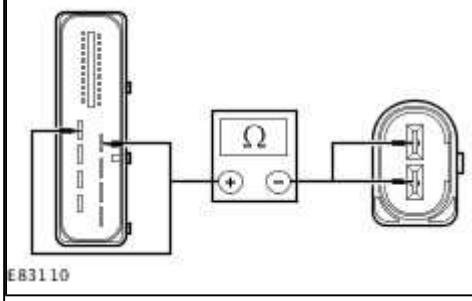
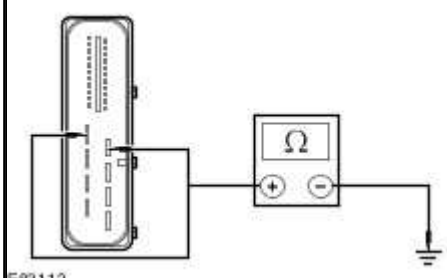
	REPEAT the self-test, CLEAR the DTCs. If the DTC remains GO to G2.
G2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the parking brake release actuator C4CB07 pin 1, circuit CCB18A (YE/GY), harness side. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and the parking brake release actuator C4CB07 pin 2, circuit CCB19B (GN/BN), harness side.
	Are the resistances less than 2 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST H : DTC C2007.11: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR FOR A SHORT TO GROUND	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and ground. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. **No** GO to H2.
H2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS FOR A SHORT TO GROUND	
	1 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the:

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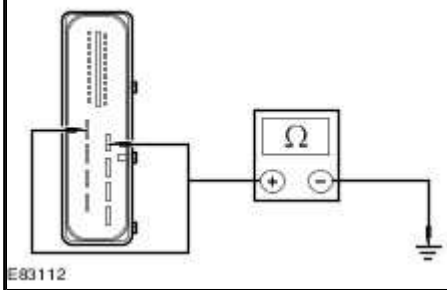
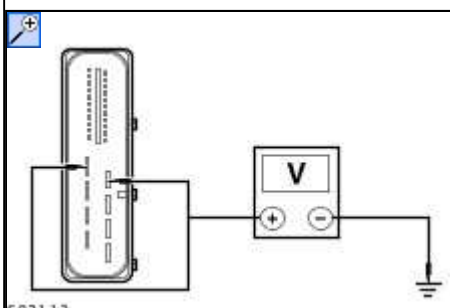
	• EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and ground. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST I : DTC C2007.12: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS FOR A SHORT TO BATTERY	
	1 Disconnect EPB Module C4CB01.
	2 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	3 Measure the voltage between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and ground. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs. **No** REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST J : DTC C2007.13: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE EPB MODULE SUPPLY CIRCUIT	
	1 Disconnect EPB Module C4CB01.

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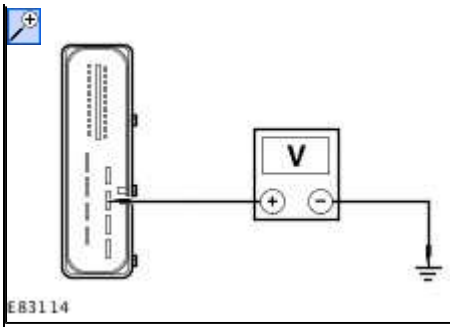
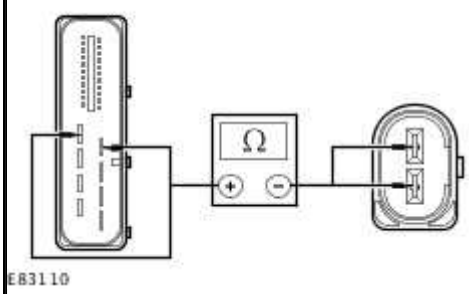
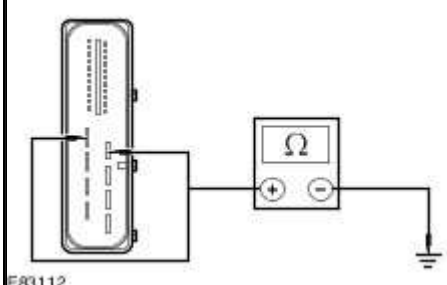
	2 Measure the voltage between the EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to J2. **No** REPAIR circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.
J2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS CONTINUITY	
	1 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the parking brake release actuator C4CB07 pin 1, circuit CCB18A (YE/GY), harness side. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and the parking brake release actuator C4CB07 pin 2, circuit CCB19B (GN/BN), harness side.
	Are the resistances less than 2 ohms? **Yes** GO to J3. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.
J3: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS FOR A SHORT TO GROUND	
	1 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and ground. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B

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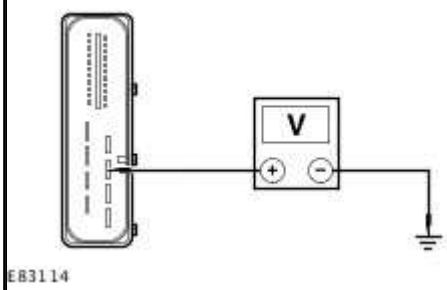
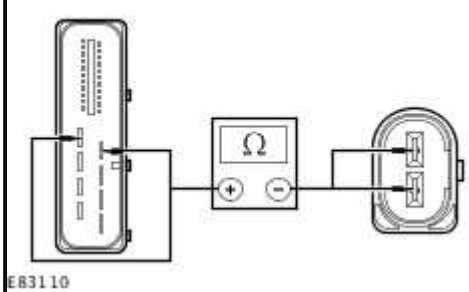
	(YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST K : DTC C2007.16: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE EPB MODULE SUPPLY CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the voltage between the EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to K2. **No** REPAIR circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.
K2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the parking brake release actuator C4CB06 pin 1, circuit CCB18A (YE/GY), harness side. • EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side and the parking brake release actuator C4CB06 pin 2, circuit CCB19B (GN/BN), harness side.
	Are the resistances less than 2 ohms? **Yes** GO to K3. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.
K3: CHECK THE EPB MODULE MOTOR SUPPLY CIRCUIT IMPEDANCE	
	1 Disconnect Rear Junction Box C4BR02.
	2 Measure the resistance between the EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and the rear junction box C4BR02-C pin 304, circuit C_SBR03A (BU/RD).
	Is the resistance less than 2 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation).

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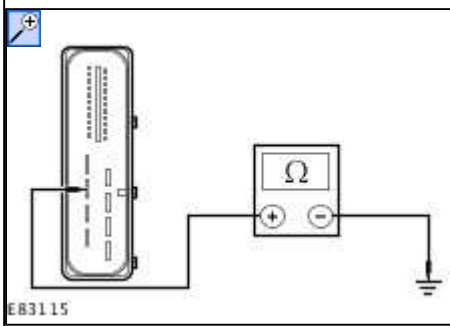
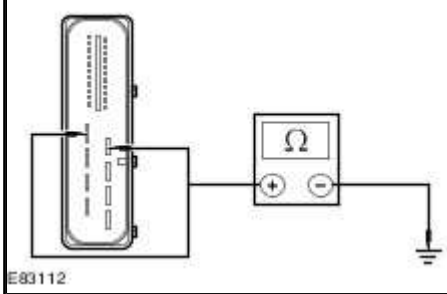
	REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST L : DTC C2007.17: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE EPB MODULE GROUND CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the EPB module C4CB01 pin 28, circuit GD147B (BK/VT), harness side and ground.
	Is the resistance less than 2 ohms? **Yes** GO to L2. **No** REPAIR circuit GD147B (BK/VT). REPEAT the self-test, CLEAR the DTCs.
L2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB07. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST M : DTC C2007.19: RIGHT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Disconnect Parking Brake Release Actuator C4CB07.

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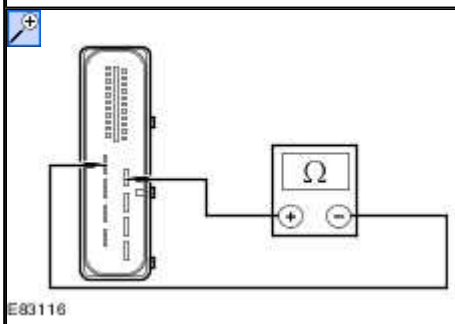
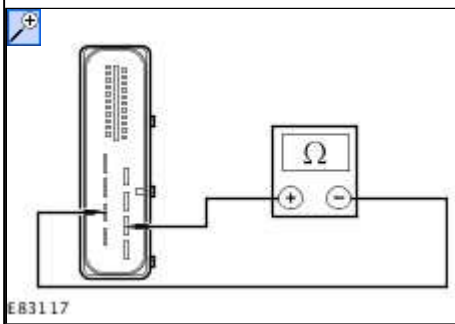
	CAUTION: Make sure that the area around the component is clean and free of foreign material.
 E83116	3 Measure the resistance between the EPB module C4CB01 pin 12, circuit CCB18B (YE/GY), harness side and the EPB module C4CB01 pin 27, circuit CCB19A (GN/BN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST N : DTC C2007.1D: RIGHT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No** REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST O : DTC C2008.01/18: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR CIRCUIT	
	1 Disconnect EPB Module C4CB01.
 E83117	2 Measure the resistance between the EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side

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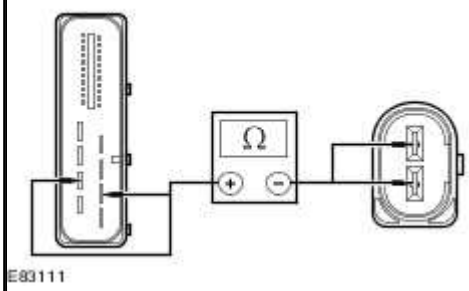
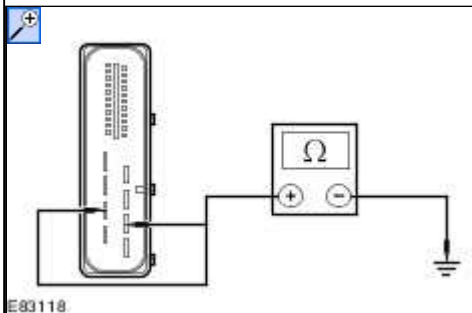
	Is the resistance greater than 10,000 ohms? **Yes** GO to O2. **No** Connect the EPB module. REPEAT the self-test, CLEAR the DTCs. If the DTC remains GO to O2.
O2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the parking brake release actuator C4CB06 pin 1, circuit CCB16A (WH/VT), harness side. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and the parking brake release actuator C4CB06 pin 2, circuit CCB17B (BU/GN), harness side.
	Are the resistances less than 2 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST P : DTC C2008.11: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR FOR A SHORT TO GROUND	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and ground. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. **No** GO to P2.
P2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS FOR A SHORT TO GROUND	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the

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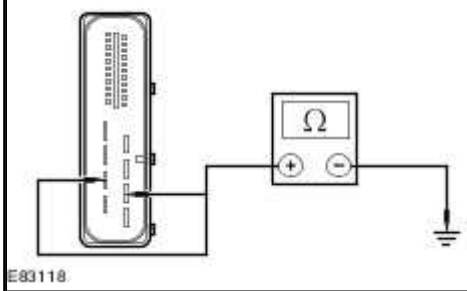
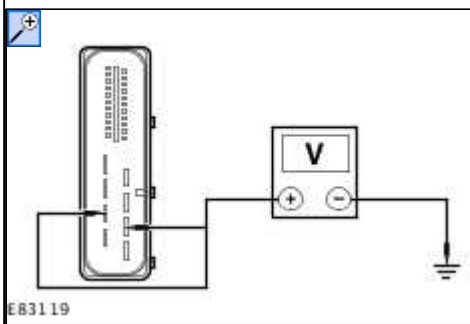
	component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and ground. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST Q : DTC C2008.12: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS FOR A SHORT TO BATTERY	
	1 Disconnect EPB Module C4CB01.
	2 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	3 Measure the voltage between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and ground. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs. **No** REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST R : DTC C2008.13: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK THE EPB MODULE SUPPLY CIRCUIT	

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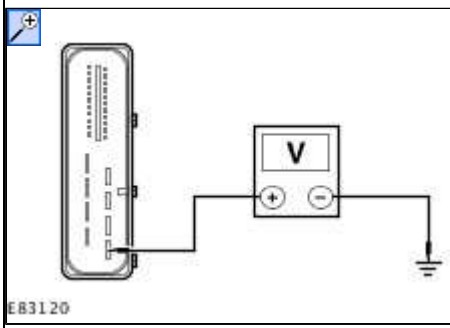
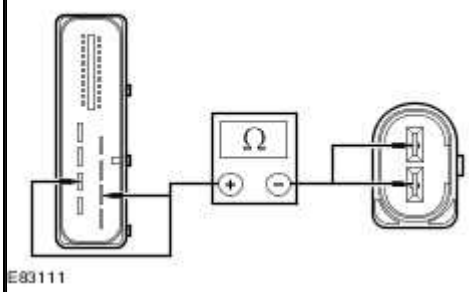
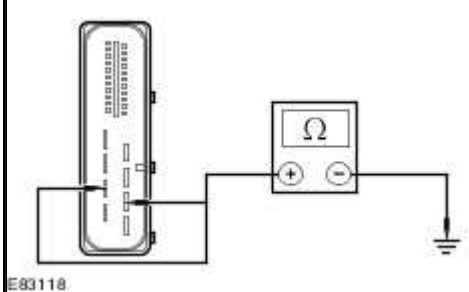
	1 Disconnect EPB Module C4CB01.
	2 Measure the voltage between the EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to R2. **No** REPAIR circuit C_SBR02A (YE/RD). REPEAT the self-test, CLEAR the DTCs.
R2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS CONTINUITY	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the parking brake release actuator C4CB07 pin 1, circuit CCB16A (WH/VT), harness side. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and the parking brake release actuator C4CB07 pin 2, circuit CCB17B (BU/GN), harness side.
	Are the resistances less than 2 ohms? **Yes** GO to R3. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.
R3: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and ground. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B

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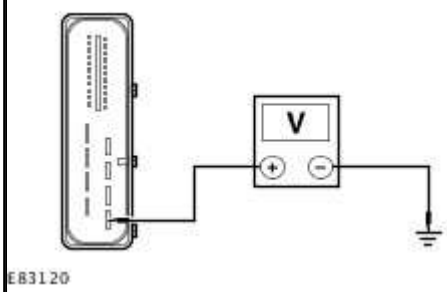
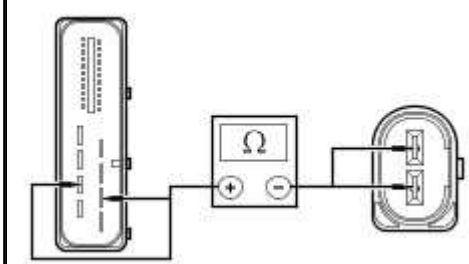
	(WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST S : DTC C2008.16: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK THE EPB MODULE SUPPLY CIRCUIT	
	1 Disconnect EPB Module C4CB01.
 E83120	2 Measure the voltage between the EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to S2. **No** REPAIR circuit C_SBR02A (YE/RD). REPEAT the self-test, CLEAR the DTCs.
S2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
 E83111	2 Measure the resistance between the: • EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the parking brake release actuator C4CB06 pin 1, circuit CCB16A (WH/VT), harness side. • EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side and the parking brake release actuator C4CB06 pin 2, circuit CCB17B (BU/GN), harness side.
	Are the resistances less than 2 ohms? **Yes** GO to S3. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.
S3: CHECK THE EPB MODULE MOTOR SUPPLY CIRCUIT IMPEDANCE	
	1 Disconnect Rear Junction Box C4BR02.
	2 Measure the resistance between the EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and the rear junction box C4BR02-C pin 303, circuit C_SBR02A (YE/RD).
	Is the resistance less than 2 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation).

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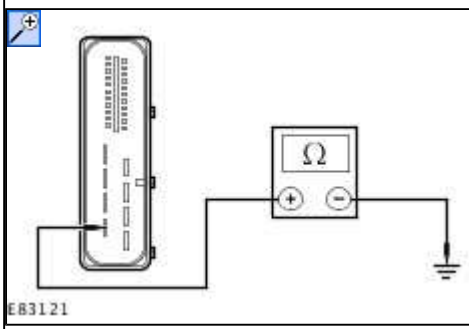
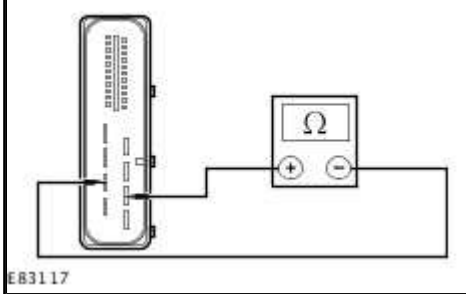
	REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit circuit C_SBR02A (YE/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST T : DTC C2008.17: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE EPB MODULE GROUND CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the EPB module C4CB01 pin 30, circuit GD147A (BK/VT), harness side and ground.
	Is the resistance less than 2 ohms? **Yes** GO to T2. **No** REPAIR circuit GD147A (BK/VT). REPEAT the self-test, CLEAR the DTCs.
T2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB16A (WH/VT), or circuit CCB16B (WH/VT), or circuit CCB17A (BU/GN), or circuit CCB17B (BU/GN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST U : DTC C2008.19: LEFT MOTOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK THE PARKING BRAKE RELEASE ACTUATOR MOTOR CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness

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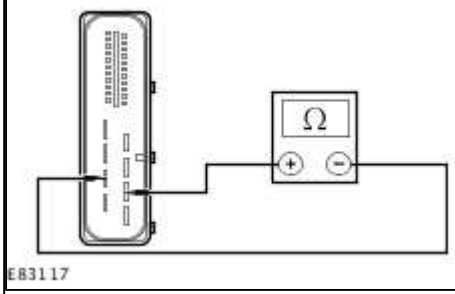
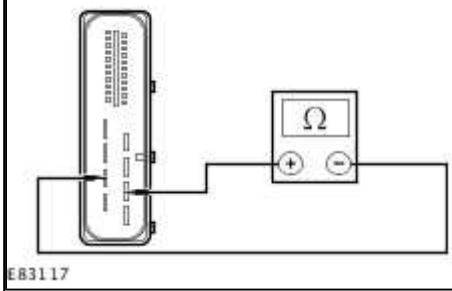
	side and the EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. If the DTC remains GO to U2. **No** GO to U2.
U2: CHECK THE PARKING BRAKE RELEASE ACTUATOR CIRCUITS	
	1 Disconnect Parking Brake Release Actuator C4CB06. CAUTION: Make sure that the area around the component is clean and free of foreign material.
	2 Measure the resistance between the EPB module C4CB01 pin 14, circuit CCB16B (WH/VT), harness side and the EPB module C4CB01 pin 29, circuit CCB17A (BU/GN), harness side
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new parking brake release actuator. REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit CCB18A (YE/GY), or circuit CCB18B (YE/GY), or circuit CCB19A (GN/BN), or circuit CCB19B (GN/BN). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST V : DTC C2008.1D: LEFT ACTUATOR FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
V1: CHECK THE BRAKE DISC AND PADS	
	1 Remove the wheel and tire. REFER to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
	2 Connect WDS.
	3 Select 'Service' mode and retract brake pads.
	4 CHECK the brake disc and brake pads.
	Are the brake disc and brake pads OK? **Yes** REFER to: Parking Brake Release Actuator (206-05 Parking Brake and Actuation, Removal and Installation). **No**

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	REFER to: Brake Pads - Vehicles With: Electronic Parking Brake (206-04 Rear Disc Brake, Removal and Installation).

PINPOINT TEST W : DTC P061E: INTERNAL CONTROL MODULE BRAKE SIGNAL PERFORMANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
W1: CHECK THE WDS IS COMMUNICATING THROUGH THE DATA LINK CONNECTOR (DLC)	
	1 Ignition switch in position II.
	2 Select an alternative system to check the DLC.
	Is WDS able to communicate with the selected system? **Yes** GO to W2. **No** CHECK the DLC. For additional information, REFER to the Wiring Diagrams.
W2: CHECK THE POWERTRAIN CONTROL MODULE (PCM) CIRCUIT	
	1 Check for PCM DTCs.
	Is WDS able to communicate with the PCM? **Yes** CLEAR any PCM DTCs, REFER to WDS, then GO to W3. **No** CHECK the PCM circuits. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
W3: CHECK THE ABS MODULE CIRCUIT	
	1 Check for ABS DTCs.
	Is WDS able to communicate with the ABS module? **Yes** CLEAR any ABS DTCs, REFER to WDS, then GO to W4. **No** REPAIR circuit VDB04S (WH/BU) or circuit VDB05S (WH). REPEAT the self-test, CLEAR the DTCs.
W4: CHECK THE CJB	
	1 Check for CJB DTCs.
	Is WDS able to communicate with the CJB? **Yes** CLEAR any CJB DTCs, REFER to WDS, then GO to W5. **No** REPAIR circuit VDB04Y (WH/BU) or circuit VDB05AB (WH). REPEAT the self-test, CLEAR the DTCs.
W5: CHECK THE EPB MODULE CIRCUIT	
	1
	Is WDS able to communicate with the EPB module? **Yes** GO to W6. **No** REPAIR circuit VDB04N (WH/BU) or circuit VDB05E (WH). REPEAT the self-test, CLEAR the DTCs.
W6: CHECK THE CENTRAL JUNCTION BOX (CJB) CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Disconnect CJB C1BP02-C.
	3 Measure the resistance between the: • EPB module C4CB01 pin 16, circuit VDB04N

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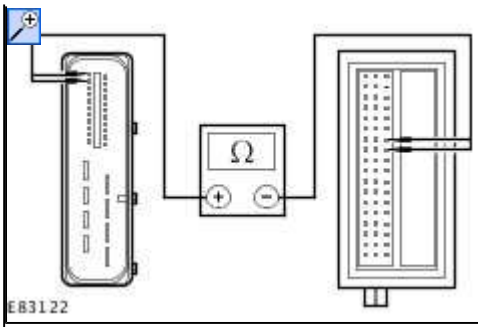
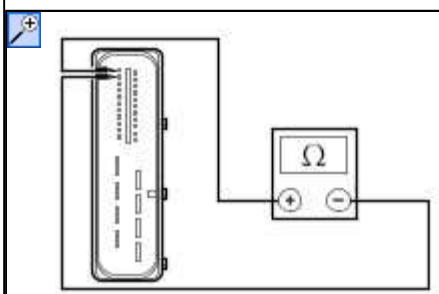
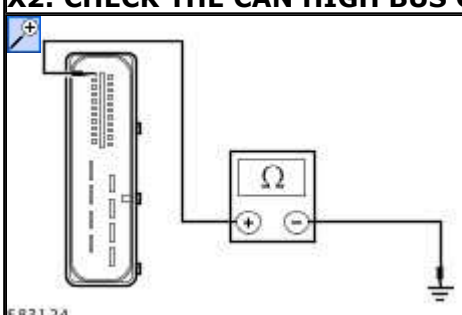
 E83122	(WH/BU), harness side and the CJB C1BP02-C pin 47, circuit VDB04Y (WH/BU), harness side. • EPB module C4CB01 pin 17, circuit VDB05E (WH), harness side and the CJB C1BP02-C pin 48, circuit VDB05AB (WH), harness side.
	Are the resistances less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit VDB04Y (WH/BU) or circuit VDB05AB (WH). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST X : DTC U0001: HIGH SPEED CAN BUS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK THE CAN BUS FOR A SHORT CIRCUIT	
	1 Disconnect EPB Module C4CB01.
 E83123	2 Measure the resistance between the EPB module C4CB01 pin 16, circuit VDB04N (WH/BU), harness side and the EPB module C4CB01 pin 17, circuit VDB05E (WH), harness side.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit VDB04N (WH/BU) or circuit VDB05E (WH). REPEAT the self-test, CLEAR the DTCs. **No** GO to X2.
X2: CHECK THE CAN HIGH BUS CIRCUIT FOR A SHORT TO GROUND	
 E83124	1 Measure the resistance between the EPB module C4CB01 pin 16, circuit VDB04N (WH/BU), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit VDB04N (WH/BU). REPEAT the self-test, CLEAR the DTCs. **No** GO to X3.
X3: CHECK THE CAN LOW BUS CIRCUIT FOR A SHORT TO POWER	
	1 Ignition switch in position II.
	2 Measure the voltage between the EPB module C4CB01 pin 17, circuit VDB05E (WH), harness side and ground.

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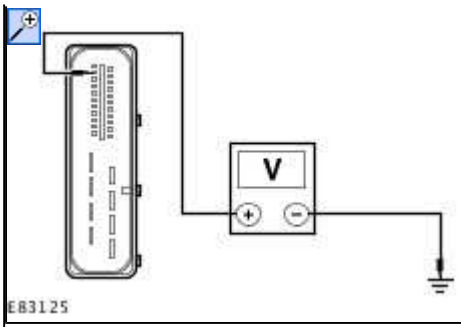
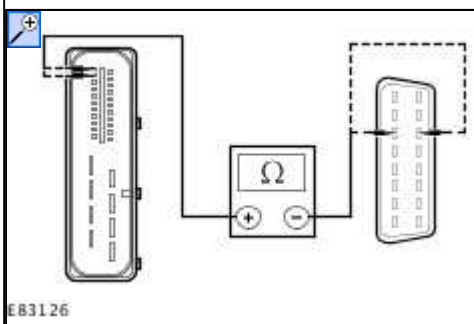
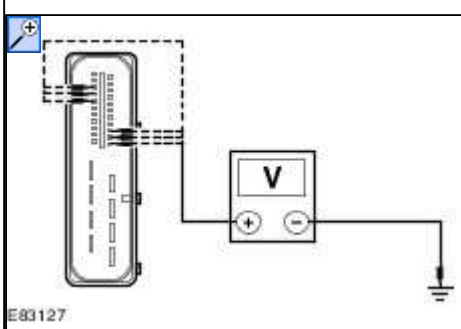
 E83125	
	Is any voltage present? **Yes** REPAIR circuit VDB05E (WH). REPEAT the self-test, CLEAR the DTCs. **No** GO to X4.
X4: CHECK THE CAN BUS CIRCUIT CONTINUITY	
	1 Ignition switch in position 0.
 E83126	2 Measure the resistance between the: • EPB module C4CB01 pin 16, circuit VDB04N (WH/BU), harness side and the DLC C3DB04 pin 6, circuit VDB04L (WH/BU), harness side. • EPB module C4CB01 pin 17, circuit VDB05E (WH), harness side and the DLC C3DB04 pin 14, circuit VDB05Z (WH), harness side.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit VDB04N (WH/BU) or circuit VDB05E (WH). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST Y : DTC U2002.62/92: EPB SWITCH FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK THE EPB SWITCH CIRCUITS FOR A SHORT TO POWER	
	1 Disconnect EPB Module C4CB01.
	2 Disconnect EPB Switch C3CB09.
	3 Ignition switch in position II.
 E83127	4 Measure the voltage between the: • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and ground. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and ground. • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and ground. • EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side and ground. • EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side and ground. • EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side and ground.

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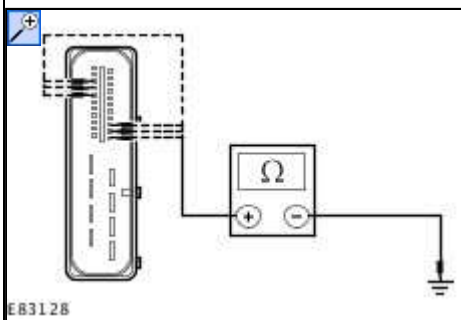
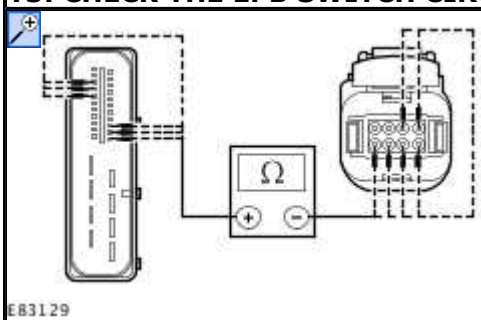
	Is any voltage present? **Yes** REPAIR circuit CCB20A (BU/WH), or circuit CCB21A (GN/VT), or circuit CCB22A (WH/BN), or circuit CCB23A (VT/GN), or circuit CCB24A (WH/OG), or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs. **No** GO to Y2.
Y2: CHECK THE EPB SWITCH CIRCUITS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the: • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and ground. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and ground. • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and ground. • EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side and ground. • EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side and ground. • EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** GO to Y3. **No** REPAIR circuit CCB20A (BU/WH), or circuit CCB21A (GN/VT), or circuit CCB22A (WH/BN), or circuit CCB23A (VT/GN), or circuit CCB24A (WH/OG), or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.
Y3: CHECK THE EPB SWITCH CIRCUITS FOR AN OPEN CIRCUIT	
	1 Measure the resistance between the: • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB Switch C3CB09 pin 4, circuit CCB23B (VT/GN), harness side. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and the EPB Switch C3CB09 pin 5, circuit CCB25B (BN), harness side. • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and the EPB Switch C3CB09 pin 8, circuit CCB21B (GN/VT), harness side. • EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side and the EPB Switch C3CB09 pin 7, circuit CCB22B (WH/BN), harness side. • EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side and the EPB Switch C3CB09 pin 6, circuit CCB24B (WH/OG), harness side. • EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side and the EPB Switch C3CB09 pin 3, circuit CCB20B (BU/WH), harness side.
	Are the resistances less than 5 ohms? **Yes** GO to Y4.

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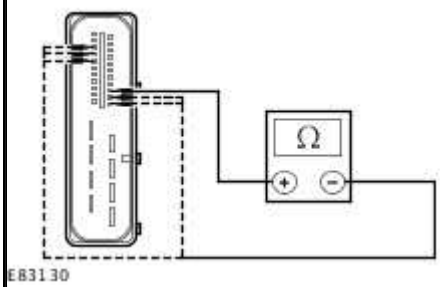
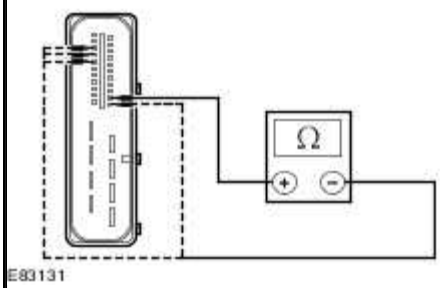
	No REPAIR circuit CCB20A (BU/WH), or circuit CCB21A (GN/VT), or circuit CCB22A (WH/BN), or circuit CCB23A (VT/GN), or circuit CCB24A (WH/OG), or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.
Y4: CHECK THE EPB SWITCH CIRCUITS FOR A CROSS LINK TO ANOTHER CIRCUIT	
	1 Measure the resistance between the: • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB module C4CB01 pin 10, circuit CCB25A (BN). • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side. • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side. • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side. • EPB module C4CB01 pin 9, circuit CCB23A (VT/GN), harness side and the EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side.
	Are the resistances greater than 10,000 ohms? **Yes** GO to Y5. **No** REPAIR circuit CCB23A (VT/GN) and circuit CCB20A (BU/WH), or circuit CCB21A (GN/VT), or circuit CCB22A (WH/BN), or circuit CCB24A (WH/OG), or circuit CCB25A (BN). REPEAT the self-test, CLEAR the DTCs.
Y5: CHECK THE EPB SWITCH CIRCUITS FOR A CROSS LINK TO ANOTHER CIRCUIT CONTINUED	
	1 Measure the resistance between the: • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and the EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and the EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and the EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side. • EPB module C4CB01 pin 10, circuit CCB25A (BN), harness side and the EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side.
	Are the resistances greater than 10,000 ohms? **Yes** GO to Y6. **No** REPAIR circuit CCB25A (BN), circuit CCB20A (BU/WH), or circuit CCB21A (GN/VT), or circuit CCB22A (WH/BN), or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.
Y6: CHECK THE EPB SWITCH CIRCUITS FOR A CROSS LINK TO ANOTHER CIRCUIT CONTINUED	

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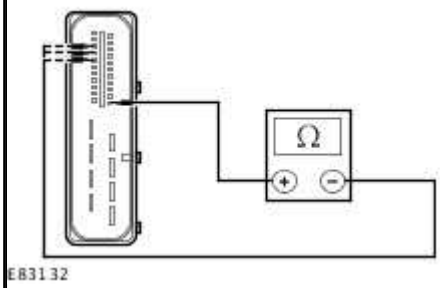
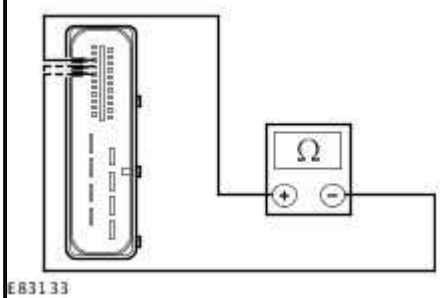
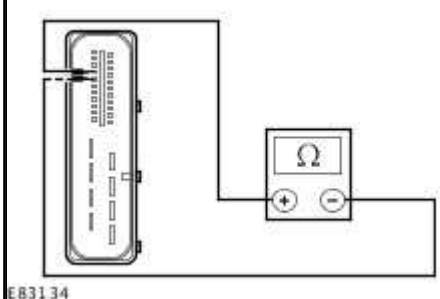
	1 Measure the resistance between the: • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and the EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side. • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and the EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side. • EPB module C4CB01 pin 11, circuit CCB21A (GN/VT), harness side and the EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side.
	Are the resistances greater than 10,000 ohms? **Yes** GO to Y7. **No** REPAIR circuit CCB21A (GN/VT) and circuit CCB20A (BU/WH), or circuit CCB22A (WH/BN), or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.
Y7: CHECK THE EPB SWITCH CIRCUITS FOR A CROSS LINK TO ANOTHER CIRCUIT CONTINUED	
	1 Measure the resistance between the: • EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side and the EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side. • EPB module C4CB01 pin 18, circuit CCB22A (WH/BN), harness side and the EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side.
	Are the resistances greater than 10,000 ohms? **Yes** GO to Y8. **No** REPAIR circuit CCB22A (WH/BN) and circuit CCB20A (BU/WH) or circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.
Y8: CHECK THE EPB SWITCH CIRCUITS FOR A CROSS LINK TO ANOTHER CIRCUIT CONTINUED	
	1 Measure the resistance between the EPB module C4CB01 pin 19, circuit CCB24A (WH/OG), harness side and the EPB module C4CB01 pin 20, circuit CCB20A (BU/WH), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REFER to: Parking Brake Switch - Vehicles With: Electronic Parking Brake (EPB) (206-05 Parking Brake and Actuation, Removal and Installation). **No** REPAIR circuit CCB20A (BU/WH) and circuit CCB24A (WH/OG). REPEAT the self-test, CLEAR the DTCs.

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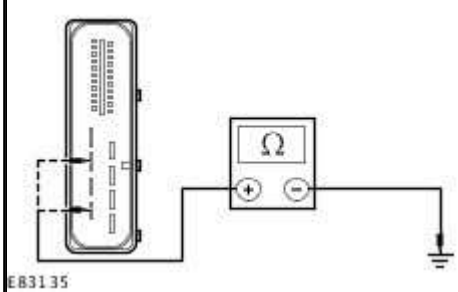
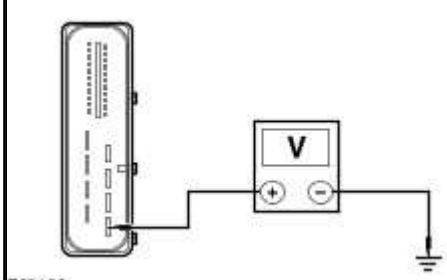
PINPOINT TEST Z : DTC U2016.05: CONTROL MODULE MAIN SOFTWARE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
Z1: CHECK THE BATTERY VOLTAGE	
	1 Check the battery voltage.
	Is the voltage greater than 10 volts? **Yes** REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** Check the charging system. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST AA : DTC U3000.13: CONTROL MODULE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AA1: CHECK THE EPB MODULE GROUND CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Measure the resistance between the: • EPB module C4CB01 pin 28, circuit GD147B (BK/VT), harness side and ground. • EPB module C4CB01 pin 30, circuit GD147A (BK/VT), harness side and ground.
	Are the resistances less than 2 ohms? **Yes** GO to AA2. **No** REPAIR circuit GD147A (BK/VT) or circuit GD147B (BK/VT). REPEAT the self-test, CLEAR the DTCs.
AA2: CHECK THE EPB MODULE MOTOR SUPPLY VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to AA3. **No** REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.
AA3: CHECK THE EPB MODULE MOTOR SUPPLY CIRCUIT	

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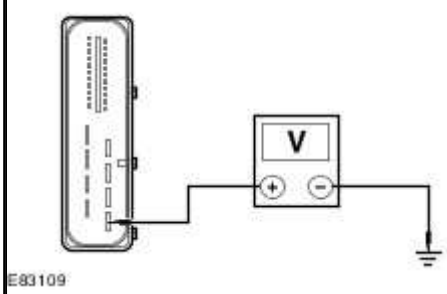
	1 Disconnect Rear Junction Box C4BR02.
	2 Measure the resistance between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and the rear junction box C4BR02-C pin 304, circuit C_SBR03A (BU/RD). • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and the rear junction box C4BR02-C pin 303, circuit C_SBR02A (YE/RD).
	Are the resistances less than 2 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST AB : DTC U3003.62: BATTERY VOLTAGE / DTC U3006.16: BATTERY VOLTAGE (LOW OR HIGH)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AB1: CHECK THE EPB MODULE MOTOR SUPPLY CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Ignition switch in position II.
	3 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to AB2. **No** GO to AB3.
AB2: CHECK THE EPB MODULE MOTOR SUPPLY CIRCUIT IMPEDANCE	
	1 Disconnect Rear Junction Box C4BR02.
	2 Measure the resistance between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and the rear junction box C4BR02-C pin 304, circuit C_SBR03A (BU/RD). • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and the rear junction box C4BR02-C pin 303, circuit C_SBR02A (YE/RD).
	Are the resistances less than 2 ohms? **Yes** INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. **No**

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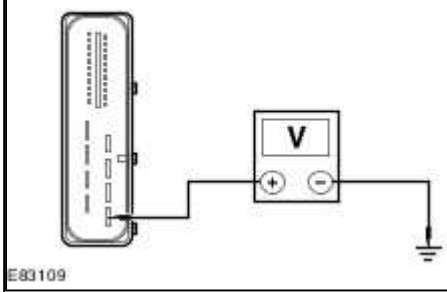
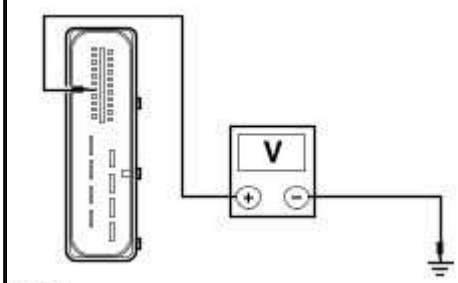
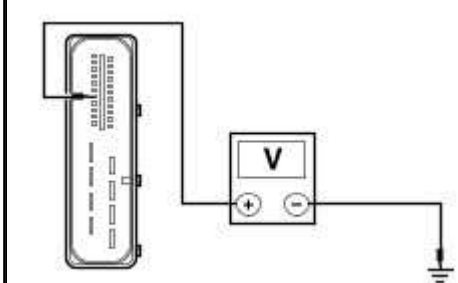
	REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.
AB3: CHECK THE EPB MODULE MOTOR SUPPLY	
 E83109	1 Measure the voltage between the: • EPB module C4CB01 pin 13, circuit C_SBR03A (BU/RD), harness side and ground. • EPB module C4CB01 pin 15, circuit C_SBR02A (YE/RD), harness side and ground.
	Is any voltage present? **Yes** Check the charging system. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs. **No** REPAIR circuit C_SBR02A (YE/RD) or circuit C_SBR03A (BU/RD). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST AC : DTC U300A.62: IGNITION CROSS CHECK FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK THE EPB MODULE SUPPLY CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Ignition switch in position II.
 E83136	3 Measure the voltage between the EPB module C4CB01 pin 22, circuit CBP03B (GY), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to AC2. **No** REPAIR circuit CBP03B (GY). REPEAT the self-test, CLEAR the DTCs.
AC2: CHECK THE EPB MODULE SUPPLY SWITCH CIRCUIT	
	1 Ignition switch in position 0.
 E83136	2 Measure the voltage between the EPB module C4CB01 pin 22, circuit CBP03B (GY), harness side and ground.

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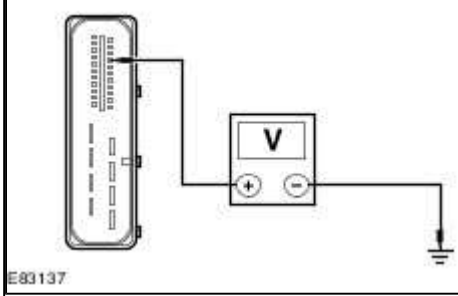
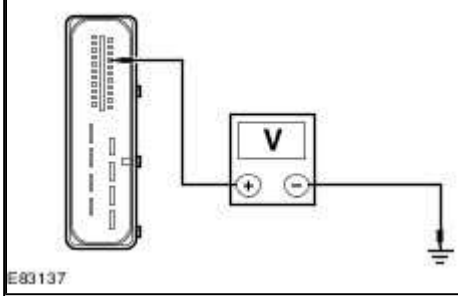
	Is any voltage present? **Yes** REPAIR circuit CBP03B (GY). REPEAT the self-test, CLEAR the DTCs. **No** REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

PINPOINT TEST AD : DTC U300A.86: IGNITION CROSS CHECK FAULT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AD1: CHECK THE EPB MODULE KEY IN CIRCUIT	
	1 Disconnect EPB Module C4CB01.
	2 Insert the ignition key.
 E83137	3 Measure the voltage between the EPB module C4CB01 pin 4, circuit CCB28A (GY/BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to AD2. **No** REPAIR circuit CCB28A (GY/BN). REPEAT the self-test, CLEAR the DTCs.
AD2: CHECK THE EPB MODULE KEY OUT CIRCUIT	
	1 Remove the ignition key.
 E83137	2 Measure the voltage between the EPB module C4CB01 pin 4, circuit CCB28A (GY/BN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CCB28A (GY/BN). REPEAT the self-test, CLEAR the DTCs. **No** REPEAT the self-test, CLEAR the DTCs. If the DTC remains, INSTALL a new EPB module. REFER to: Parking Brake Module (206-05 Parking Brake and Actuation, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

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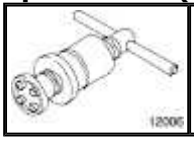
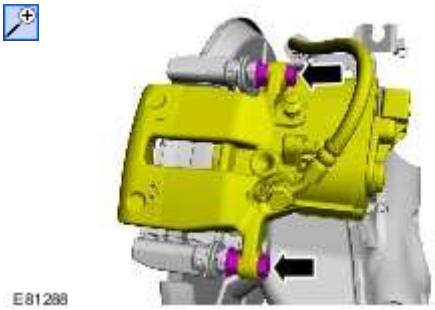
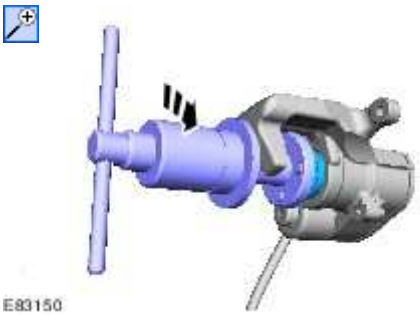
General Procedures

Special Tool(s)

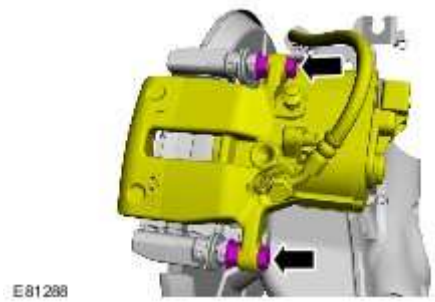
	206-012 Retractor, Rear Brake Caliper Piston


E81288

1.


E83150

2. *Special Tool(s):* 206-012


E81288

3. *Torque:* 35 Nm

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General Procedures

Service mode activation.

1. Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Release the electronic parking brake.
3.
    1. Turn the ignition switch to position II.
    2. Fully depress and hold down the accelerator pedal.
    3. Press and hold down the parking brake switch.
    4. Turn the ignition switch to position 0.
    5. Turn the ignition switch to position II within five seconds of completing sub-step 4.
    6. Wait until the EPB has fully reloaded.
    7. Turn the ignition switch to position 0.
    8. Release the accelerator pedal.
    9. Release the parking brake switch.

Service mode deactivation.

1.
    1. Turn the ignition switch to position II.
    2. Fully depress and hold down the accelerator pedal.
    3. Lift up and hold up the parking brake switch.
    4. Turn the ignition switch to position 0.
    5. Turn the ignition switch to position II within five seconds of completing sub-step 4.
    6. Wait until the EPB has fully applied.
    7. Turn the ignition switch to position 0.
    8. Release the accelerator pedal.
    9. Release the parking brake switch.

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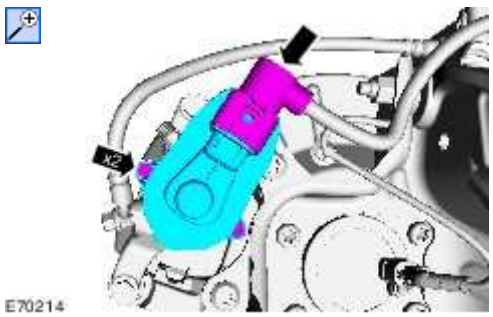
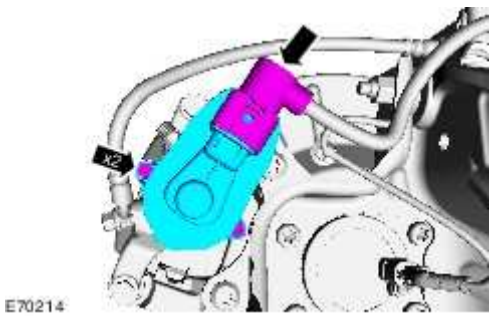
General Procedures

1. Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. To release the brake, turn the spindle clockwise using a T40 socket spanner or a 6mm Allen key.
4. *Torque:* 9 Nm



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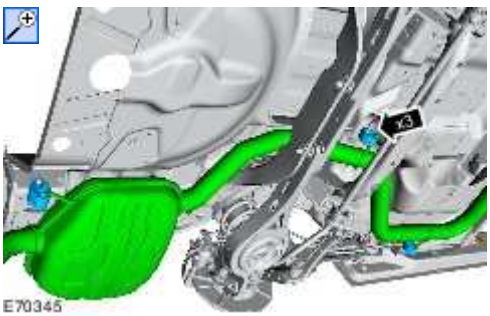
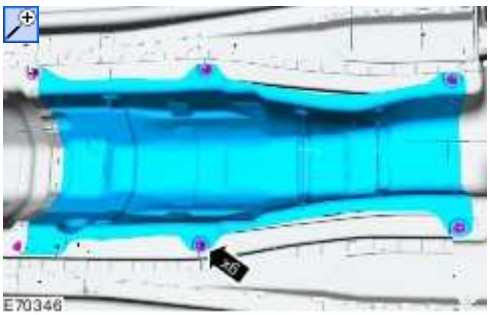
General Procedures

1.
   1. Fully apply the parking brake.
   2. Fully release the parking brake control.
2. Raise and support the vehicle.

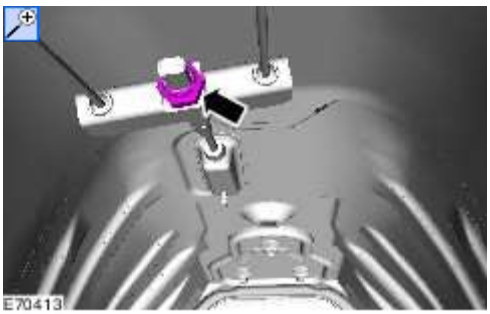
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



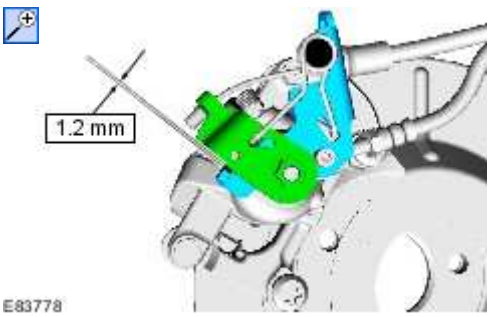
3. Support the muffler and tailpipe assembly.



4. *Torque:* 5 Nm



5. Loosen the parking brake cable adjustment nut to the end of the parking brake cable thread.



6. NOTE: This step requires the aid of another technician.
   1. Insert a 1.2 mm feeler gauge between the parking brake lever and the brake caliper abutment, on both sides.
   2. Tighten the parking brake cable adjustment nut until movement is observed on one of the parking brake levers.
   3. Remove the feeler gauges.
   4. Rotate the rear wheels and tires and check for brake drag. If brake drag is felt, loosen the parking brake cable adjustment nut to the end of the parking brake cable thread, clean the parking brake cables and repeat the parking brake cable adjustment

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procedure.

5. If brake drag is still felt after, repeat the adjustment using a 1.0 mm feeler gauge. If brake drag is still felt, loosen the parking brake adjustment nut and reduce the feeler gauge measurement by 0.2 mm each time, until no brake drag can be felt at the rear wheels and tires.

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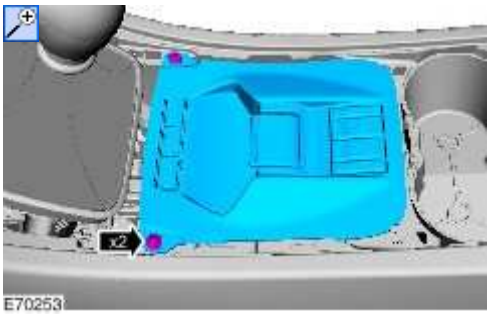
Removal and Installation

General Equipment

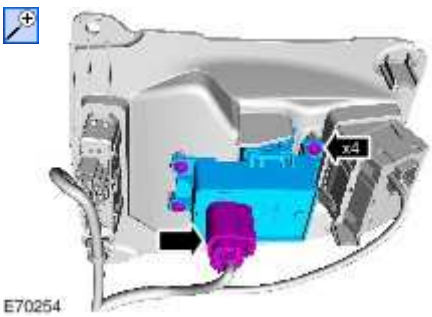
Worldwide Diagnostic System (WDS)

Removal

1.



2.



3.

Installation

1. To install, reverse the removal procedure.
2. Carry out a parking brake Function Test.

   General Equipment: Worldwide Diagnostic System (WDS)

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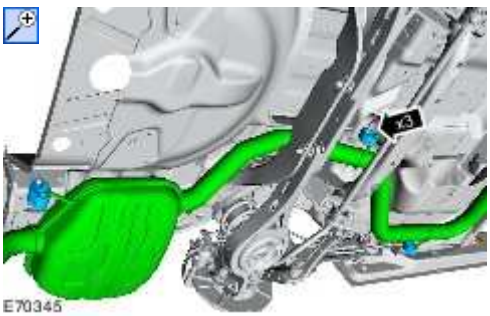
Removal and Installation

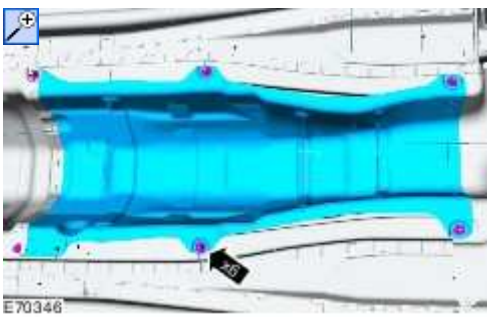
Removal

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

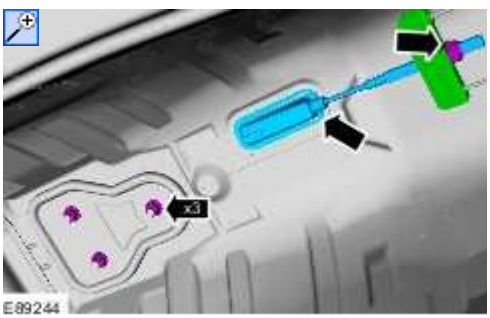
1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. Support the muffler and tailpipe assembly.

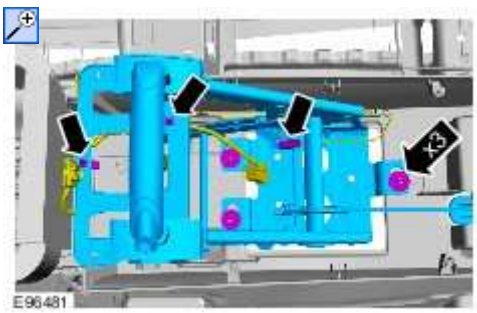


3.



4. *Torque:* 25 Nm

5. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).



6.

Installation

1. To install, reverse the removal procedure.

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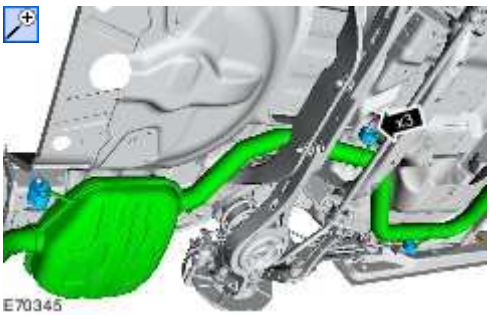
Removal and Installation

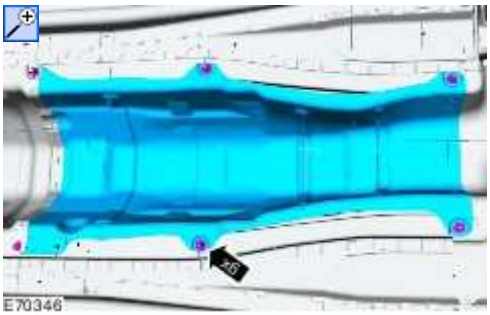
Removal

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

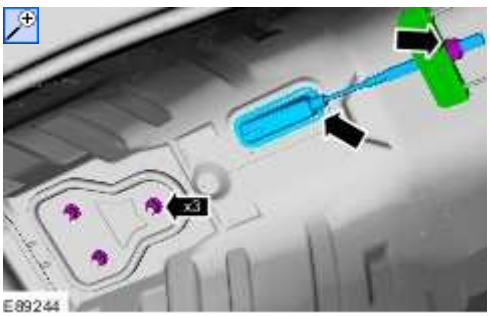
1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. Support the muffler and tailpipe assembly.



3.



4. *Torque:* 25 Nm

5. Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

6.

7.

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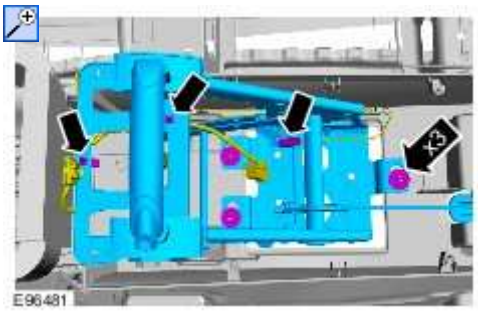

Installation

1. To install, reverse the removal procedure.

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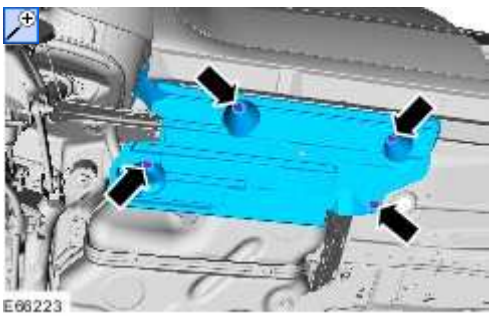
Removal and Installation

Removal

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

1. Release the parking brake.
2. Remove the rear wheels and tires.

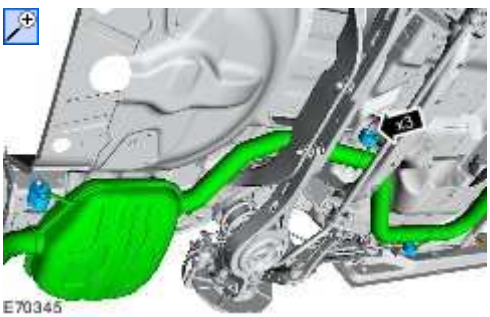
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E68223

3. *Torque:* 10 Nm

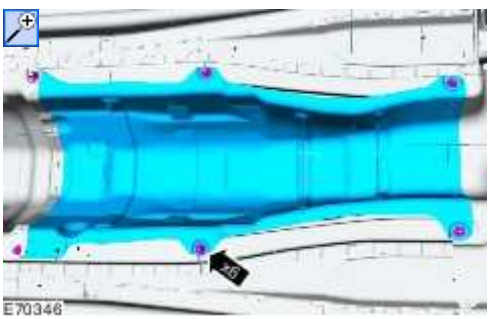
E68413

4. *Torque:* 10 Nm



E70345

5. Support the muffler and tailpipe assembly.

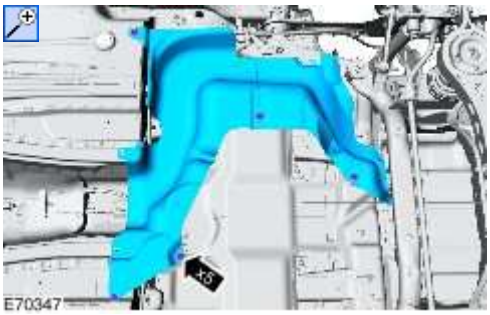


E70346

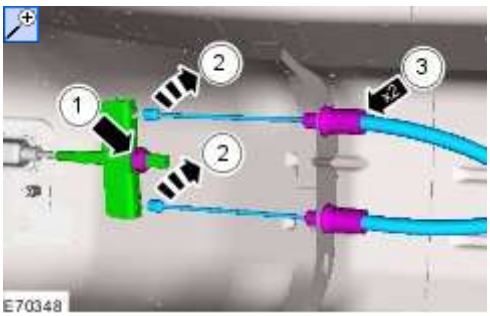
6. *Torque:* 5 Nm

7. *Torque:* 5 Nm

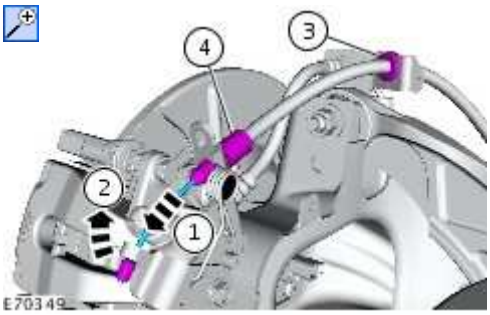
http://vnx.su



8.



9.



10.

1. *Torq*
   2.8 |

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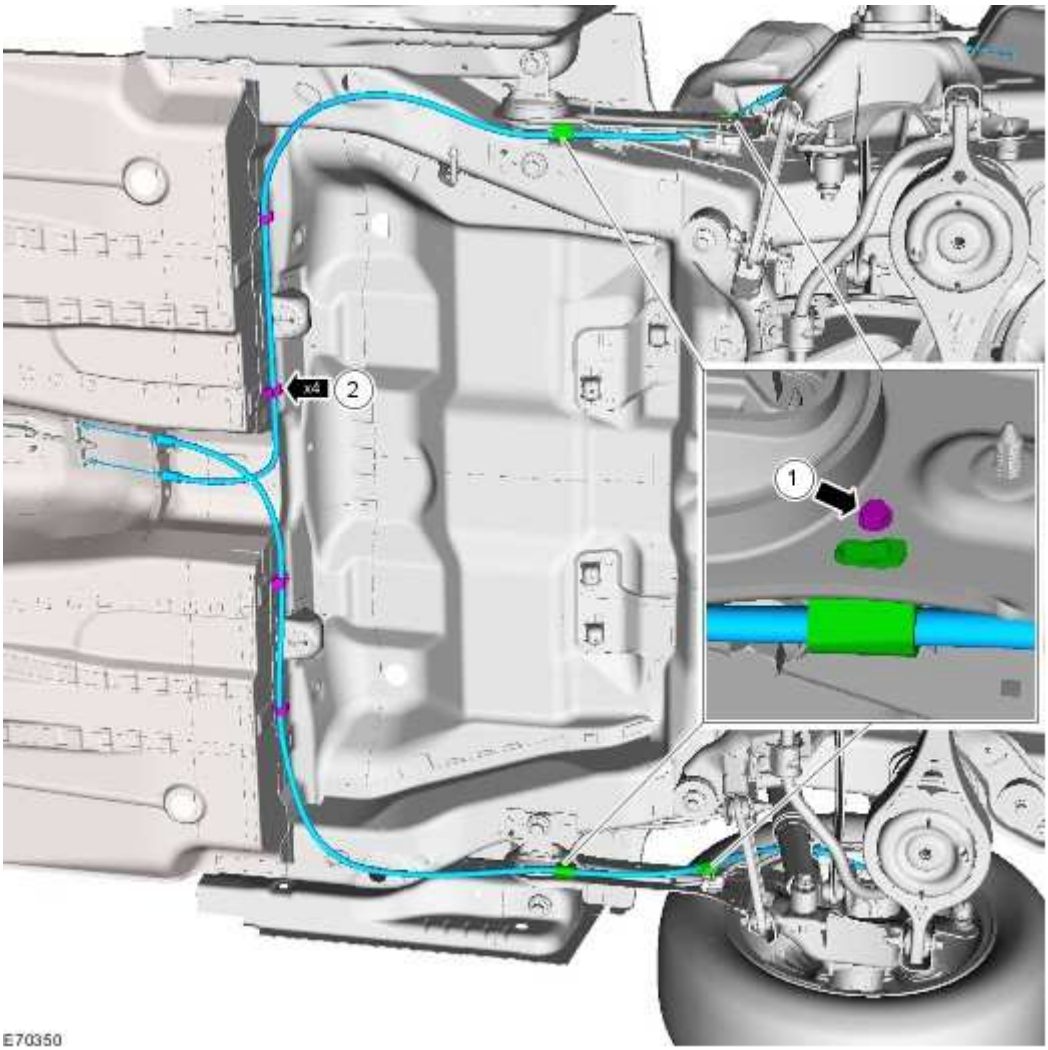

Installation

1. To install, reverse the removal procedure.
2. Refer to: Parking Brake Cable Adjustment (206-05 Parking Brake and Actuation, General Procedures).

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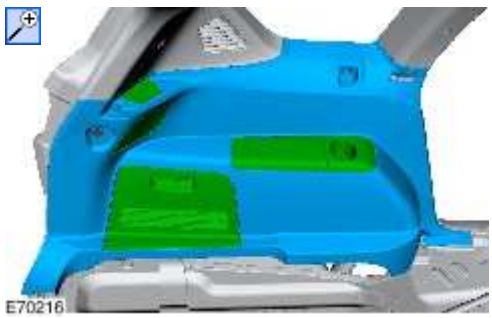
Print

Removal and Installation

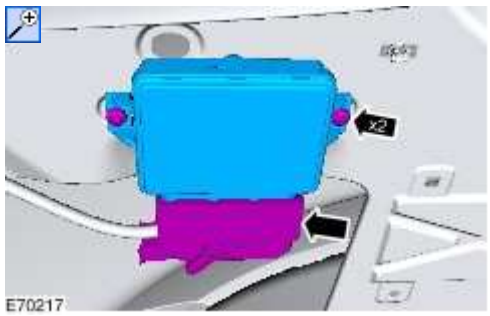
General Equipment

Worldwide Diagnostic System (WDS)

Removal



1.



2. *Torque:* 9 Nm

Installation

1. To install, reverse the removal procedure.
2. Configure the electronic parking brake program.

   General Equipment: Worldwide Diagnostic System (WDS)

3. Carry out a parking brake Function Test.

   General Equipment: Worldwide Diagnostic System (WDS)

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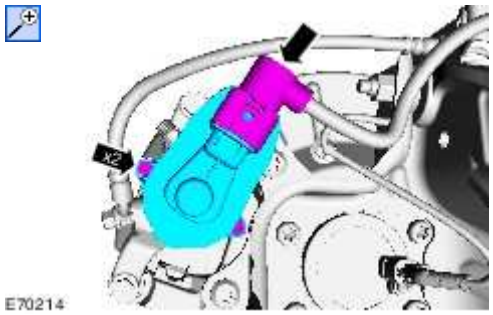
Removal and Installation

Removal

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



1. *Torque:* 9 Nm

Installation

1. To install, reverse the removal procedure.

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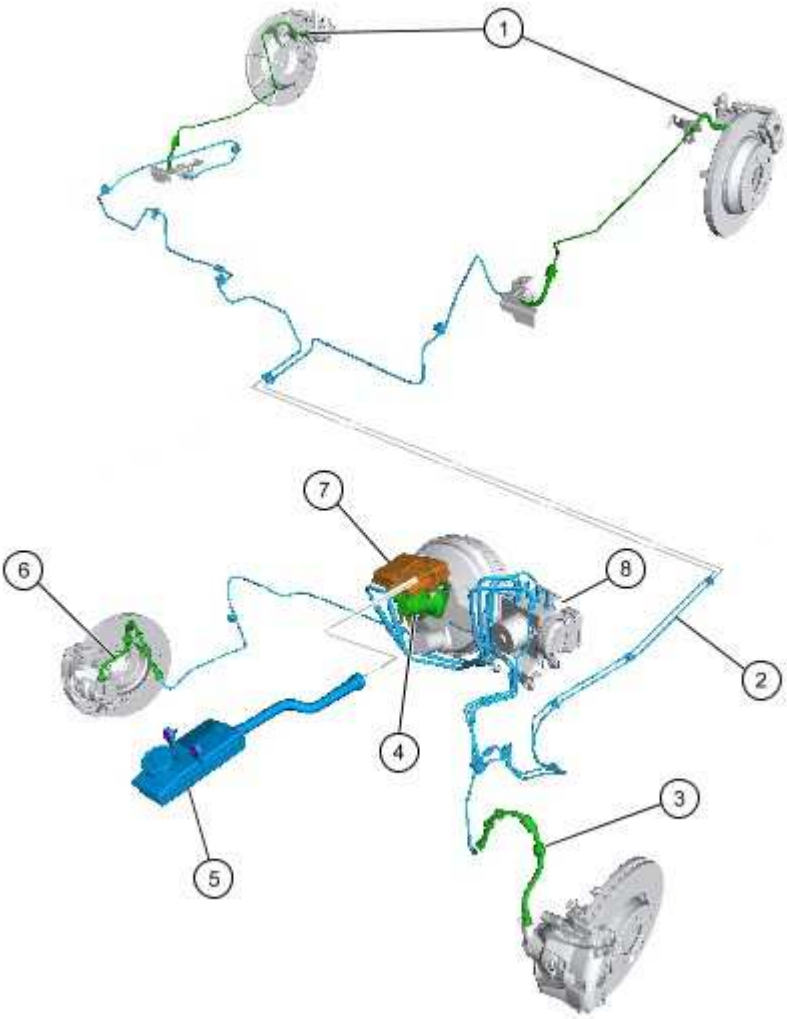
Description and Operation



E68721

Item	Part Number	Description
1	-	Rear brake hoses
2	-	Brake tubes
3	-	Front brake hose - LH
4	-	Brake master cylinder
5	-	Brake fluid reservoir extension
6	-	Front brake hose - RH
7	-	Brake fluid reservoir
8	-	Hydraulic control unit (HCU) - see section 206-09A

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Diagnosis and Testing

REFER to Section 206-00 Brake System - General Information.

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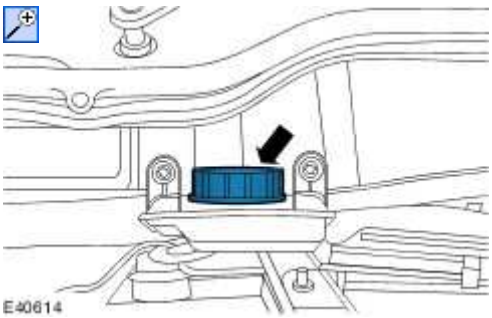
Removal and Installation

Removal

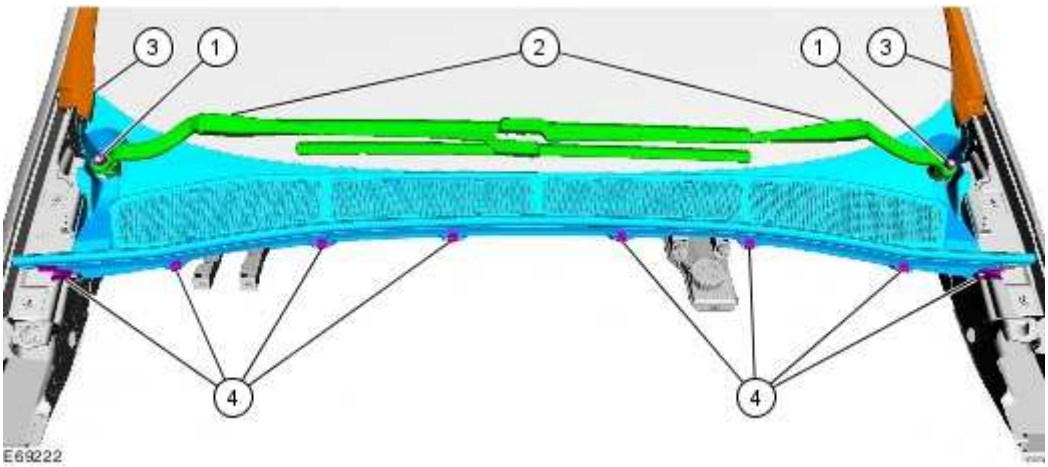
NOTE: Removal steps in this procedure may contain installation details.

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



2.

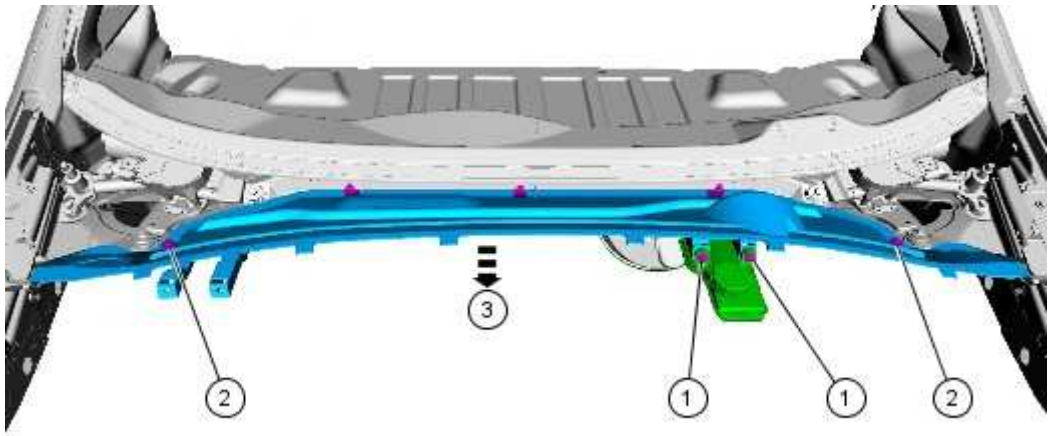
3.
   1. Connect one end of a suitable piece of clear plastic pipe to the brake caliper bleed nipple a place the other end into a suitable container.
   2. Loosen the bleed nipple.
   3. Depress the brake pedal until all the brake flui drained from the brake fluid reservoir.
   4. Tighten the bleed nipple.
   5. Repeat the draining procedure on the opposite side brake caliper.



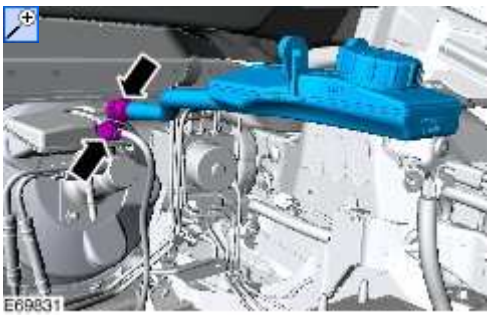
4.
   3. Deta the A pillar exte trim lowe retai clips

5.

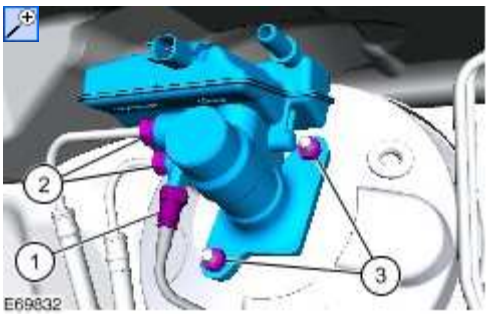
http://vnx.su



E69223


E69831

6. CAUTION: Make sure that all openings are sealed.



E69832

7. CAUTION: Make sure that all openings are sealed.
   2. *Torque:* 18 Nm
   3. *Torque:* 25 Nm

Installation

1. NOTE: Make sure that the seal is correctly located
   To install, reverse the removal procedure.
2. Bleed the brake system.

   Refer to: Brake System Bleeding (206-00 Brake Syst - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

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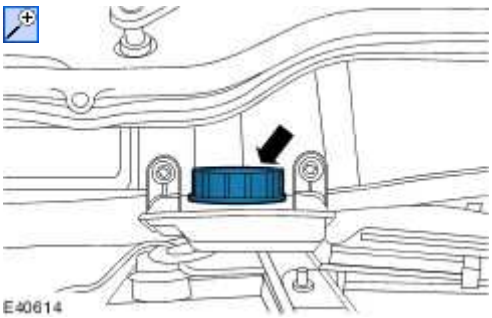
Removal and Installation

Removal

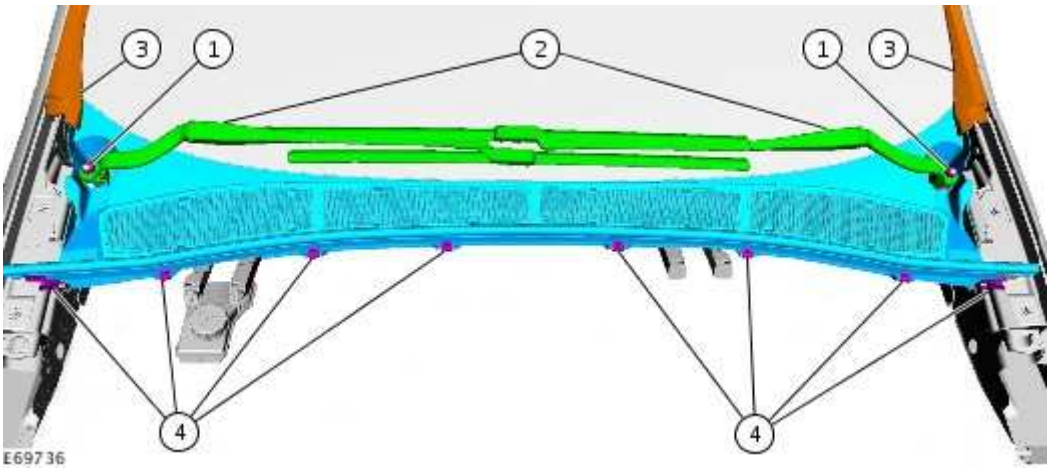
NOTE: Removal steps in this procedure may contain installation details.

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



2.

3.
   1. Connect one end of a suitable piece of clear pl pipe to the brake caliper bleed nipple and plac the other end into a suitable container.
   2. Loosen the bleed nipple.
   3. Depress the brake pedal until all the brake flui drained from the brake fluid reservoir.
   4. Tighten the bleed nipple.
   5. Repeat the draining procedure on the opposite side brake caliper.



4.
   3. Deta the pilla exte trim lowe retai clips

5.

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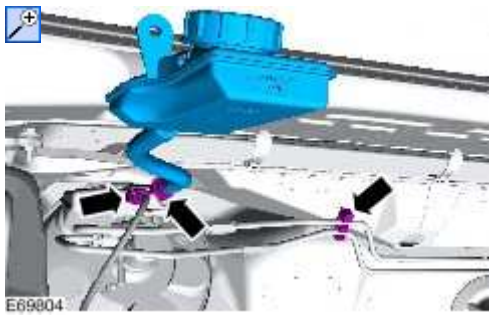
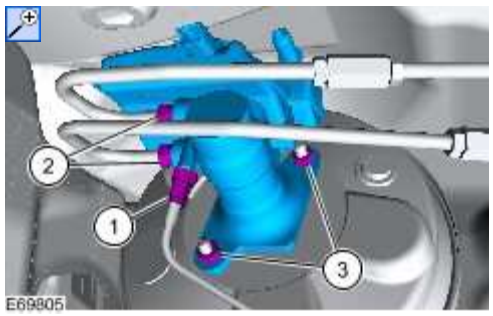
E69737


E69804

6. CAUTION: Make sure that all openings are sealed.



E69805

7. CAUTION: Make sure that all openings are sealed.
   2. *Torque:* 18 Nm
   3. *Torque:* 25 Nm

Installation

1. NOTE: Make sure that the seal is correctly located
   To install, reverse the removal procedure.
2. Bleed the brake system.

   Refer to: Brake System Bleeding (206-00 Brake Syst - General Information, General Procedures).
   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

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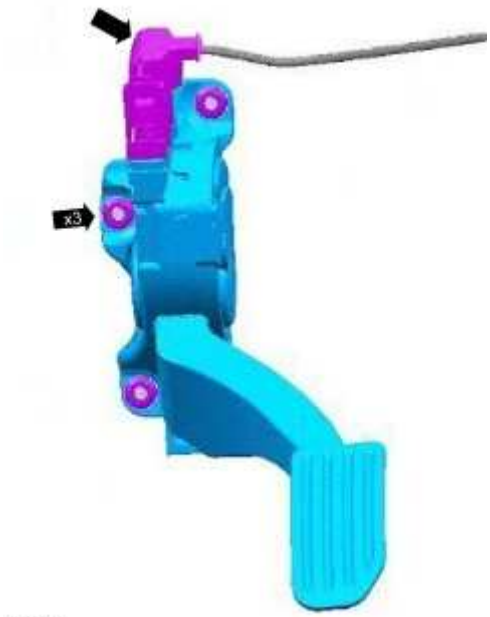
Removal and Installation

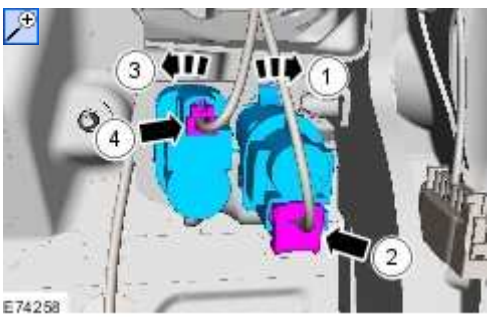
Removal

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

1. *Torque:* 10 Nm

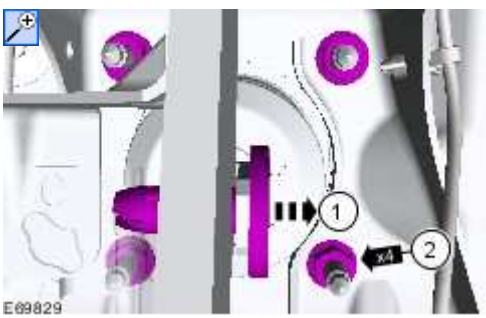


E70095



E74258

2. CAUTION: Make sure that the brake pedal remains in the rest position.



E69829

3. CAUTIONS:

   Make sure that the brake pedal remains in the rest position.

   The brake pedal actuating rod pin will be damaged during removal.
   Torque: 24 Nm

4. *Torque:* 24 Nm

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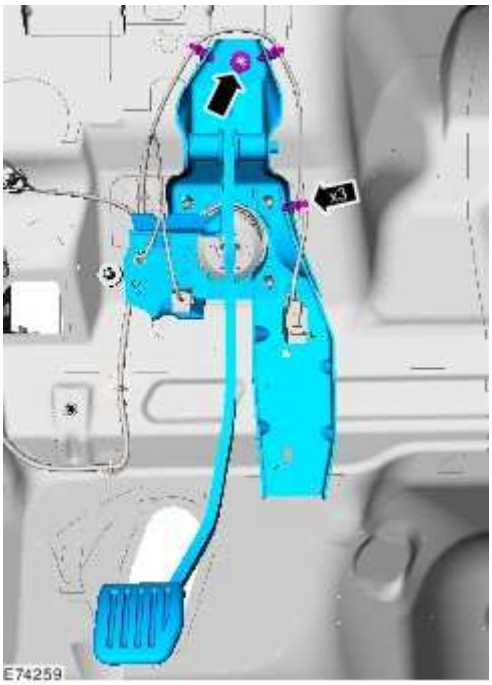

Installation

1. CAUTIONS:

   Make sure that the brake booster pushrod is correctly located.

   Make sure that the brake pedal remains in the rest position.

   To install, reverse the removal procedure.

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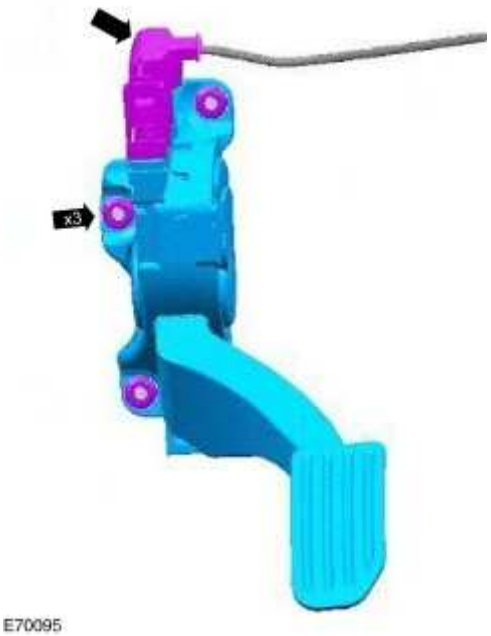
Removal and Installation

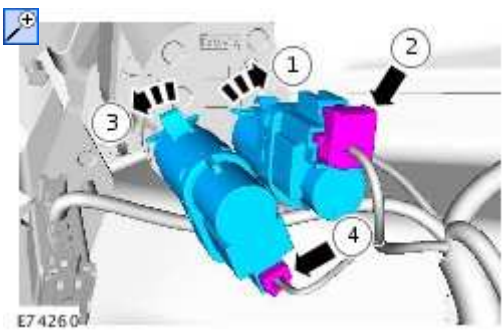
Removal

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

1. *Torque:* 10 Nm

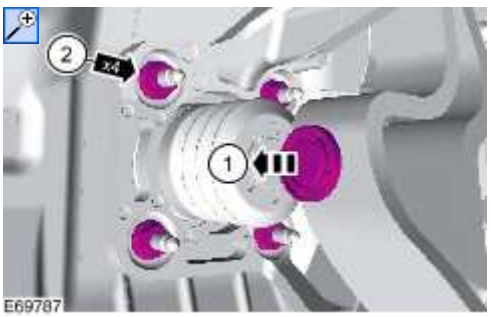


E70095



E74260

2. CAUTION: Make sure that the brake pedal remains in the rest position.



E69787

3.
   1. CAUTIONS:

      Make sure that the brake pedal remains in the rest position.

      The brake pedal actuating rod pin will be damaged during removal.
   2. *Torque:* 24 Nm

4. *Torque:* 24 Nm

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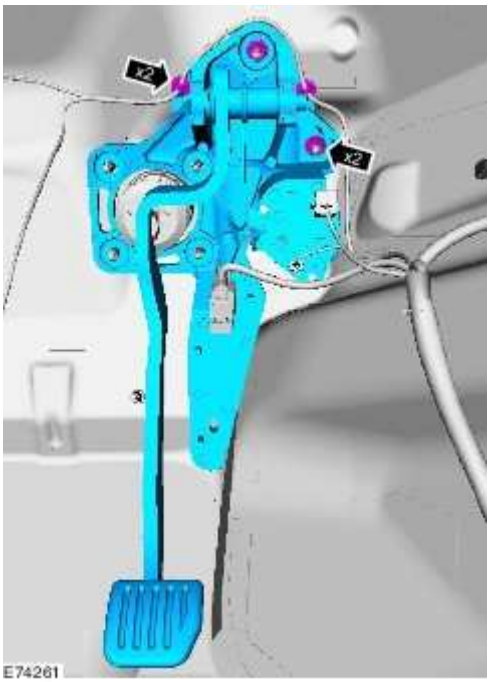

Installation

1. CAUTIONS:

   Make sure that the brake booster pushrod is correctly located.

   Make sure that the brake pedal remains in the rest position.

   To install, reverse the removal procedure.

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Diagnosis and Testing

REFER to Section 206-00 Brake System - General Information.

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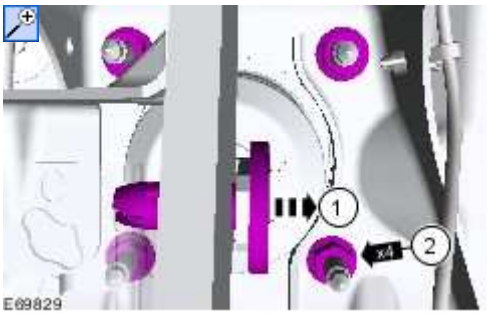
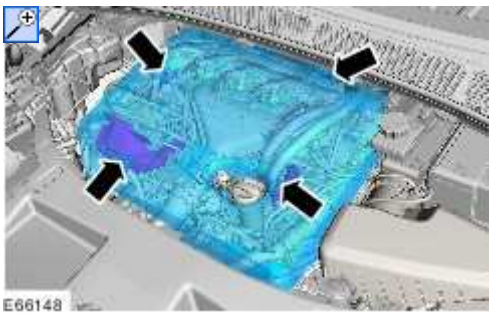
Removal and Installation

Removal

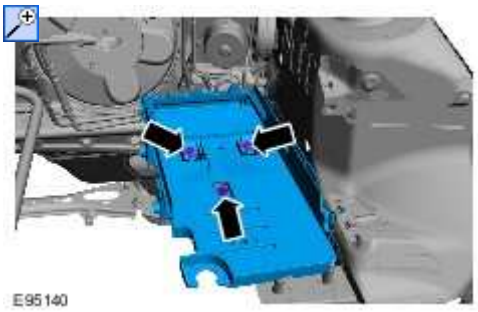
NOTE: Removal steps in this procedure may contain installation details.



1. CAUTION: Make sure that the brake pedal remains in the rest position.
   NOTE: The brake pedal actuating rod pin will be damaged during removal.
   Torque: 24 Nm



2. If equipped.
3. Refer to: Brake Master Cylinder - LHD FWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
4. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).



5. *Torque:* 12 Nm
6.

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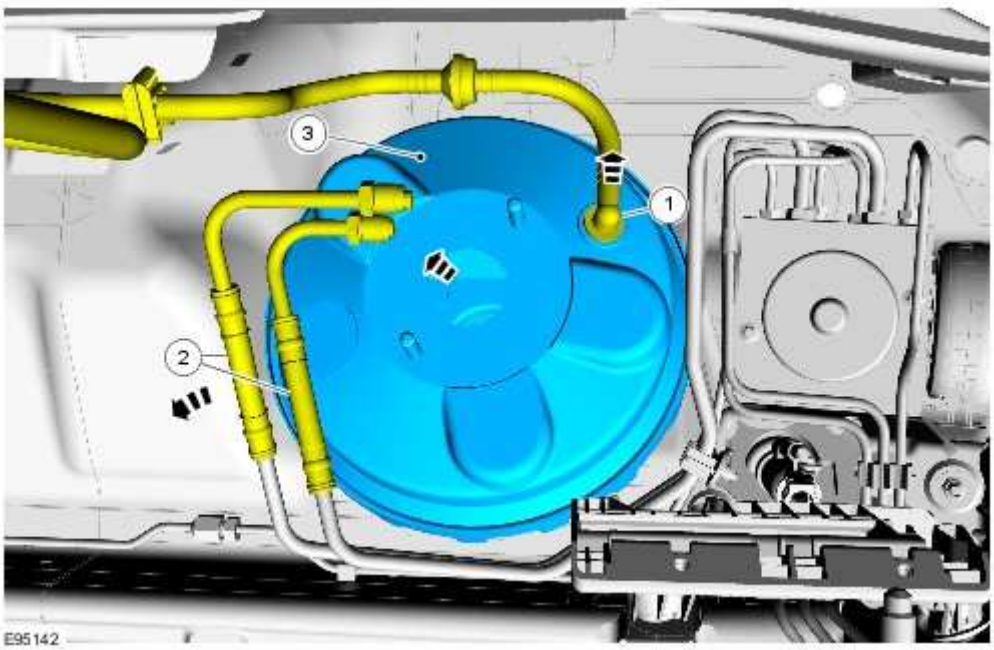

Installation

1. CAUTION: Make sure that the brake booster pushrod is correctly located.
   To install, reverse the removal procedure.

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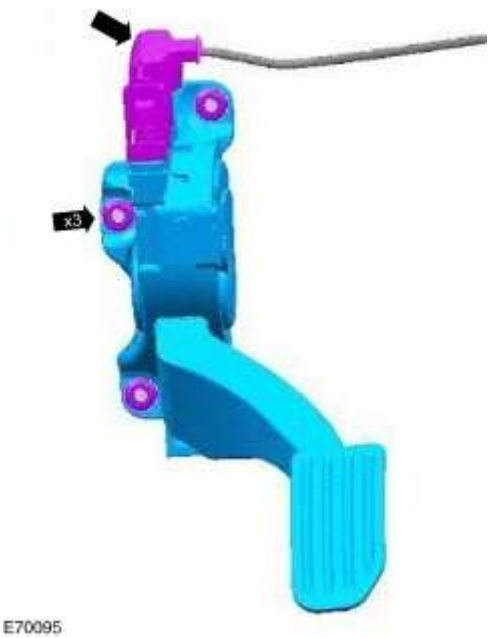
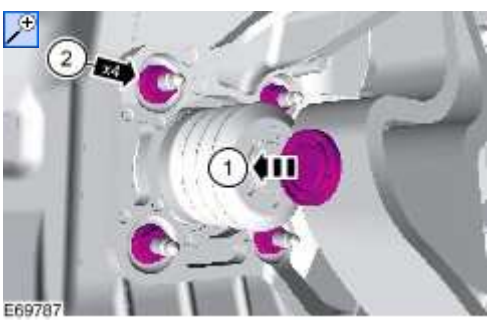
Removal and Installation

Removal

1. Remove the following items:
    1. Refer to: Brake Master Cylinder - RHD FWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
    2. Refer to: Brake Pedal and Bracket - RHD FWD (206-06 Hydraulic Brake Actuation, Removal and Installation).
2.

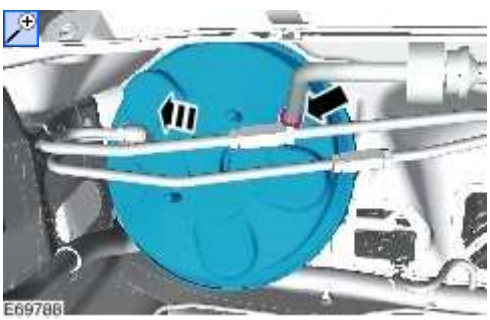


E70095



E69787

3. NOTE: The brake pedal actuating rod pin will be damaged during removal.
    2. *Torque:* 24 Nm


E69788

4.

Installation

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1. CAUTION: Make sure that the brake booster pushrod is correctly located.
   To install, reverse the removal procedure.

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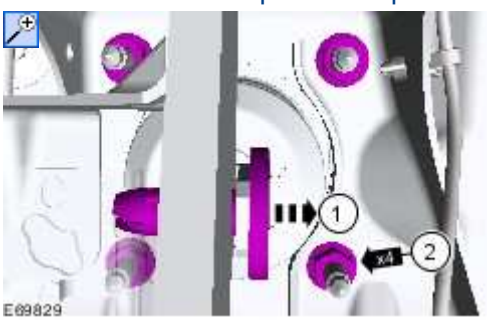
Removal and Installation

Materials

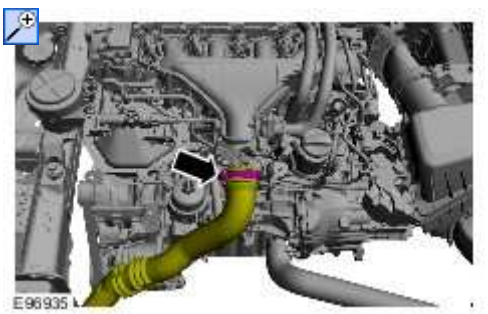
Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

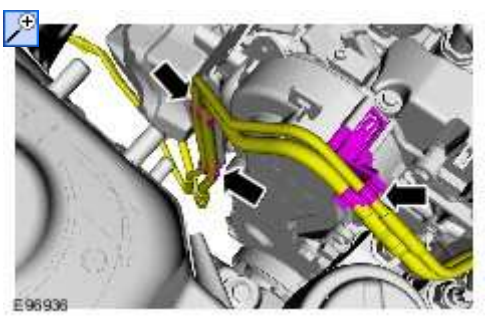
NOTE: Removal steps in this procedure may contain installation details.



1. CAUTION: Make sure that the brake pedal remains in the rest position.
   NOTE: The brake pedal actuating rod pin will be damaged during removal.
   Torque: 24 Nm
2. Refer to: Accessory Drive Belt (303-05E Accessory D - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq- (103kW/140PS) - DW, Emission Requirements: Stag Removal and Installation).
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).



4.
5. Refer to: Brake Master Cylinder - RHD FWD (206-06 Hydraulic Brake Actuation, Removal and Installation)



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7.

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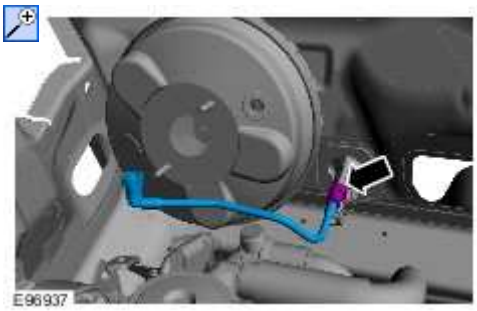
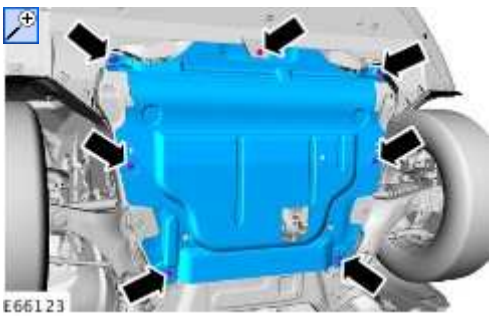


8. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).



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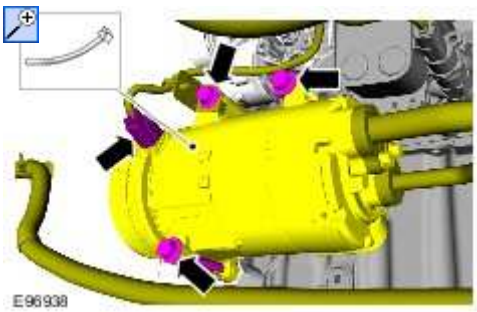
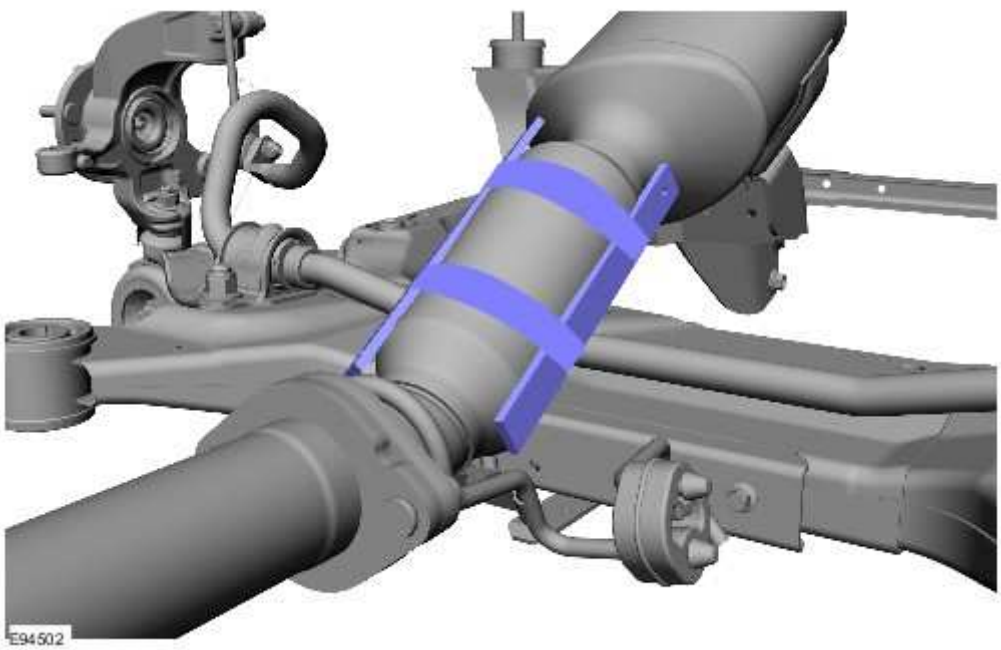


10. *Torque:* 25 Nm



11. CAUTIO
Make sure th
the exhaust
flexible pipe
not forcibly
bent.

12. *Torque:* 48 Nm

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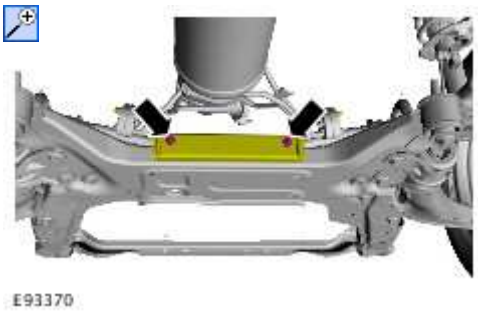
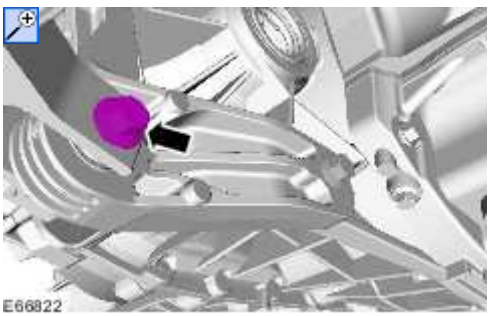
13. *Torque:* 10 Nm



14. *Torque:* 80 Nm



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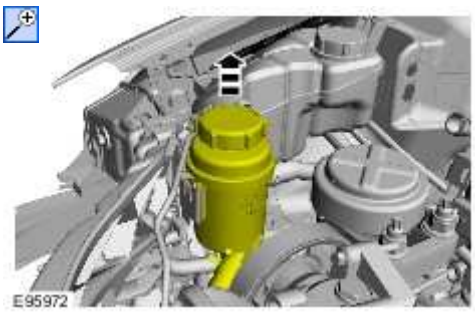

16.

17.
1. *Torque:* 80 Nm
2. *Torque:* 133 Nm

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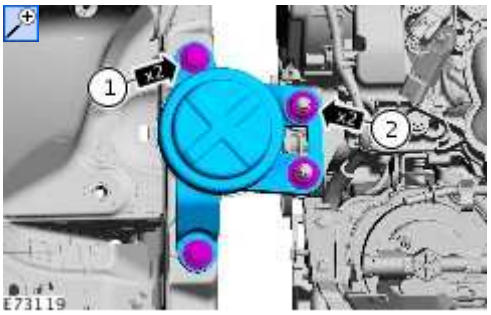

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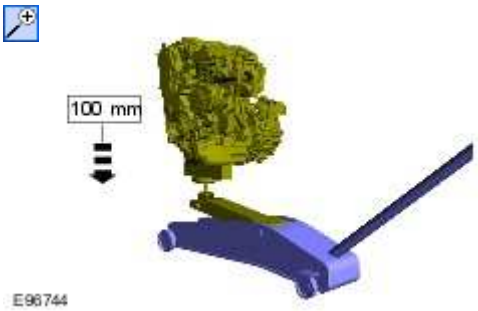

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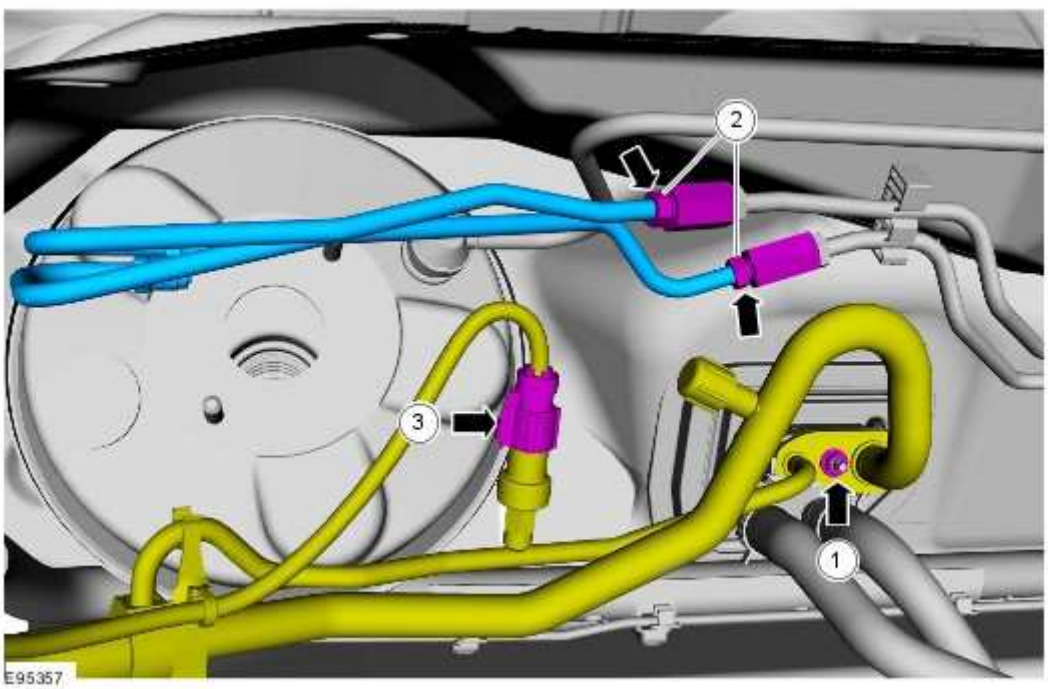

1. *To* 8 I
2. *To* 18

21.

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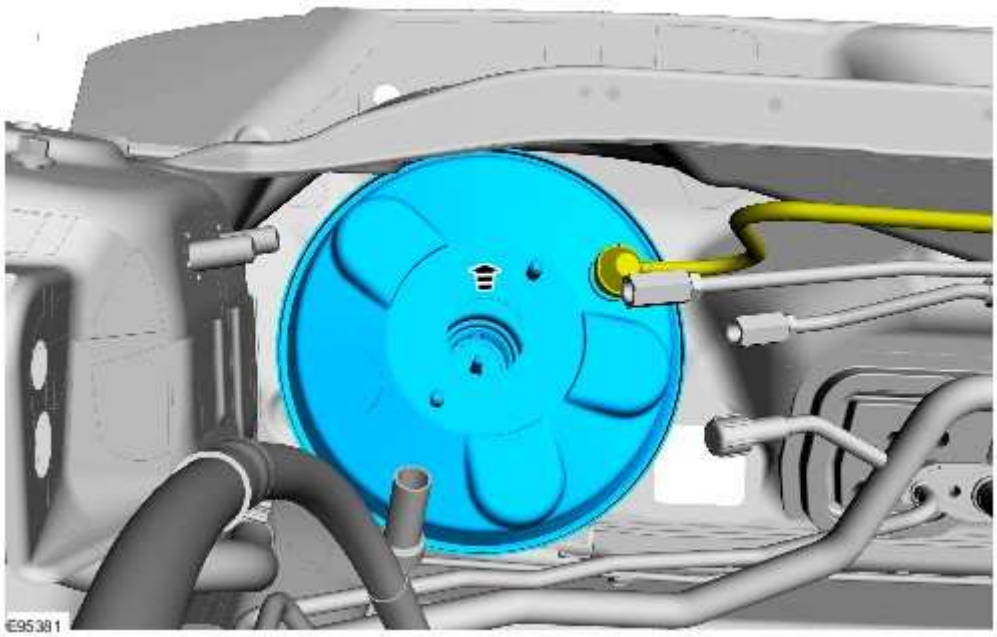

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. CAUTION: Make sure that the brake booster pushrod is correctly located.
   To install, reverse the removal procedure.

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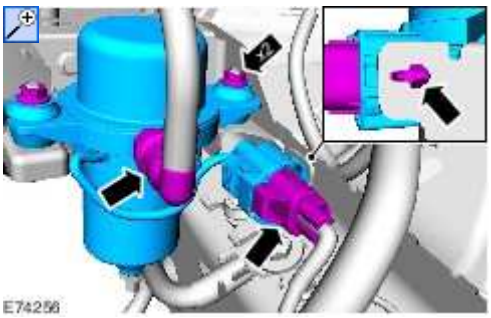
Removal and Installation

Removal

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



1. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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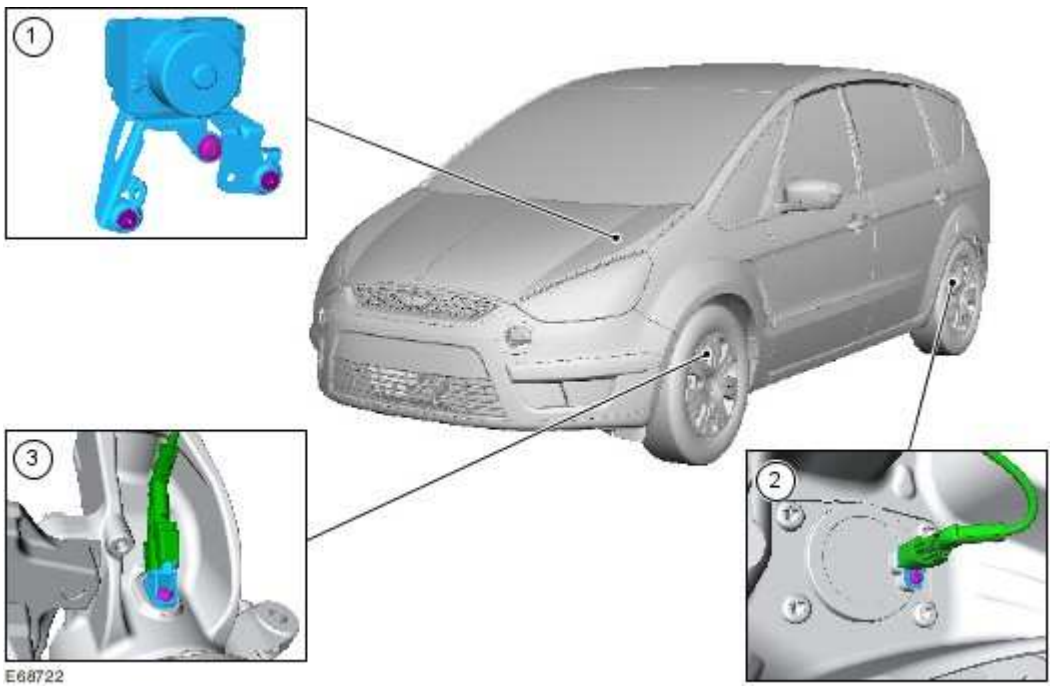
Description and Operation



E68722

Item	Part Number	Description
1	-	Hydraulic control unit (HCU)
2	-	Rear wheel speed sensors
3	-	Front wheel speed sensors

In addition to the conventional brake system with two diagonally split brake circuits, the anti-lock brake system (ABS) consists of an ABS hydraulic control unit with an integrated electronic control unit, four wheel speed sensors and the ABS warning indicator in the instrument cluster.

Electronic brake force distribution software is integrated in the electronic control unit, which electronically regulates and optimizes the hydraulic pressure applied to the brake calipers on the front and rear axles in accordance with the operating conditions.

Function

The ABS is a closed loop control system which prevents the wheels from locking up under braking and therefore maintains steerability and driving stability in extreme situations within the physical limits.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 206-09A, for schematic and connector information.

General Equipment

Worldwide diagnostic system (WDS)

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Wheel speed sensor(s) • Wheel speed sensor ring(s)	• Fuse(s) • Electrical connector(s) • Wiring harness(s).

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu.

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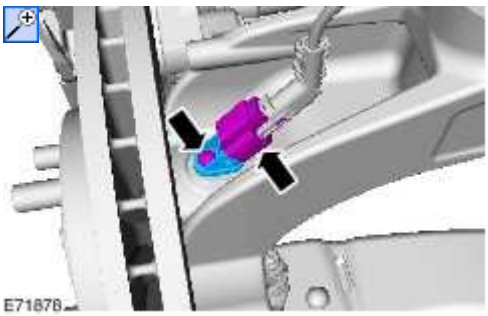
Removal and Installation

Removal

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

1. Remove the wheel and tire.

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



2. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.

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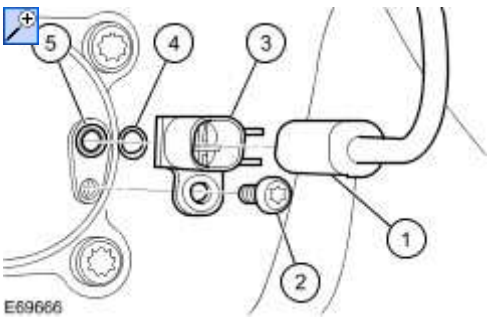
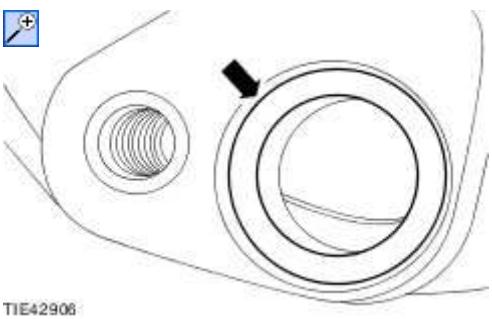
Removal and Installation

Removal

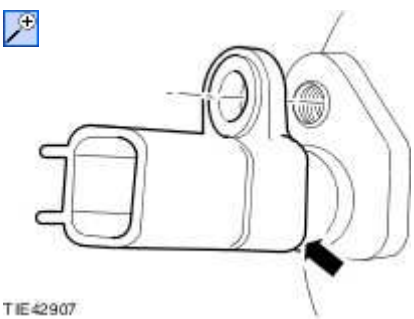


1. Clean the sensor, electrical connector and the area around the sensor.
2. CAUTION: Make sure that all openings are sealed.
   5. Using a lint-free cloth, clean the sensor O-ring groove and the sensor bolt housing.

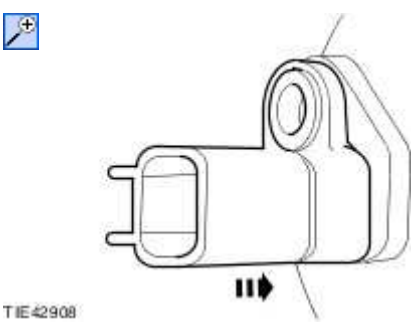
Installation



1. CAUTION: Take extra care not to damage the seal.
   NOTE: Make sure that the sensor housing is clean and free of foreign material.



2. CAUTION: Take extra care not to damage the seal.
   NOTE: Make sure that the mating faces are clean and free of foreign material.
   Position the sensor.



3. WARNING: Only use moderate force when installing the sensor.
4.
   1. *Torque:* 5 Nm

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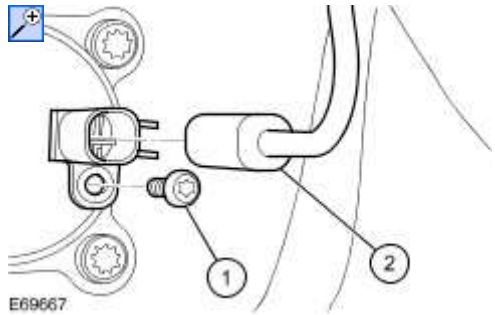

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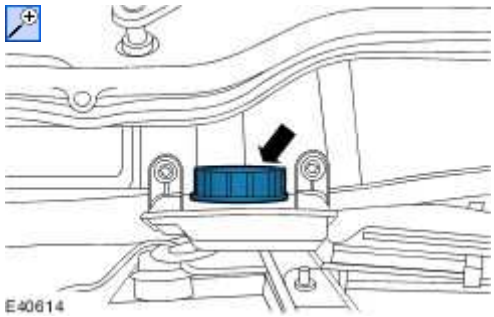
Removal and Installation

Removal

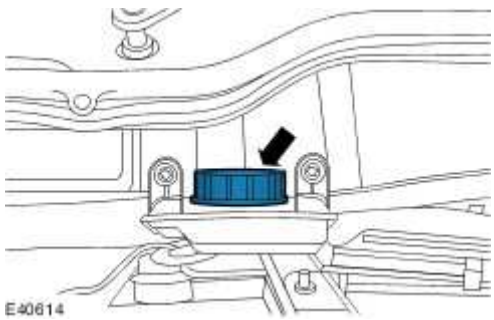
CAUTION: Refer to: Brake System Health and Safety Precautions (100-00 General Information, Description and Operation).



1.

2.

1. Connect one end of a suitable piece of clear plastic pipe to the brake caliper bleed nipple a place the other end into a suitable container.
2. Loosen the bleed nipple.
3. Depress the brake pedal until all the brake flui drained from the brake fluid reservoir.
4. Tighten the bleed nipple.
5. Repeat the draining procedure on the opposite side brake caliper.



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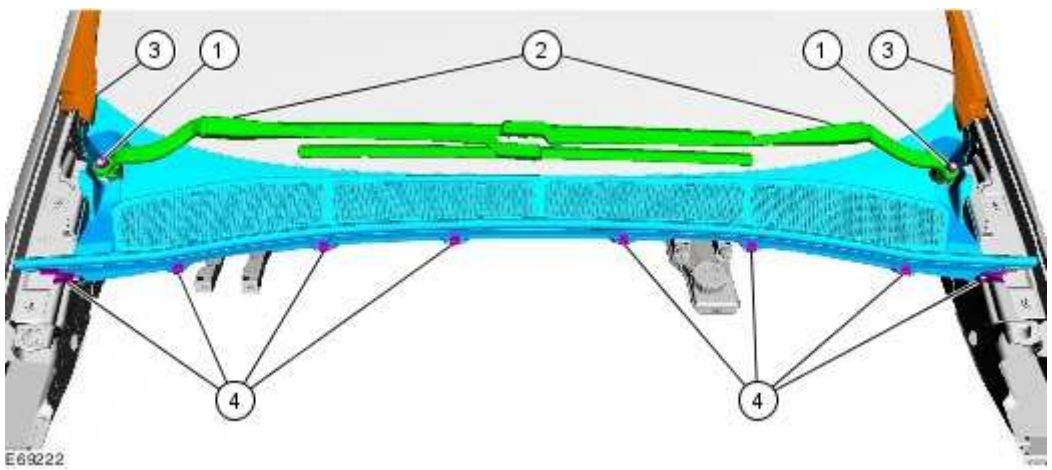

4.

3. Deta the A pillar exte trim lowe retai clips

5.

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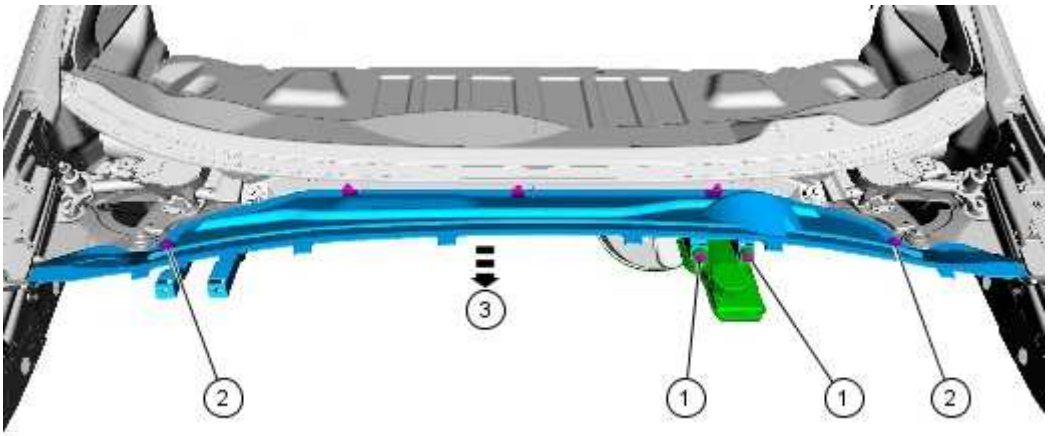
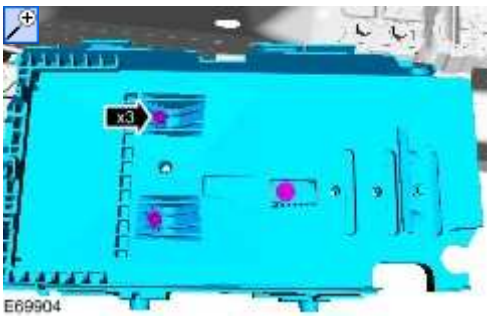


E69223

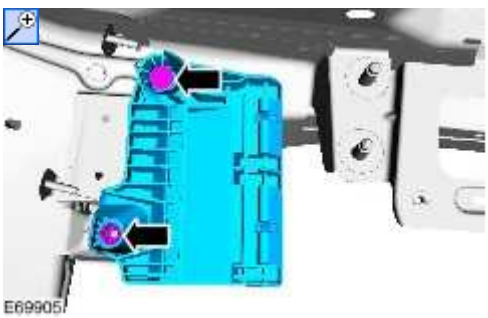
6. Remove the battery.

   Refer to: Battery (414-01 Battery, Mounting and Cal Removal and Installation).

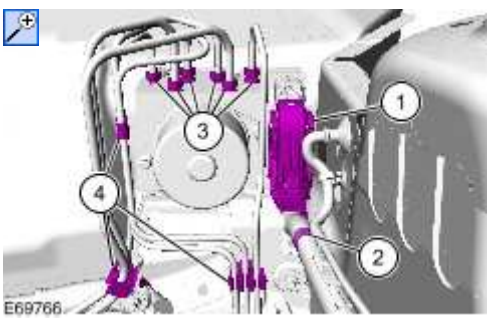


E69904

7. *Torque:* 12 Nm


E69905

8. *Torque:* 12 Nm



E69766

9. CAUTION: Make sure that all openings are sealed.
   NOTE: Note the position of the brake tubes to aid installation.
   Torque:
   6 mm brake tubes 14 Nm
   8 mm brake tubes 18 Nm

10. CAUTION: Make sure that all openings are sealed.
    Torque: 14 Nm

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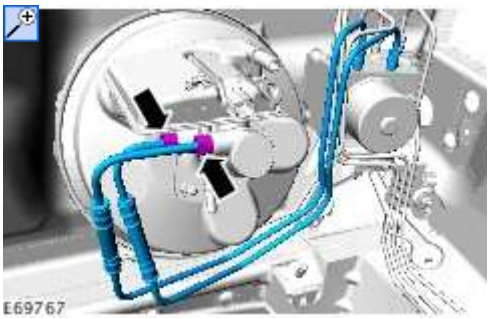
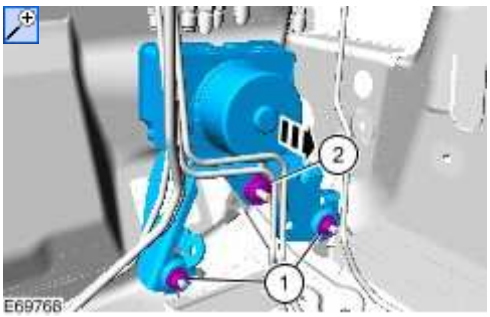
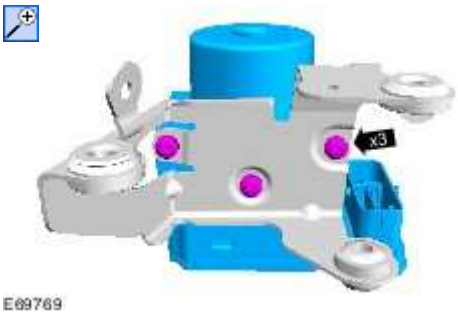




11. *Torque:* 9 Nm



12. *Torque:* 9 Nm

Installation

1. CAUTIONS:

   If accidentally dropped or knocked install a ne hydraulic control unit (HCU) and module assembly

   The blanking caps/plugs must not be removed until the brake tubes are ready to be connected.
   To install, reverse the removal procedure.
2. Bleed the brake system.

   Refer to: Brake System Pressure Bleeding (206-00 Brake System - General Information, General Procedures).

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Pneumatic vacuum gun

Removal

Anti-Lock Control - Anti-Lock Brake System (ABS) Module	S-MAX/Galaxy 2006.5 (02/2006-)

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Removal and Installation

Materials

Name	Specification
Spoiler Adhesive Kit 2 Component	WSK-M5B401-A1 / 2U7J-M2G376-AA

General Equipment

Ford approved diagnostic tool

1. Remove the hydraulic control unit (HCU).

   Refer to: Hydraulic Control Unit (HCU) (206-09A Anti-Lock Control, Removal and Installation).

2.

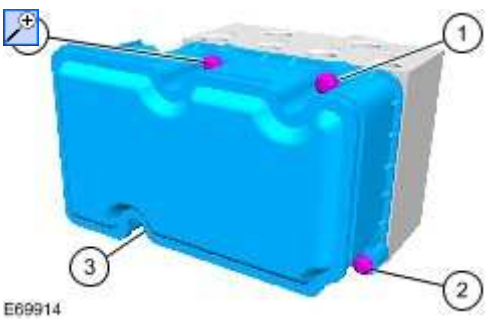
3. Clean the HCU contact surface.

   Material: Spoiler Adhesive Kit 2 Component (WSK-M5B401-A1 / 2U7J-M2G376-AA)

4. Remove all traces of the cleaner and foreign material.

   General Equipment: Pneumatic vacuum gun

Installation



1. WARNING: Make sure that the module is correctly located on the hydraulic control unit (HCU).

   CAUTIONS:

   If accidentally dropped or knocked install a new module.

   Take extra care not to damage the seal.

   NOTE: Make sure that the seal is correctly located.

   Torque:

   Stage 1: 0.5 Nm
   Stage 2: 1.0 Nm
   Stage 3: 1.5 Nm
   Stage 4: 2.0 Nm
   Stage 5: 2.5 Nm

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2. Install the HCU.

   Refer to: Hydraulic Control Unit (HCU) (206-09A Anti-Lock Control, Removal and Installation).
3. Configure the Anti-Lock Brake System (ABS) program.

   General Equipment: Ford approved diagnostic tool
4. Configure the remote function actuator (RFA).

   General Equipment: Ford approved diagnostic tool
5. Carry out the ABS Function Test.

   General Equipment: Ford approved diagnostic tool
6. Carry out a road test.

   Refer to: Road/Roller Testing (100-00 General Information, Description and Operation).

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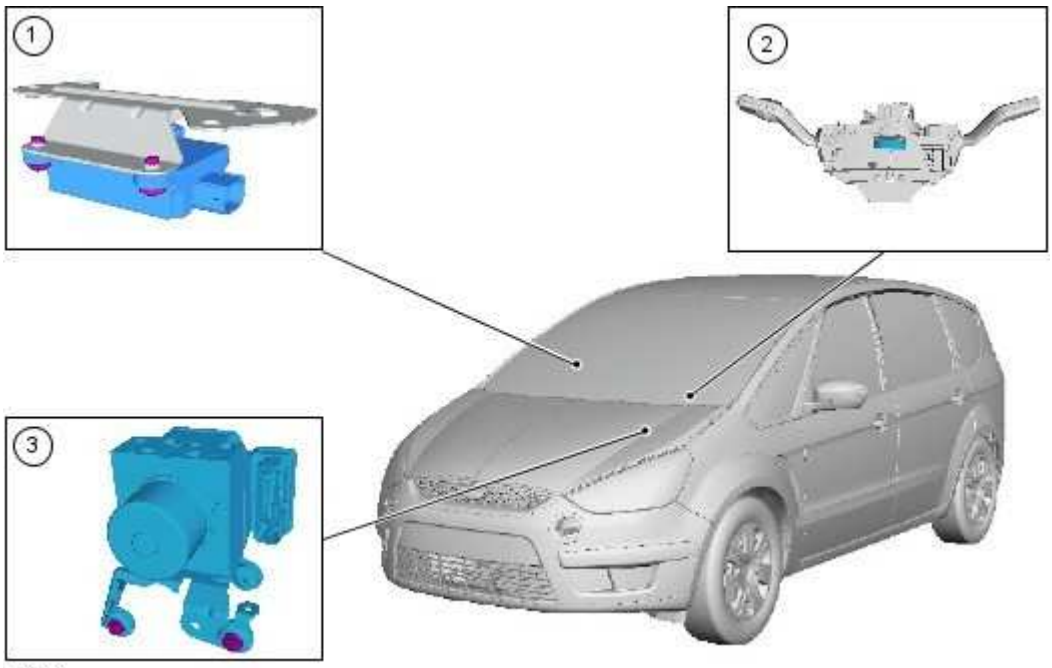
Description and Operation



E68723

Item	Part Number	Description
1	-	Yaw rate sensor and accelerometer
2	-	Steering wheel rotation sensor
3	-	Hydraulic control unit (HCU) and stability assist module assembly

The stability assist module adds a further function known as electronic stability program (ESP) to the anti-lock brake system (ABS) and includes a traction control function. Whereas the ABS prevented wheel lock up during braking, the traction control function controls wheel slip during acceleration (longitudinal dynamics) and the ESP stabilizes the vehicle about its vertical axis.

Sensors measure the position of the steering wheel, the pressure in the brake master cylinder, the yaw velocity (yaw rate) and the acceleration transverse to the vehicle (lateral acceleration). This makes it possible to compare the driver's intention with the momentary vehicle behaviour so that in the event of the vehicle becoming unstable, ESP can initiate the appropriate corrective action.

The ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle, within the physical limits, by individually braking each wheel and giving engine control intervention without need for the driver to actuate the brake or the accelerator pedal.

Stability assist components

The ESP uses the same components as the ABS program with the addition of the following:

* Stability assist module: This is attached to the HCU and is fitted instead of the ABS module. The stability assist module carries out the same function as the ABS module.

* Yaw rate sensor and accelerometer: This sensor cluster combines the yaw rate and the lateral acceleration sensors in a single component. The sensor is attached the floor crossmember.

* Steering wheel rotation sensor: This sensor measures the rotation of the steering wheel.

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It is attached to the clockspring and is located on the steering column.

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Removal and Installation

Materials

Name	Specification
Spoiler Adhesive Kit 2 Component	WSK-M5B401-A1 / 2U7J-M2G376-AA

General Equipment

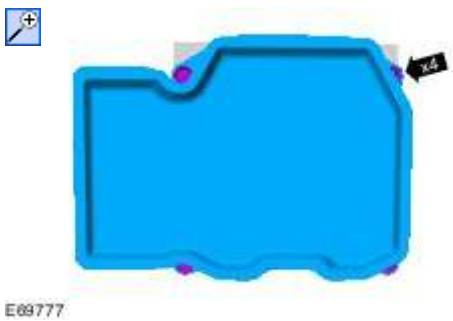
Pneumatic vacuum gun
Worldwide Diagnostic System (WDS)

Removal

1. Remove the hydraulic control unit (HCU).

   Refer to: Hydraulic Control Unit (HCU) (206-09A Anti-Lock Control, Removal and Installation).

2.



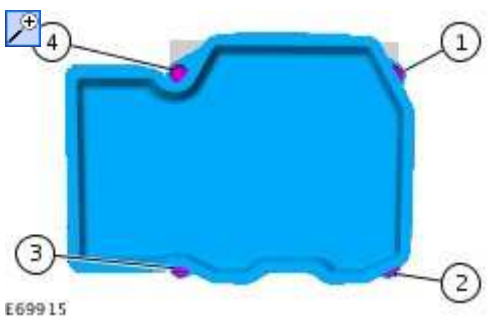
3. Clean the HCU contact surface.

   Material: Spoiler Adhesive Kit 2 Component (WSK-M5B401-A1 / 2U7J-M2G376-AA)

4. Remove all traces of the cleaner and foreign material.

   General Equipment: Pneumatic vacuum gun

Installation



1. WARNINGS:

   Make sure that the module is correctly located on the hydraulic control unit (HCU).

   A new seal is required again once the seal has touched the mating faces and the component is then removed and installed again.

   CAUTIONS:

   If accidentally dropped or knocked install a new module.

   Take extra care not to damage the seal.
   NOTE: Make sure that the seal is correctly located.
   Torque:

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Stage 1: 0.5 Nm
Stage 2: 1.0 Nm
Stage 3: 1.5 Nm
Stage 4: 2.0 Nm
Stage 5: 2.5 Nm

2. Install the HCU.

   Refer to: Hydraulic Control Unit (HCU) (206-09A Anti-Lock Control, Removal and Installation).

3. Configure the stability assist program.

   General Equipment: Worldwide Diagnostic System (WDS)

4. Carry out the stability assist program Function Test.

   General Equipment: Worldwide Diagnostic System (WDS)

5. Carry out a road test.

   Refer to: Road/Roller Testing (100-00 General Information, Description and Operation).

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Removal and Installation

Removal and Installation

1. Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).

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Removal and Installation

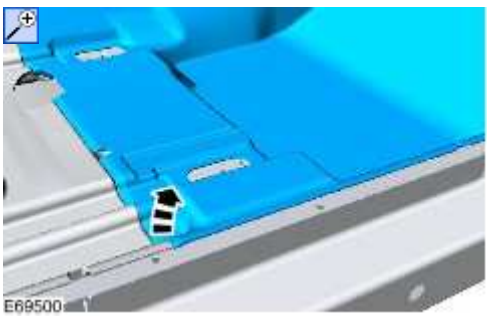
Removal

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

1. Remove the following items:
   1. Remove the right-hand front seat.

      Refer to: Front Seat (501-10 Seating, Removal and Installation).
   2. Remove the right-hand B-pillar trim panel.

      Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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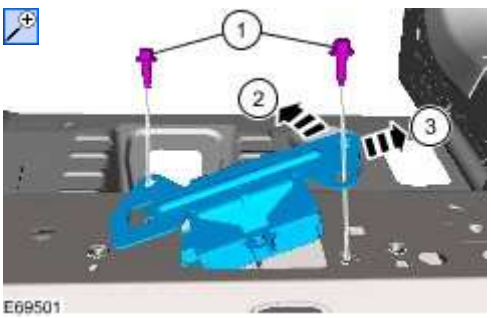
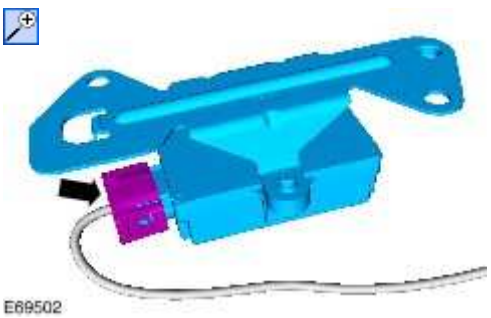


3.
   1. *Torque:* 9 Nm



4.

Installation

1. WARNING: Make sure that the yaw rate sensor and accelerometer assembly is correctly located.
   To install, reverse the removal procedure.

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Lubricants, Fluids, Sealers and Adhesives

Fluids
Hydraulic Fluid with the specification WSS-M2C204-A2 (green fluid) can also be used to top up or fill steering systems that are filled with Hydraulic Fluid with the specification 98SX-M2C195-AB (red fluid).

Steering Wheel Free play

	mm
Measured at the steering wheel outer rim with the engine running	±3

Turning Effort Test

	Effort (Nm)	Effort (lb-in)
Turning effort	10	89

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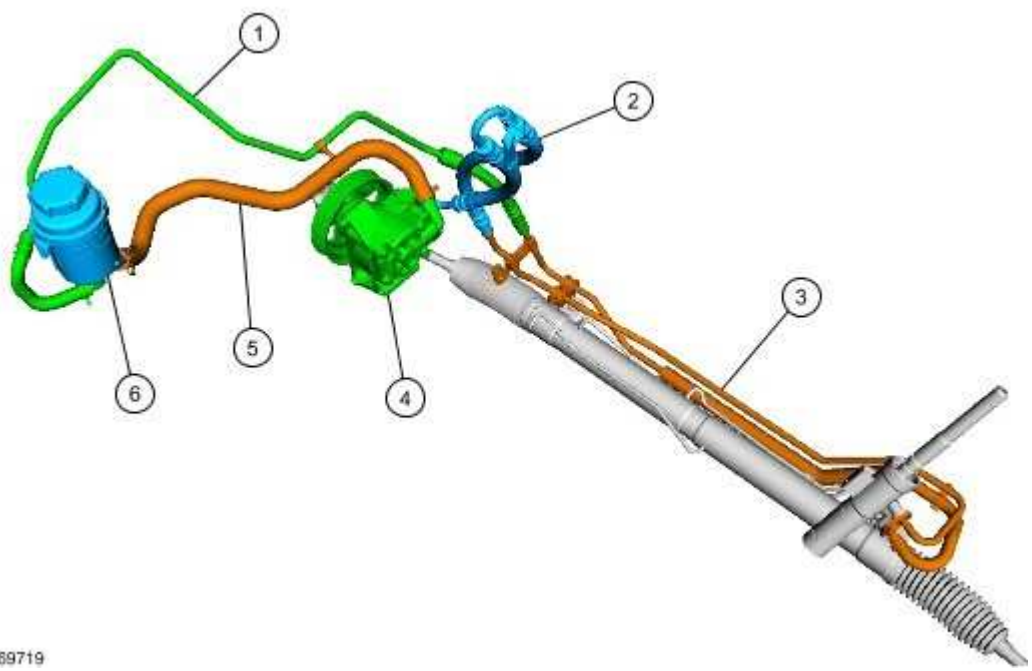
Description and Operation

1.8L Duratorq-TDCi (Kent) Diesel



E69719

Item	Part Number	Description
1	-	Power steering fluid return line
2	-	Power steering fluid pressure line
3	-	Steering gear pressure line and return line
4	-	Power steering pump
5	-	Power steering fluid supply line
6	-	Power steering fluid reservoir

2.0L Duratec-HE (MI4)

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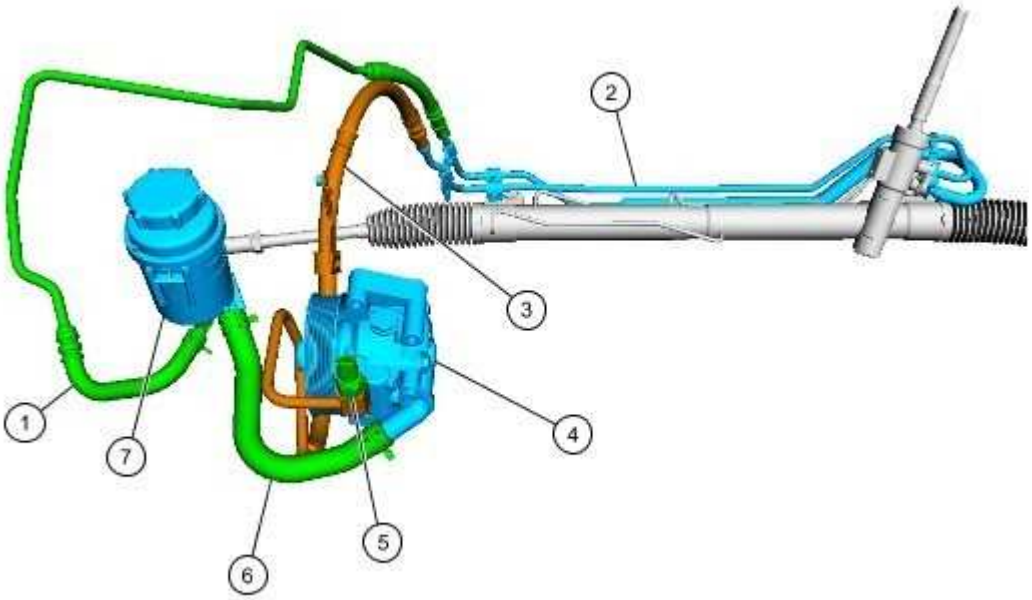
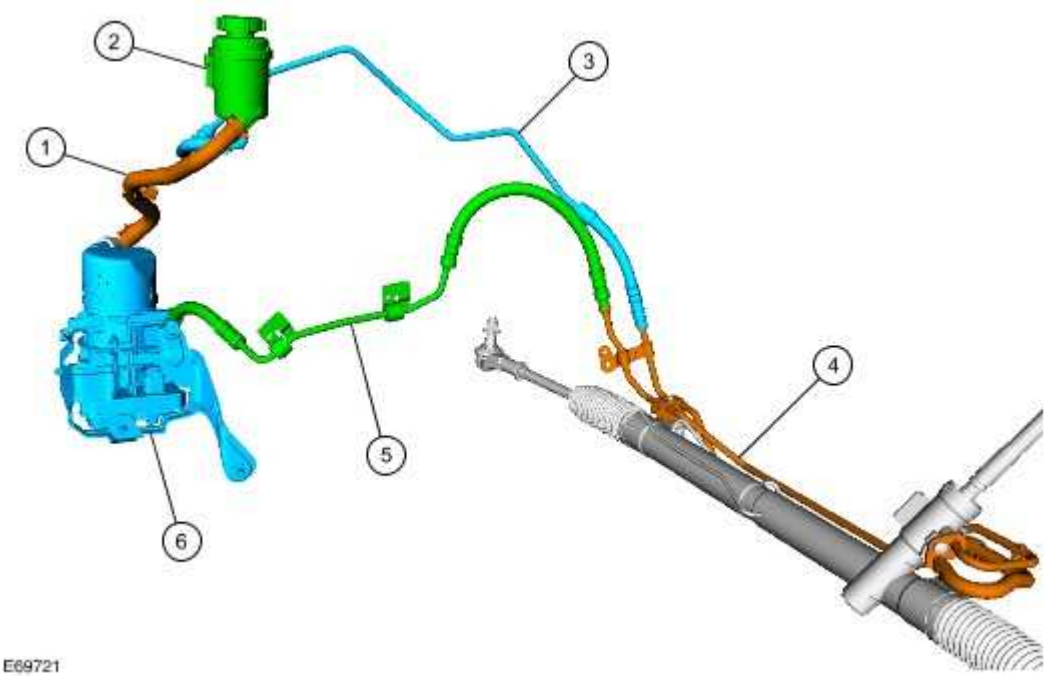


E69720

Item	Part Number	Description
1	-	Power steering fluid return line
2	-	Steering gear pressure line and return line
3	-	Power steering fluid pressure line
4	-	Power steering pump
5	-	Power steering pressure switch
6	-	Power steering fluid supply line
7	-	Power steering fluid reservoir

2.0L Duratorq-TDCi (DW) Diesel



E69721

Item	Part Number	Description
1	-	Power steering fluid supply line

-

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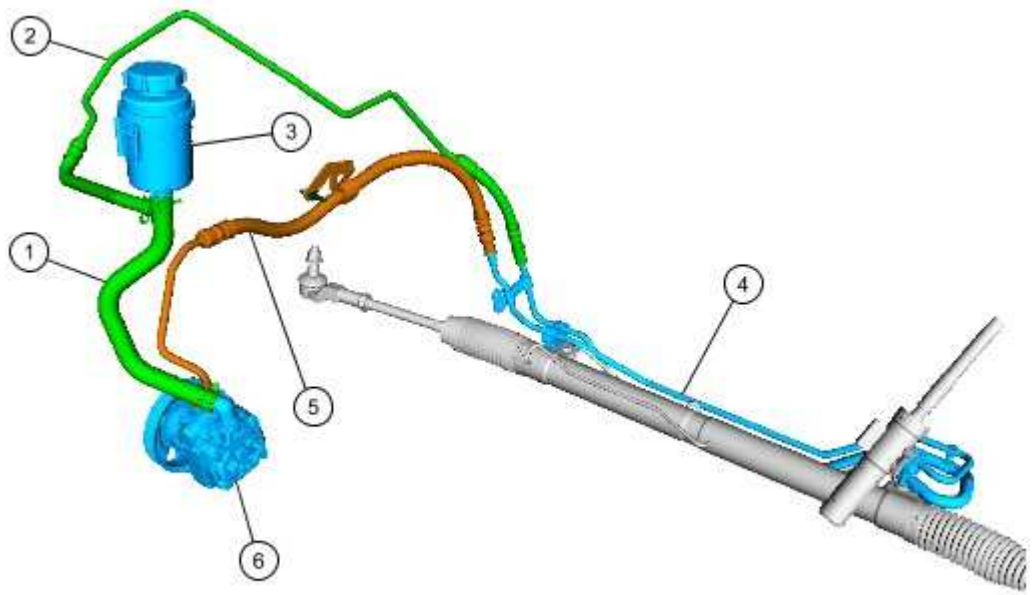
2		Power steering fluid reservoir
	3 -	Power steering fluid pressure line
4	-	Steering gear pressure line and return line
5	-	Power steering fluid return line
6	-	Power steering pump

2.5L Duratec-ST (VI5)



E69722

Item	Part Number	Description
1	-	Power steering fluid supply line
2	-	Power steering fluid return line
3	-	Power steering fluid reservoir
4	-	Steering gear pressure line and return line
5	-	Power steering fluid pressure line
6	-	Power steering pump

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Diagnosis and Testing

Special Tool(s)

	Alignment Pins, Subframe 205-316 (15-097A)
	Simulator, Driver and Passenger Air Bags and Side Air Curtains 501-073 (40-016)

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Tire pressure(s) • Accessory drive belt • Loose tie-rod end(s) • Tie-rod(s) • Steering gear housing • Loose strut and spring assemblies or ball joints • Loose pinch bolts on steering column shaft flexible coupling • Wheels and tires • Power steering lines fluid leaks • Steering gear bellows	• Battery • Battery cables • Electro-hydraulic power steering pump control module electrical connectors • Electro-hydraulic power steering pump control module ground cable • Electro-hydraulic power steering pump control module ground cable retaining screw • Fuses • Power steering pressure (PSP) switch

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
Drift left or right	* Vehicle attitude incorrect (front or rear is high or low).	* CHECK for abnormal loading, coil spring sag or non-standard springs.
	* Incorrect wheel alignment.	* CHECK the wheel alignment and ADJUST if necessary. REFER to: (204-00 Suspension System - General Information) Front Toe Adjustment (General Procedures), Rear Toe Adjustment (General Procedures).

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	* Incorrect front subframe alignment.	* Using the special tool and a suitable washer, CHECK the front subframe alignment. REFER to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
	* Worn front wheel bearings.	* CHECK and INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
	* Brake system.	* CHECK the brake system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Steering linkage.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
	* Steering gear.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
	* Wheels and tires.	* REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
Steering wheel off center	* Vehicle attitude incorrect (front or rear is high or low).	* CHECK for abnormal loading, coil spring sag or non-standard springs.
	* Incorrect wheel alignment.	* CHECK the wheel alignment and ADJUST if necessary. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
	* Suspension lower arm ball joint.	* CARRY OUT the Ball Joint Inspection Component Test.
	* Steering linkage.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
	* Steering gear.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
Vibration	* Incorrect wheel alignment.	* CHECK the wheel alignment and ADJUST if necessary. REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
	* Wheels and tires.	* CHECK the wheels and tires. BALANCE or INSTALL new wheels and tires as necessary. REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
	* Damaged or worn front wheel bearings.	* CHECK and INSTALL new wheel bearings as necessary. REFER to: Front Wheel Bearing (204-01 Front Suspension, Removal and Installation).
	* Front strut and spring assemblies.	* CHECK and INSTALL new suspension components as necessary.
	* Damaged front suspension lower arm (s).	* CHECK and INSTALL new suspension components as necessary.
	* Steering linkage.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
Steering effort is high/low	* Power steering hose restriction.	* CHECK the power steering hoses for damage, kinks or restrictions. INSTALL new components as necessary.
	* Power steering fluid contamination.	* FLUSH the power steering system. REFER to: Power Steering System Flushing (211-00 Steering System - General Information, General Procedures).

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	* Aeration of the power steering fluid.	* BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
	* Steering gear floor seal touch condition.	* CHECK the installation of the floor seal.
	* Steering column.	* CHECK if the floor covering is obstructing the steering gear pinion. * CHECK the installation of the floor seal. * CARRY OUT the Steering Column Universal Joint Component Test. REFER to Steering Column Universal Joint Component Test.
	* Steering linkage.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
	* Steering gear.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
	* Worn power steering pump.	* INSTALL a new power steering pump. REFER to: (211-02 Power Steering) Power Steering Pump - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation), Power Steering Pump - 2.5L Duratec-ST (VI5) (Removal and Installation), Power Steering Pump - 1.8L Duratorq-TDCi (Kent) Diesel (Removal and Installation), Power Steering Pump - 2.0L Duratorq-TDCi (DW) Diesel, Vehicles With: Electro-Hydraulic Power Steering (EHPS) (Removal and Installation).
Excessive noise	* Power steering operation noise.	* CARRY OUT the Power Steering Operation Noise Check. REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).
	* Aeration of the power steering fluid.	* BLEED the power steering system. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
	* Power steering lines.	* CHECK that the power steering line clamps are secure. * CHECK the power steering lines for clearance from the vehicle body, subframe and steering gear. * CHECK the steering gear transfer lines for clearance from the steering gear.
	* Loose steering gear retaining bolts.	* CHECK and INSTALL new bolts as necessary. REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).
	* Power steering pump.	* INSTALL a new power steering pump. REFER to: (211-02 Power Steering) Power Steering Pump - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation), Power Steering Pump - 2.5L Duratec-ST (VI5) (Removal and Installation), Power Steering Pump - 1.8L Duratorq-TDCi

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		(Kent) Diesel (Removal and Installation), Power Steering Pump - 2.0L Duratorq-TDCi (DW) Diesel, Vehicles With: Electro-Hydraulic Power Steering (EHPS) (Removal and Installation).
	* Tie-rod.	* CARRY OUT the Tie-Rod Component Test. REFER to Tie-Rod Component Test.
Steering does not vary with increased wheel rotation	* Worn tie-rod ends.	* INSTALL new components as necessary. REFER to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).
	* Worn front suspension bushings.	* CHECK and INSTALL new components as necessary.
	* Worn suspension ball joints.	* CARRY OUT the Ball Joint Inspection Component Test.
	* Steering gear insulator bushings worn or perished.	* CHECK and INSTALL new components as necessary.
	* Loose steering gear retaining bolts.	* CHECK and INSTALL new bolts as necessary. REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).
	* Loose steering column retaining bolts.	* CHECK and INSTALL new bolts as necessary. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).
	* Loose steering column to steering gear pinion retaining bolt.	* CHECK and INSTALL a new bolt as necessary. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).
	* Excessive steering gear backlash.	* CARRY OUT the Steering Linkage Component Test. REFER to Steering Linkage Component Test.
Steering assist does not vary with vehicle assist	* Powertrain control module (PCM).	* REFER to WDS.
	* Electro-hydraulic power steering (EHPS) control module.	* REFER to WDS.

Components Tests

Steering Linkage

1. **1.** Grasp the steering wheel firmly and move it up and down and to the left and right without turning the steering wheel to check the steering column bearing for wear, steering column shaft for wear, steering wheel for looseness and steering column for looseness. If the steering column bearing or the steering column shaft is worn install a new steering column.
   REFER to: Steering Column (211-04 Steering Column, Removal and Installation).
   If the steering wheel or the steering column is loose, tighten the steering wheel or the steering column retaining bolts.

2. **2.** With the road wheels in the straight ahead position, gently turn the steering wheel to the left and the right to check for free play in the steering linkage.

3. **3.** There should be no excessive free play at the steering wheel rim. If there is excessive free play, CHECK the tie-rod inner and outer ball joints, REFER to Tie-Rod Component Test in this procedure. CHECK the steering column universal joint, REFER to Steering Column Universal Joint Component Test in this procedure. If there is no free play in the tie-rod and the steering column, install a new steering gear.
   REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).

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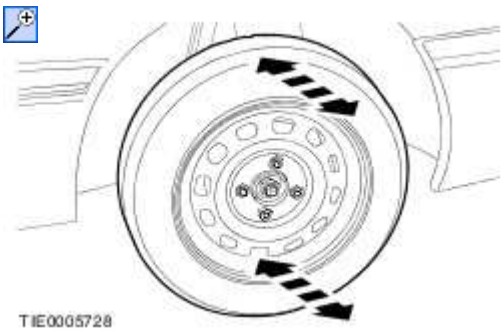
Tie-Rod

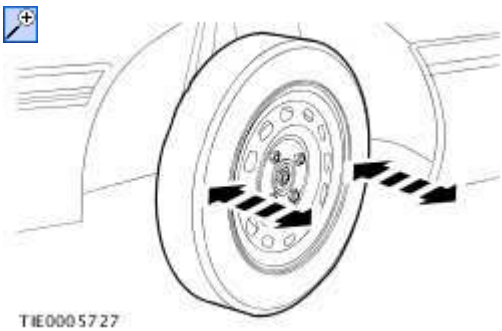
1. **1.** Noises such as knocks, which may appear to originate from the steering linkage, may also be generated by front suspension components.
   REFER to: Noise, Vibration and Harshness (NVH) (100-04 Noise, Vibration and Harshness, Diagnosis and Testing).

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

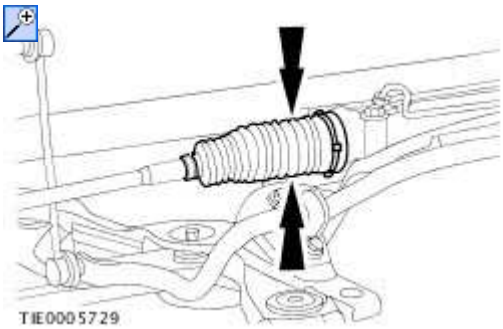


3. **3.** Firmly grasp the road wheel and apply a rocking motion checking for any free play in the wheel bearing or suspension components.

4. **4.** Turn the steering wheel to position the steering linkage against the right-hand steering lock stop.



5. **5.** With the aid of another technician holding the steering linkage against the right-hand steering lock stop, firmly grasp the road wheel and apply a rocking motion checking for any free play in the steering linkage.



6. **6.** Detach the steering gear boot from the steering gear body and check for free play at the tie-rod inner ball joint.

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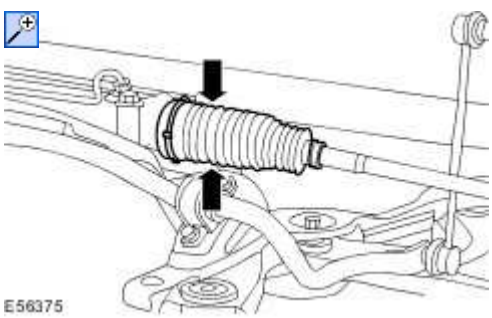
7. **7.** If there is free play at the tie-rod inner ball joint, install a new tie-rod.
   REFER to: Tie Rod (211-03 Steering Linkage, Removal and Installation).

8. **8.** Check the tie-rod end for free play. Install a new tie-rod end if necessary.
   REFER to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).

9. **9.** Turn the steering wheel to position the steering linkage against the left-hand steering lock stop.

10. **10.** With the aid of another technician holding the steering against the left-hand steering lock stop, firmly grasp the road wheel and apply a rocking motion checking for any free play in the steering linkage.



11. **11.** Detach the steering gear boot from the steering gear body and check for free play at the tie-rod inner ball joint.

12. **12.** If there is free play at the tie-rod inner ball joint, install a new tie-rod.
    REFER to: Tie Rod (211-03 Steering Linkage, Removal and Installation).

13. **13.** Check the tie-rod end for free play. Install a new tie-rod end if necessary.
    REFER to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).

Turning Effort Test

1. **1.** Before carrying out the turning effort test, make sure that the following are serviceable:

- Suspension components.
- Steering column.
- Toe adjustment.
  REFER to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
- Tire pressures.

2. **2.** Park the vehicle on a dry, even surface and apply the parking brake.

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3. **3.** Remove the driver air bag module.
   REFER to: Driver Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

4. **4.** Connect the air bag simulators to the sub-harnesses in place of the driver air bag module at the top of the steering column.

5. **5.** Start the engine and turn the steering wheel from lock to lock several times until the power steering fluid has reached normal operating temperature.

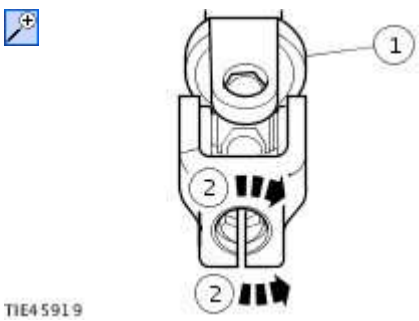
6. **6.** Using a suitable torque wrench and socket, check the steering wheel turning effort.

7. **7.** If the steering wheel turning effort is greater than the specification, install a new steering gear. REFER to:

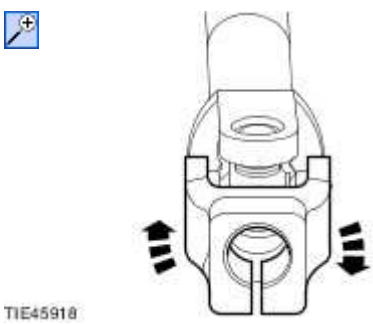
   Specifications (211-00 Steering System - General Information, Specifications), Steering Gear (211-02 Power Steering, Removal and Installation).

Steering Column Universal Joint

1. WARNING: Make sure a new steering column flexible coupling bolt is installed.
   1. Detach the steering column from the steering gear pinion.
   - Discard the steering column to steering gear pinion retaining bolt.



2. **2.** Check for smooth movement of the steering column universal joint.
   1. Hold the steering column universal joint yoke.
   2. Articulate the free yoke in a figure of eight movement.
   - If the movement is not smooth or resistance is felt, install a new steering column. REFER to: Steering Column (211-04 Steering Column, Removal and Installation).



3. **3.** Hold both of the steering column universal joint yokes and twist them clockwise and counterclockwise.
   - If movement is felt, install a new steering column.
     REFER to: Steering Column (211-04 Steering Column, Removal and Installation).

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Lower Arm Ball Joint Inspection

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

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

3. **3.** If there is any free movement, install a new lower arm.
   REFER to: Lower Arm (204-01 Front Suspension, Removal and Installation).

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Diagnosis and Testing

General Equipment

Feeler gauge
Straight edge

Items to be observed when checking the steering system

The following list of steering gear conditions and the methods of testing should be taken into account when carrying out checks to the steering system:

- If the steering gear has no faults after completing the following checks, do not install a new steering gear.
- Surface corrosion and marks on the tie-rod are acceptable.
- When checking for turning effort torque peaks in the steering gear, turn the steering wheel from steering lock stop to steering lock stop in approximately 15 seconds.
- A steady increase of turning effort torque from steering center to steering lock stop is acceptable.
- When checking for power steering fluid leaks, turn the steering wheel to the steering lock stop in approximately 10 seconds.
- Noises from the power steering, for example the power steering pump relief valve, are acceptable.

STEERING GEAR HOUSING

- Raise and support the vehicle.
  REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
- Visually inspect the steering gear housing for cracks and damage. If the steering gear housing is cracked or damaged, install a new steering gear.
  REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).

TIE-RODS

- Using a straight edge and feeler gauge, check the tie-rods to see if they are straight. If the distance between the tie-rod and straight edge is greater than 0.5 mm, install a new steering gear.
  REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).
- Check the tightening torque of the tie-rod end to wheel knuckle nut.
  REFER to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).
- Check the tightening torque of the tie-rod end locking nut.
  REFER to: Tie Rod End (211-03 Steering Linkage, Removal and Installation).

CHECK FOR TURNING EFFORT TORQUE PEAKS IN THE STEERING GEAR

- Lower and support the vehicle making sure that the road wheels are just clear of the floor.
- With the ignition switch in position I, slowly turn the steering wheel from steering lock stop to steering lock stop. If a turning effort torque peak or judder is felt while turning the steering wheel, detach the tie-rods from the wheel knuckles.
- Slowly turn the steering wheel from steering lock stop to steering lock stop. If a turning effort torque peak or judder is felt while turning the steering wheel, install a new steering gear.
  REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).

CHECK FOR POWER STEERING FLUID LEAKS

- Lower the vehicle.
- Run the engine at a fast idle and slowly turn the steering wheel to the left-hand steering lock stop. Hold the steering wheel in this position for 5 seconds with a turning effort

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torque of 15 Nm at the steering wheel rim.
- Turn the steering wheel away from the left-hand steering lock stop for 30 seconds.
- Run the engine at a fast idle and slowly turn the steering wheel to the right-hand steering lock stop. Hold the steering wheel in this position for 5 seconds with a turning effort torque of 15 Nm at the steering wheel rim.
- Turn the steering wheel away from the right-hand steering lock stop.
- Check for power steering fluid leaks at the steering gear housing and the power steering line connections to the steering gear. If there is a power steering fluid leak at the steering gear, install a new steering gear.
  REFER to: Steering Gear (211-02 Power Steering, Removal and Installation).

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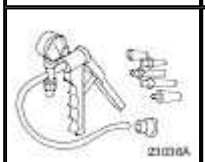
General Procedures

Special Tool(s)

	211-189 Adapter, Power Steering Bleeding
	416-D001 Hand Vacuum Pump/Pressure Pump

Materials

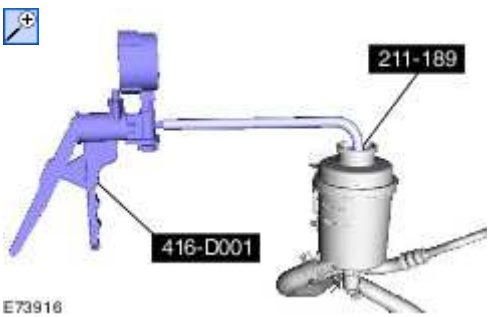
Name	Specification
Hydraulic Fluid DP-PS	WSS-M2C204-A2 / 5U7J-M2C204-AA

1. Fill the power steering fluid reservoir to the MAX mark.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)
2. Raise the vehicle until the road wheels are clear of the floor. Support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. Start the engine and slowly turn the steering wheel from lock to lock and add power steering fluid until the power steering fluid in the power steering fluid reservoir does not drop.
4. Switch OFF the engine and examine the power steering hose connections, steering gear boots, power steering valve body and power steering pump for external leaks.
5. Check the power steering fluid level. Fill the power steering fluid reservoir to the MAX mark.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)



6. When bleeding the power steering system the vacuum will decrease. Using the special tools, maintain a sufficient vacuum of 38cm-Hg. If the vacuum decreases by more than 5cm-Hg in 5 minutes, the system should be checked for leaks.

   Special Tool(s): 211-189, 416-D001
7.
   1. Start the engine and slowly turn the steering wheel from lock to lock once; then turn the steering wheel to the right, just off the stop.

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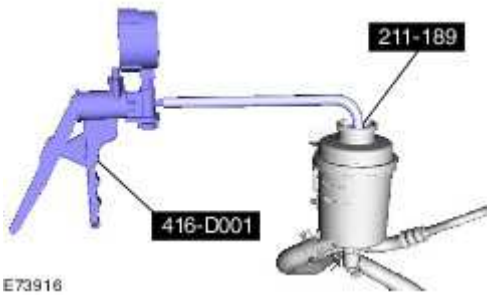

2. Switch OFF the engine.
3. Using the special tools, create a vacuum of 38cm-Hg. Maintain the vacuum until the air is evacuated from the system (minimum of five minutes).

   Special Tool(s): 211-189, 416-D001
4. Release the vacuum.
5. Repeat the power steering bleeding procedure, turning the steering wheel to the left, just off the stop.
6. Remove the special tools. Fill the power steering fluid reservoir to the MAX as necessary.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)
8. Start the engine, turn the steering wheel from lock to lock. If excessive noise is apparent, repeat the power steering bleeding procedure.
9. Lower the vehicle.
10. If the noise level is still unacceptable, leave the vehicle standing overnight then repeat the power steering system bleeding procedure.

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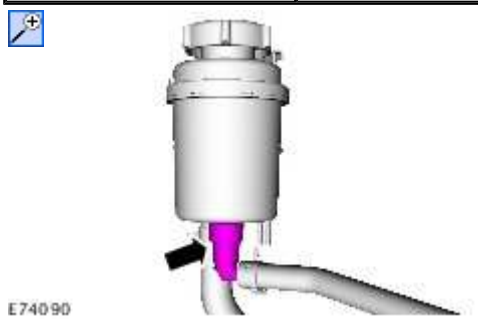
General Procedures

Materials

Name	Specification
Hydraulic Fluid DP-PS	WSS-M2C204-A2 / 5U7J-M2C204-AA



1. WARNING: Be prepared to collect escaping fluids.
   Using a blanking cap, cap the power steering fluid reservoir.
2. Place the end of the steering gear return line into a container.
3. Fill the power steering reservoir to the MAX mark.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)
4. Raise the vehicle until the road wheels are clear of the floor. Support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
5. NOTE: This step requires the aid of another technician.
   1. Start the engine and slowly turn the steering from steering lock to steering lock until clean power steering fluid comes out of the return line.
   2. With the aid of another technician, add the power steering fluid until the system is free of contaminated power steering fluid.

      Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)

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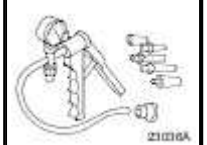
General Procedures

Special Tool(s)

	211-189 Adapter, Power Steering Bleeding
	416-D001 Hand Vacuum Pump/Pressure Pump

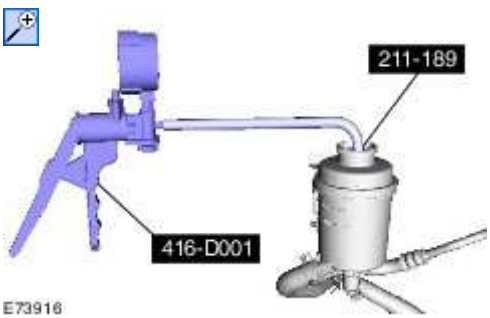
Materials

Name	Specification
Hydraulic Fluid DP-PS	WSS-M2C204-A2 / 5U7J-M2C204-AA

1. Fill the power steering fluid reservoir to the MAX mark.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)
2. Raise the vehicle until the road wheels are clear of the floor. Support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. Slowly turn the steering wheel from lock to lock and add power steering fluid until the power steering fluid in the power steering fluid reservoir stops dropping.
4. Start the engine and slowly turn the steering wheel from lock to lock and add power steering fluid until the power steering fluid in the power steering fluid reservoir stops dropping.



5. Switch the engine OFF and using the special tools, create a vacuum of 62cm-Hg - 75cm-Hg for 30 seconds.

   Special Tool(s): 211-189, 416-D001
6.
   1. Observe the vacuum gauge reading.
   2. If the vacuum decreases by more than 5cm-Hg in 5 minutes, the system should be checked for leaks.
7. Remove the special tools. Fill the power steering fluid reservoir to the MAX mark as necessary.

   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)

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8. Lower the vehicle.

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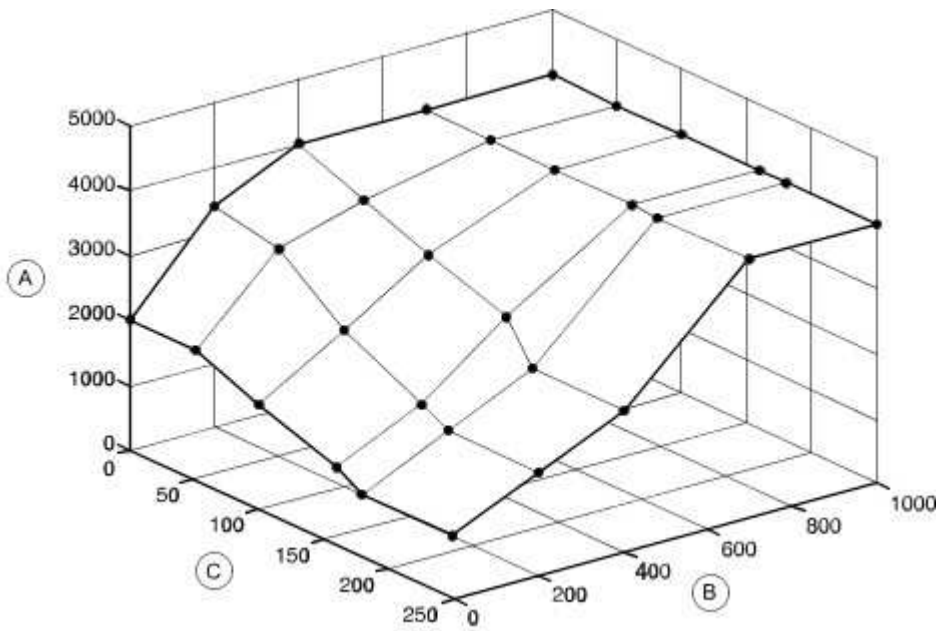
Description and Operation

Electro-hydraulic power steering (EHPS)

The EHPS system uses an electrically driven hydraulic pump and a conventional rack and pinion steering gear.

Using signals from the engine speed sensor, the vehicle speed sensor and the steering wheel rotation sensor, the EHPS control module uses a 3 dimensional look up table to adjust the turning speed of the pump.

For the EHPS pump to operate, the ignition must be in position II and the engine speed signal must show a value greater than 800 rpm.



E40956

Item	Part Number	Description
A	-	Pump speed (rev/min)
B	-	Steering angle rate (degrees/second)
C	-	Road speed (km/h)

In more than 85% of all driving situations the EHPS pump operates at standby speed and consumes less than 10A. EHPS pump speed can quickly increase to full turning speed when steering manoeuvres require it.

Steering wheel rotation sensor

The steering wheel rotation sensor is attached to the clockspring and monitors the speed with which the steering wheel is turned. This information is then sent via the control are network (CAN) bus to the EHPS control module.

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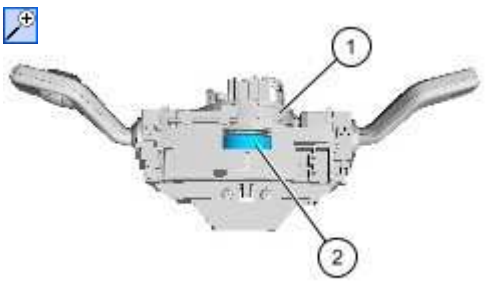
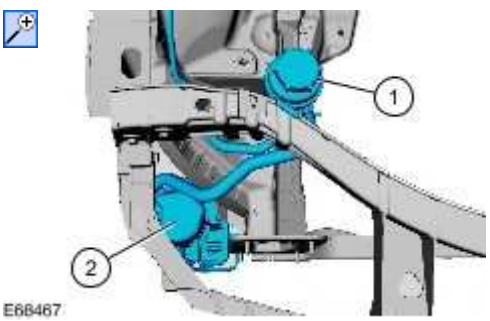


E68466

Item	Part Number	Description
1	-	Clockspring
2	-	Steering wheel rotation sensor

EHPS pump

The power steering pump comprises an electric motor, hydraulic pump, power steering fluid reservoir and a power steering fluid reservoir extension to maintain the fluid level in the reservoir and to refill the system during service.



E68467

Item	Part Number	Description
1	-	EHPS pump reservoir extension
2	-	EHPS pump

A pressure relief and check valve is built into the EHPS pump housing which limits the hydraulic fluid pressure to a maximum of 125 bar. The check valve will allow trapped air to vent the EHPS pump when the EHPS pump is not operating.

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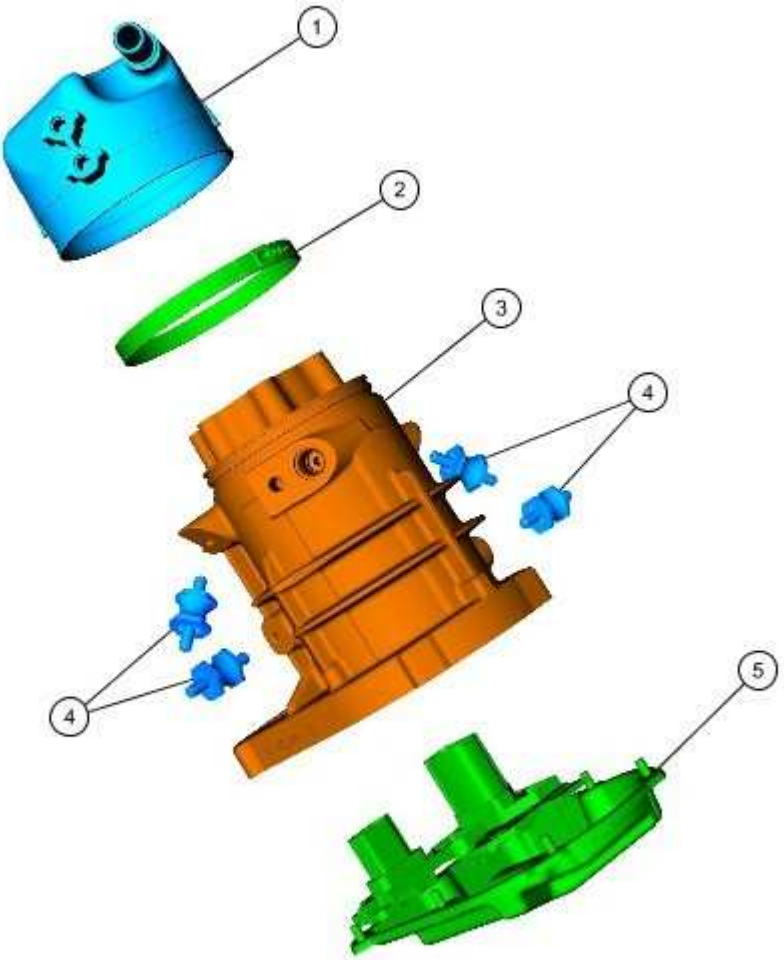

E68823

Item	Part Number	Description
1	-	Power steering fluid reservoir
2	-	Power steering fluid reservoir clamp
3	-	Motor housing
4	-	Rubber mountings
5	-	EHPS control module

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Diagnosis and Testing

REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

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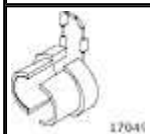
Removal and Installation

Special Tool(s)

	205-316A Alignment Pins, Subframe
	307-242 Remover, Transmission Fluid Cooler
	308-440 Disconnect Tool, Hydraulic Line

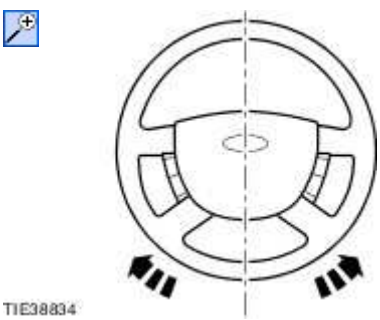
General Equipment

Transmission jack

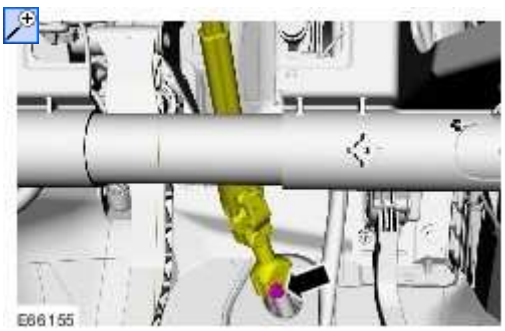
Removal

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

All vehicles


TIE38834

1. CAUTION: Make sure that the steering wheel lock is engaged.
   NOTE: Make sure that the road wheels are in the straight ahead position.


E66155

2. CAUTION: Make sure that a new bolt is installed.
   Torque: 30 Nm

3. Remove the wheel and tire on both sides.

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

4.

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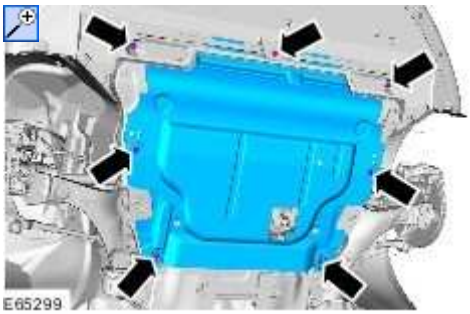
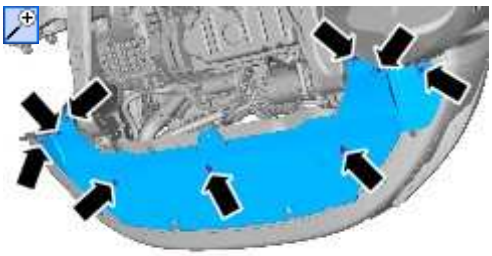
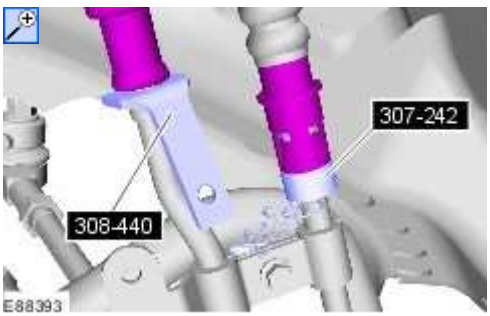


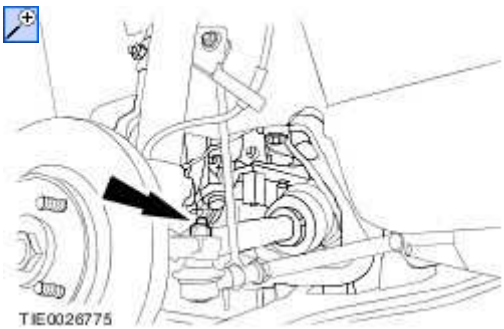


5.

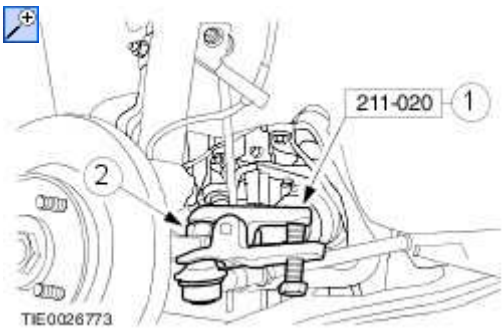


6. WARNING: Be prepared to collect escaping fluids.

CAUTION: Make sure that all openings are sealed.
Special Tool(s): 307-242, 308-440



7. CAUTION: Make sure that the ball joint ball does not rotate.
Loosen the tie-rod end nut, on both sides.



8. CAUTIONS:

Use suitable packing material to prevent damage to the component.

Make sure that the ball joint ball does not rotate.
On both sides.

Torque: 80 Nm

9. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

Torque: 60 Nm

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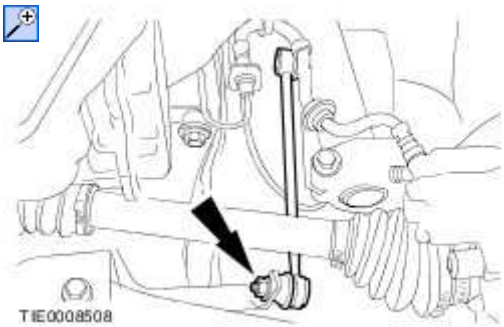
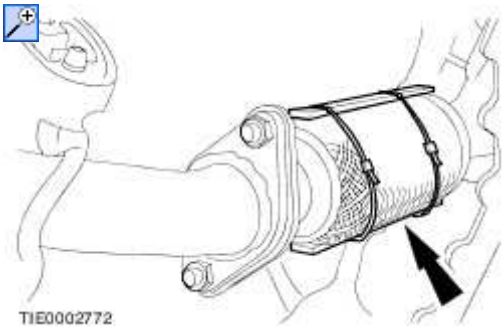
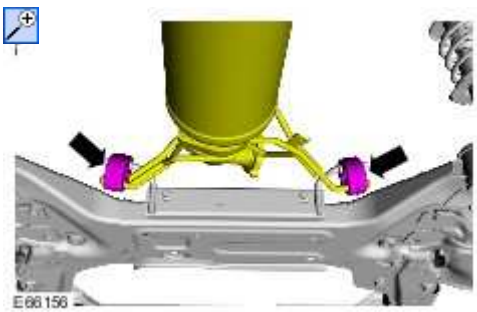


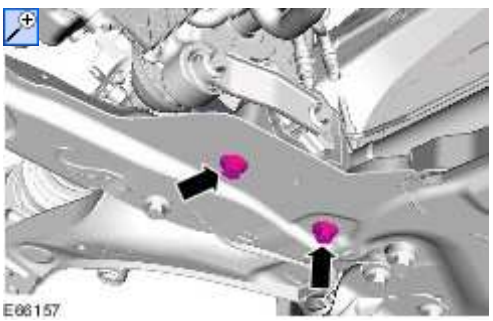


10. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



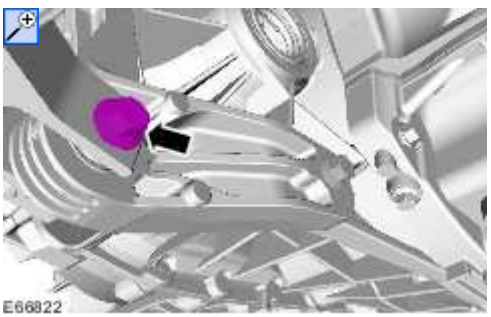
11.

Vehicles with 2.5L engine



12. *Torque:* 110 Nm

Vehicles with 2.0L or diesel engine



13. *Torque:* 80 Nm

Right-hand drive vehicles

14. *Torque:* 3 Nm

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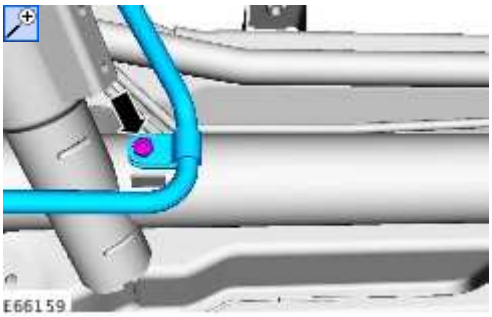
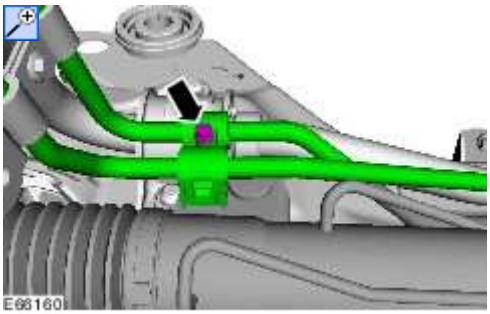
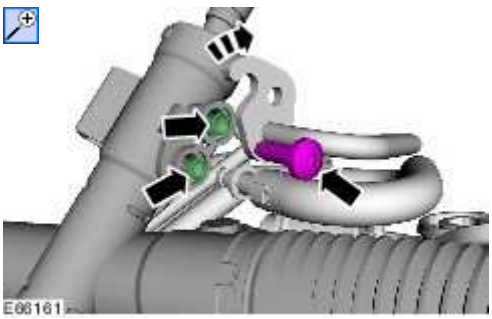


Left-hand drive vehicles



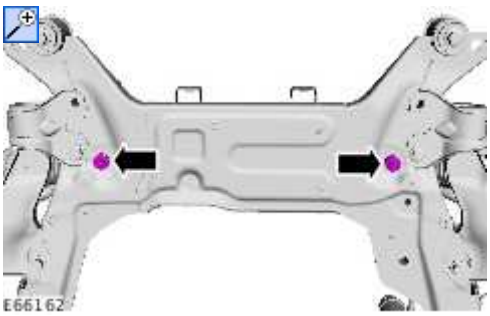
15. *Torque:* 1 Nm

All vehicles

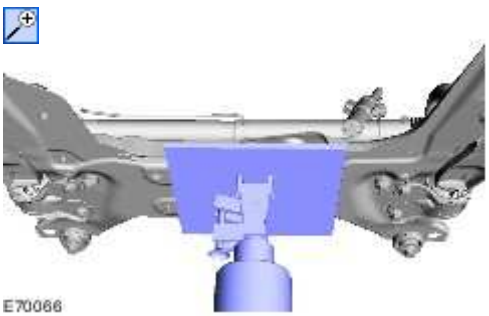


16. WARNING: Be prepared to collect escaping fluids.

    CAUTION: Make sure that all openings are sealed.
    Torque: 20 Nm



17. *Torque:* 120 Nm



18. *General Equipment:* Transmission jack

19.
    1. *Torque:* 30 Nm
    2. *Torque:*
       Stage 1: 150 Nm
       Stage 2: 90°

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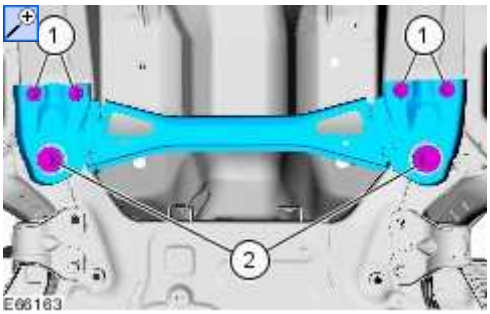
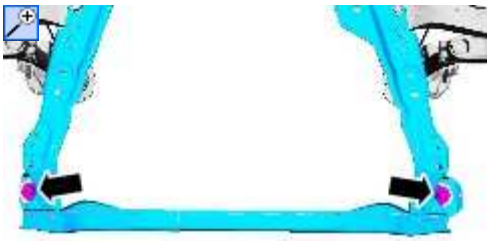


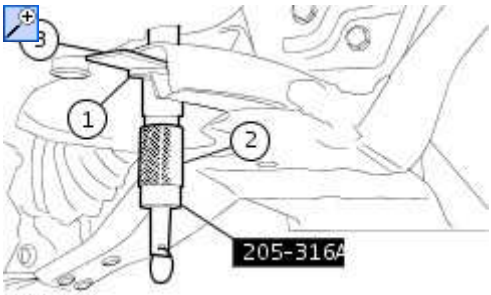
E68163


E68164

20. WARNING: This step requires the aid of another technician.
Lower the front subframe and remove the steering gear on the driver side.

Torque:
Stage 1: 150 Nm
Stage 2: 90°

Installation



E0021863

1. To install, reverse the removal procedure.
2.
    1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the front frame above the alignment hole.
    2. Insert the alignment pin through the front subframe alignment holes and the washer.

    Special Tool(s): 205-316A
    3. Slide the locking plates on top of the washer and into the groove of the special tool and tighten the alignment pin.
3. Fill the power steering system.

    Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
4. Bleed the power steering system.

    Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
5. Check the toe setting and adjust as necessary.

    Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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Removal and Installation

Removal

Vehicles with 2.0L engine

1.

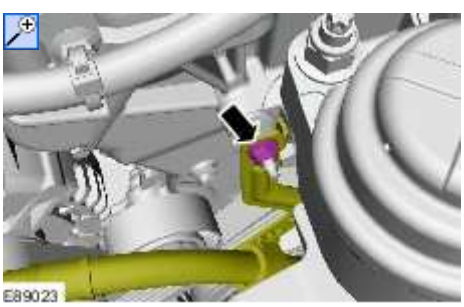
Vehicles with 2.3L engine

2.

All vehicles

3. Remove the following items:
    1. Right-hand headlamp.

       Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
    2. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
4. Lower the vehicle.
5. *Torque:* 10 Nm



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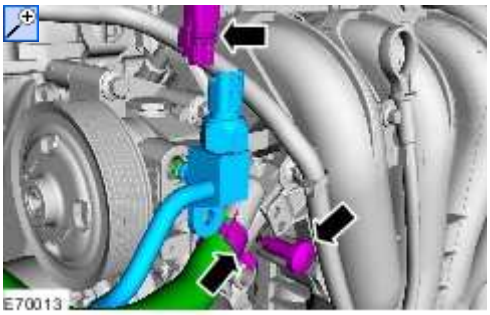
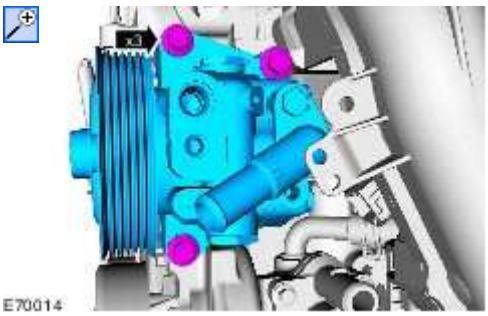


6. WARNING: Be prepared to collect escaping fluids.

   CAUTION: Make sure that all openings are sealed.
   Torque: 24 Nm



7. *Torque:* 24 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

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Removal and Installation

Removal

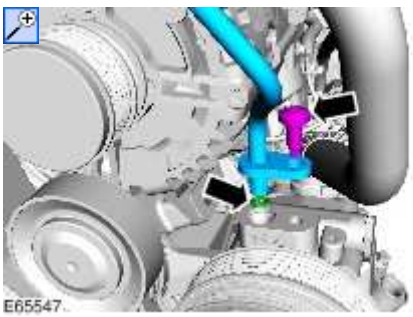
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the following items:
    1. Remove the right-hand headlamp assembly.

       Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
    2. Remove the accessory drive belt.

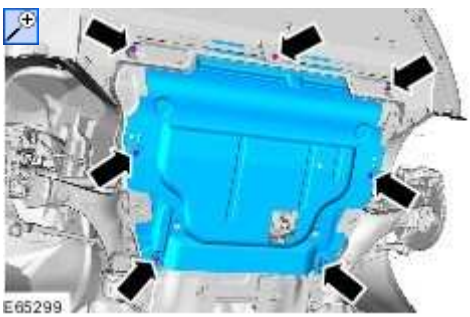
       Refer to: Accessory Drive Belt (303-05B Accessory Drive - 2.5L Duratec-ST (VI5), Removal and Installation).
2. Lower the vehicle.
3. Position the power steering fluid reservoir to one side.

E65546


E65547

4. CAUTION: Make sure that all openings are sealed.
    - *Torque:* 23 Nm
5. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.


E65299

7. Position the air conditioning (A/C) compressor to one side.

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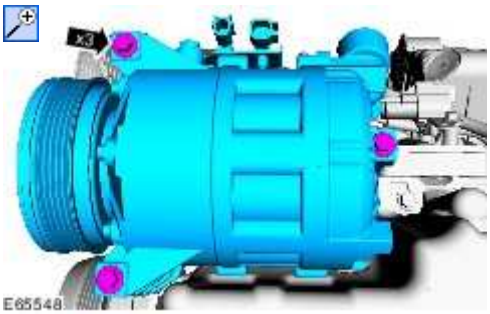
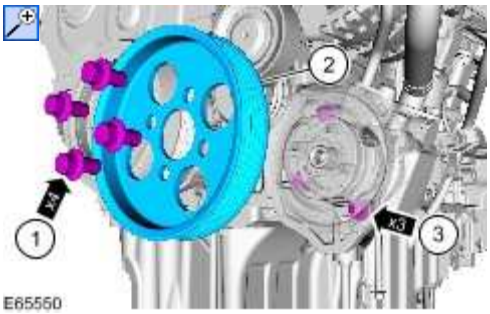
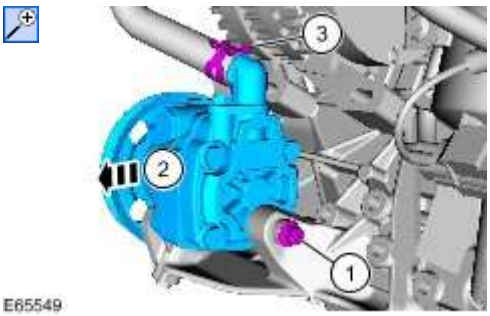


Torque: 25 Nm



8.
1. *Torque:* 25 Nm
3. *Torque:* 25 Nm



9. CAUTION: Make sure that all openings are sealed.
1. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.
2. Fill the power steering system.

   Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Bleed the power steering system.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

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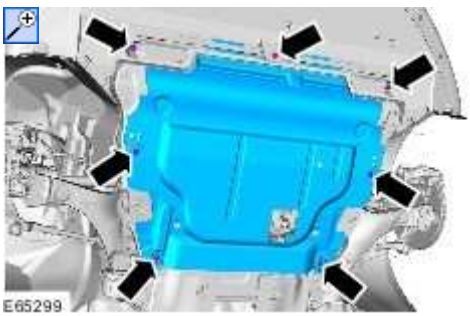
Removal and Installation

Removal

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

1. Raise and support the vehicle.

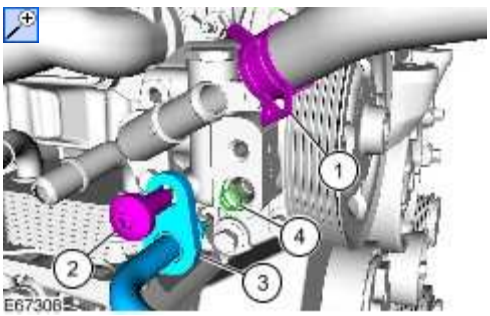
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



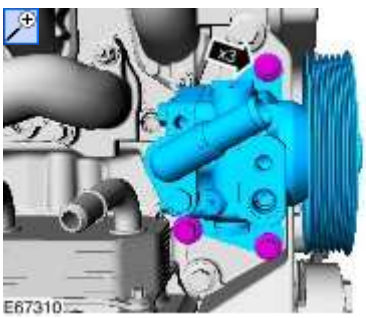
2.

3. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



4. CAUTION: Make sure that all openings are sealed.
   2. *Torque:* 23 Nm



5. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.
2. Fill the power steering system.

   Refer to: Power Steering System Filling (211-00 Steering System - General Information, General

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Procedures).

3. Bleed the power steering system.

   Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

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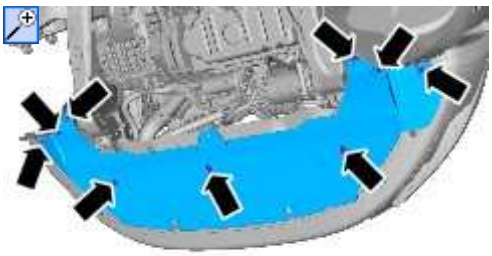
Removal and Installation

Removal

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

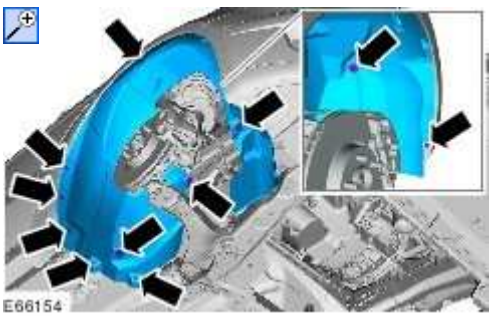
1. Remove the front right-hand wheel and tire.

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



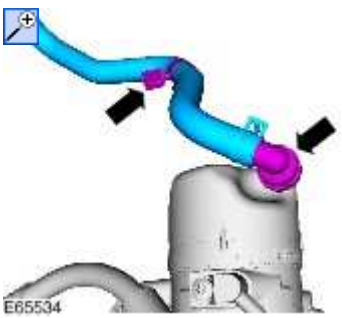
E68962

2.



E66154

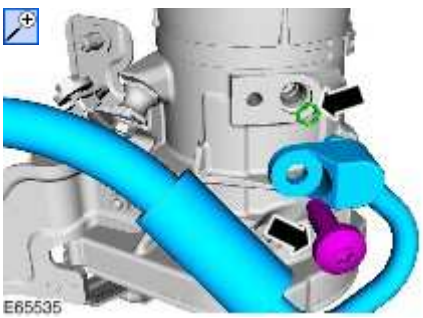
3.



E65534

4. WARNING: Be prepared to collect escaping fluids.

   CAUTION: Make sure that all openings are sealed.



E65535

5. WARNING: Be prepared to collect escaping fluids.

   CAUTION: Make sure that all openings are sealed.
   Torque: 20 Nm

6. *Torque:* 10 Nm

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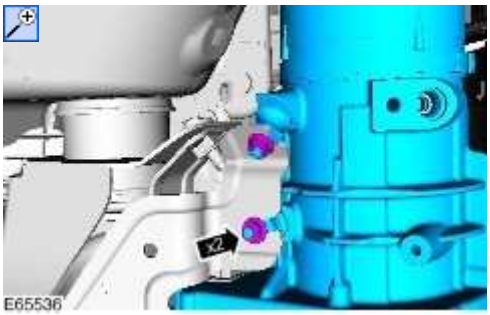
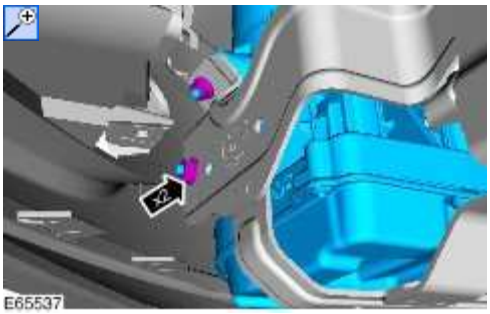
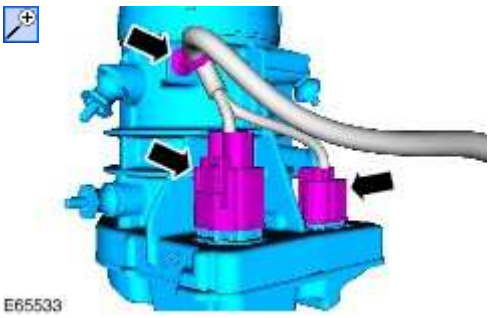




7. *Torque:* 10 Nm



8.

Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

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Removal and Installation

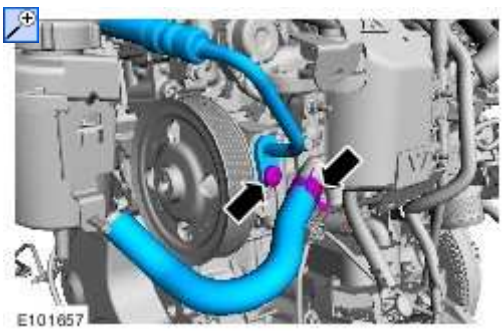
Materials

Name	Specification
Hydraulic Fluid DP-PS	WSS-M2C204-A2 / 5U7J-M2C204-AA

Removal

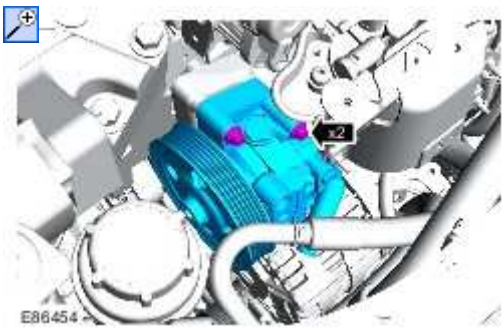
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

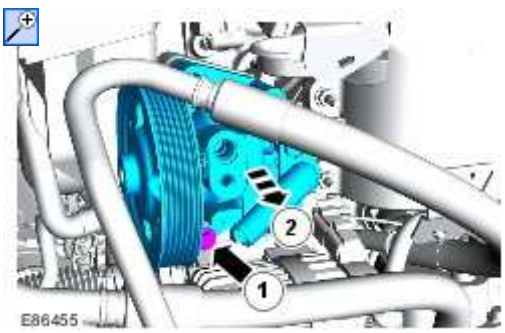


2. WARNING: Be prepared to collect escaping fluids.

   CAUTION: Make sure that all openings are sealed.
   Material: Hydraulic Fluid DP-PS (WSS-M2C204-A2 / 5U7J-M2C204-AA)
   Torque: 23 Nm



3. *Torque:* 24 Nm



4. *Torque:* 24 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).

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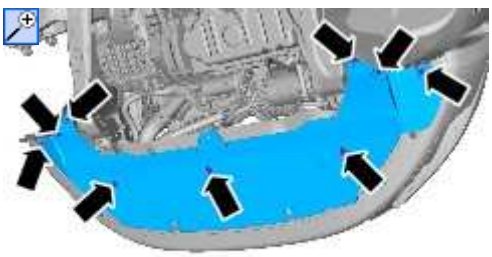
Removal and Installation

Special Tool(s)

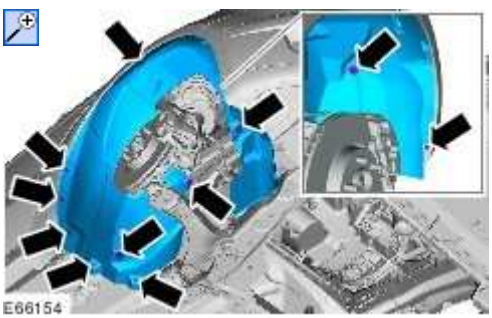
	308-440 Disconnect Tool, Hydraulic Line

Removal

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

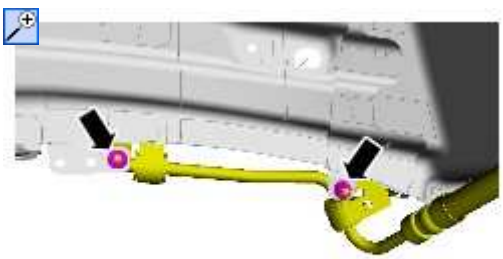
1. Refer to: Lifting (100-02 Jacking and Lifting, Descrip Operation).
2. Refer to: Wheel and Tire (204-04 Wheels and Tires, and Installation).
3. 

E68962

4. 

E66154

5. *Torque:* 10 Nm



E117025

6. WAI
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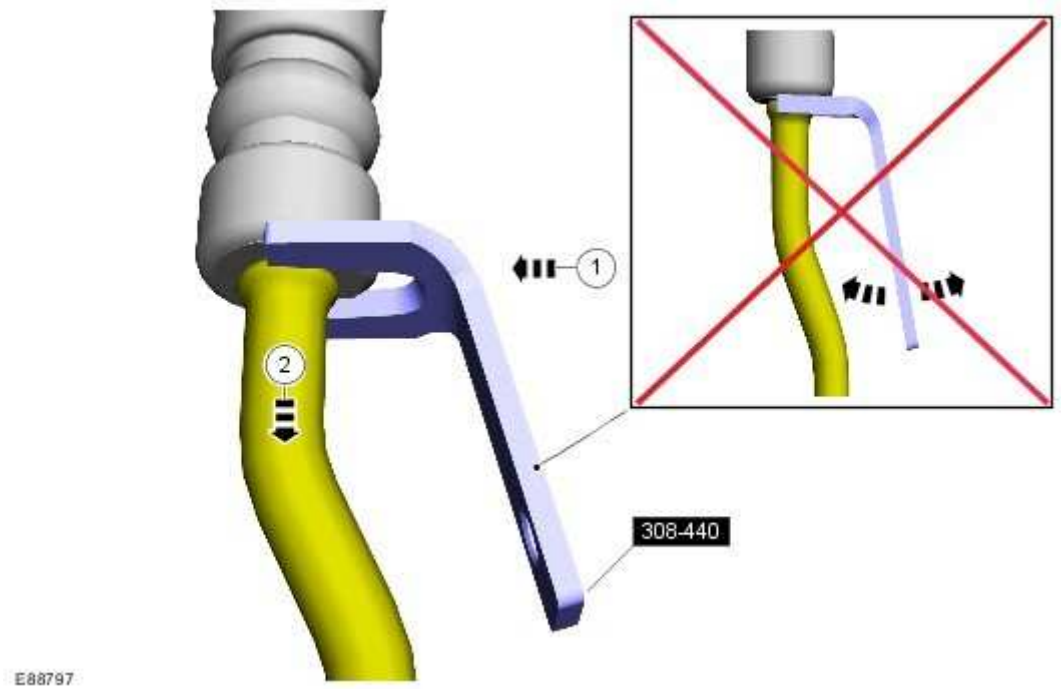

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are seal
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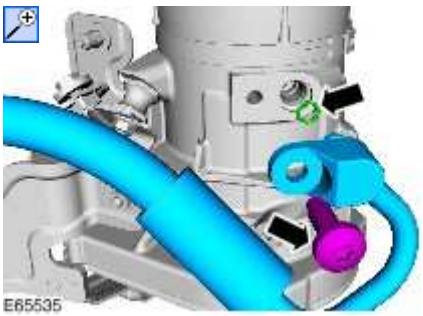
308-440



7. WARNING: Be prepared to collect escaping flu

   CAUTION: Make sure that all openings are sea
   Torque: 20 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Ste
   System - General Information, General Procedures).
3. Refer to: Power Steering System Bleeding (211-00 S
   System - General Information, General Procedures).

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Removal and Installation

Special Tool(s)

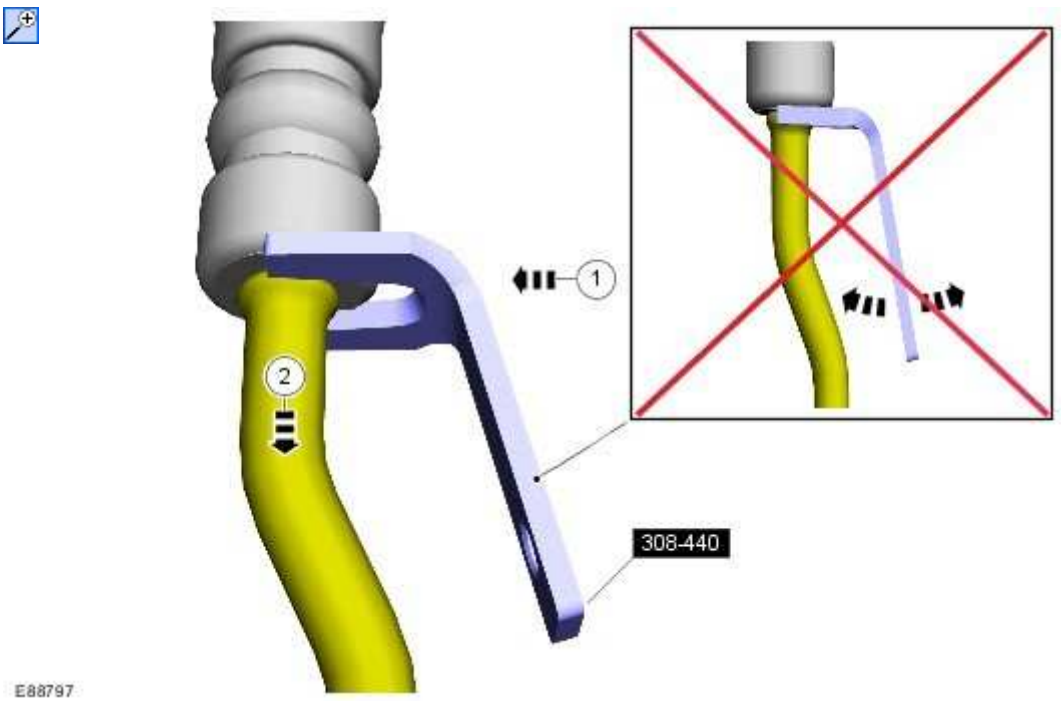
	308-440 Disconnect Tool, Hydraulic Line

Removal

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

1. Raise and support the vehicle.

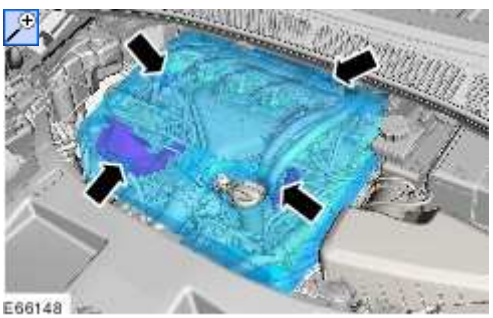
   Refer to: Lifting (100-02 Jacking and Lifting, Descrip Operation).



2. WAI Be prepa collect escapinc

   CAU Make su all openi are seal *Special T* 308-440

3. Lower the vehicle.



4.

5. WARNING: Be prepared to collect escaping flu

   CAUTION: Make sure that all openings are sea

   1. *Torque:* 24 Nm
   2. *Torque:* 10 Nm

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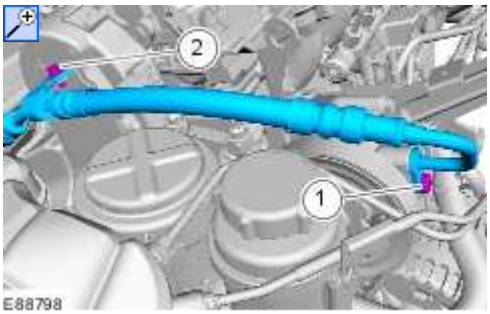

Installation

1. To install, reverse the removal procedure.
2. Fill the power steering system.

   Refer to: Power Steering System Filling (211-00 Ste
   System - General Information, General Procedures).
3. Bleed the power steering system.

   Refer to: Power Steering System Bleeding (211-00 S
   System - General Information, General Procedures).

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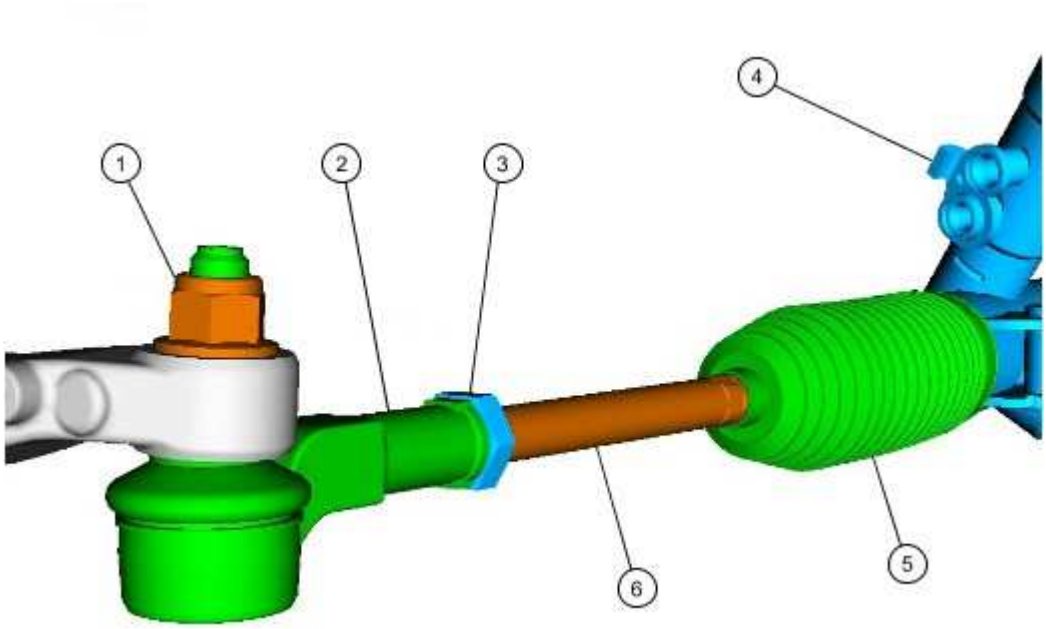
Description and Operation



E69551

Item	Part Number	Description
1	-	Tie-rod end nut
2	-	Tie-rod end
3	-	Tie-rod end locknut
4	-	Steering gear
5	-	Steering gear boot
6	-	Tie-rod

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Diagnosis and Testing

REFER to Section 211-00 Steering System - General Information.

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Removal and Installation

Special Tool(s)

	204-169 Clamping Tool, Boot Retaining Clamp
	211-245 Socket, Steering Gear Tie-Rod

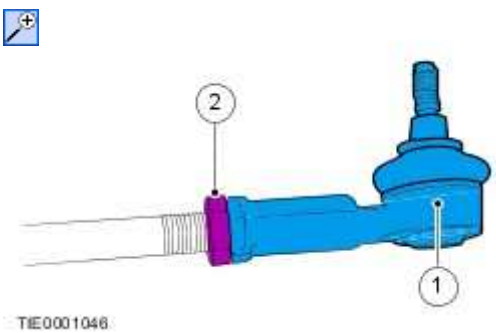
General Equipment

Vise
Vise jaw protectors

Removal

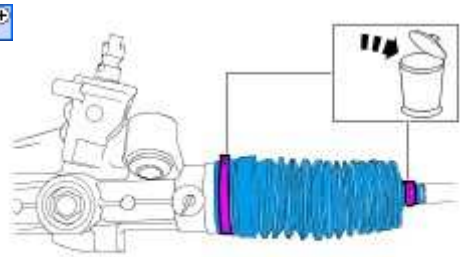
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Steering Gear (211-02 Power Steering, Removal and Installation).

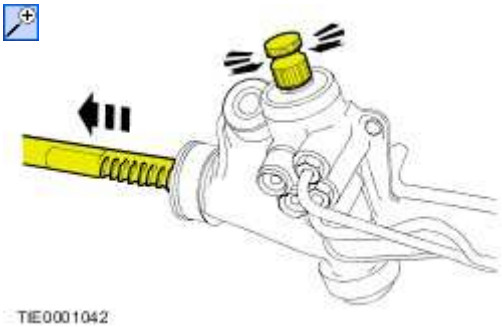


TIE0001046

2. NOTE: Make sure that the tie rod end is installed with the same number of turns as when removed.
Torque: 90 Nm


TIE0001041

3. NOTE: Note the position of each component before removal.


TIE0001042

4.

5. *General Equipment:* Vise
General Equipment: Vise jaw protectors

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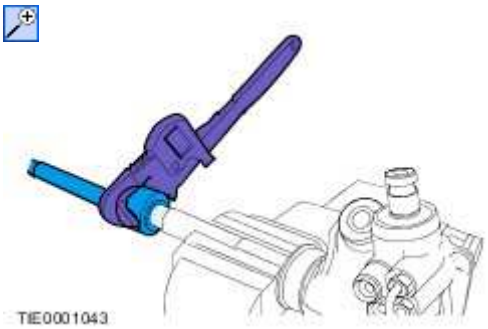
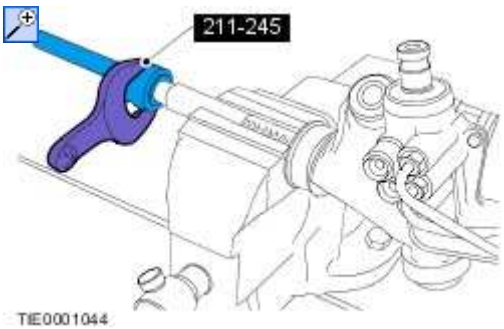
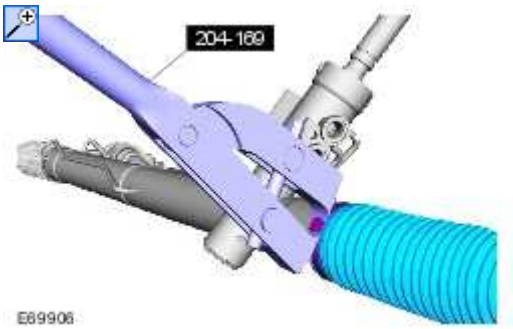


Installation



1. *Special Tool(s):* 211-245
   Torque: 110 Nm



2. NOTE: Make sure that these components are installed to the noted removal position.
   Special Tool(s): 204-169

3. To install, reverse the removal procedure.

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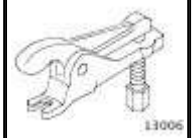
Removal and Installation

Special Tool(s)

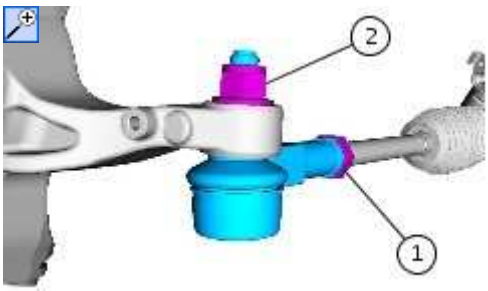
	211-020 Separator, Ball Joint

Removal

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

1. Remove the front wheel and tire.

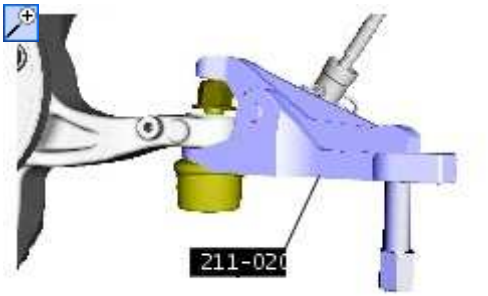
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



E69553

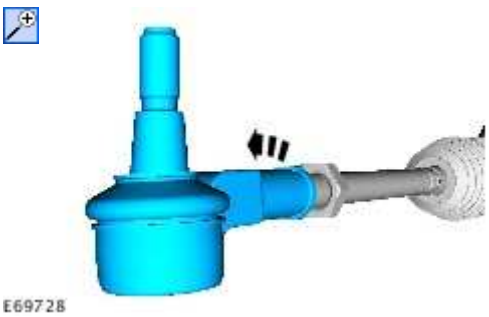
2. WARNING: Make sure a new tie rod end nut is installed.

   CAUTION: Make sure that the ball joint ball does not rotate.
   1. *Torque:* 90 Nm
   2. *Torque:* 80 Nm



E69554

3. *Special Tool(s):* 211-020


E69728

4. NOTE: Make sure that the tie rod end is installed with the same number of turns as when removed.

Installation

1. To install, reverse the removal procedure.
2. Check the toe setting and adjust as necessary.

   Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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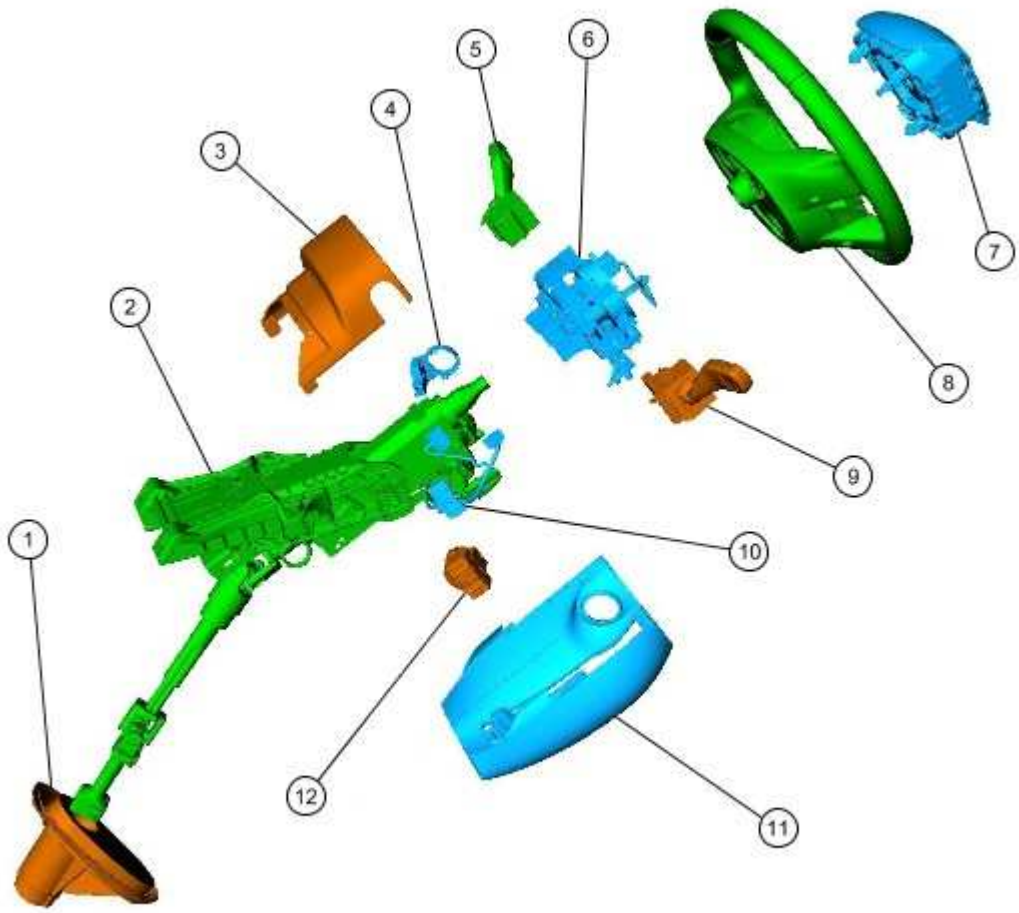
Description and Operation



E68596

Item	Part Number	Description
1	-	Steering gear to bulkhead seal
2	-	Steering column
3	-	Steering column upper shroud
4	-	Passive anti-theft system (PATS) transceiver
5	-	Windshield wiper/washer switch
6	-	Clockspring and steering wheel rotation sensor assembly
7	-	Driver air bag module
8	-	Steering wheel
9	-	Turn signal lamp switch
10	-	Wiring harness
11	-	Steering column lower shroud
12	-	Ignition switch

On vehicles with automatic transmission, the steering wheel can be equipped with select and shift switches which are integrated into the steering wheel spokes.

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E68724

If a select and shift switch becomes inoperative, a new steering wheel must be installed.

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Diagnosis and Testing

REFER to: Steering System (211-00 Steering System - General Information, Diagnosis and Testing).

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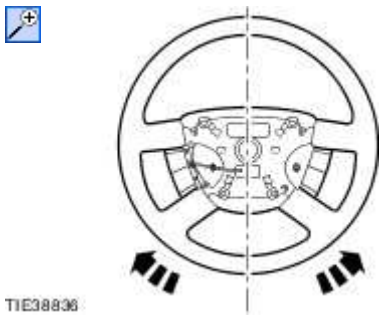
Removal and Installation

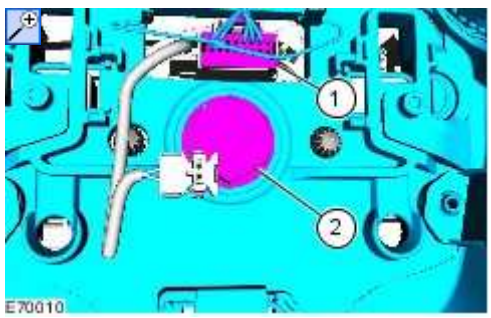
Removal

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

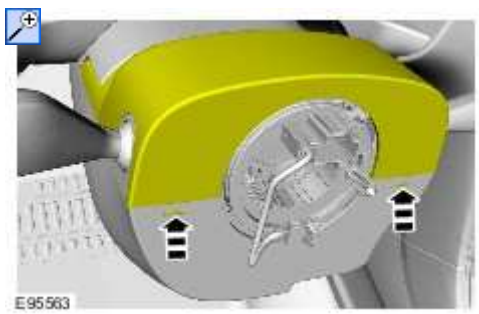
1. Refer to: Driver Air Bag Module - Vehicles Built From: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation).
   Refer to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation).



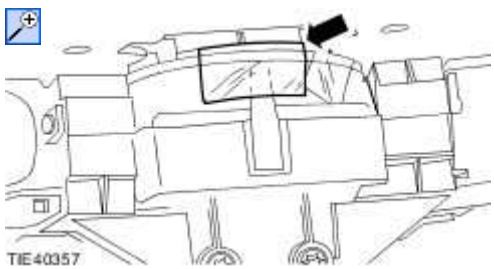
2. CAUTION: Make sure that the steering wheel lock is engaged.
   NOTE: Make sure that the road wheels are in the straight ahead position.



3.
   2. *Torque:* 48 Nm



4.



5. CAUTION: Make sure that the clockspring rotor does not rotate.
   Secure the clockspring rotor with adhesive tape to the clockspring outer.

Installation

1. CAUTION: Make sure that the clockspring pins are not bent or damaged.
   Carry out the clockspring adjustment procedure, if the yellow roller is not visible in the clockspring

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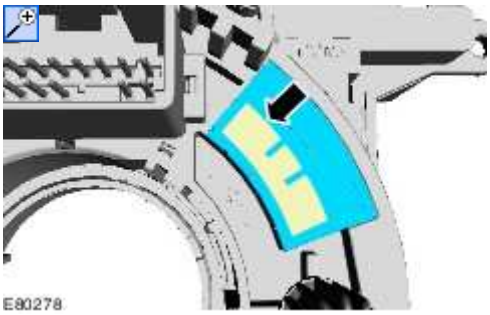

window.

Refer to: Clockspring Adjustment (501-20B Supplemental Restraint System, General Procedures).

2. To install, reverse the removal procedure.

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Removal and Installation

Removal

WARNINGS:

Take extra care when handling supplemental restraint system (SRS) components.

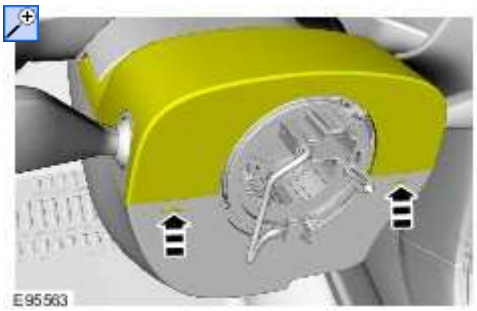
The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

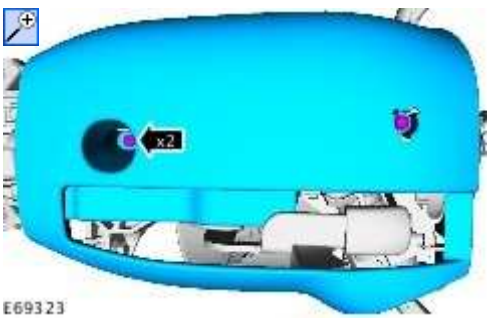
Do not probe supplemental restraint system (SRS) electrical connectors.

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

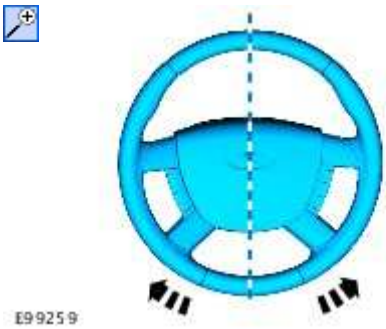
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. NOTE: This step is only necessary when installing a new component.
   Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).



3. NOTE: This step is not necessary when installing a new component.



4. NOTE: This step is not necessary when installing a new component.



5. NOTE: This step is not necessary when installing a new component.
   NOTE: Make sure that the road wheels are in the straight ahead position.
6. CAUTIONS:

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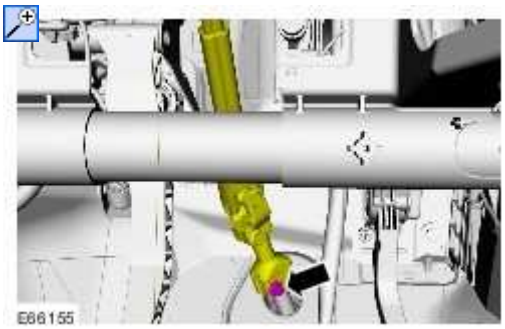
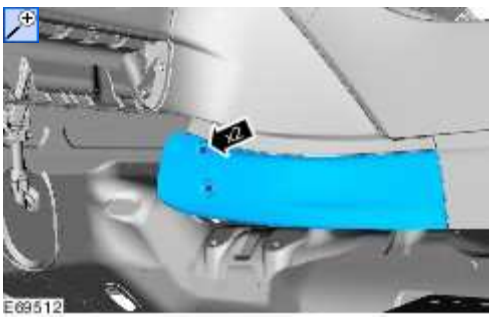
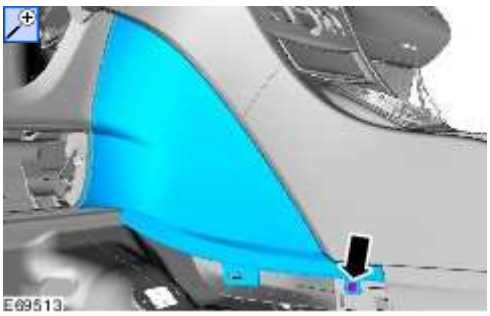
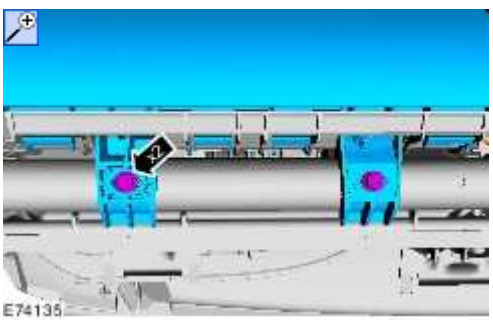


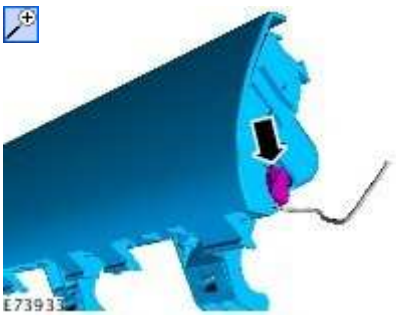
Make sure that the steering wheel lock is engaged.

Make sure that a new bolt is installed.
Torque: 30 Nm

7. 

8. 

9. *Torque:* 8 Nm


10. 

11.

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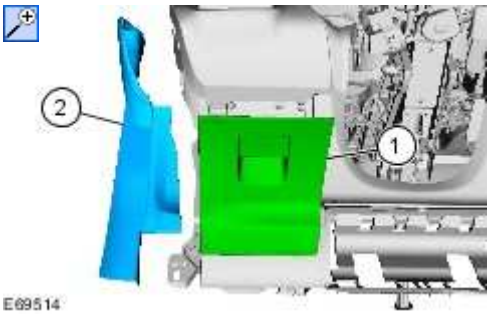

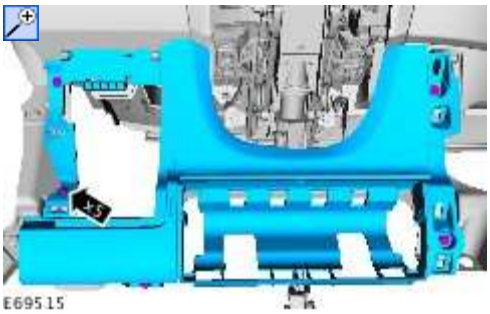

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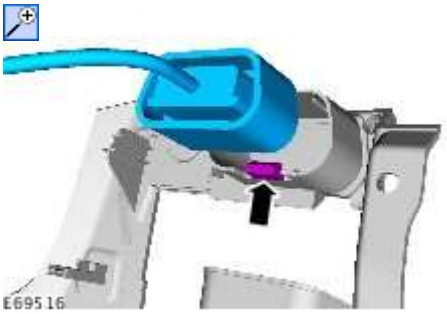

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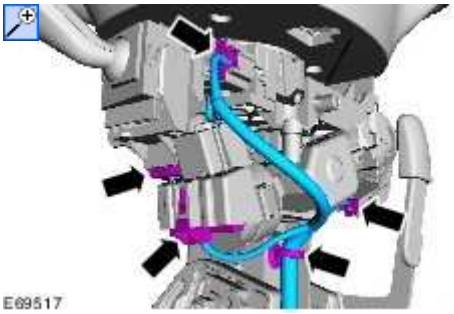

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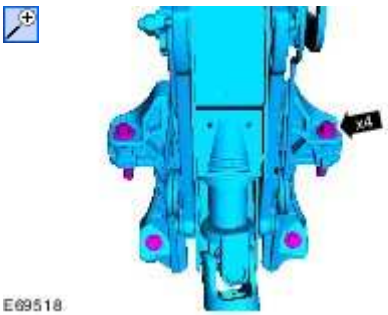

15. *Torque:* 24 Nm

16. NOTE: This step is only necessary when installing a new component.
Refer to: Steering Column (211-04 Steering Column, Disassembly and Assembly).

Installation

1. To install, reverse the removal procedure

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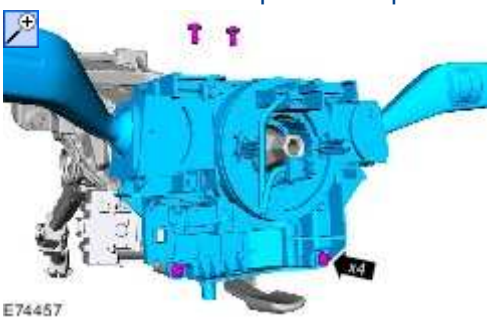
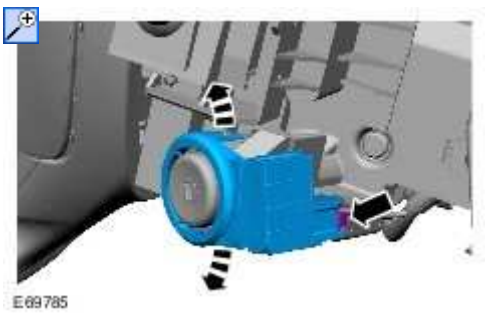
Disassembly and Assembly

Disassembly

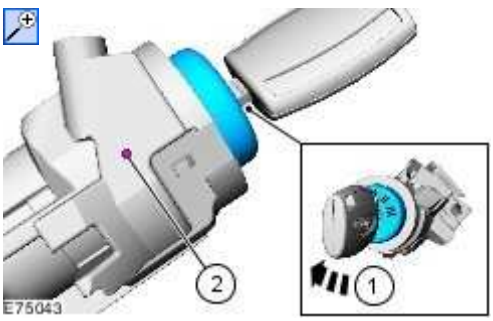
NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 3 Nm

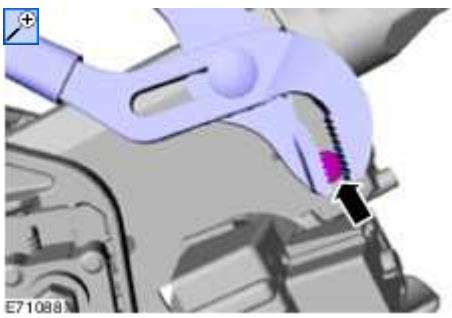


2.



3.

4. On both sides.



5. On both sides.

6.

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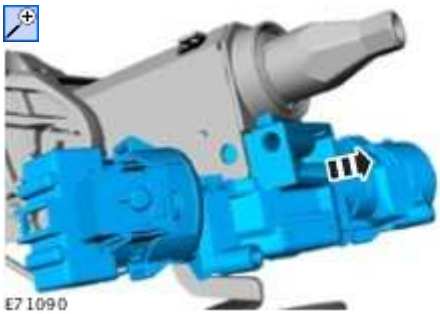

Assembly

7. To assemble, reverse the disassembly procedure.

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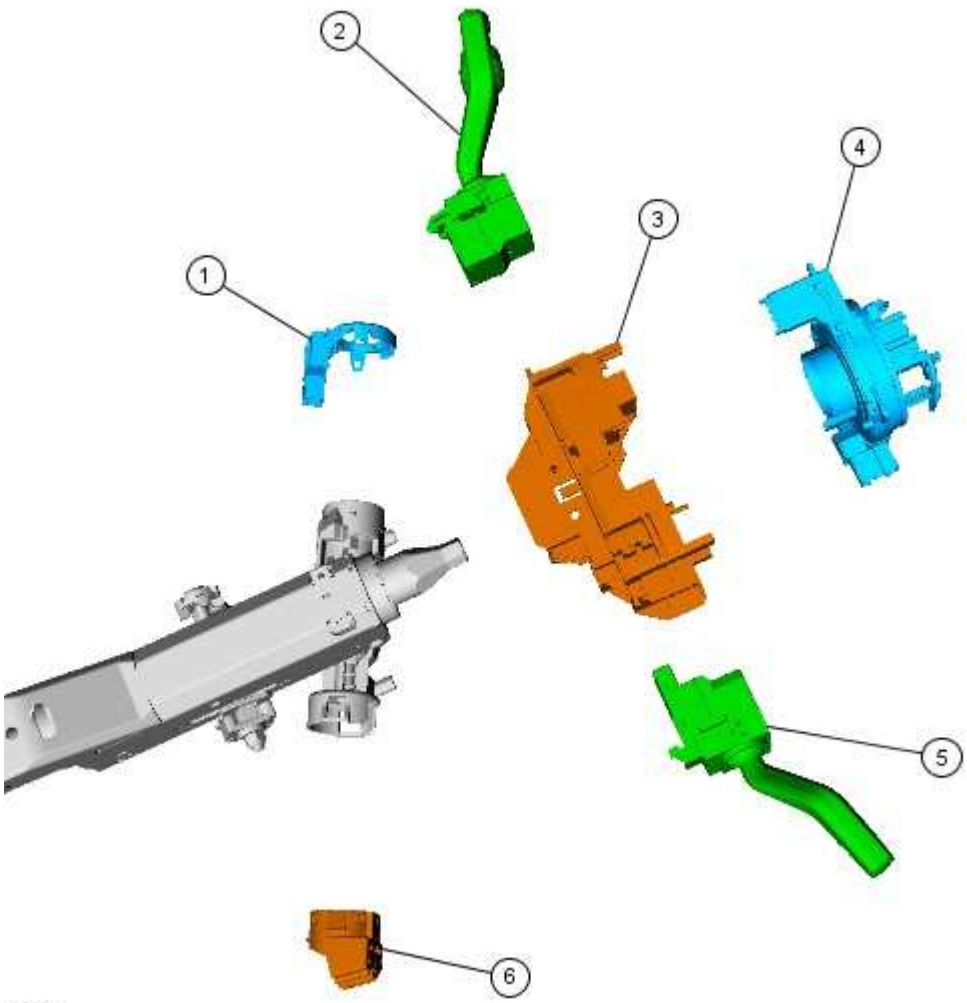
Description and Operation



Item	Part Number	Description
1	-	Passive anti-theft system (PATS) transceiver
2	-	Steering column multifunction switch right-hand
3	-	Steering column switch carrier
4	-	Clockspring and steering wheel rotation sensor
5	-	Steering column multifunction switch left-hand
6	-	Ignition switch

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Diagnosis and Testing

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Fuse(s). • Wiring harness. • Electrical connector(s). • Switch(es). • Battery.

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Sympton Chart.

Symptom Chart

Symptom	Possible Sources	Action
The ignition switch is inoperative	* Ignition switch.	* CARRY OUT the Ignition Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test A.
No power in ACC	* Ignition switch.	* CARRY OUT the Ignition Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test B.
No power in RUN	* Ignition switch.	* CARRY OUT the Ignition Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test C.
No power in START	* Ignition switch.	* CARRY OUT the Ignition Switch Component Test. REFER to the Wiring Diagrams
	* Circuit(s).	* GO to Pinpoint Test D.
The multifunction switch does not operate correctly	* Switch (es). * Circuit(s).	* REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing), Headlamps (417-01 Exterior Lighting, Diagnosis and Testing), Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).

Pinpoint Test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE IGNITION SWITCH IS INOPERATIVE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE IGNITION SWITCH ELECTRICAL CONNECTOR	
	1 Remove the steering column shrouds.

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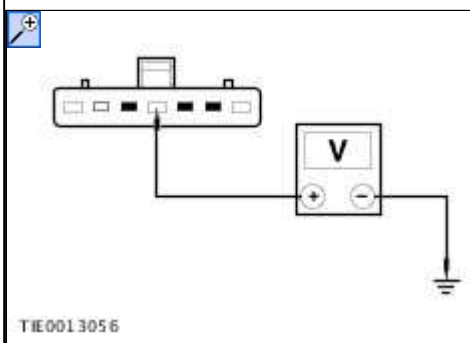
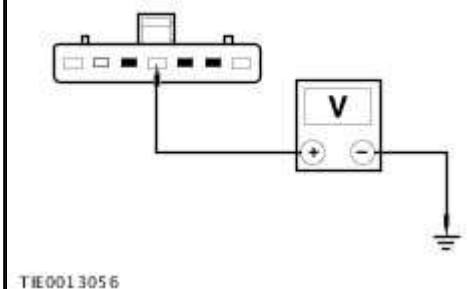
	2 Check the ignition switch electrical connector.
	Is the ignition switch electrical connector clean and secure? **Yes** GO to A2. **No** CLEAN and SECURE the ignition switch electrical connector. TEST the system for normal operation.
A2: CHECK FOR VOLTAGE ON CIRCUIT SBP24A (VT/RD)	
	1 Disconnect Ignition Switch C2DC32.
	2 Measure the voltage between the ignition switch C2DC32 Pin 4, circuit SBP24A (VT/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** VERIFY the customers concern. **No** REPAIR the circuit SBP24A (VT/RD). TEST the system for normal operation.

PINPOINT TEST B : NO POWER IN ACC	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FOR VOLTAGE ON CIRCUIT SBP24A (VT/RD)	
	1 Disconnect Ignition Switch C2DC32.
	2 Measure the voltage between the ignition switch C2DC32 Pin 4, circuit SBP24A (VT/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** REPAIR circuit CDC33A (VT/GN). TEST the system for normal operation. **No** REPAIR circuit SBP24A (VT/RD). TEST the system for normal operation.

PINPOINT TEST C : NO POWER IN RUN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FOR VOLTAGE ON CIRCUIT SBP24A (VT/RD)	
	1 Disconnect Ignition Switch C2DC32.
	2 Measure the voltage between the ignition switch CDC32 Pin 4, circuit CDC33A (VT/GN), harness side and ground.

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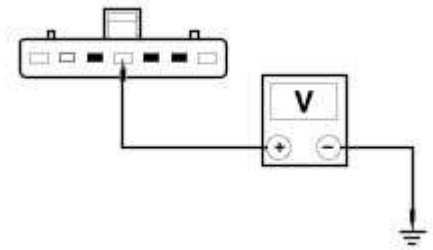
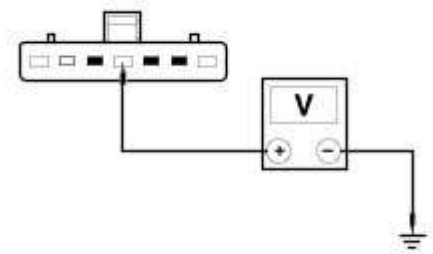
 TIE0013056	
	Is the voltage greater than 10 volts? **Yes** REPAIR the circuit CDC32D (BN/YE). TEST the system for normal operation. **No** REPAIR the circuit SBP24A (VT/RD). TEST the system for normal operation.

PINPOINT TEST D : NO POWER IN START	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK FOR VOLTAGE ON CIRCUIT SBP24A (VT/RD)	
	1 Disconnect Ignition Switch CDC32.
 TIE0013056	2 Measure the voltage between the ignition switch CDC32 Pin 4, circuit SBP77B (RD/GY) harness side and ground.
	Is the voltage greater than 10 volts? **Yes** REPAIR circuit CDC35F (BU/WH). TEST the system for normal operation. **No** REPAIR circuit SBP24A (VT/RD). TEST the system for normal operation.

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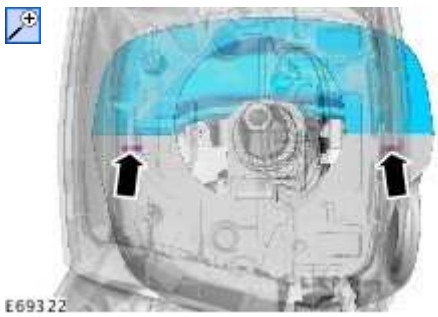
Removal and Installation

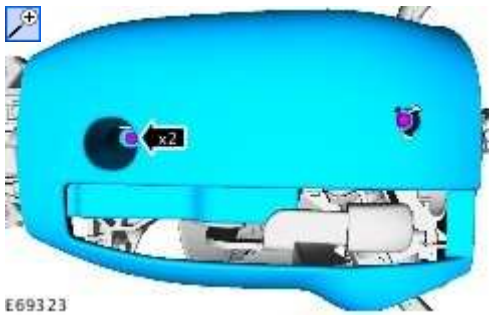
Removal

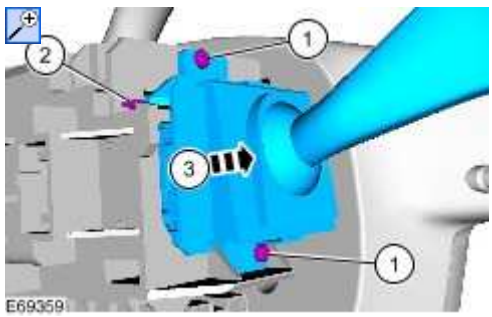
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. 

3. 

4. 

Installation

1. To install, reverse the removal procedure.

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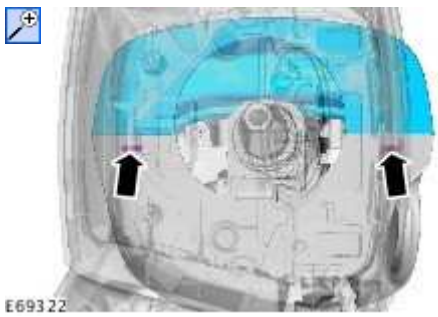
Removal and Installation

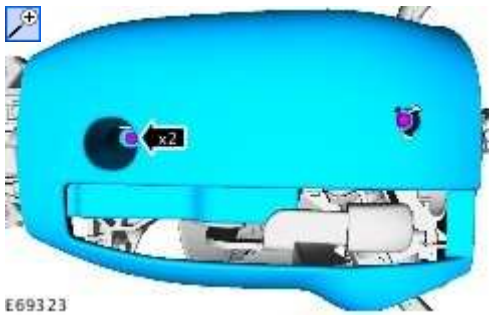
Removal

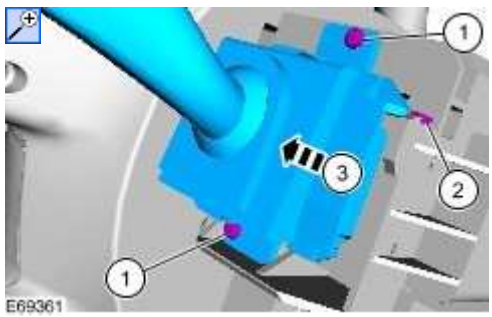
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. 

3. 

4. 

Installation

1. To install, reverse the removal procedure.

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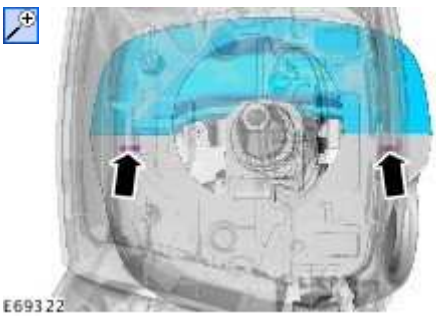
Removal and Installation

Removal

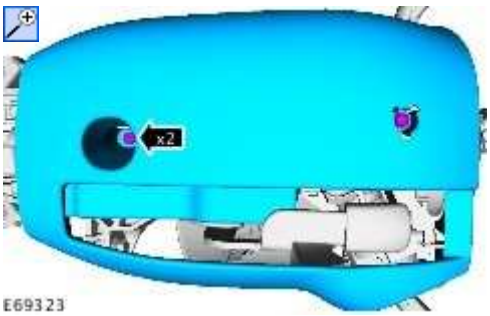
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

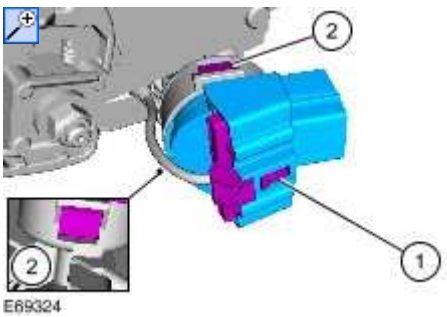


2.



3.

4. Turn the ignition key to position I.



5. CAUTION: The ignition switch lock cylinder must not be turned while the ignition switch is removed.

Installation

1. To install, reverse the removal procedure.

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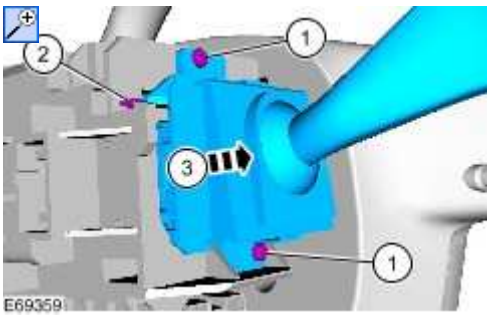
Removal and Installation

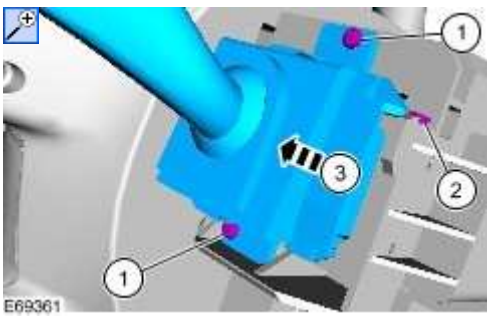
Removal

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

1. Refer to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).



2.



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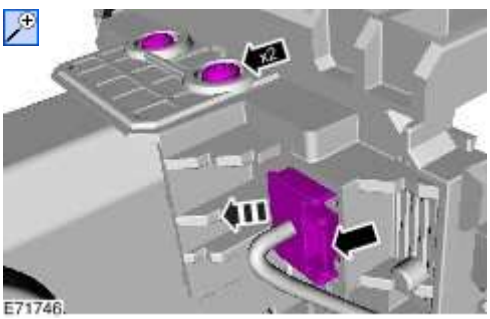
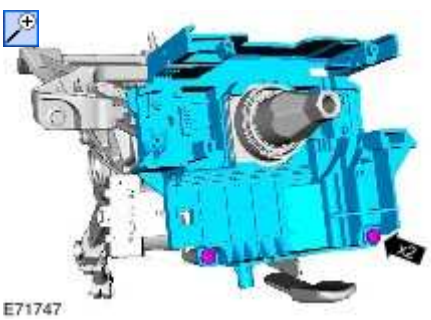


4. *Torque:* 3 Nm



5. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

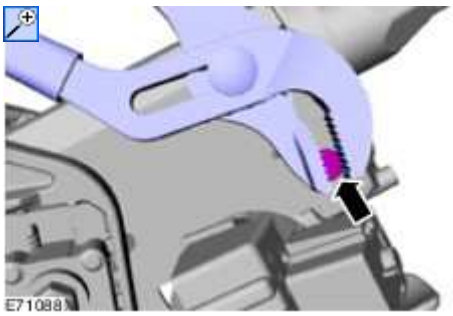
Removal

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

1. Remove the steering wheel module.

   Refer to: Steering Wheel Module (211-05 Steering Column Switches, Removal and Installation).

2.



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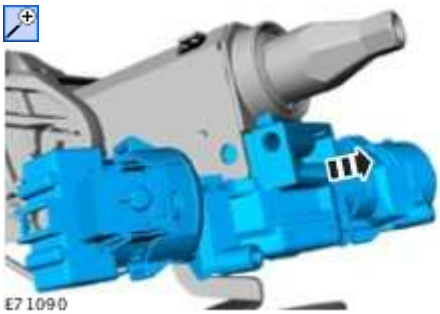
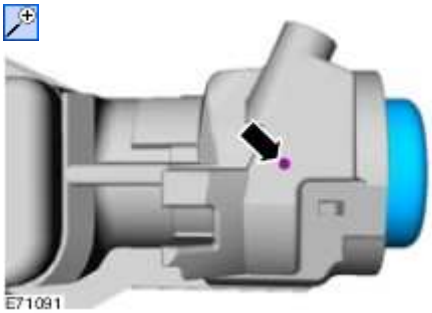


4.

5. Turn the ignition key to position I.



6.

Installation

1. To install, reverse the removal procedure.

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Engine data

Description		
Engine code	AOWA	AOWB
Firing order	1-3-4-2	
Emission standard	Stage IV	Stage V
Bore	87.5 mm	
Stroke	83.1 mm	
Cubic capacity	1998 cm³	
Compression ratio	10.8 : 1	
Power output at 6000 rpm	107 kW (145 PS)	
Maximum torque at 4500 rpm	185 Nm	
Maximum engine speed (for a short period)	6675 rev/min	
Maximum engine speed (continuous)	6450 rev/min	
Idle speed	700 ± 50 rpm	
Number of crankshaft main bearings	5	
Camshaft drive	Timing chain	
Maximum oil consumption	0.5 l/1000 Km	

Engine data - Ethanol fuel mixture (E85)

Description		
Engine code	TBWA	TBWB
Fuel type	Petrol / E85	
Firing order	1-3-4-2	
Emission standard	Stage IV	Stage V
Bore	87.5 mm	
Stroke	83.1 mm	
Cubic capacity	1998 cm³	
Compression ratio	10.8 : 1	
Power output at 6000 rpm	107 kW (145 PS)	
Maximum torque at 4500 rpm	185 Nm	
Maximum engine speed (for a short period)	6675 rev/min	
Maximum engine speed (continuous)	6450 rev/min	
Idle speed	700 ± 50 rpm	
Number of crankshaft main bearings	5	
Camshaft drive	Timing chain	
Maximum oil consumption	0.5 l/1000 Km	

Engine oil

Viscosity/ambient temperature	Type	Specification
Recommended engine oil		
SAE 5W-30 / below -20°C to over +40°C	Ford Formula E	WSS-M2C913-C
Alternative engine oils (for topping up only)		
SAE 10W-40 / -20°C below -20°C to over +40°C	Ford Formula XR+	ACEA A3/B3
SAE 5W-40 / below -20°C to over +40°C	Ford Formula S/SD	ACEA A3/B3

Capacities

	Litres
Initial fill including oil filter	4.6
Service fill including oil filter	4.3

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Service fill without oil filter	3.9

Lubricants, Sealants and Adhesives

	Specifications
Sealant, oil pan contact surface to crankshaft rear seal retainer, oil pan to cylinder block, oil pan to front cover, engine front cover to cylinder block/ oil pan	WSE-M4G323-A4
Oil pressure switch and engine front cover blanking plug sealant	WSK-M2G349-A7

Valve Clearances

Description	
Valve clearance (engine cold) - intake valves	0,22 - 0,28
Valve clearance (engine cold) - exhaust valves	0,27 - 0,33

Cylinder head

CAUTION: The cylinder head sealing surfaces must not be re-worked.

Description	mm
Maximum distortion, mating face	0,1

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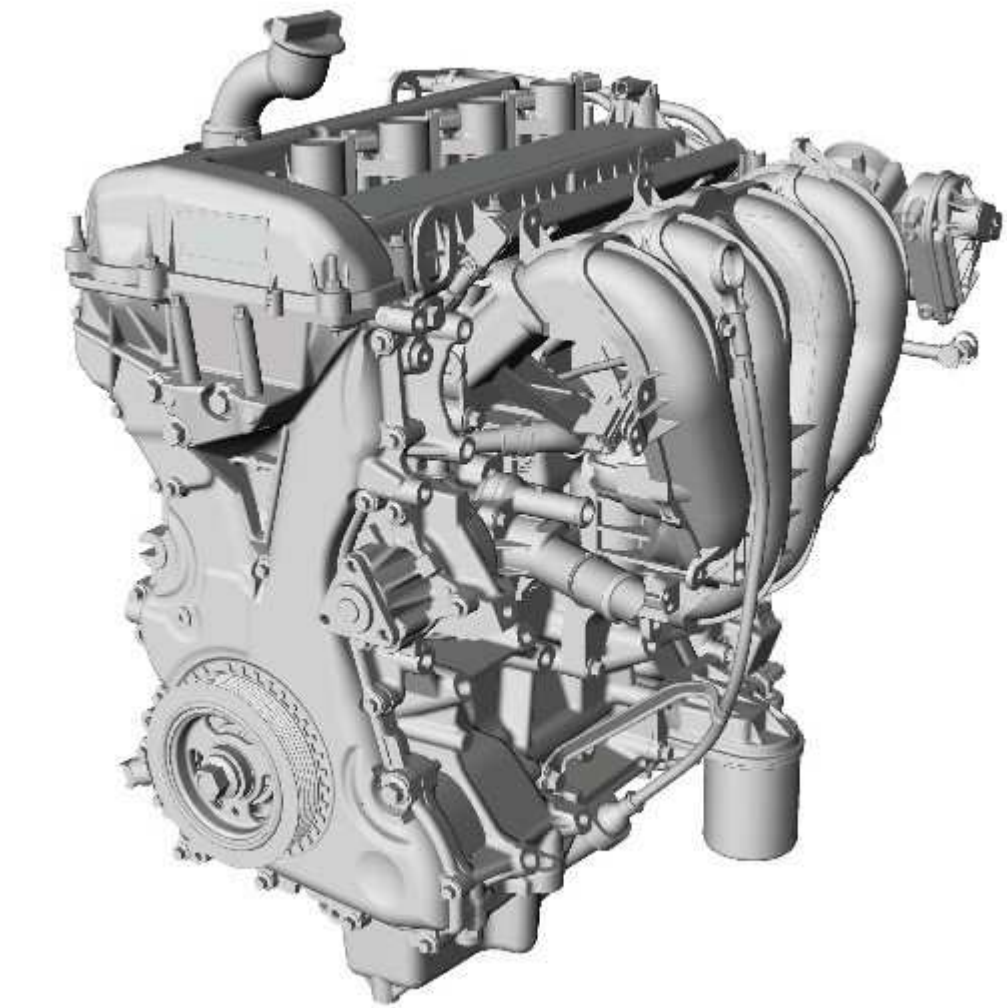
Description and Operation

2.0 Duratec-HE (MI4)



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Apart from a few changes, the 2.0L Duratec-HE (MI4) engine is largely based on the engine already used in Focus 2004.75 (07/2004-) vehicles.

Key features of the engine include:

- Direct ignition coils
- Electronic throttle valve
- Mechanical thermostat
- Variable intake system with swirl valves
- Dual-mass flywheel
- Oil cooler

Changes over the variant last installed in Focus 2004.75 (07/2004-) vehicles include:

- Exhaust manifold; the shape of the individual pipes has been changed to accommodate the new position of the alternator.

Exhaust manifold

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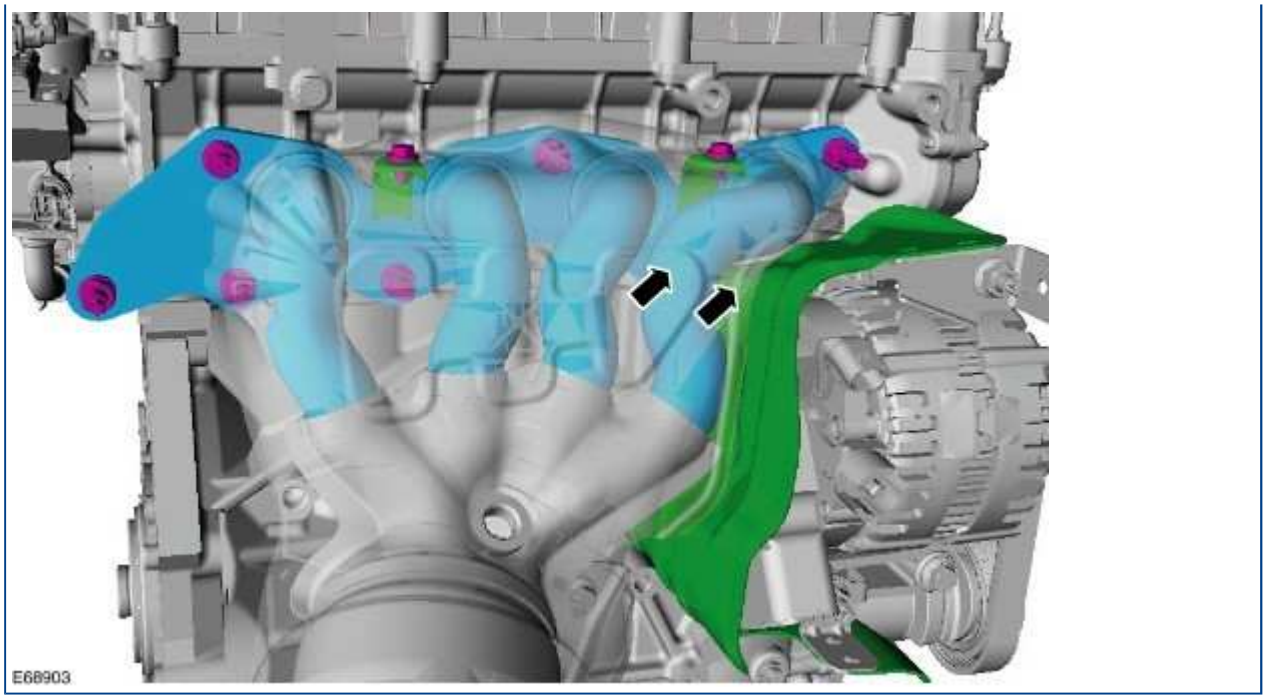

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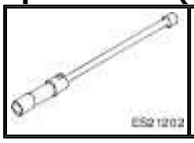
Diagnosis and Testing

Special Tool(s)

	Socket, Spark Plug 303-499

General Equipment

Compression Tester

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.
4. **4.** If the concern persists, check the symptoms and continue with the Symptom Chart.

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Leaking oil. • Fuel leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts	• Fuse(s) • Loose or corroded connector(s) • Control unit • Damaged or worn switch(es)

Symptom Chart

Symptom chart

Symptom	Possible Sources	Action
Loss of oil	* Oil leaks on components that are either coated in oil themselves or on components local to them.	* CHECK for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if an oil leak is not evident. INSTALL new gaskets or components as required.
	* Internal or external leak at the oil cooler.	* CHECK whether there is an oil film on the coolant in the coolant expansion tank. INSTALL a new oil cooler or oil cooler seal.
	* Leak on the crankshaft oil seal	* INSTALL a new crankshaft oil seal. REFER to: Crankshaft Front Seal (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation), Crankshaft Rear Seal (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

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	* Leaks from oil carrying components or basic engine.	* CHECK for cracks in oil-carrying components of the basic engine by means of a UV leak test. INSTALL new components or seals as necessary.
Oil Consumption	* Use of the wrong type of engine oil.	* DETERMINE the last type of engine oil used and compare with the specification. Change the engine oil to the specification.
	* Faulty positive crankcase ventilation (PCV) system. - Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes oil to enter the combustion chamber. - The PCV oil separator is damaged. Oil can enter the combustion chamber through the intake manifold.	* CHECK if the PCV system is operating correctly and repair as necessary.
	* Damaged gaskets or mating surfaces. - Damaged cylinder head gasket or warped mating faces. - Worn valve stem oil seals. Engine oil can enter the combustion chamber between the valve stem and the valve guide.	* CHECK the gaskets and mating surfaces for damage. - Remove the cylinder head. CHECK the condition of the mating faces and the cylinder head gasket and CHECK the evenness of the cylinder head and cylinder block mating faces. - INSTALL new valve stem oil seals. REFER to: Valve Stem Seals (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
	* Piston ring or cylinder liner wear.	* INSTALL new components as necessary.
	* Damaged cylinder liners or excessive clearance of engine components. - Piston - Piston rings (clearance in groove and end gap). - Cylinder liners	* CHECK the running surfaces and clearances of the individual engine components. INSTALL new components as necessary. INSTALL a new cylinder block if necessary. * Check the pistons and piston rings.
Coolant consumption	* Cooling system components.	* Check the cooling system components. REFER to: Engine Cooling (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Oil cooler	* INSTALL a new oil cooler.
	* Damaged gaskets or warped mating faces.	* CHECK the cylinder head gasket for damage. CHECK the cylinder head for distortion.
	* Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	* DETERMINE the damaged engine component(s) and install new component (s) as necessary.

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Engine will not crank	* Battery or battery cable	* CHECK the battery, battery holder and battery cable(s). REFER to: Specifications (414-01 Battery, Mounting and Cables, Specifications).
	* Starter motor or cables.	* CHECK the starting system. REFER to: Starting System (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
Engine cranks but will not start.	* Fuel tank is empty.	* CHECK the fuel level.
	* Intake Air Distribution and Filtering	* CHECK the intake air system.
	* Engine management	* CHECK the engine management system.
	* Ignition system	* CHECK the ignition system.
	* Incorrect valve timing.	* CHECK and adjust valve timing. REFER to: Crankshaft Pulley (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Timing chain or timing chain sprockets damaged or broken	* CHECK the timing chain and timing chain sprockets. INSTALL new components as necessary. REFER to: Timing Chain (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
Very poor power output or fuel consumption too high or engine running rough	* Fuel system	* CHECK the fuel system.
	* Intake Air Distribution and Filtering	* CHECK the intake air system.
	* Restricted exhaust system.	* CHECK the exhaust system. REFER to: Exhaust System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (309-00A Exhaust System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Description and Operation).
	* Engine management	* CHECK the engine management system.
	* Ignition system is faulty	* CHECK the ignition system.
	* Incorrect valve timing, timing chain or timing chain sprockets damaged	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4) Crankshaft Pulley (Removal and Installation), Timing Chain (Removal and Installation).
	* Incorrect ignition timing	* CHECK the electronic engine controls.
Noisy running	* Engine auxiliary components loose or damaged.	* CHECK engine auxiliary components for damage or looseness. CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4) Crankshaft Pulley (Removal and Installation), Timing Chain (Removal and Installation).
Noisy running, misfiring,	* Incorrect fuel	* DETERMINE which type of fuel was last put in the tank (note the country specific

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backfiring or knocking		fuel specifications).
	* Water in fuel or fuel contaminated.	* CHECK the fuel system for water or other contamination.
	* Incorrect valve timing, timing chain or timing chain sprockets damaged	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4) Crankshaft Pulley (Removal and Installation), Timing Chain (Removal and Installation).
Noisy running or valve train noise	* Valve clearance too large due to faulty valve tappets or worn valve train components.	* ADJUST valve clearance. REFER to: Valve Clearance Adjustment (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
	* Timing chain damaged.	* INSTALL a new timing chain. REFER to: Timing Chain (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Timing chain incorrectly tensioned	* CHECK the timing chain tension. INSTALL a new timing chain if required. REFER to: Timing Chain (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
Noisy running or engine noise	* Engine components - Piston - Piston rings - Connecting rod big end, main bearing or thrust bearing journals - Connecting rods bent or damaged.	* CHECK the engine components for wear or damage. Make sure all components are within specification. INSTALL new components as necessary. REFER to: Specifications (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Specifications).

Oil Leaks - Engine

NOTE: Before renewing gaskets or oil seals, make sure that the cause of the fault is clearly established.
If the oil leak cannot be identified clearly by a visual inspection, carry out an UV test:

Ultraviolet (UV) Testing

1. **1.** Clean the engine and transmission with a suitable cleaning fluid.
2. **2.** Pour the UV-test fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.

WARNING: Vehicles with manual transaxle, shift the transaxle into Neutral. Failure to observe this instruction can lead to injuries.

3. **3.** Start the engine and let it run for about five minutes.
4. **4.** Stop the engine.

NOTE: If no leak is found, perform a road test. Drive the vehicle under different loads and then re-check the engine for leaks.

5. **5.** Check the engine for oil leaks using a suitable UV lamp.

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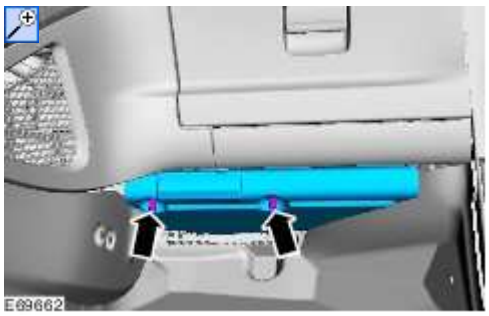
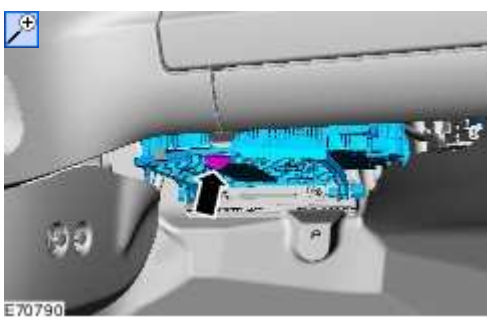
6. **6.** Rectify any leaks found and check the engine for oil leaks.

Measure the compression pressure



1. **1.** Remove the central junction box cover.

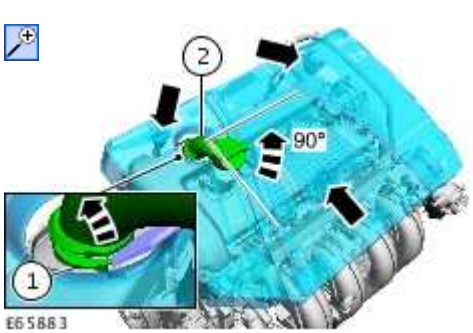


2. **2.** Detach the central junction box (CJB).

3. **3.** Open the CJB and remove fuse 23 - fuel pump relay.

NOTE: The engine will start, run for a few seconds and then stop.

4. **4.** Start the engine.



5. **5.** Detach the engine cover.

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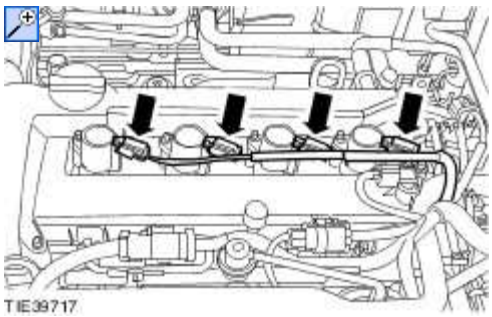
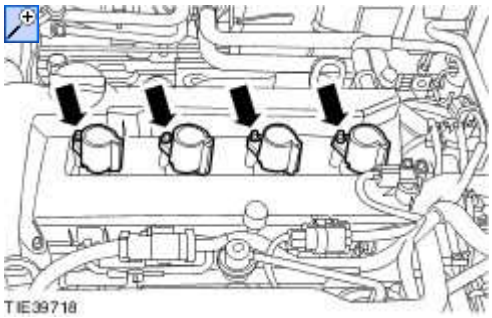
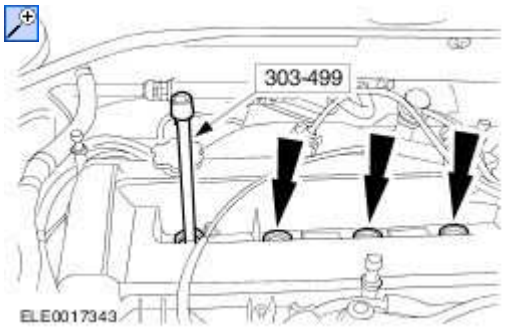


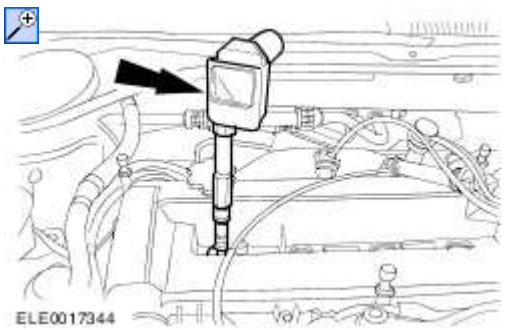
6. **6.** Disconnect the ignition coil-on-plug electrical connectors.



7. **7.** Remove the ignition coil-on-plug



8. **8.** Remove the spark plugs using the special tool.



NOTE: Operate the starter motor with wide open throttle until the reading on the compression tester stops rising.

9. **9.** Perform the measurement on each cylinder according to the instructions provided by the manufacturer of the measuring device. Use a compression tester with a suitable adapter.

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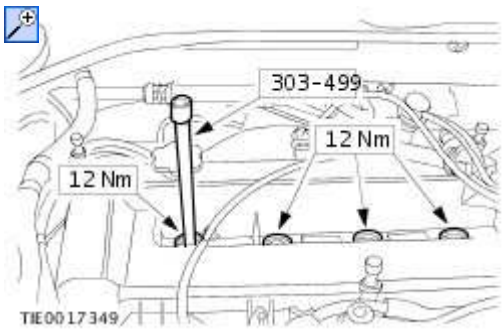
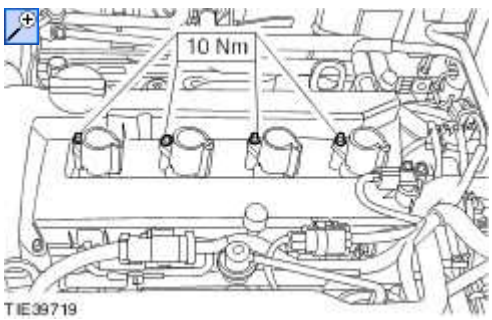
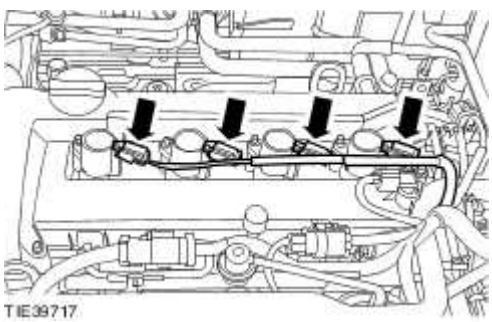


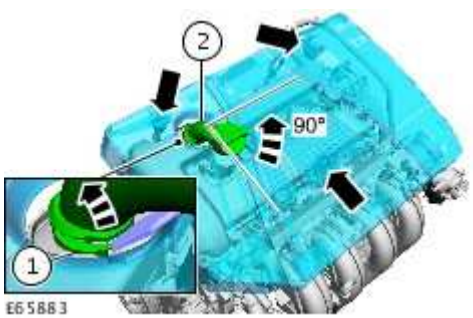
10. **10.** Install the spark plugs using the special tool.



11. **11.** Install the ignition coil-on-plug.



12. **12.** Connect the ignition coil-on-plug electrical connectors.



13. **13.** Install the engine cover.

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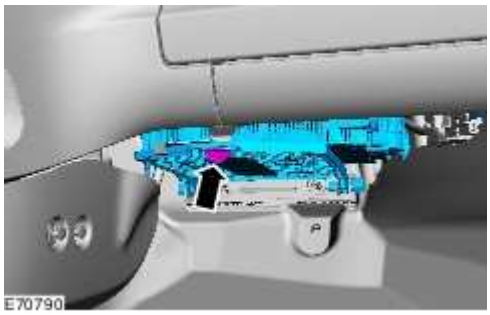
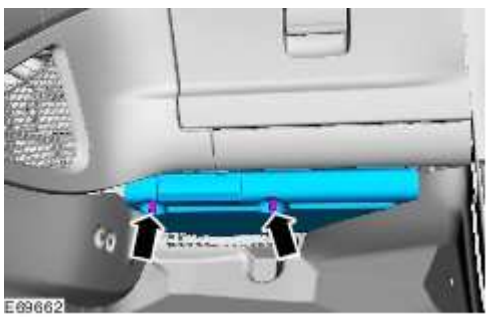
14. **14.** Install fuse 23 (fuel pump relay) and close the central junction box (CJB).



15. **15.** Attach the CJB.



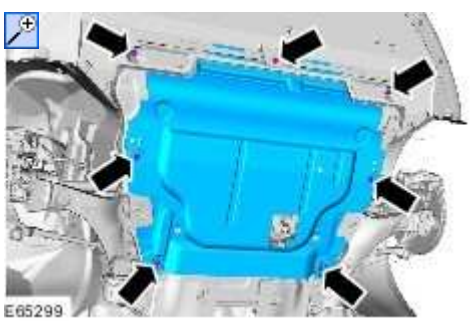
16. **16.** Install the central junction box cover.

17. **17.** Reset the PCM fault memory.

Measuring the oil pressure

1. **1.** Raise the vehicle for access. REFER to: (100-02 Jacking and Lifting)

   Jacking (Description and Operation),
   Lifting (Description and Operation).



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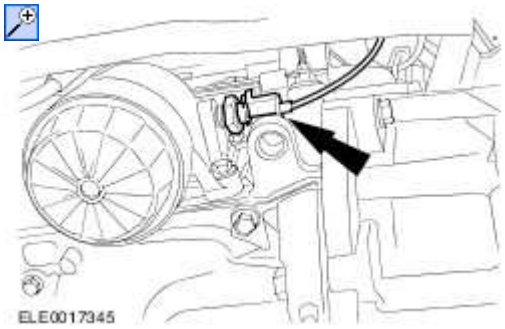
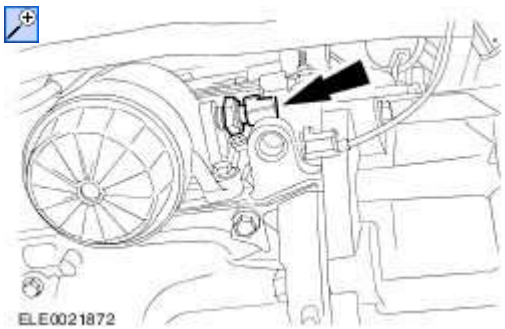
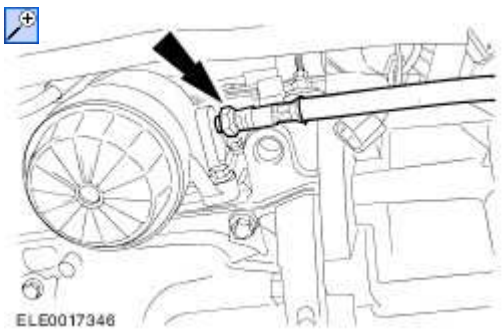
2. **2.** Remove the engine undershield.



3. **3.** Pull off the oil pressure switch connector.

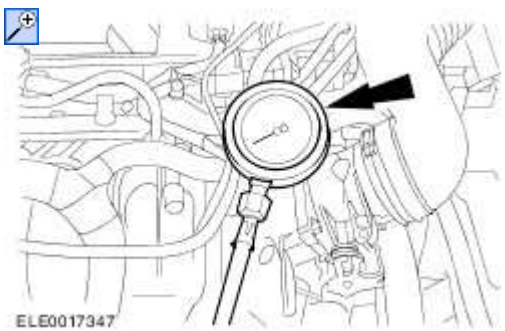


4. **4.** Remove the oil pressure switch.



5. **5.** Attach the oil pressure gauge with the oil pressure gauge connector to the oil pressure switch bore, and position it to allow reading from above.

6. **6.** Lower the vehicle.



7. NOTE: Measure the oil pressure at the specified engine speed. Measure the oil

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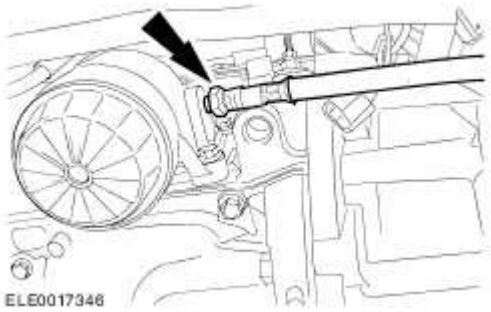
pressure at an oil temperature of 100 °C.
NOTE: Oil pressure at 1500 rev/min: 1.3 - 2.7 bar.
NOTE: Oil pressure at 3000 rev/min: 2.3 -5.2 bar.
7. Check the oil pressure

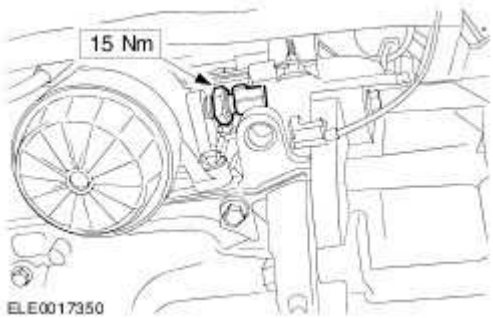
8. **8.** Raise the vehicle for access. REFER to: (100-02 Jacking and Lifting)

   Jacking (Description and Operation),
   Lifting (Description and Operation).

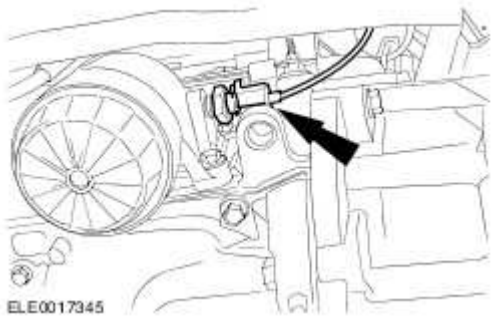


9. **9.** Detach the oil pressure gauge and connector from the oil pressure switch bore.

10. **10.** Coat the oil pressure switch with adhesive.



11. **11.** Install the oil pressure switch.



12. **12.** Push on the oil pressure switch connector.

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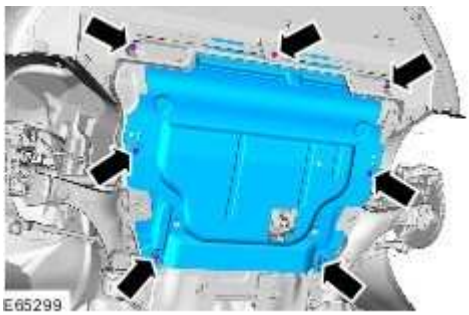

13. **13.** Install the engine undershield.

14. **14.** Lower the vehicle.

Valve train analysis - static (engine off)

Remove the cylinder head cover.

Check all valve train components for damage and wear. Ensure that only original components are installed and that all bolts and nuts have been tightened to the correct tightening torque.

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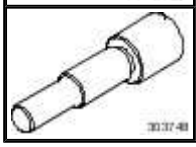
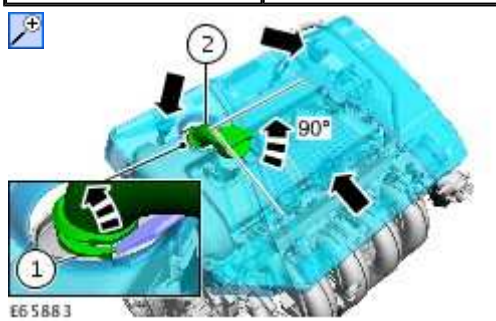
General Procedures

Special Tool(s)

	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

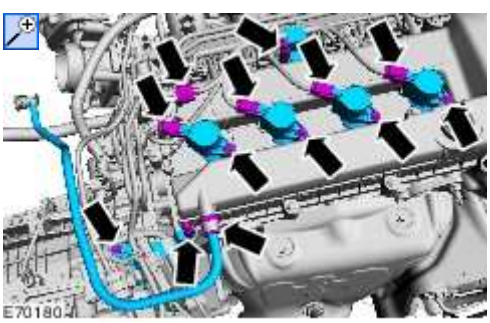
Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA



1.

2.



3.

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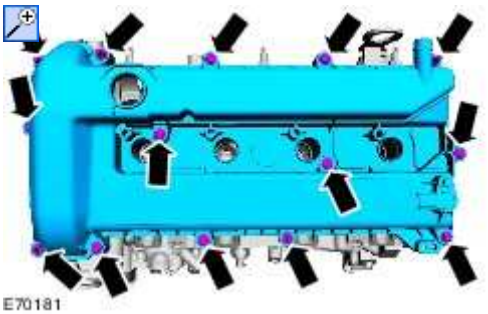
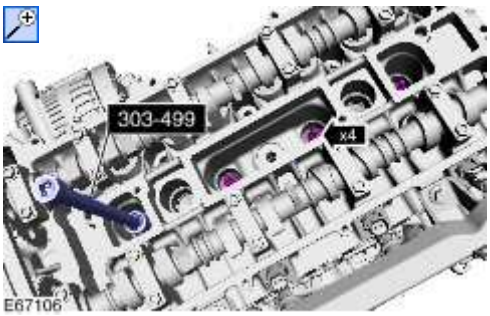
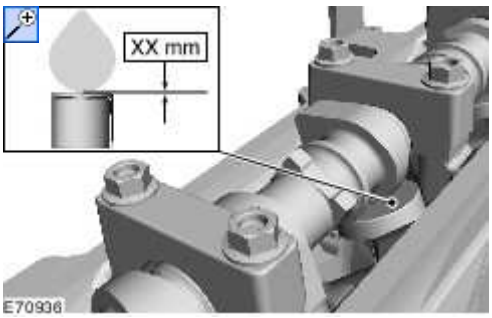


4. NOTE: The gasket is to be reused unless damaged.



5. *Special Tool(s):* 303-499



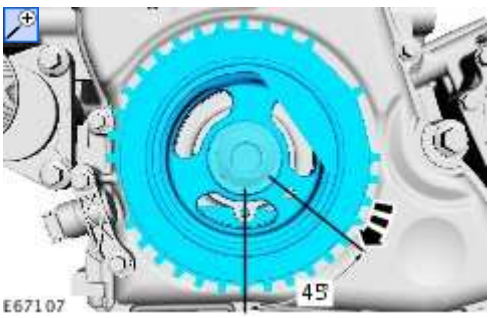
6. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until each piston is at top dead center (TDC) and measure the valve clearance(s), using a suitable set of feeler gauges.

7. Note down each cylinder number and the valve clearance(s) measured.

8. Compare the measured valve clearance(s) with the specifications.

   Refer to: Specifications (303-01A Engine - 2.0L Duratec-HE (MI4), Specifications).

9. NOTE: Only carry out the following steps when the valve clearance(s) require adjustment.



10. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until piston No. one is approximately 45 degrees before top dead center (TDC).

11.

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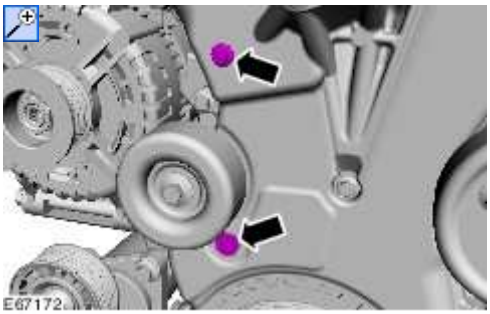

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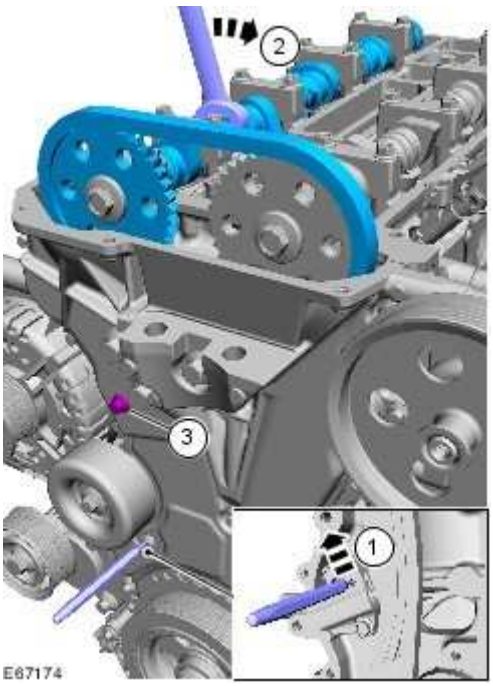
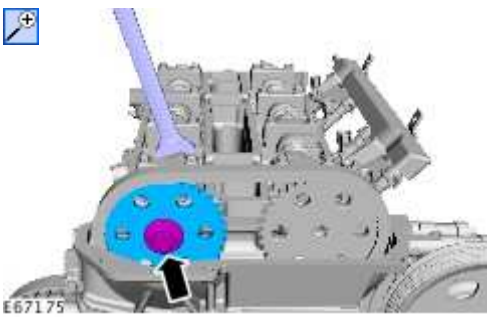


13.

1. Punch 2 mm
2. Open ended wrench
3. Bolt M6 x 25 mm



14. CAUTION: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.

15. CAUTION: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.
Loosen the intake camshaft sprocket retaining bolt by 5 turns.

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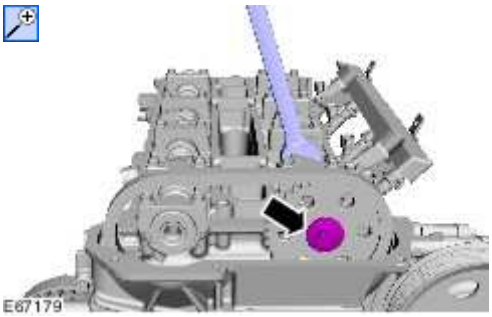
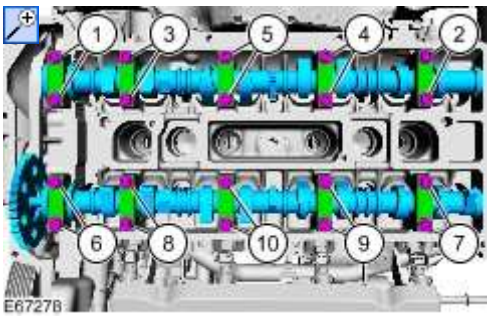


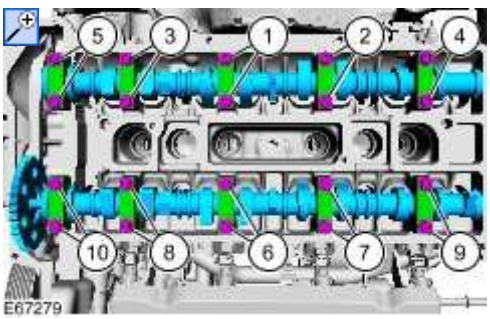


16. NOTE: Note the position of the bearings.

17.
- Remove the valve tappet and read the thickness from the underside.
- The number on the valve tappet is the valve tappet thickness, however only the decimal places are marked (for example .650 = 3.650).

18. Calculate the valve tappet thickness required (thickness of the currently installed tappet + the measured valve clearance - the required valve clearance).

19. Install the correct valve tappet.



20. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
Coat the camshaft bearing caps with oil.

Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

21. Install the camshafts approximately at valve overlap position cylinder No. 4.

Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm

22. NOTE: Only tighten the bolt finger tight at this stage.
NOTE: Make sure that the camshaft sprockets can rotate on the camshafts.

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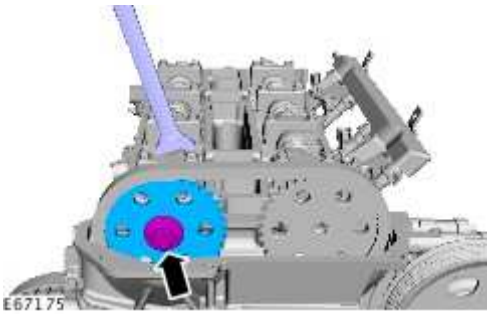
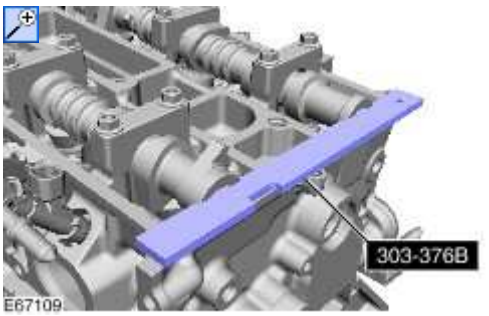
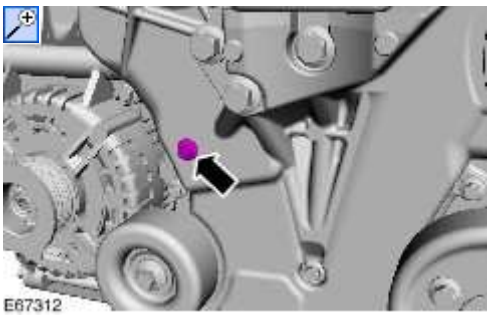




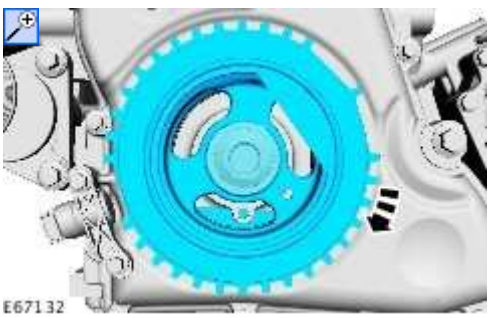
23. Install the special tool.

    Special Tool(s): 303-376B



24.
- Bolt M6 x 25 mm

25. Install the special tool.



26. CAUTION: Only rotate the crankshaft clockwise.
    Rotate the crankshaft until it contacts the special tool.

27. CAUTION: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.
    Torque: 72 Nm

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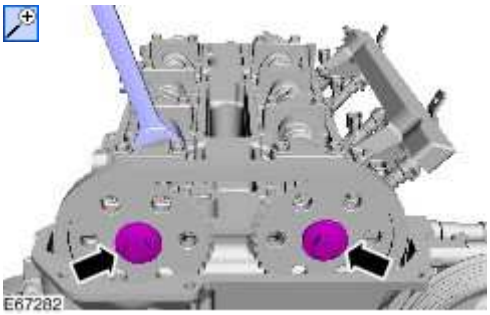
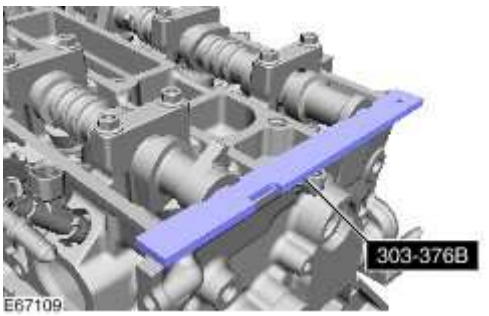


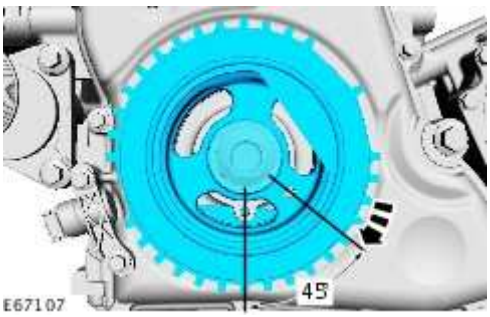


28. Remove the special tool.

    Special Tool(s): 303-376B

29. Remove the special tool.

    Special Tool(s): 303-748



30. CAUTION: Only rotate the crankshaft clockwise.
    Rotate the crankshaft one and three quarters until piston No. 1 is approximately 45 degrees before top dead center (TDC).

31. Install the special tool.

    Special Tool(s): 303-748

32. CAUTION: Only rotate the crankshaft clockwise.
    Rotate the crankshaft until it contacts the special tool.

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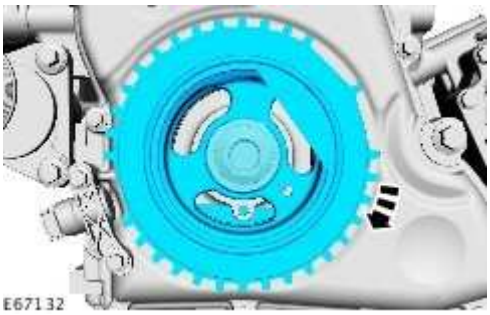
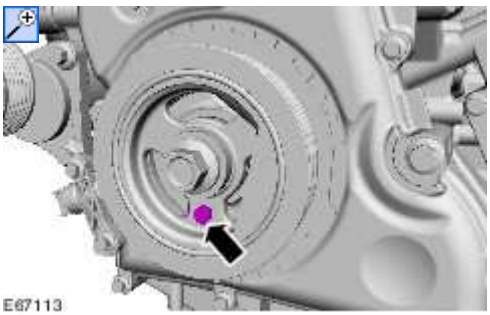
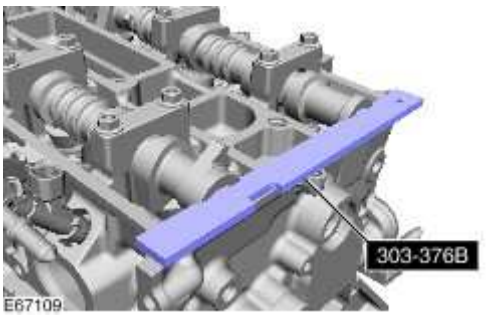


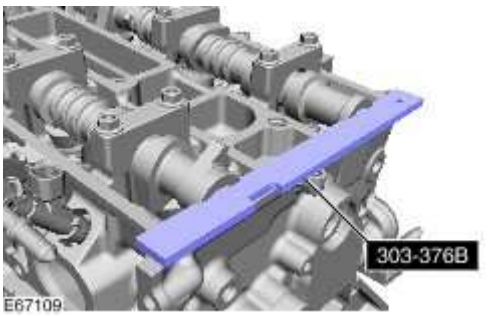


33. NOTE: Only tighten the bolt finger tight at this stage.
NOTE: The bolt can only be installed if the valve timing is correct.
    - Bolt M6 x 18 mm



34. NOTE: The special tool can only be installed if the valve timing is correct.
Install the special tool.

Special Tool(s): 303-376B



35. Remove the special tool.

Special Tool(s): 303-376B

36. Remove the special tool.

Special Tool(s): 303-748

37.

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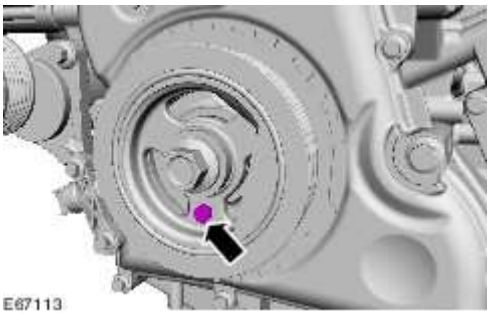
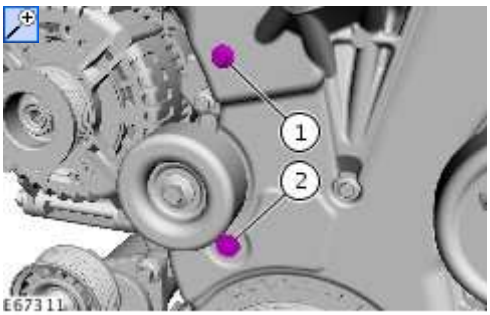


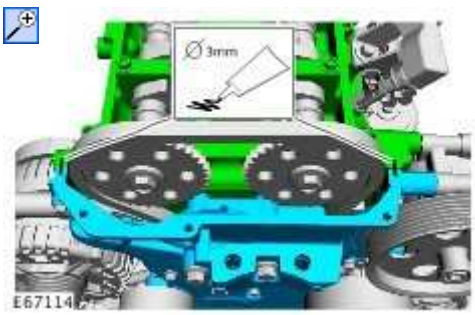
38. *Torque:* 20 Nm



39.
1. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
   Torque: 10 Nm
2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
   Torque: 12 Nm

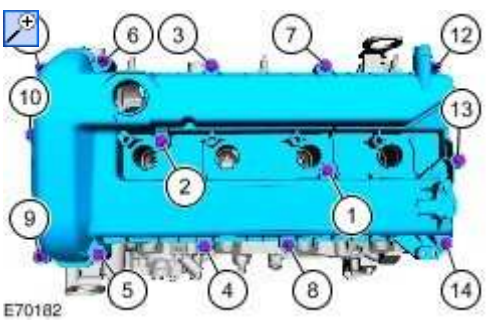
40. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until each piston is at (TDC) and measure the valve clearance(s).

41. Repeat the procedure as necessary until all valve clearances are within the specified tolerance.



42. Apply a small bead of sealant to the areas indicated.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



43. *Torque:* 10 Nm

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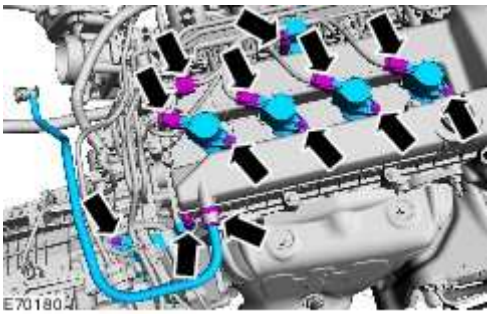
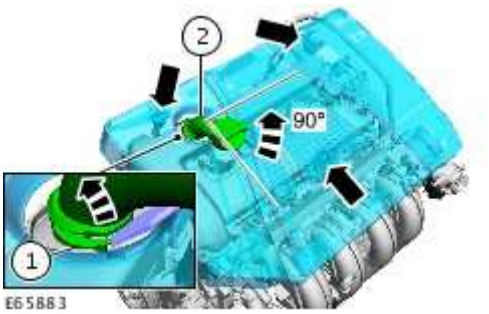


44. *Torque:* 10 Nm

45. *Torque:* 10 Nm



46.

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Removal and Installation

General Equipment

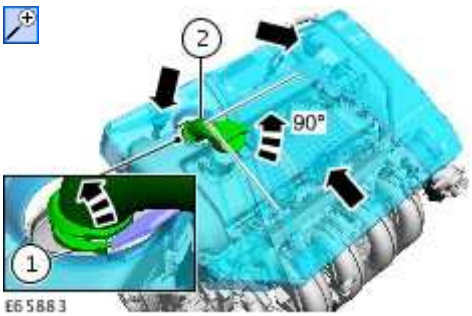
Hose clamp remover/installer
Trolley jack

Removal

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

1. Remove the right-hand head lamp unit.

   Refer to: Scheinwerfer (417-01 Außenbeleuchtung, Removal and Installation).



2.

3. Remove the air cleaner.

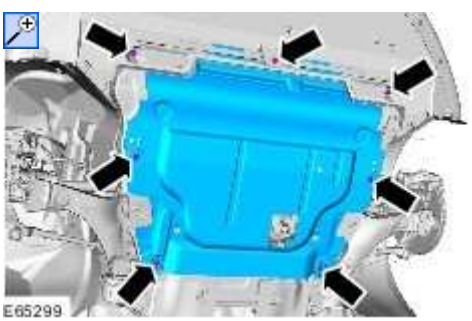
   Refer to: Luftfilter (303-12A Ansaugsystem - 2.0L Duratec-HE (MI4), Removal and Installation).

4. Disconnect the battery.

   Refer to: Batterie abklemmen (414-01 Batterie, Befestigung und Batteriekabel, General Procedures).

5. Raise the vehicle for access

   Refer to: Anheben mit Wagenheber (100-02 Fahrzeug anheben, Description and Operation).
   Refer to: Anheben mit Hebebühne (100-02 Fahrzeug anheben, Description and Operation).



6.

7.
   1. *Torque:* 18 Nm
   2. *Torque:* 47 Nm

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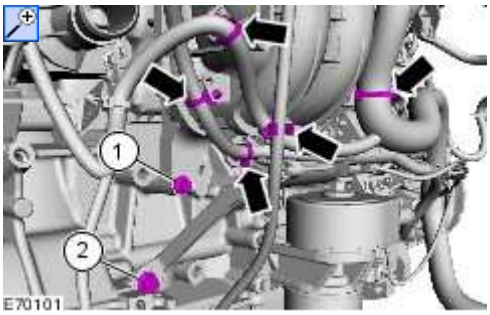
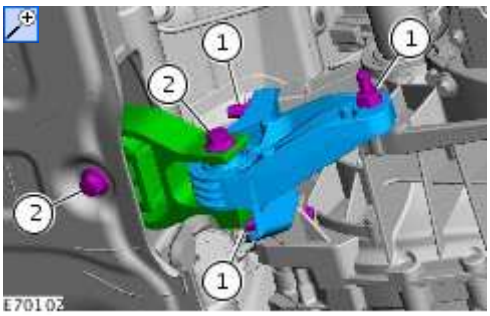
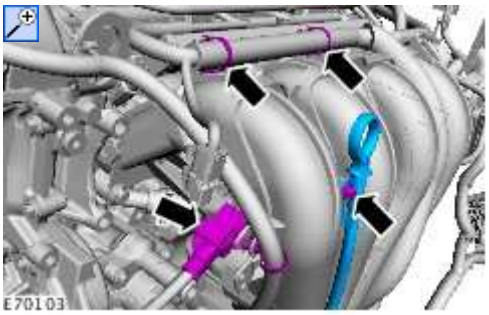


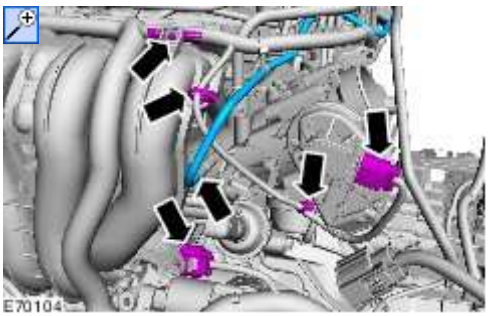


8.
   1. *Torque:* 48 Nm
   2. *Torque:* 80 Nm

9. Lower the vehicle.



10.
   - *Torque:* 10 Nm



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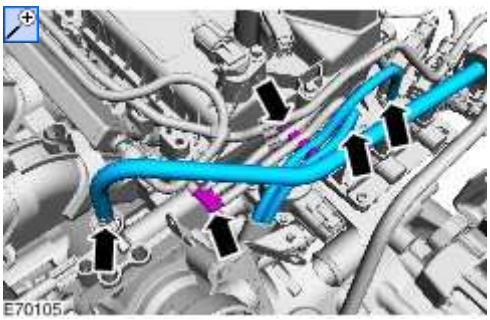

12.

13. *General Equipment:* Trolley jack

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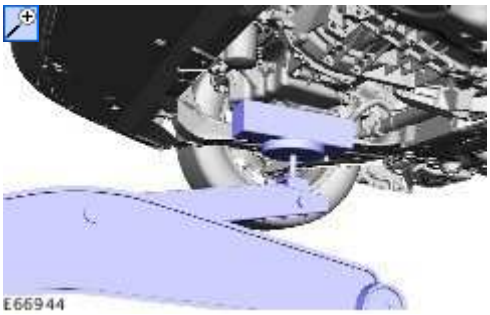
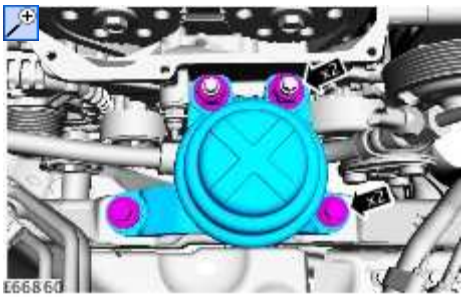
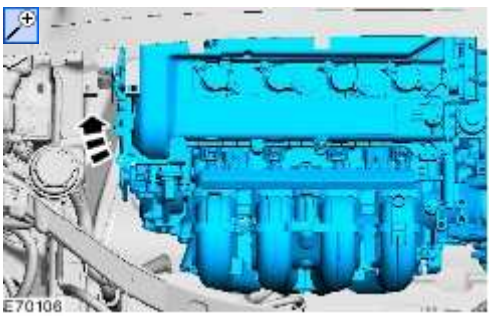
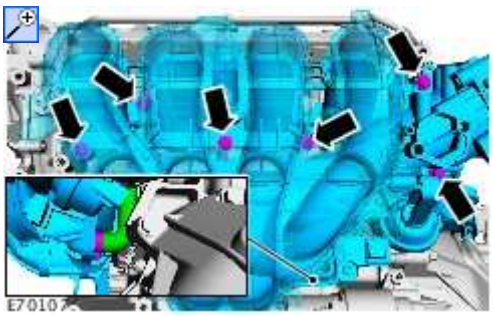




14. *Torque:*
    Bolts - front engine mounting 80 Nm
    Nuts - front engine mounting 90 Nm



15.



16. *General Equipment:* Hose clamp remover/installer
    Torque: 18 Nm

Installation

1. To install, reverse the removal procedure.
2. NOTE: During initialisation the pedals must be in the rest position.
   Turn the ignition key to position II and then wait one minute in order to initialise the throttle valve.
3. Turn the ignition key to the OFF position.

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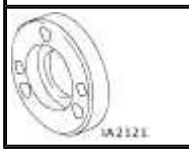
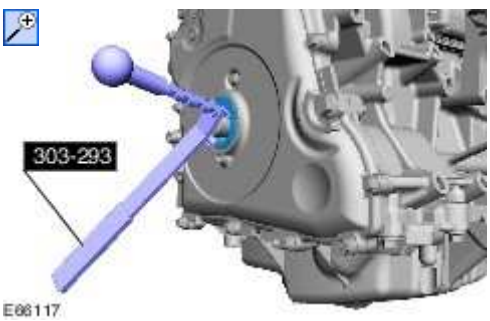
Removal and Installation

Special Tool(s)

	303-293 Remover, Crankshaft Seal
	303-509 Remover, Vibration Damper Hub

Removal

1. Refer to: Crankshaft Pulley (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
2. *Special Tool(s):* 303-293



3.
   - Discard the friction washer.

Installation

1. CAUTION: Make sure that a new friction washer is installed.
2. *Special Tool(s):* 303-509

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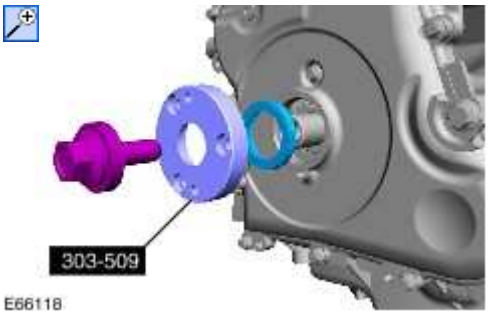

3. Refer to: Crankshaft Pulley (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).

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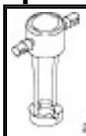
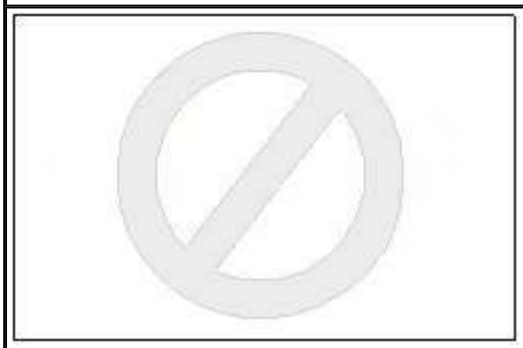
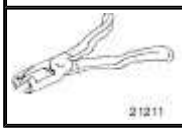
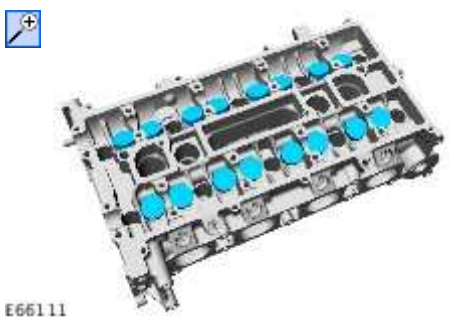
Removal and Installation

Special Tool(s)

	303-361-02 Adapter for 303-361A
	303-361A Compressor, Valve Spring
	303-362 Installer, Valve Stem Collets
	303-363 Adapter, Air Supply (Cylinder Head)
	303-508 Pliers, Valve Stem Seal

Removal

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

1. Refer to: Camshafts (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
2. 
E66111
3. *Special Tool(s):* 303-363

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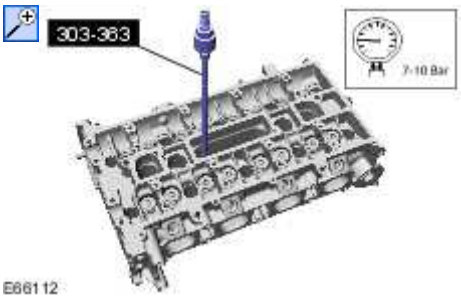
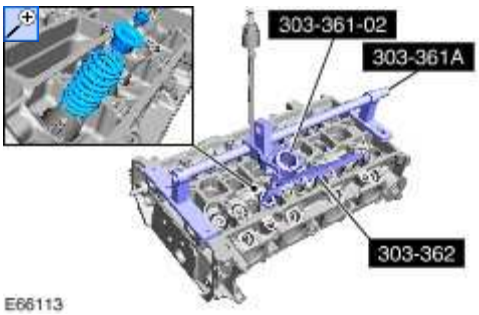
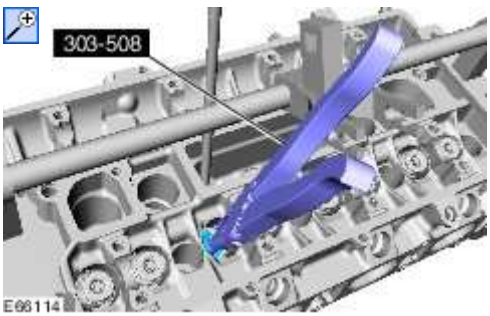




4. *Special Tool(s):* 303-361A, 303-361-02, 303-362



5. *Special Tool(s):* 303-508

Installation

1. To install, reverse the removal procedure.

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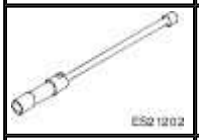
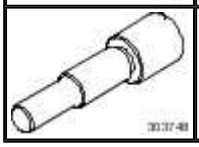
Removal and Installation

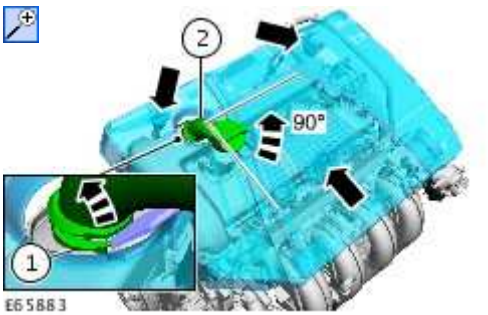
Special Tool(s)

	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

Removal



1.

2. Remove the drive belt.

   Refer to: Antriebsriemen - Zusatzaggregate (303-05A Antrieb - Zusatzaggregate - 2.0L Duratec-HE (MI4), Removal and Installation).

3.

4.

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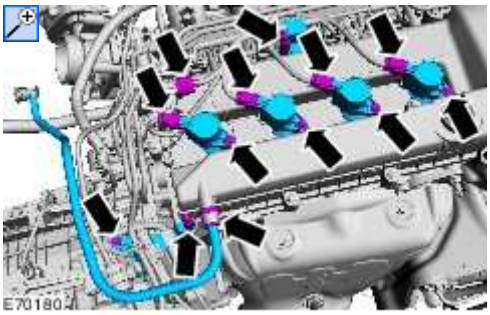
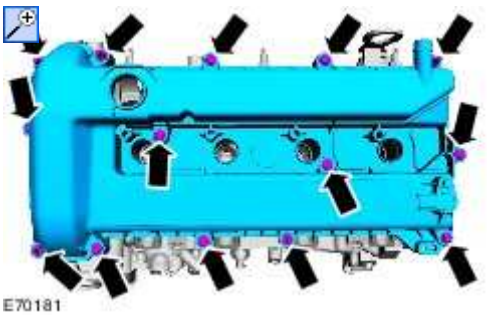
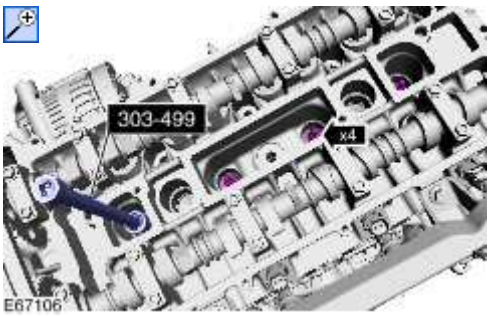
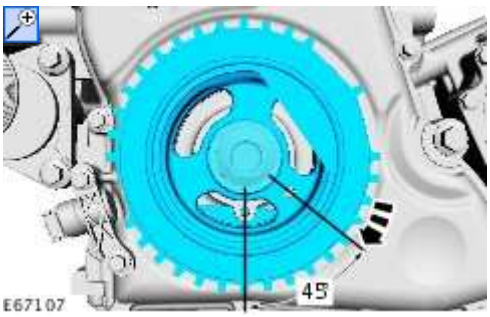




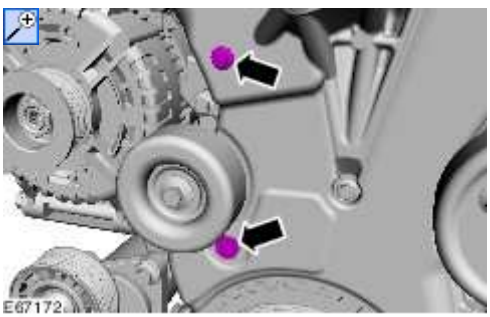
5. NOTE: If the gaskets are not damaged, re-use them.



6. *Special Tool(s):* 303-499



7. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until no. 1 piston is at about 45° before TDC.



8.

9.

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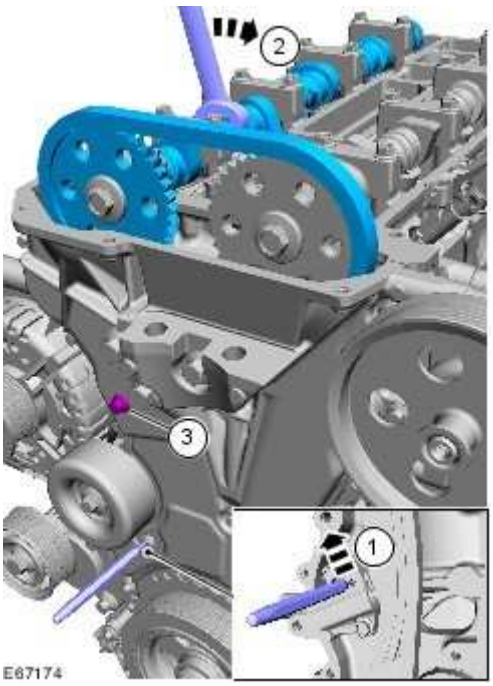
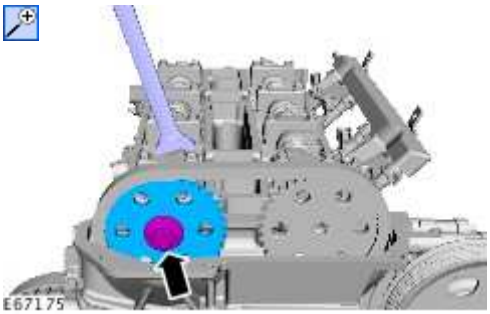
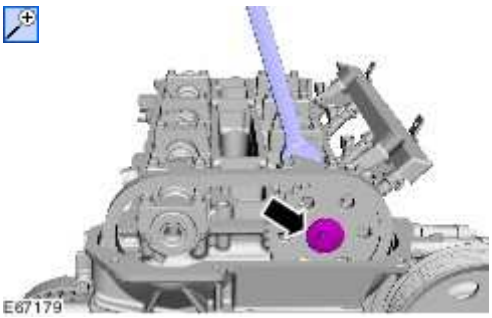


10.
1. Release the chain tensioner using a 2 mm pin punch.
2. Tension the timing chain.
3. NOTE: Only tighten the bolt finger tight at this stage.
   Secure the timing chain guide using an M6 x 25 mm bolt.



11. WARNING: Counterhold the camshafts at the hexagon using an open-ended spanner to prevent the camshafts from rotating.



12. WARNING: Counterhold the camshafts at the hexagon using an open-ended spanner to prevent the camshafts from rotating.
Undo the bolt of the camshaft sprocket by 5 turns.

13. CAUTION: Make a note of/mark the installed positions of the components before removal.

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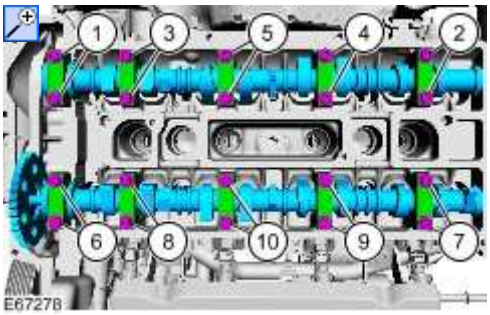
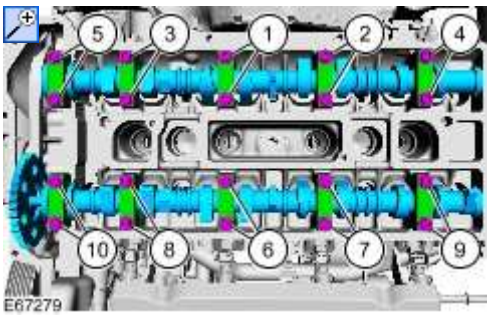


Installation



1. WARNING: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
   Apply oil to the camshaft bearing caps.

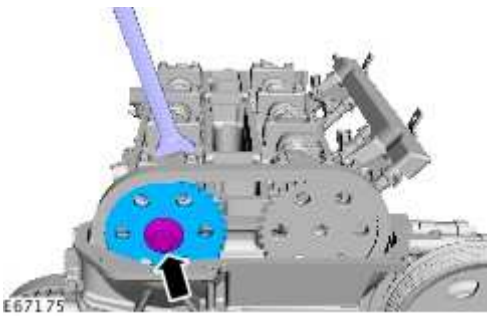
   Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

2. Install the camshafts approximately at valve overlap position cylinder No. 4.

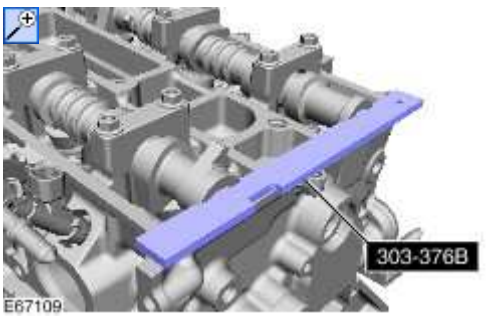
   Torque:
   Stage 1: 7 Nm
   Stage 2: 16 Nm

3. NOTE: This step is only required when installing a new component.
   Adjust the valve clearances.

   Refer to: Ventilspiel einstellen (303-01A Motor - 2.0L Duratec-HE (MI4), General Procedures).



4. NOTE: Only tighten the bolt finger tight at this stage.
   NOTE: Make sure that the camshaft sprockets can rotate on the camshafts.



5. Install the special tool.

   Special Tool(s): 303-376B

6.

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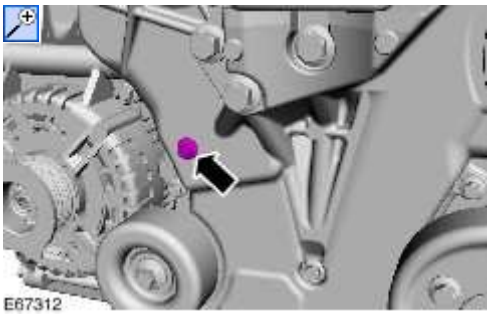
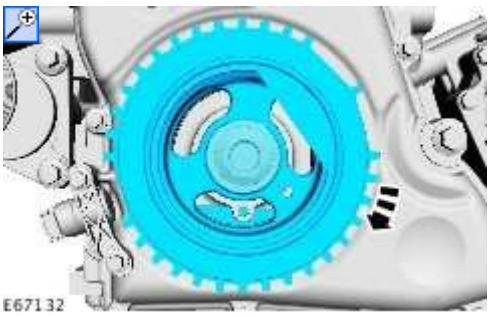
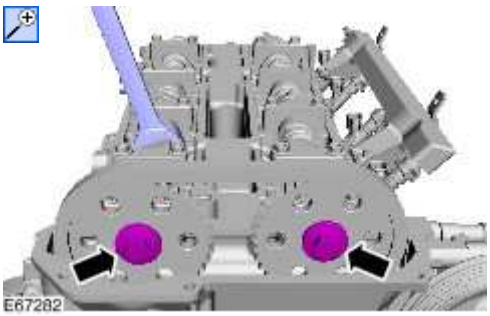


7. Install the special tool.

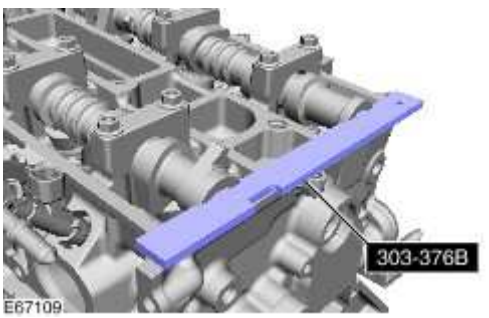
   Special Tool(s): 303-748



8. WARNING: Only rotate the crankshaft clockwise.
   Turn the crankshaft until it stops against the special tool.



9. WARNING: Counterhold the camshafts at the hexagon using an open-ended spanner to prevent the camshafts from rotating.
   Torque: 72 Nm



10. Remove the special tool.

    Special Tool(s): 303-376B

11. Remove the special tool.

    Special Tool(s): 303-748

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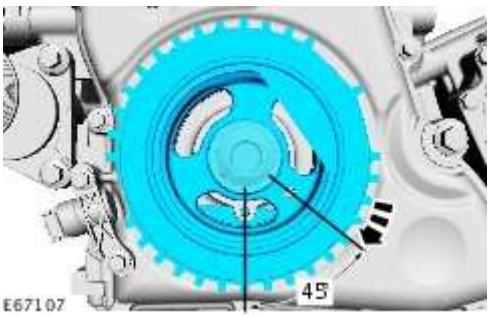
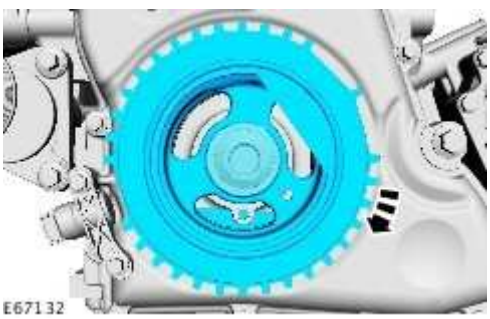


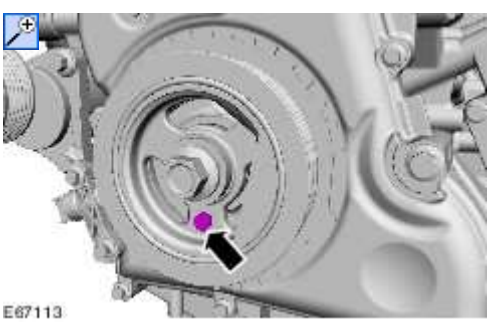
12. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft one and three quarters of a turn until no. 1 piston is at about 45° before TDC.

13. Install the special tool.

Special Tool(s): 303-748



14. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.



15. NOTE: Only tighten the bolt finger tight at this stage.
NOTE: The bolt may only be installed if the valve timings are correct.
    - Bolt M6 x 18 mm

16. NOTE: The special tool may only be installed if the valve timings are correct.
Install the special tool.

Special Tool(s): 303-376B

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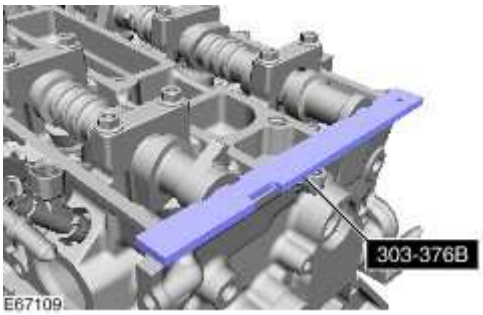
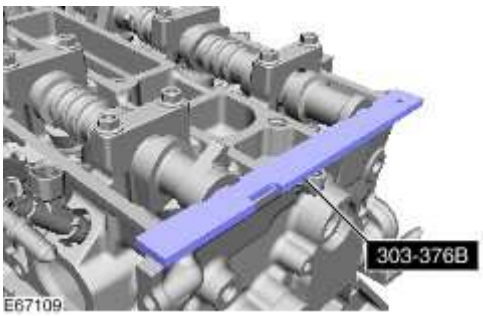


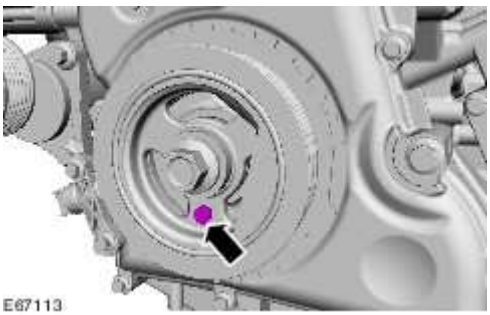


17. Remove the special tool.

    Special Tool(s): 303-376B

18. Remove the special tool.

    Special Tool(s): 303-748



19.

20. *Torque:* 20 Nm

21.
    1. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 10 Nm
    2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 12 Nm

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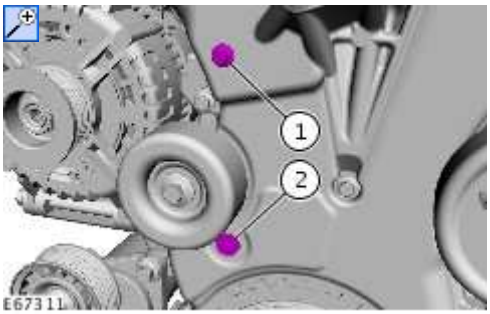
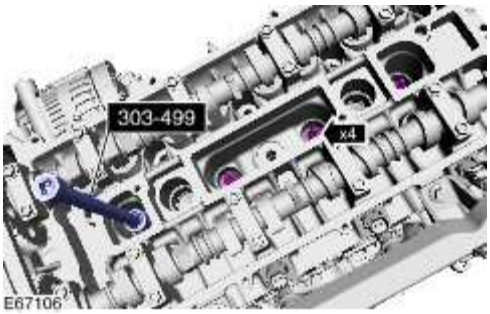
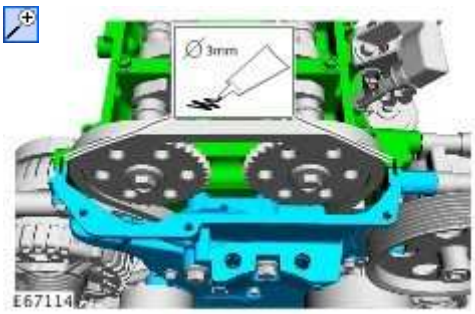


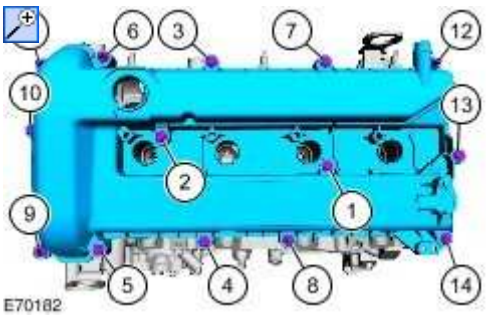


22. *Special Tool(s):* 303-499
Torque: 12 Nm

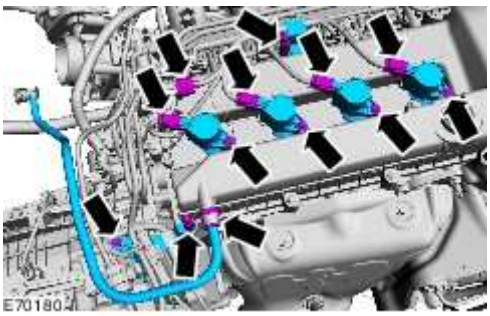


23. Apply a small bead of sealant to the areas shown.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



24. *Torque:* 10 Nm



25. *Torque:* 10 Nm

26. *Torque:* 10 Nm

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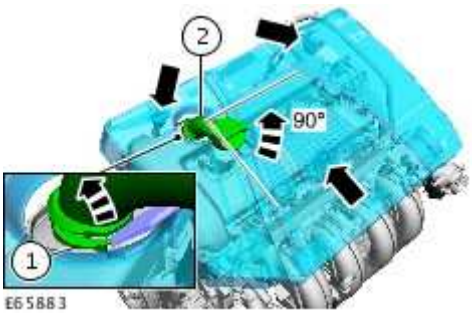
27. Install the drive belt.

    Refer to: Antriebsriemen - Zusatzaggregate (303-05A Antrieb - Zusatzaggregate - 2.0L Duratec-HE (MI4), Removal and Installation).

28.



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Removal and Installation

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

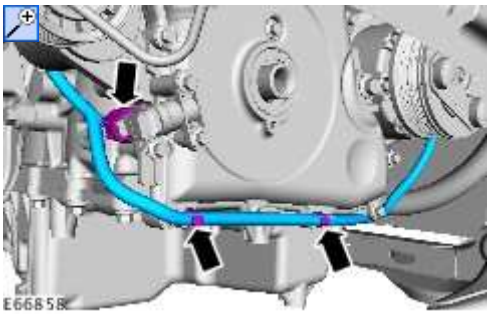
General Equipment

Trolley jack

Removal

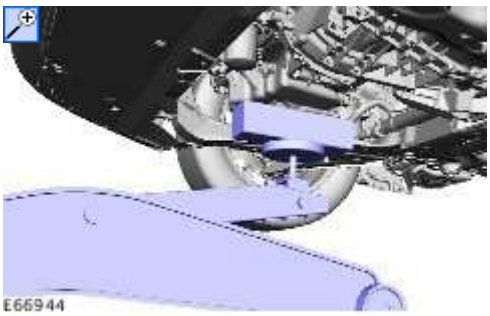
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the following items:
    1. Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
    2. Refer to: Crankshaft Pulley (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



2.

3.



4. *General Equipment:* Trolley jack

5.

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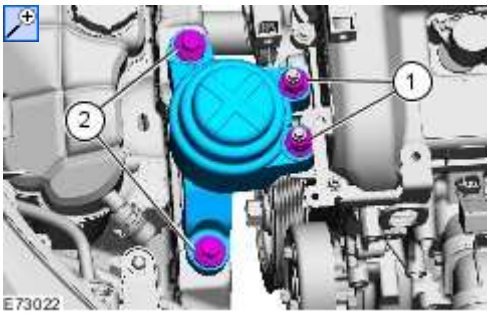
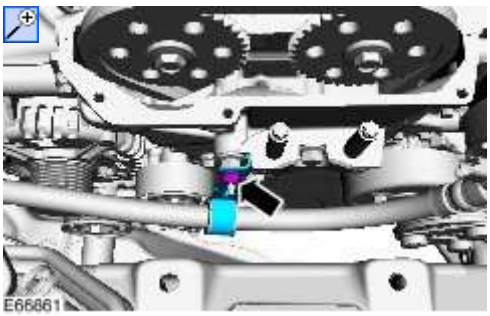
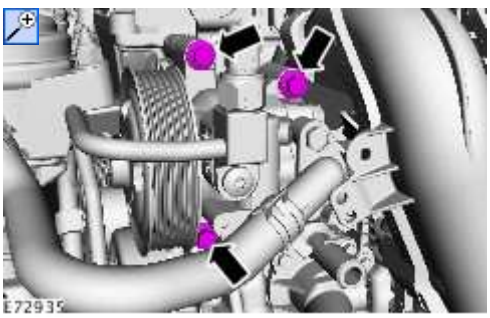
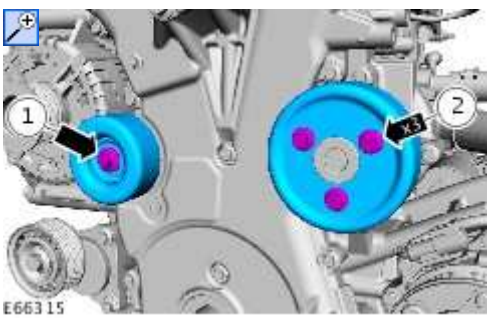




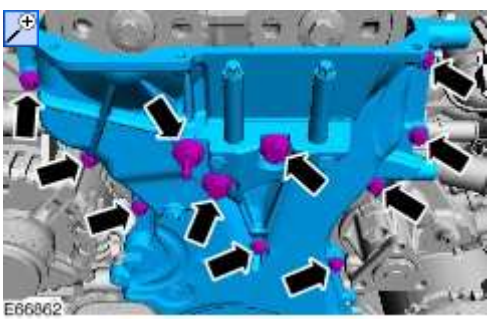
6. *Torque:* 15 Nm



7. *Torque:* 25 Nm



8. *Torque:* 25 Nm



9.

Installation

1. To install, reverse the removal procedure.
2.
   - *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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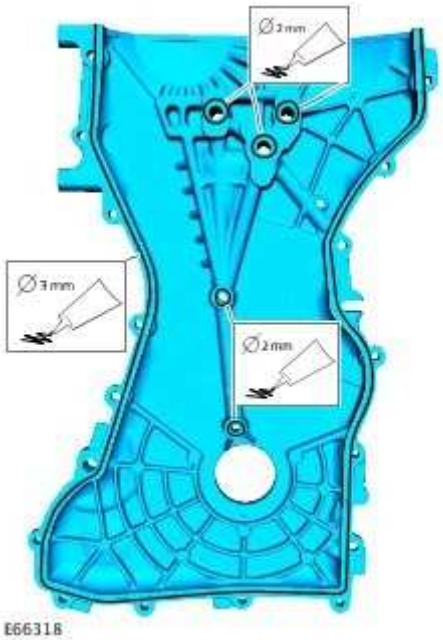
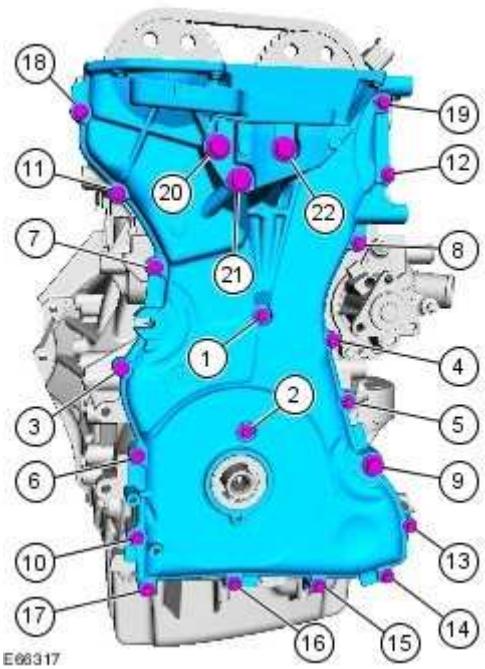
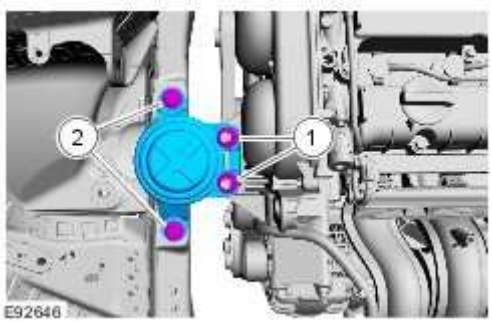


E66318



E68317

3. *Torque:*
   1-8 10 Nm
   9 48 Nm
   10-19 10 Nm
   20-22 48 Nm



E92646

4.
   1. *Torque:* 80 Nm
   2. NOTE: Only tighten the bolts finger tight at this stage.
   3. Lower the jack.

5. *Torque:* 90 Nm

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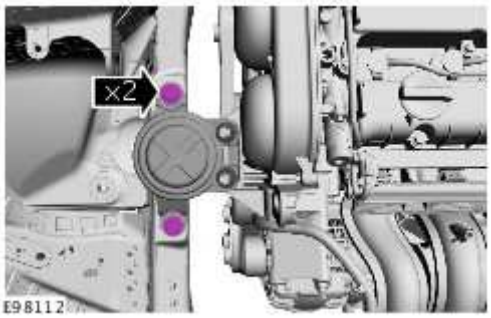

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Removal and Installation

Special Tool(s)

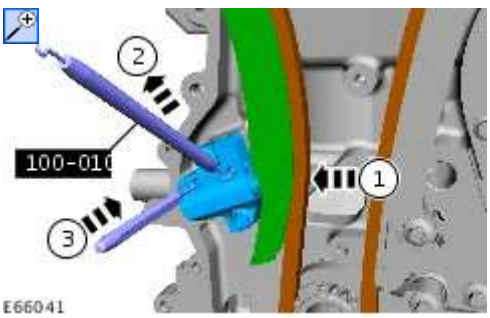
	100-010 Remover, O-Ring Seal

General Equipment

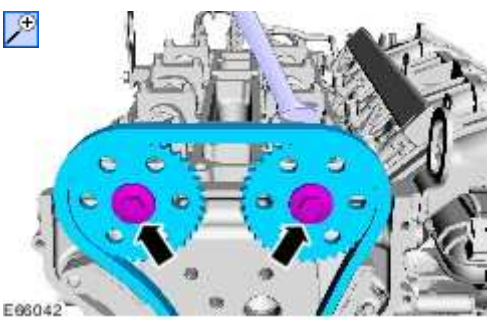
2 mm punch

Removal

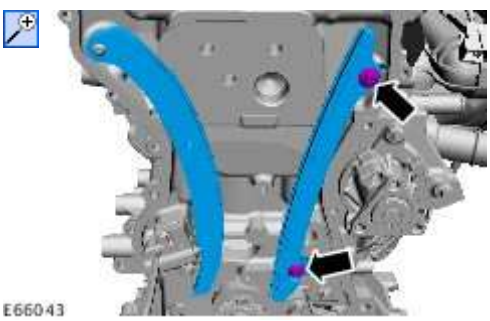
1. Remove the following items:
   1. Refer to: Engine Front Cover (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



2.
   2. *Special Tool(s):* 100-010
   3. *General Equipment:* 2 mm punch



3. CAUTION: Counterhold the camshafts at the hexagon using an open-ended spanner to prevent the camshafts from turning.



4.

5. *General Equipment:* 2 mm punch

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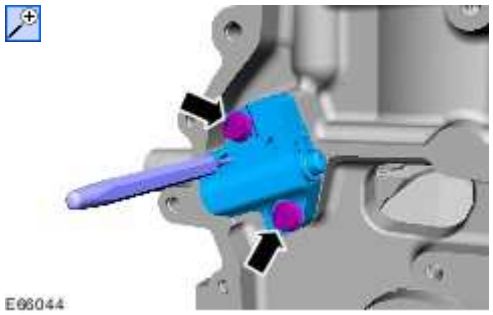
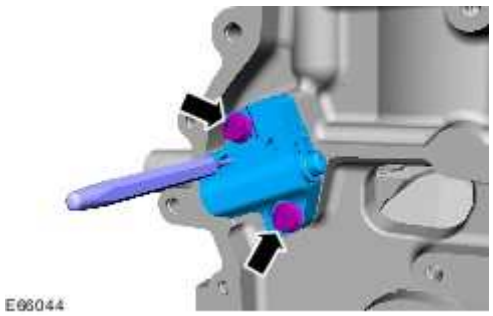
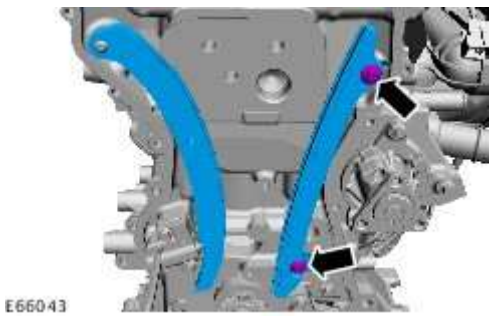


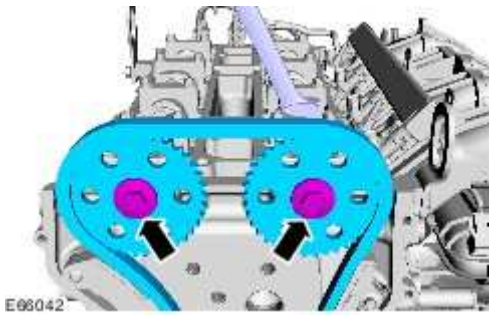
Installation



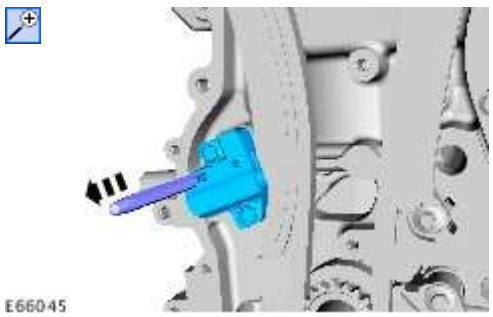
1. *General Equipment:* 2 mm punch
   Torque: 10 Nm



2. *Torque:* 10 Nm



3. NOTE: Only tighten the bolts finger tight at this stage.



4. *General Equipment:* 2 mm punch

5. CAUTION: Counterhold the camshafts at the hexagon using an open-ended spanner to prevent the camshafts from turning.
   Torque: 72 Nm

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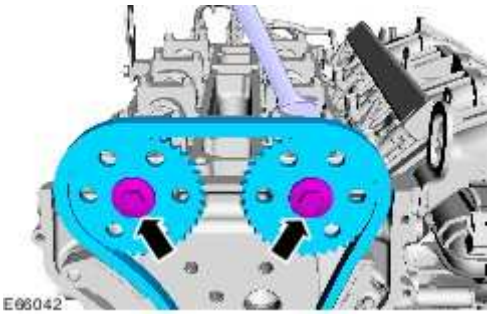

6. Install the following items:
    1. Refer to: Engine Front Cover (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).

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Removal and Installation

Special Tool(s)

	310-137 Disconnect Tool, Fuel Line

Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA

General Equipment

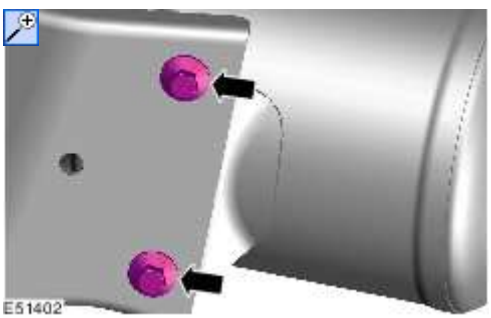
Hose clamp remover/installer

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
3. Remove the following items:
   1. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   2. Refer to: Generator - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (414-02 Generator and Regulator, Removal and Installation).



4. *Torque:* 24 Nm
5.

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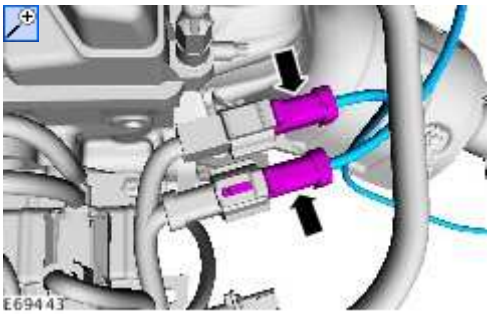
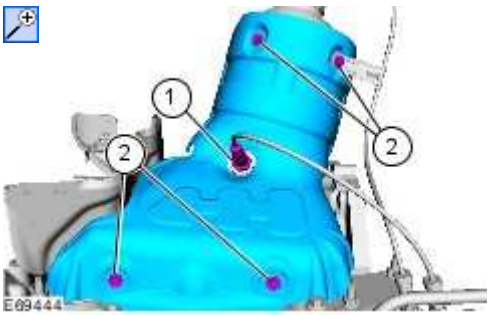
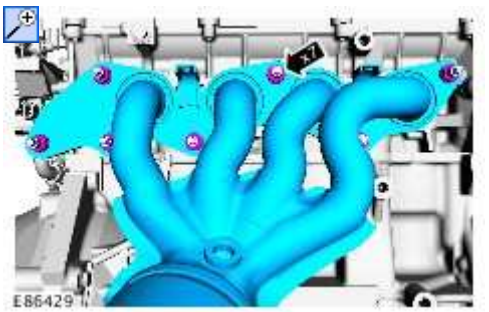


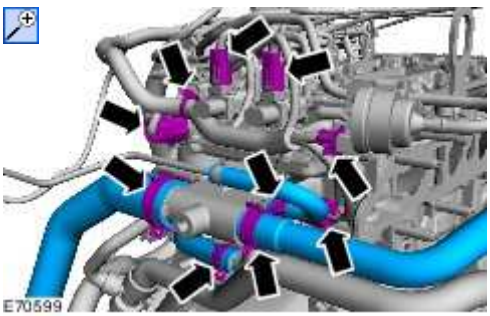


6.
1. *Torque:* 48 Nm
2. *Torque:* 10 Nm



7. CAUTION: No sealant must be used upstream of the catalytic converter.
Torque: 55 Nm

8. Remove the following items:
1. Refer to: Intake Manifold (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
2. Refer to: Timing Chain (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



9. *General Equipment:* Hose clamp remover/installer

10. *Special Tool(s):* 310-137
General Equipment: Hose clamp remover/installer

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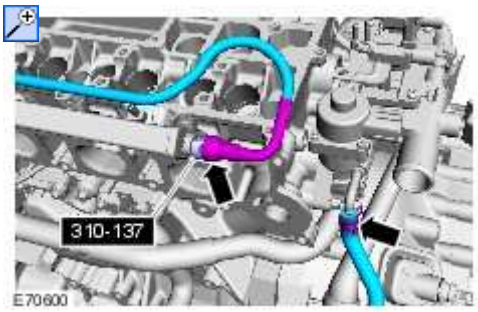
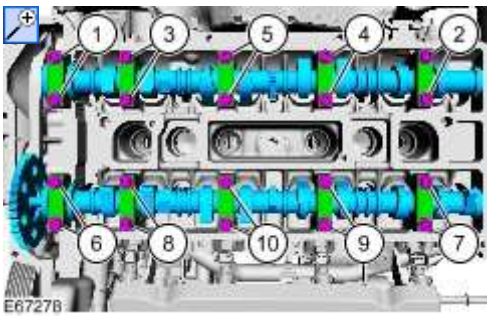
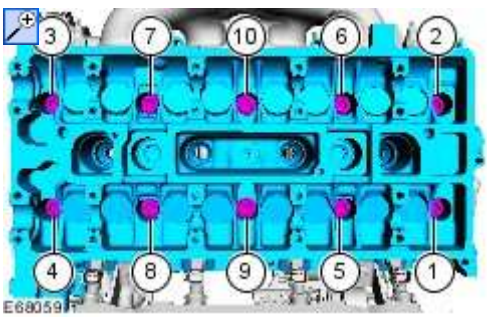


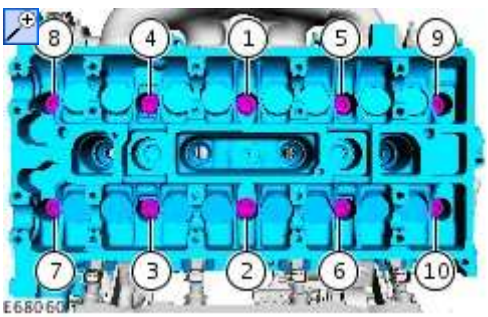


11. CAUTION: Make a note of/mark the installed positions of the components before removal.



12. Remove and discard the cylinder head bolts.

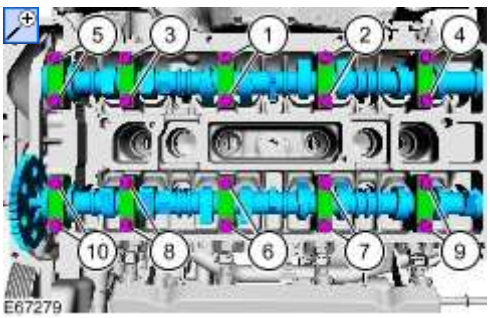
Installation



1. Install the components in reverse order.
2. Install new cylinder head bolts.

   Torque:

   Stage 1: 5 Nm
   Stage 2: 15 Nm
   Stage 3: 45 Nm
   Stage 4: 90°
   Stage 5: 90°



3. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
   Apply hypoid gear oil to the camshaft bearing caps.

   Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

4. Install the camshafts approximately at valve overlap position cylinder No. 4.

   Torque:

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	Stage 1: 7 Nm Stage 2: 16 Nm

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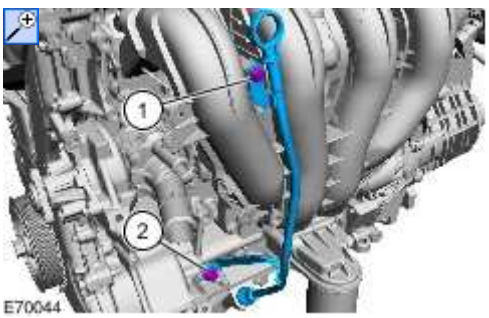
Removal and Installation

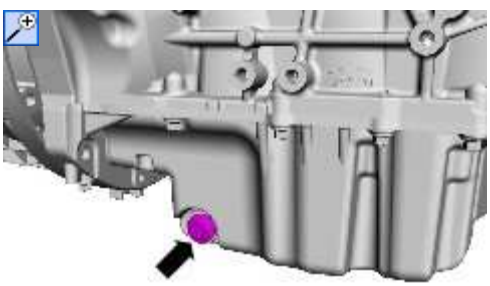
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

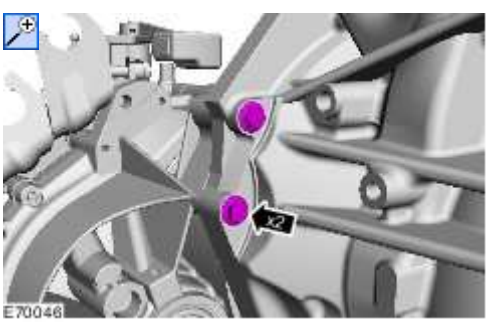
Removal



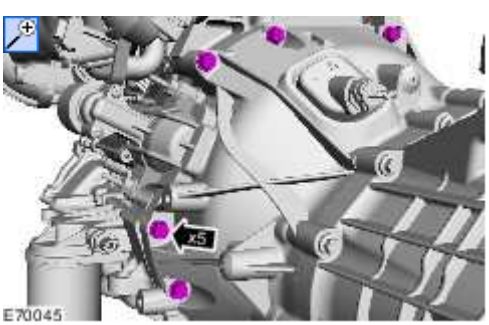
1. NOTE: Reuse the oil seal if it is not damaged.



2. NOTE: Reuse the oil seal if it is not damaged.



3. *Loosen:* 5 turn(s)



4. *Loosen:* 5 turn(s)

5.

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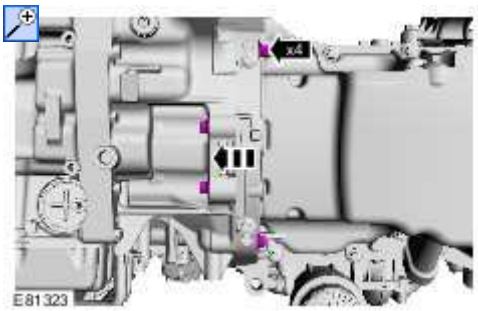
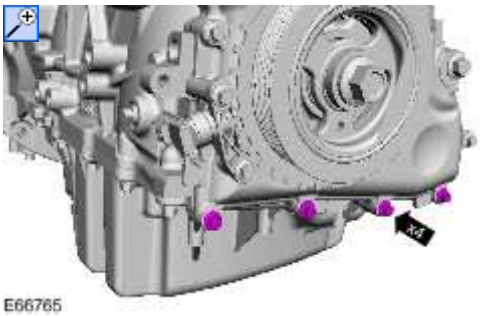
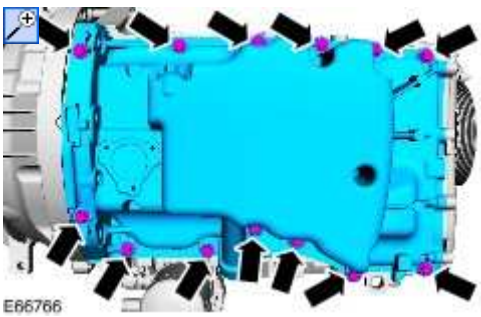


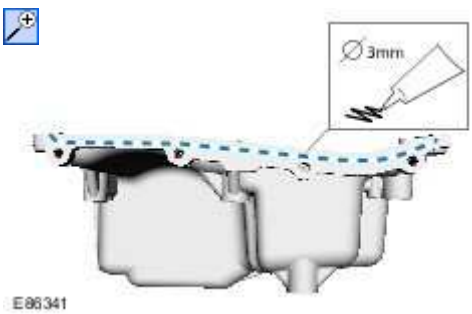


6.

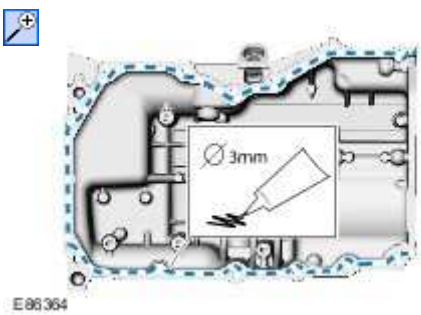


7.

Installation



1. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

3. NOTE: Only tighten the bolts finger tight at this stage.

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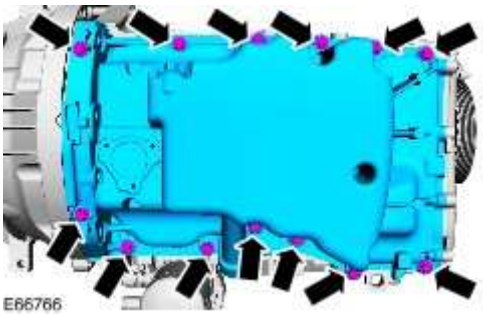
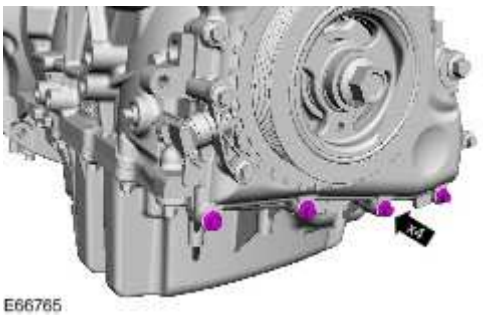
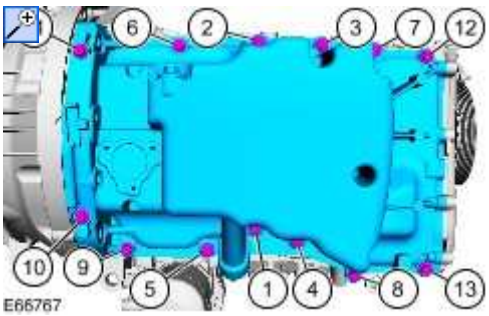
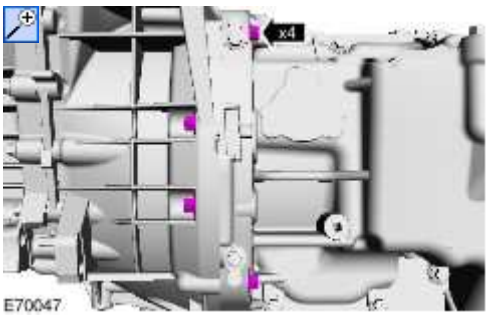




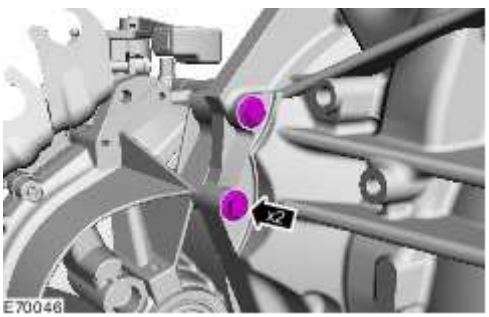
4. *Torque:* 10 Nm



5. *Torque:* 25 Nm



6. *Torque:* 40 Nm



7. *Torque:* 40 Nm

8. *Torque:* 40 Nm

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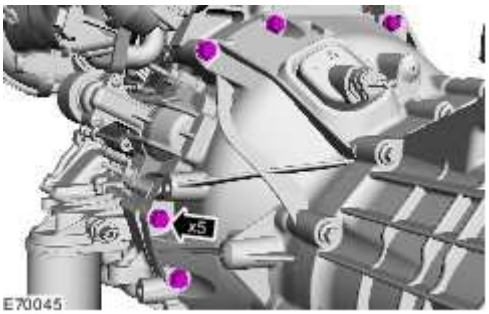

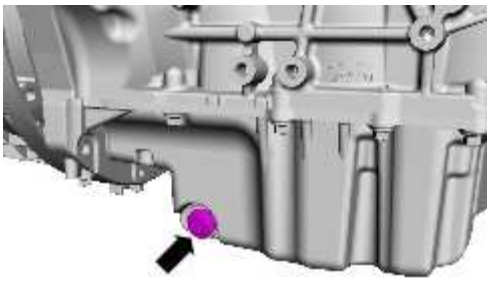
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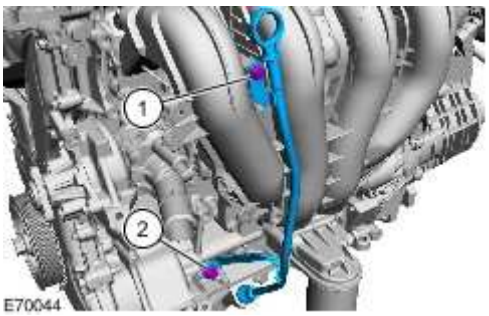
9. *Torque:* 25 Nm



10. *Torque:* 10 Nm

11. CAUTION: Make sure that fluid level is to the MAX mark.
Refer to: Specifications (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Specifications).
Material: Engine Oil - 5W-30 (WSS-M2C913-C)

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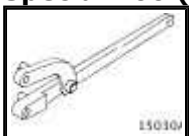
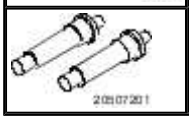
Removal and Installation

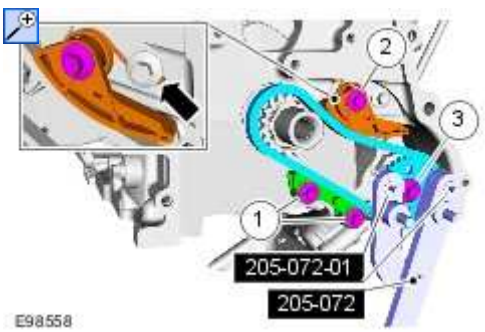
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072

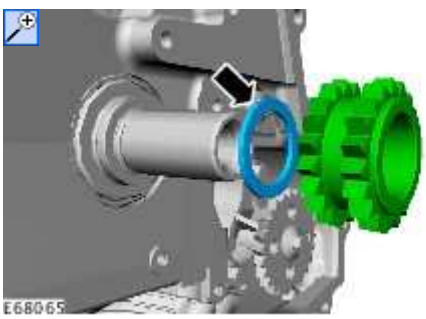
Removal

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

1. Remove the following items:
    1. Refer to: Timing Chain (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
    2. Refer to: Oil Pan (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



2.
    1. *Torque:* 10 Nm
    2. *Torque:* 10 Nm
    3. *Special Tool(s):* 205-072, 205-072-01
       Torque: 25 Nm



3. CAUTION: Make sure that a new friction washer is installed.

4. *Torque:*
   Stage 1: 10 Nm
   Stage 2: 23 Nm

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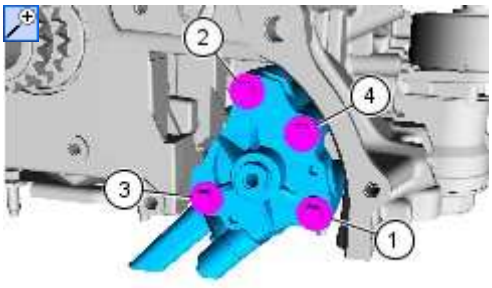

E68033

Installation

1. To install, reverse removal procedure

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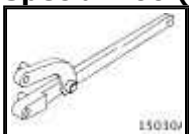
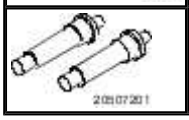
Removal and Installation

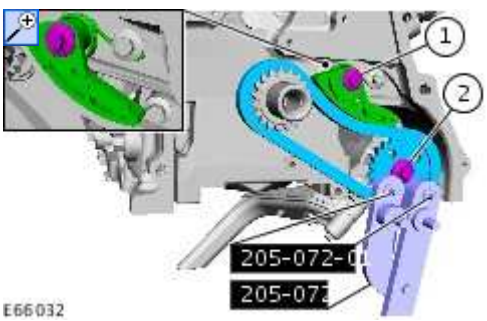
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072

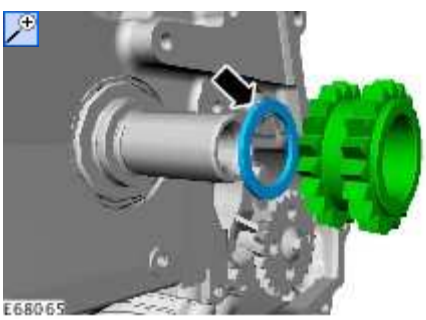
Removal

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

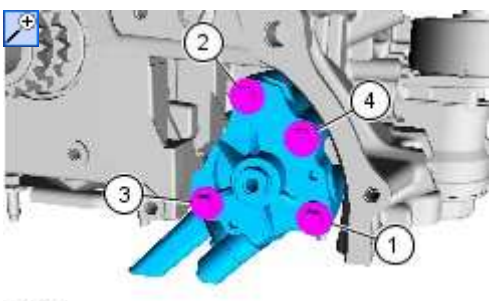
1. Remove the following items:
    1. Refer to: Timing Chain (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
    2. Refer to: Oil Pan (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



2.
    1. *Torque:* 10 Nm
    2. *Special Tool(s):* 205-072, 205-072-01
    Torque: 25 Nm



3. CAUTION: Make sure that a new friction washer is installed.



4. *Torque:*
    Stage 1: 10 Nm
    Stage 2: 23 Nm

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Installation

1. To install, reverse the removal procedure.

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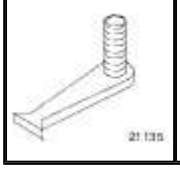
Removal and Installation

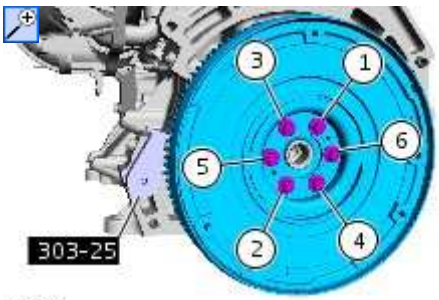
Special Tool(s)

	303-254 Locking Tool, Flywheel

Removal

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

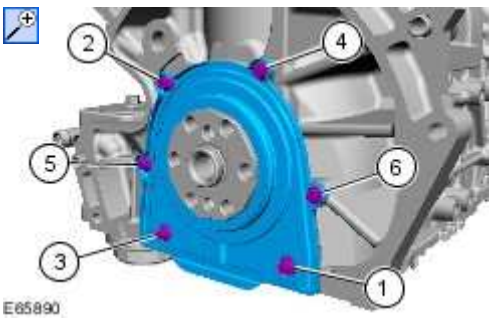
1. Remove the following items:
    1. Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal and Installation).
    2. Refer to: Oil Pan (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



E65889

2. Discard the flywheel bolts.

    Special Tool(s): 303-254
    Torque:
    Stage 1: 50 Nm
    Stage 2: 80 Nm
    Stage 3: 112 Nm



E65890

3. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
    Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.

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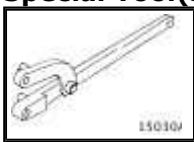
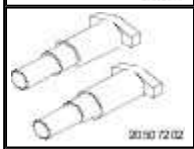
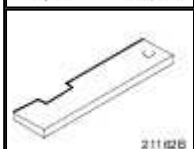
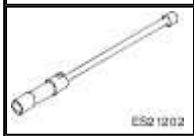
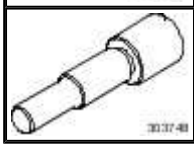
Removal and Installation

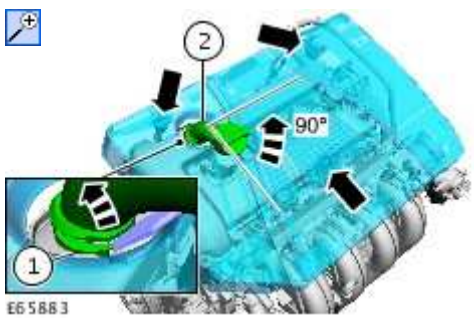
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal



1. Remove the auxiliary drive belt.

   Refer to: Antriebsriemen - Zusatzaggregate (303-05A Antrieb - Zusatzaggregate - 2.0L Duratec-HE (MI4), Removal and Installation).

2.

3.

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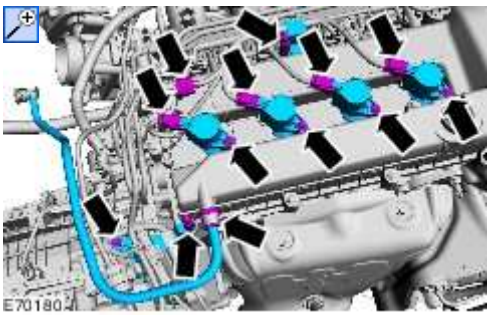
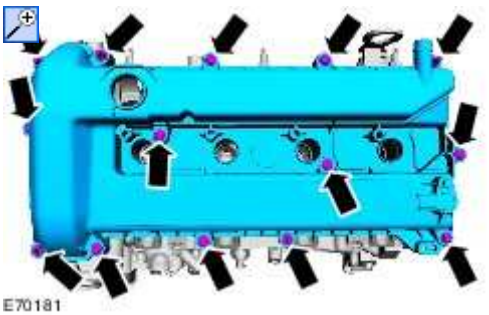
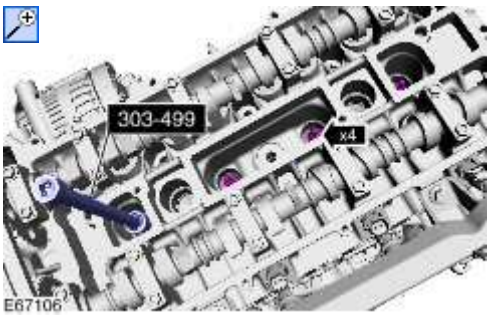


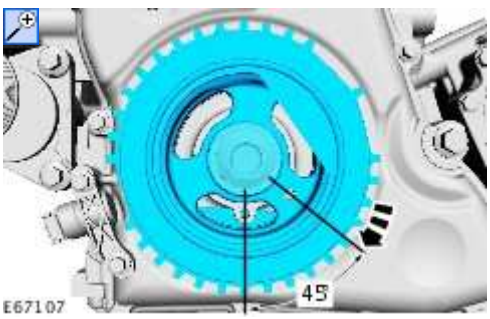
4.



5. NOTE: The gaskets are to be reused unless damaged.



6. *Special Tool(s):* 303-499



7. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until no. 1 piston is at about 45° before TDC.

8. *Special Tool(s):* 205-072, 205-072-02

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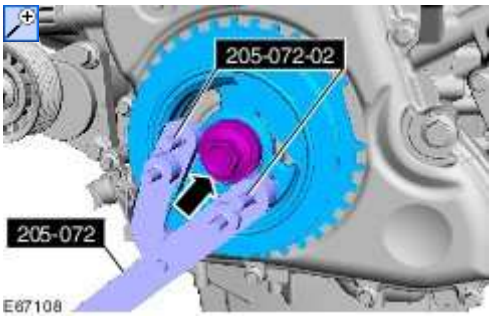
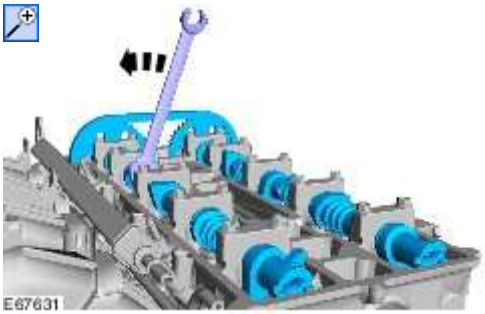


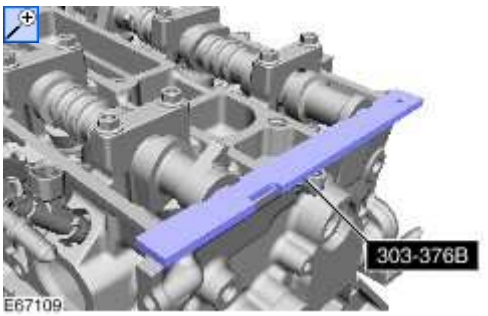
Installation

1. Install the crankshaft oil seal.

   Refer to: Kurbelwellendichtring vorn (303-01A Motor - 2.0L Duratec-HE (MI4), Removal and Installation).



2. WARNING: Only rotate the camshaft clockwise.
   Turn the camshafts to cylinder no. 4 valve overlap position.



3. Install the special tool.

   Special Tool(s): 303-376B

4.

5. Install the special tool.

   Special Tool(s): 303-748

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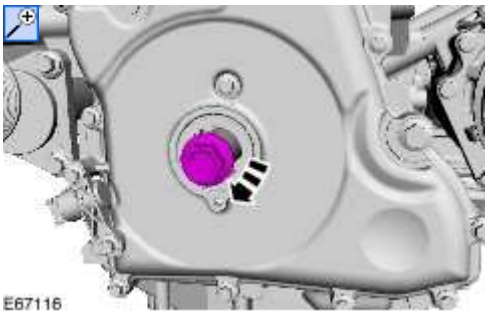
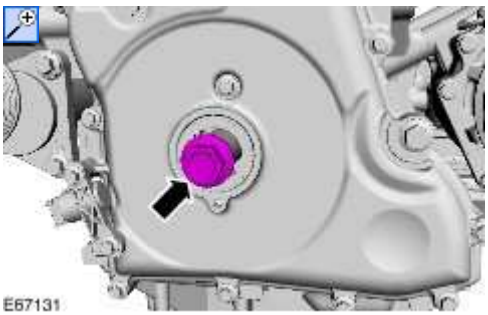
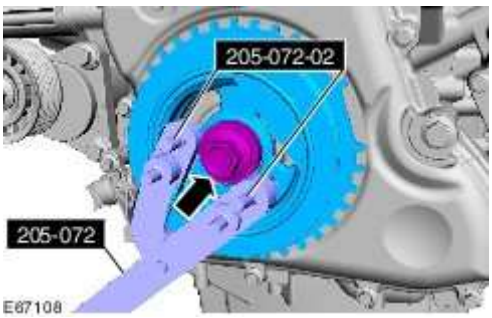


6. WARNING: Only rotate the crankshaft clockwise.
   Turn the crankshaft until it stops against the special tool.

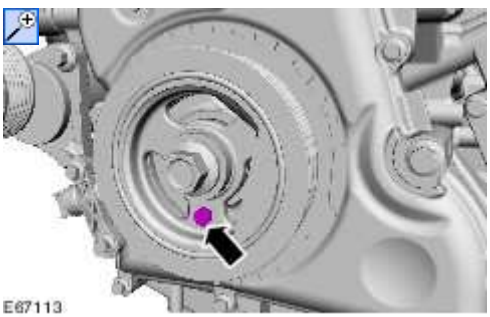


7.

8. NOTE: Only tighten the bolt finger tight at this stage.
   - Bolt M6 x 18 mm



9. *Special Tool(s):* 205-072, 205-072-02
   Torque:
   Stage 1: 100 Nm
   Stage 2: 90°



10.

11. Remove the special tool.

    Special Tool(s): 303-376B

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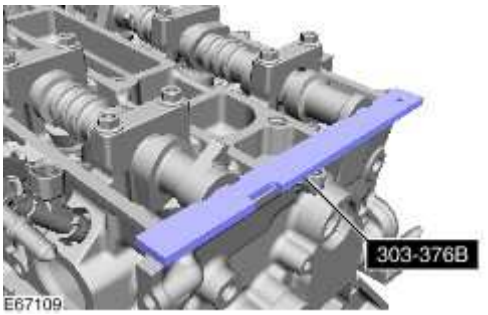
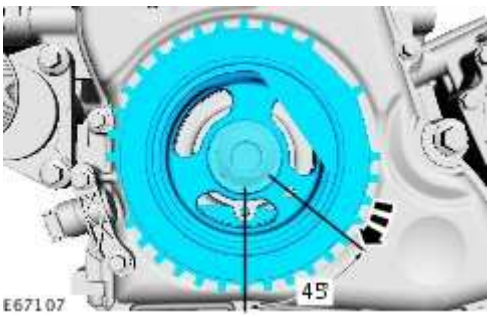


12. Remove the special tool.

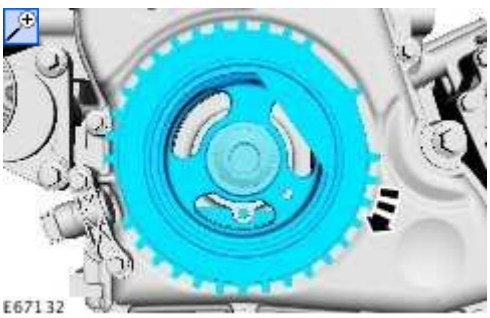
    Special Tool(s): 303-748



13. WARNING: Only rotate the crankshaft clockwise.
    Turn the crankshaft one and three quarters of a turn until no. 1 piston is at about 45° before TDC.

14. Install the special tool.

    Special Tool(s): 303-748



15. WARNING: Only rotate the crankshaft clockwise.
    Turn the crankshaft until it stops against the special tool.

16. NOTE: Only tighten the bolt finger tight at this stage.
    NOTE: The bolt can only be installed if the valve timing is correct.
    - Bolt M6 x 18 mm

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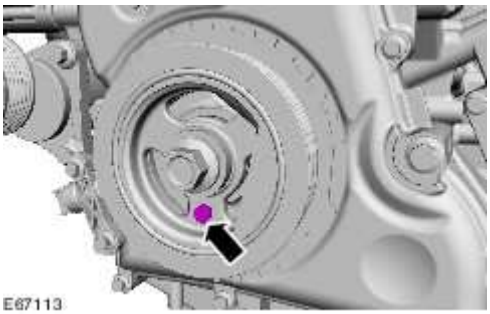
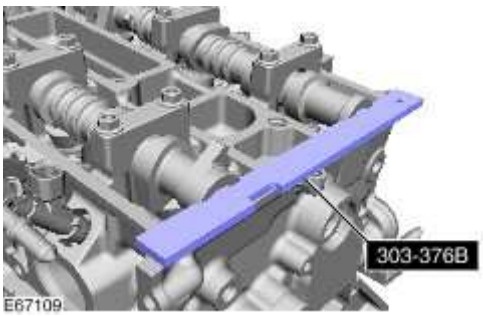
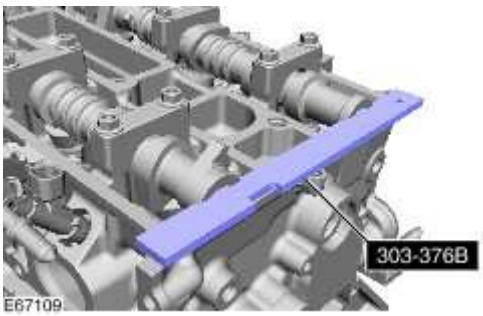




17. NOTE: The special tool may only be installed if the valve timings are correct.
Install the special tool.

Special Tool(s): 303-376B

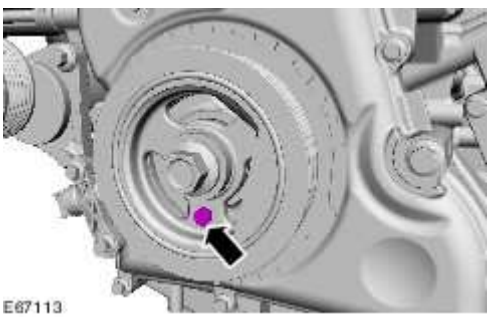


18. Remove the special tool.

Special Tool(s): 303-376B

19. Remove the special tool.

Special Tool(s): 303-748



20.

21. *Torque:* 20 Nm

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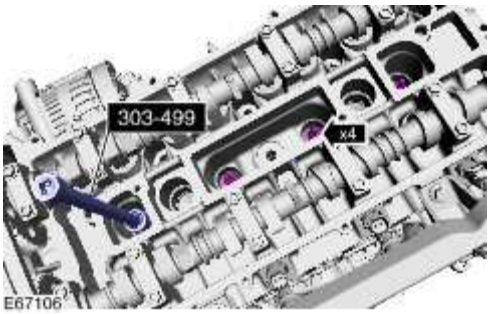
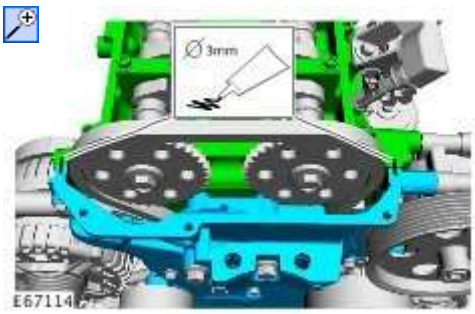
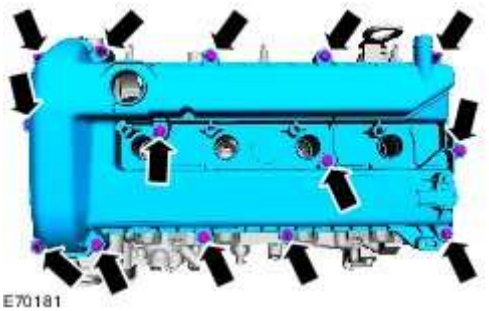


22. *Special Tool(s):* 303-499
Torque: 12 Nm

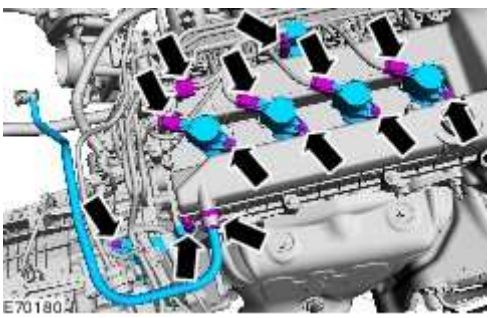


23. Apply a small bead of sealant to the areas shown.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



24. NOTE: If the gaskets are not damaged, re-use them.
Torque: 10 Nm



25. *Torque:* 10 Nm

26. *Torque:* 10 Nm

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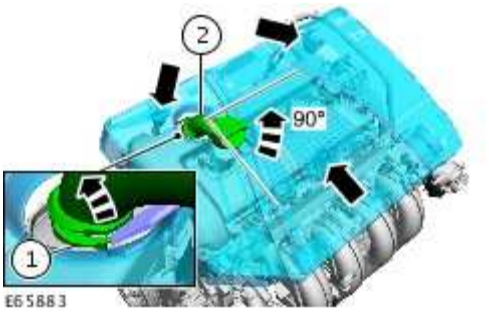
27.



28. Install the auxiliary drive belt.

    Refer to: Antriebsriemen - Zusatzaggregate (303-05A Antrieb - Zusatzaggregate - 2.0L Duratec-HE (MI4), Removal and Installation).

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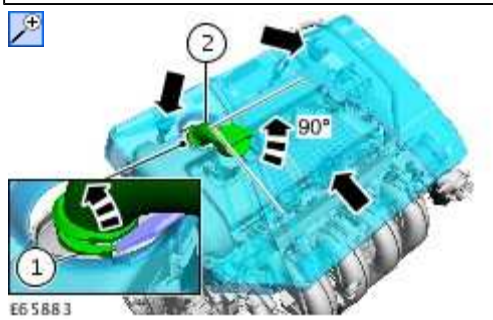
Removal

Special Tool(s)

	303-122 Lifting Bracket, Engine
	310-137 Disconnect Tool, Fuel Line

General Equipment

3.5 mm drill bit
Center punch
Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Retaining Strap
Schlitzschraubendreher



1. *General Equipment:* Schlitzschraubendreher

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

3. Remove the following items:
   1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   2. Remove the right-hand headlamp.

      Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
   3. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

4.

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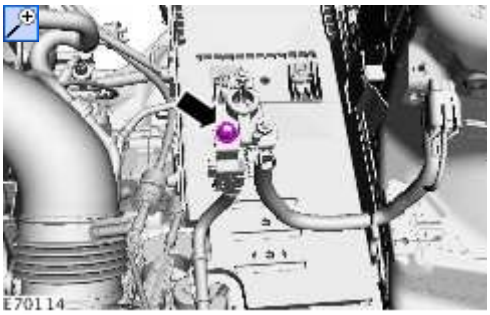
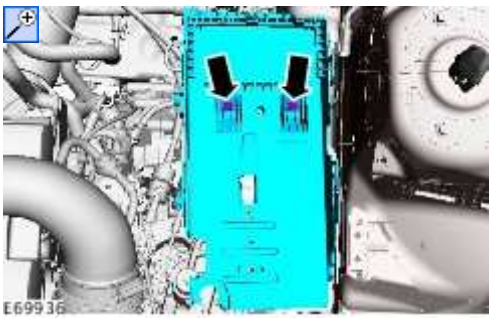


5.



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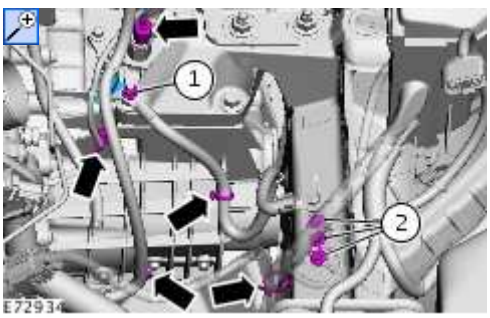
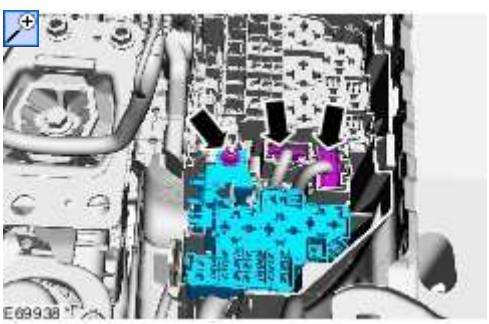


7.

8.



9. CAUTION: The gearshift cables must not be kinked or twisted.

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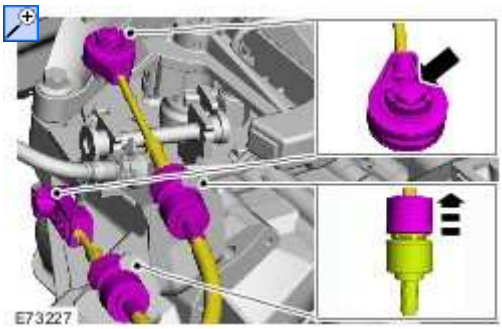
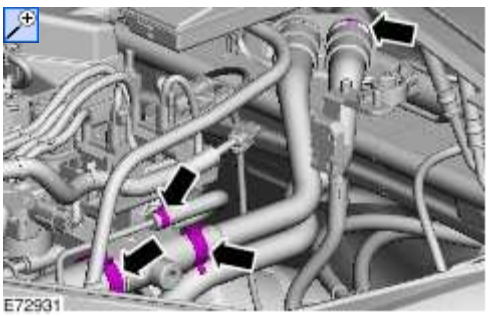
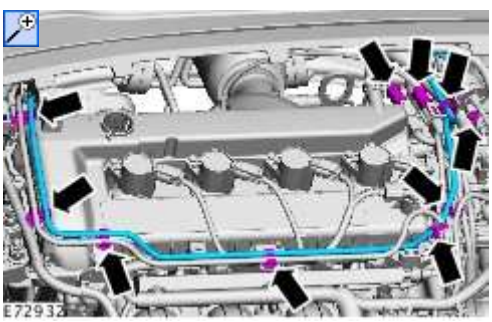


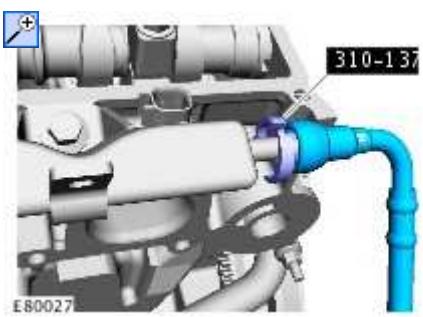
10. *General Equipment:* Hose clamp remover/installer



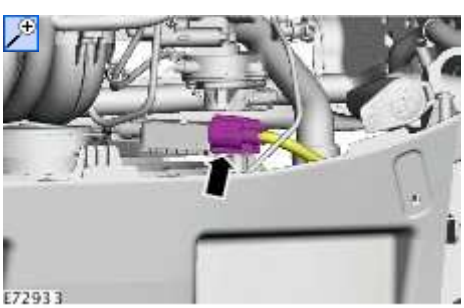
11.



12. *Special Tool(s):* 310-137



13.



14.

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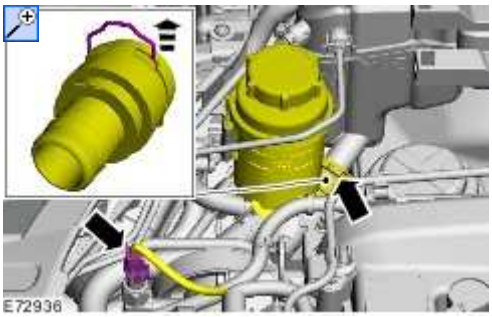
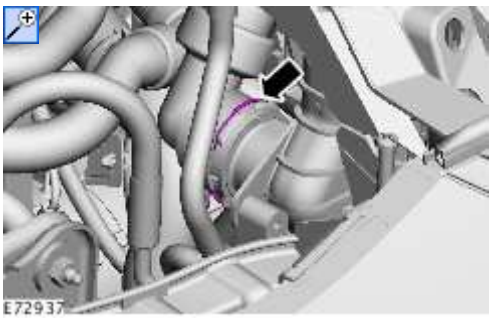
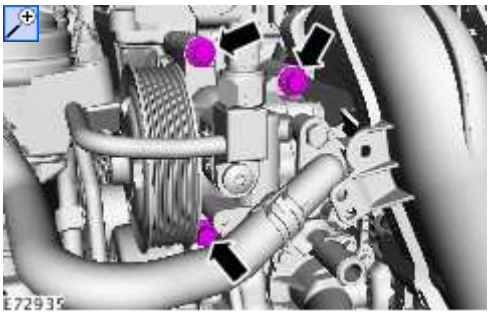


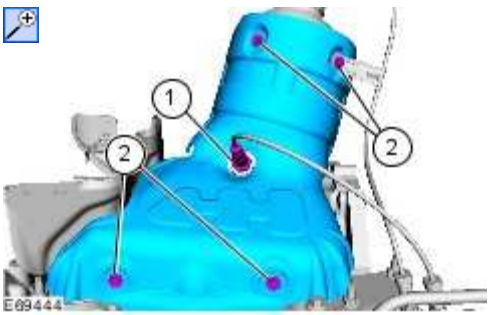
15.



16.



17. Remove the following items:
    1. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
    2. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).



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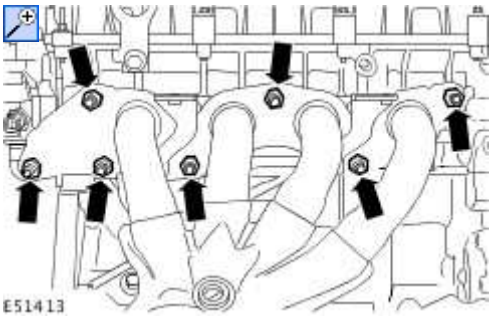

19.

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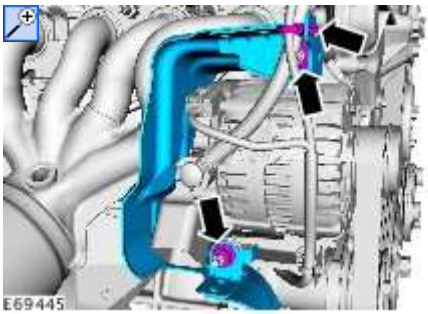

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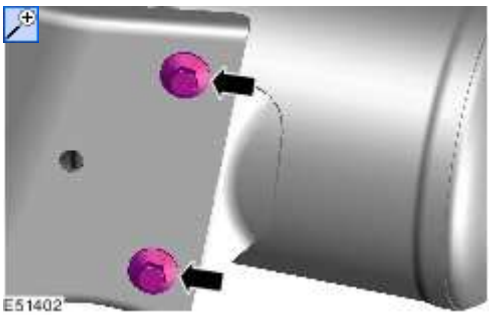

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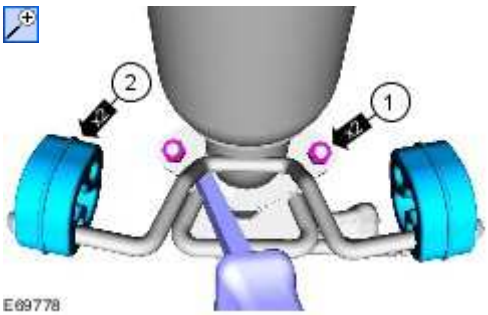
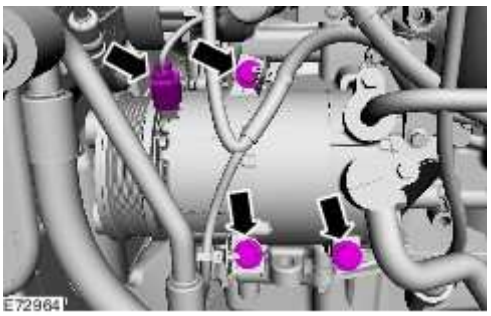


22. NOTE: The flexible exhaust pipe must not be twisted.

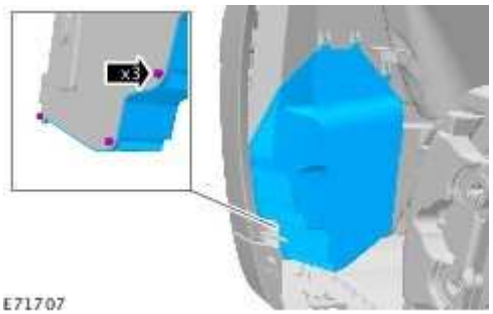


23. Detach the air conditioning compressor and secure to one side.

24.

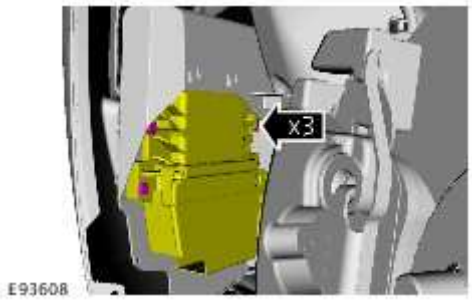
25.

http://vnx.su

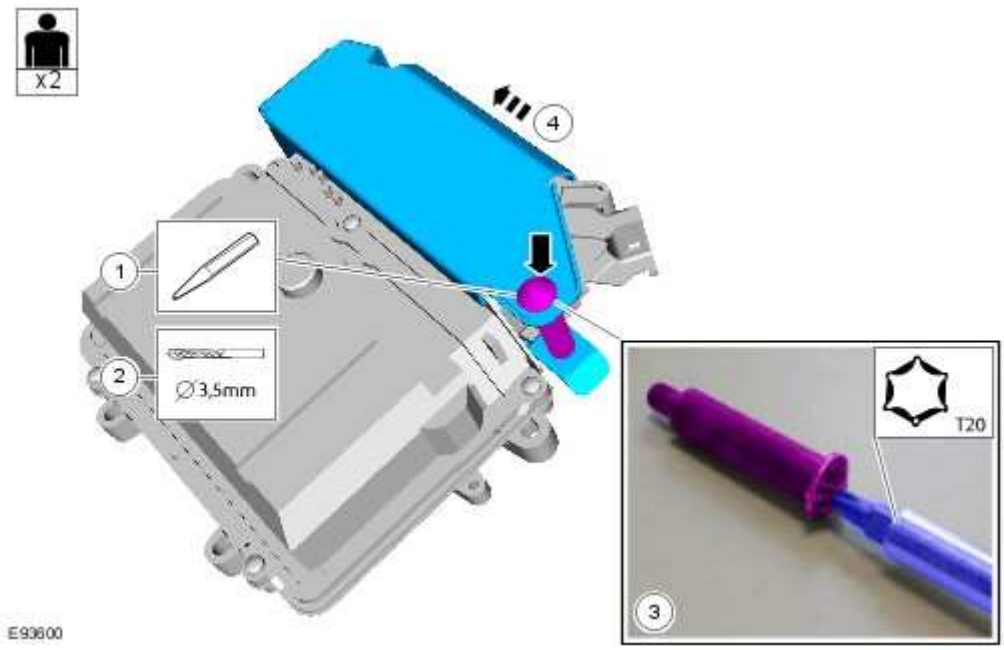


Vehicles with PCM security shield

26.



27. *General Equipment:* Center punch *General Equipment:* 3.5 mm drill bit



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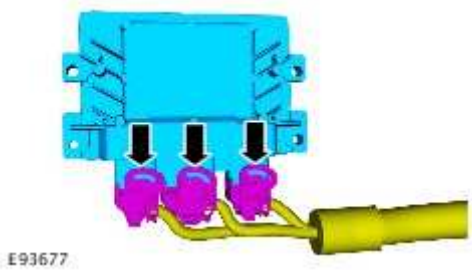
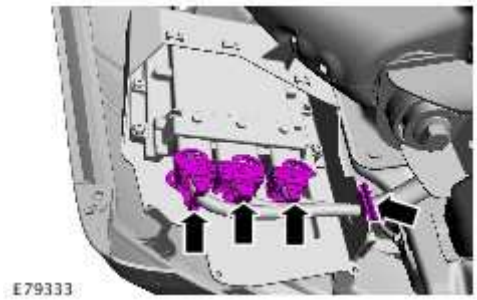


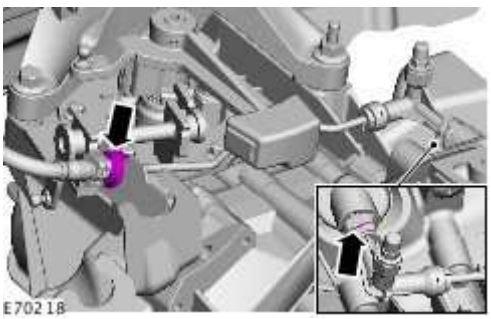
Vehicles with PCM safety plate

29.

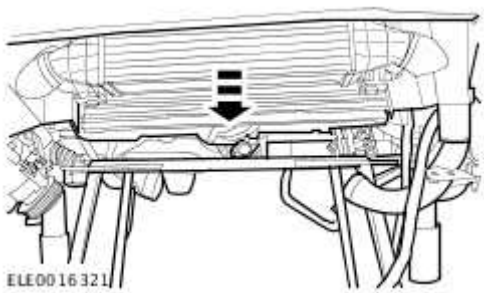
http://vnx.su



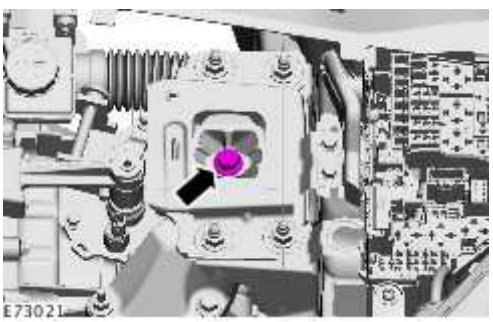
All vehicles



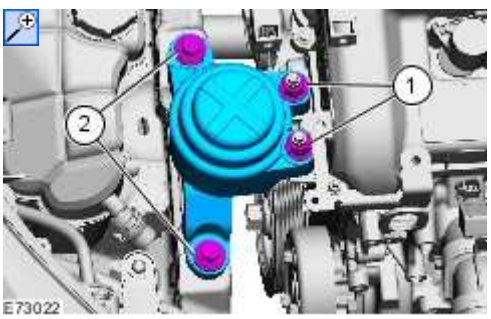
30.



31. WARNING: Support the engine/transmission on wood blocks and secure with suitable straps.
General Equipment: Mounting table set
General Equipment: Retaining Strap



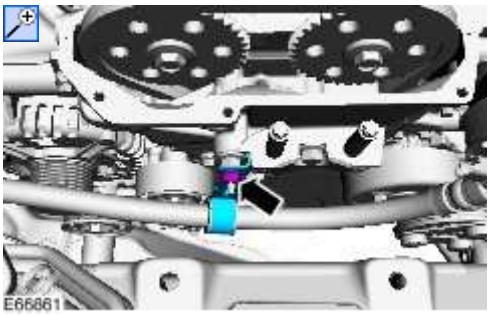
32. Discard the bolt on the rear engine mounting.



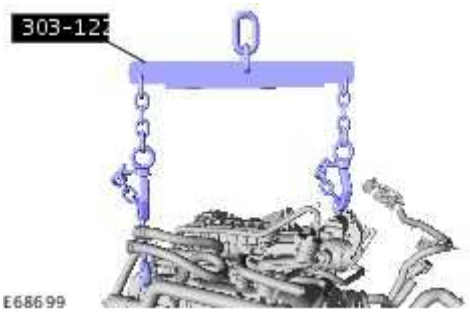
33.

34.

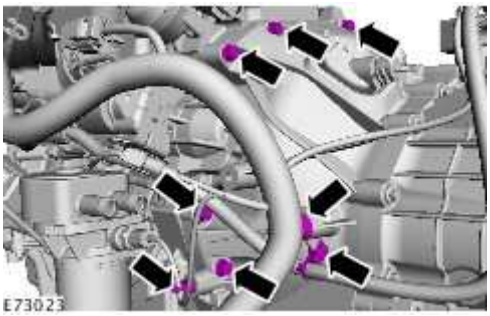
http://vnx.su



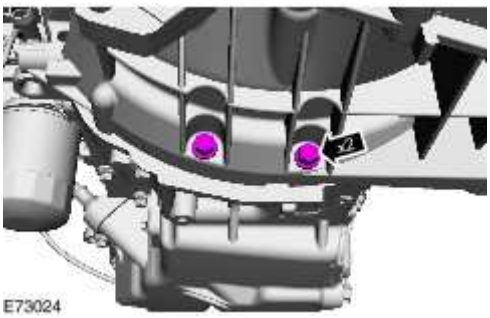
35. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



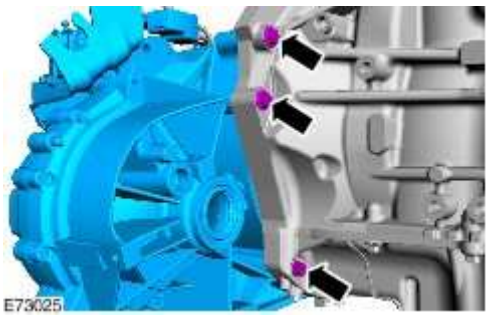
36. *Special Tool(s):* 303-122
General Equipment: Hydraulic jib crane



37.



38.



39.

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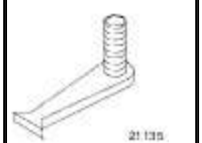
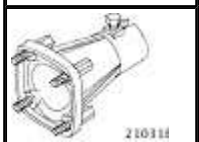
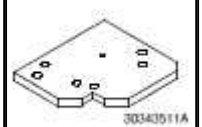
Print

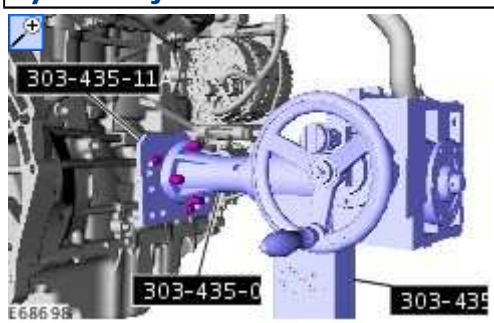
Removal

Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-397 Remover/Installer, Hose Clamp
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06

General Equipment

Hose clamp remover/installer
Hydraulic jib crane



1. Install the special tools.

   Special Tool(s): 303-435, 303-435-06, 303-435-11A

2. Remove the special tool.

   Special Tool(s): 303-122
   General Equipment: Hydraulic jib crane

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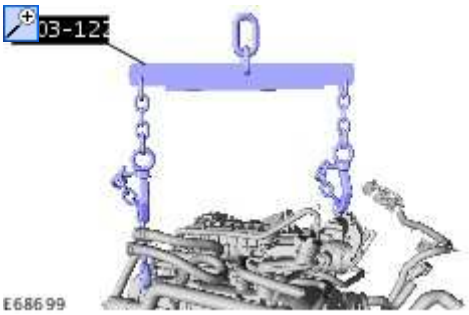

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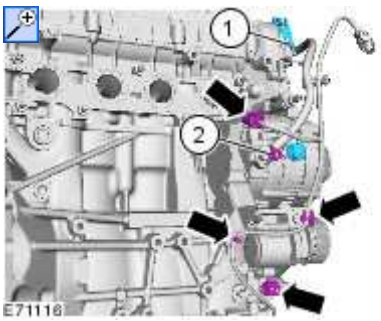
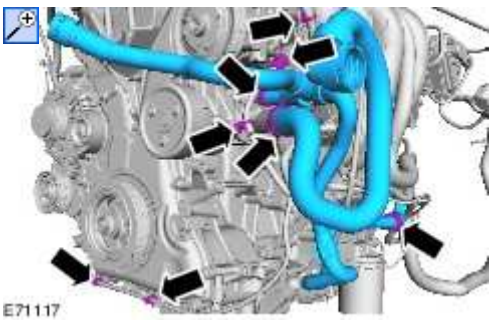


4. *General Equipment:* Hose clamp remover/installer



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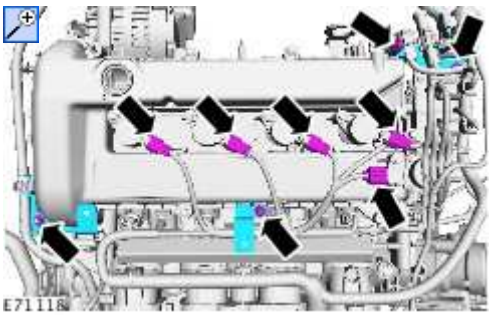

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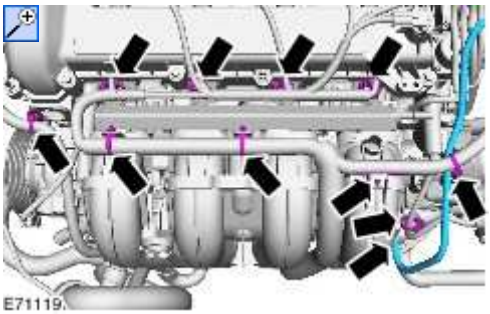

7. *General Equipment:* Hose clamp remover/installer

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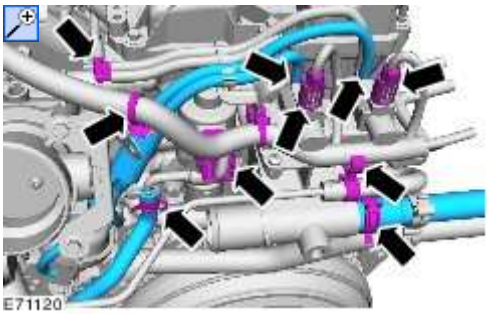
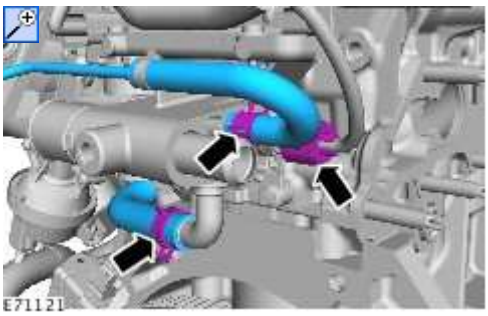
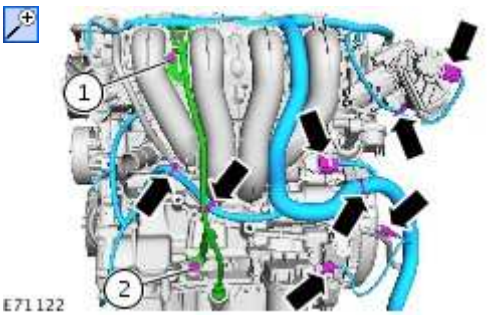




8. *General Equipment:* Hose clamp remover/installer



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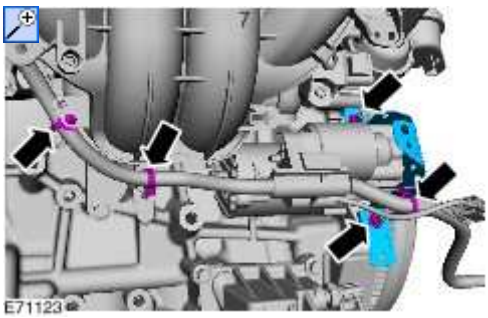

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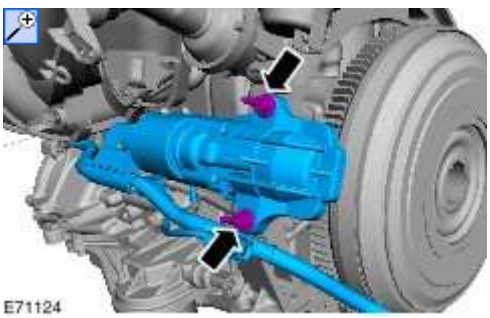

11.

12.

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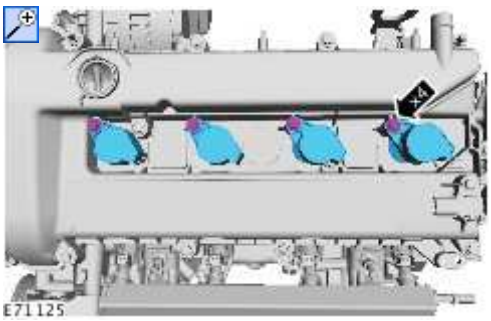
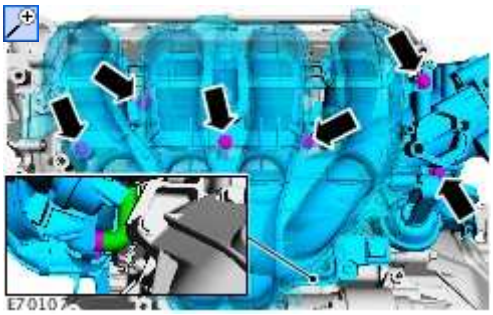
13.



14. *Special Tool(s):* 303-397



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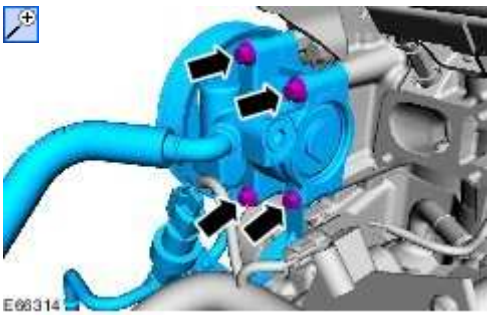

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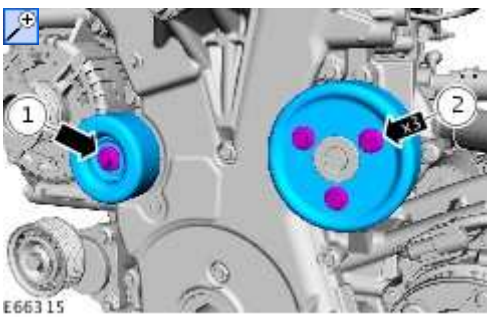

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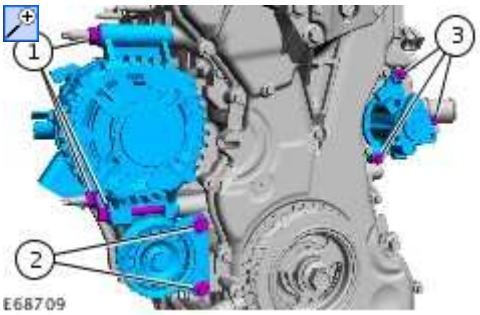

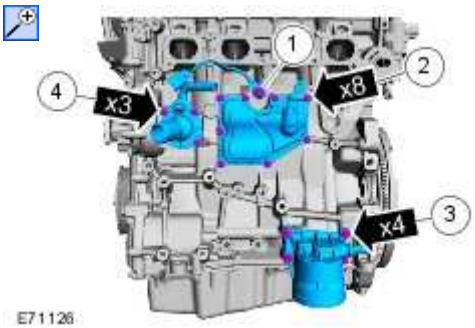

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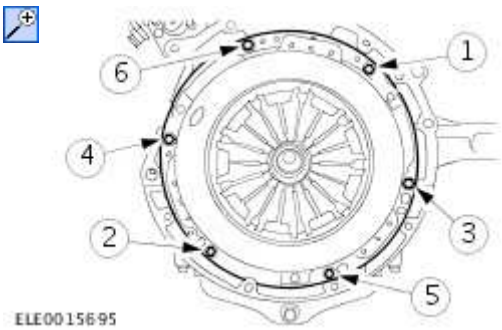

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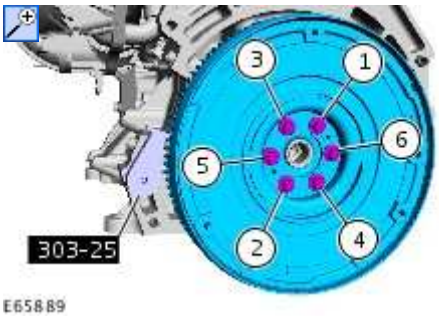

20. Discard the flywheel bolts.

Special Tool(s): 303-254

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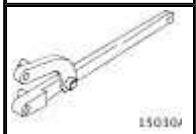
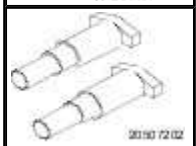
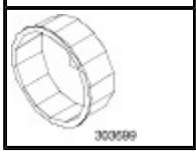
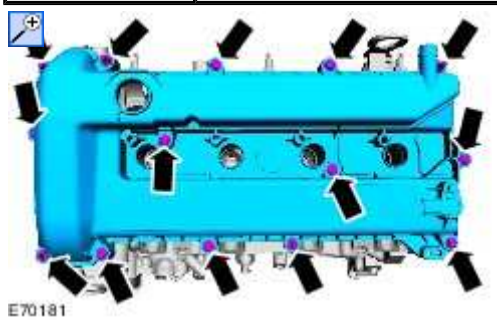
Print

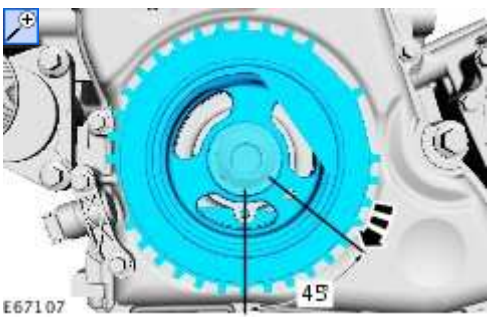
Disassembly

Special Tool(s)

	100-010 Remover, O-Ring Seal
	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	205-072-02 Adapter for 205-072
	303-293 Remover, Crankshaft Seal
	303-699 Wrench, Oil Filter


E70181

1.



E67107

2. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until piston No. 1 is approximately 45 degrees before top dead center (TDC).

3. *Special Tool(s):* 205-072, 205-072-02

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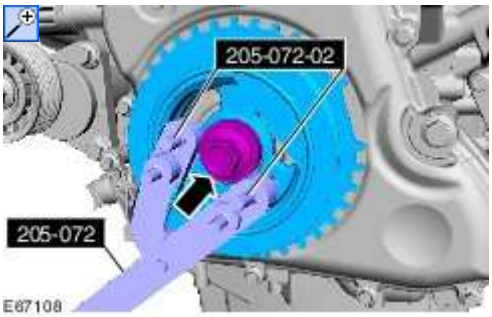
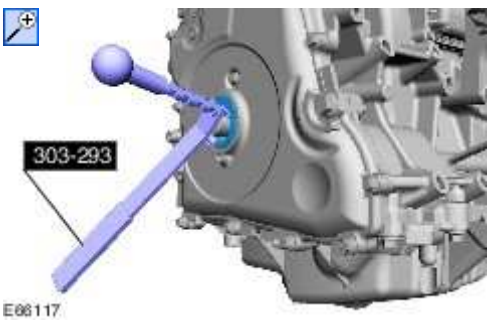
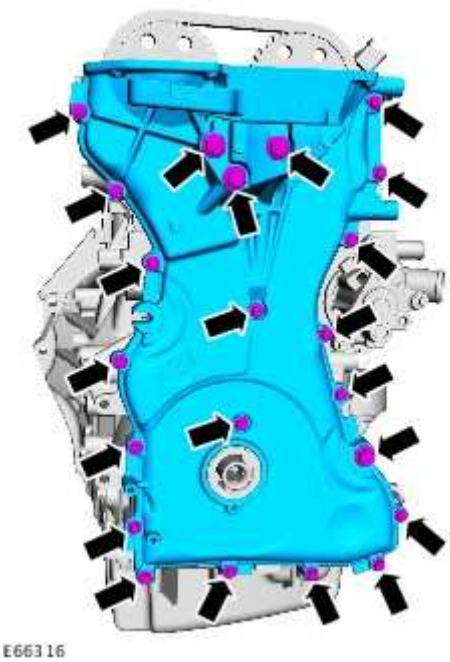




4. *Special Tool(s):* 303-293

5.
   - Discard the friction washer.



6.

7.
   2. *Special Tool(s):* 100-010
   3. Punch, 2 mm

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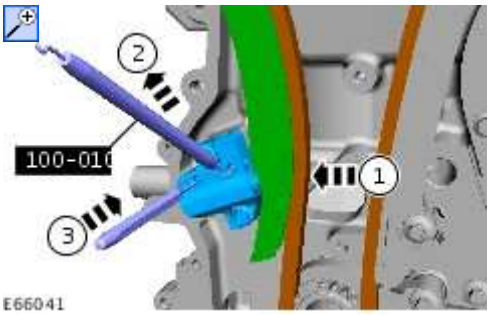
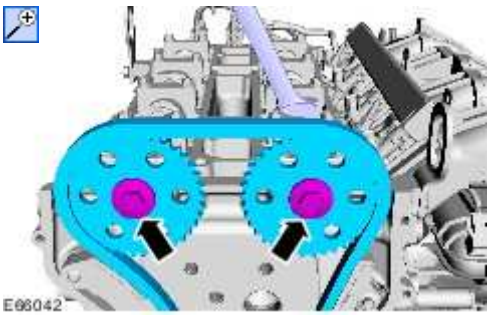
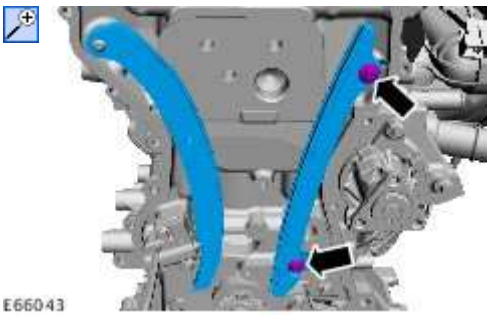




8. CAUTION: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.



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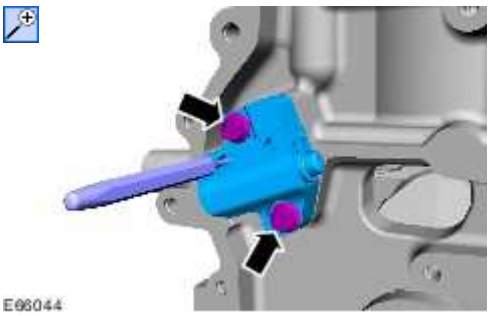

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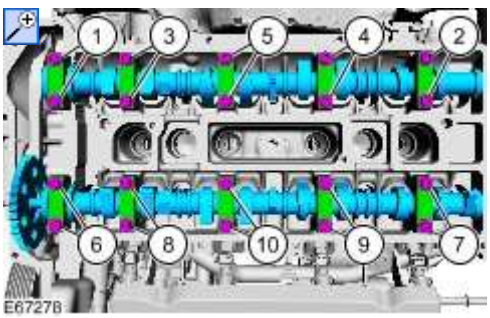

11. CAUTION: Note the position of each component before removal.

12. Discard the cylinder head bolts.

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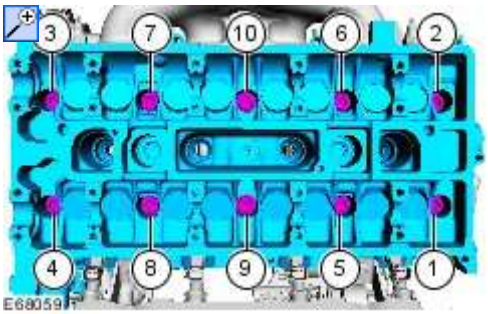
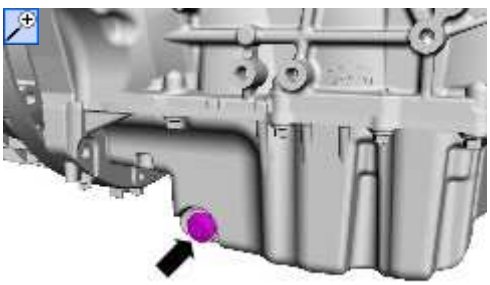


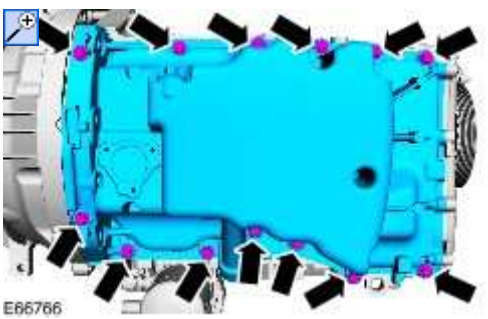
E68059

E68794

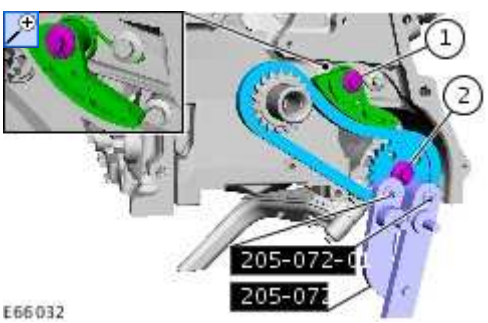
13. *Special Tool(s):* 303-699


E68761

14. NOTE: The seal is to be reused unless damaged.


E66766

15.



E66032

16.

2. *Special Tool(s):* 205-072, 205-072-01

17. Discard the friction washer.

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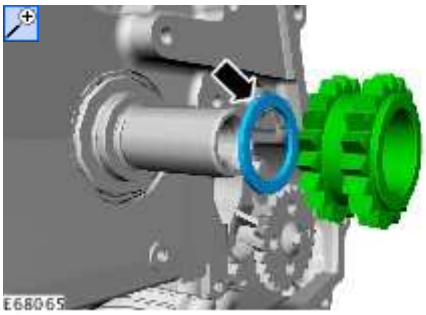

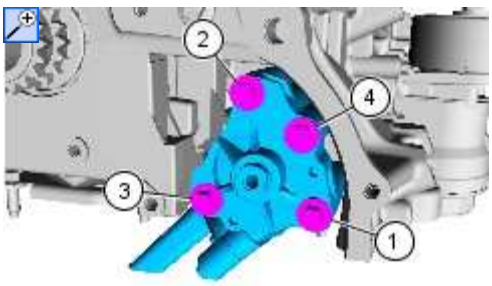

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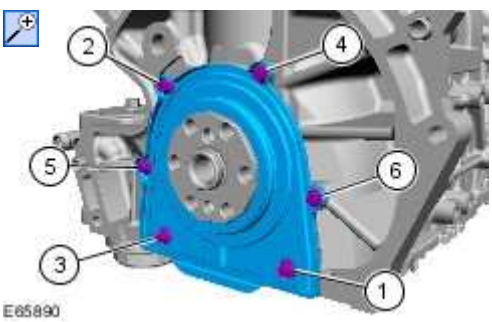

19.

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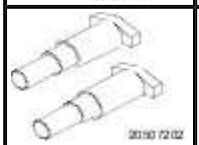
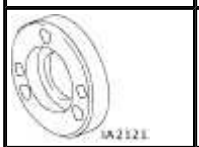
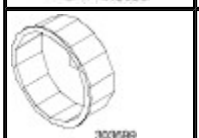
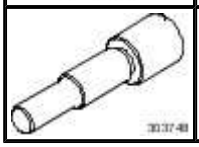
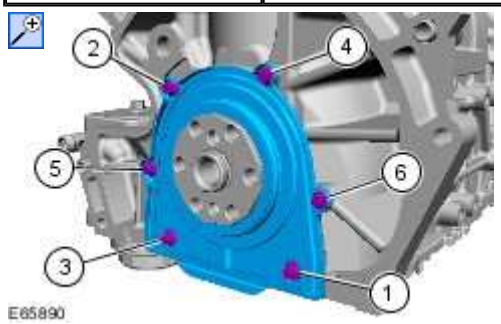
Assembly

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-509 Remover, Vibration Damper Hub
	303-699 Wrench, Oil Filter
	303-748 Locking Tool, Crankshaft

Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA



1. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Torque: 10 Nm

2. *Torque:*
   Stage 1: 10 Nm
   Stage 2: 23 Nm

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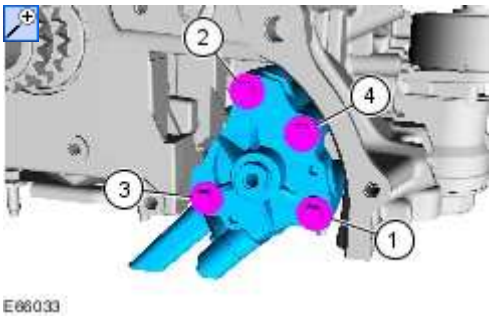
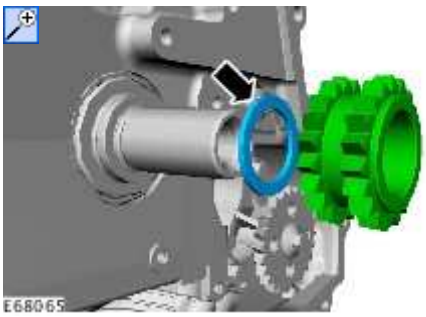
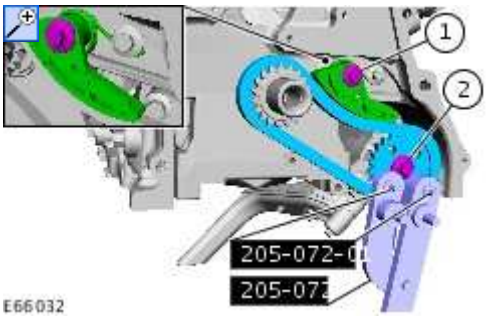


E68033

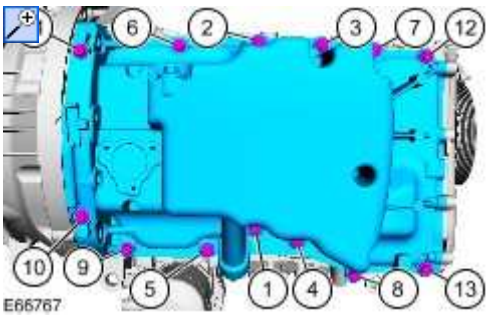

E68065

3. CAUTION: Make sure that a new friction washer is installed.



E66032

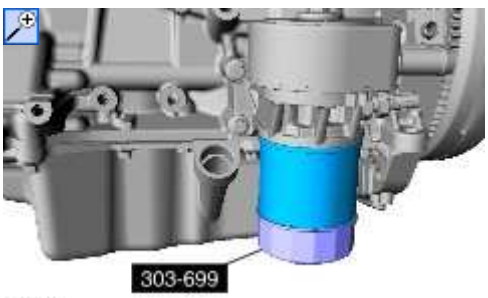
4.
1. *Torque:* 10 Nm
2. *Special Tool(s):* 205-072, 205-072-01
   Torque: 25 Nm



E66767

5.
- Apply a 3 mm bead of sealant to the oil pan.

  Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)
- *Torque:* 25 Nm



E68794

6. *Special Tool(s):* 303-699
   Torque: 17 Nm

7. CAUTION: Only rotate the crankshaft clockwise.
   Rotate the crankshaft until piston No. 1 is approximately 20 mm before top dead center (TDC).

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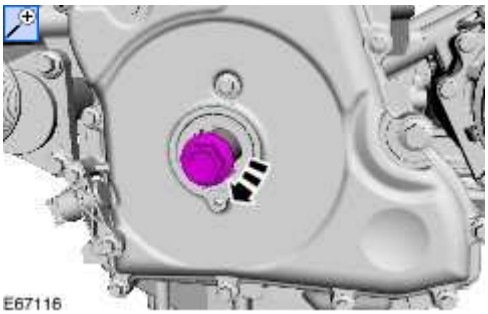
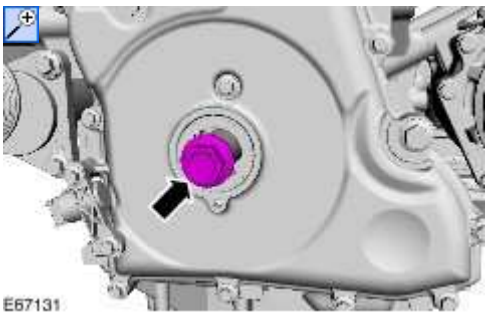
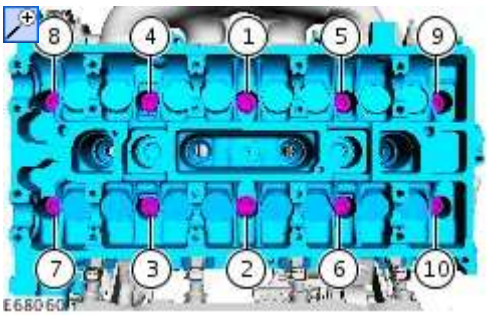
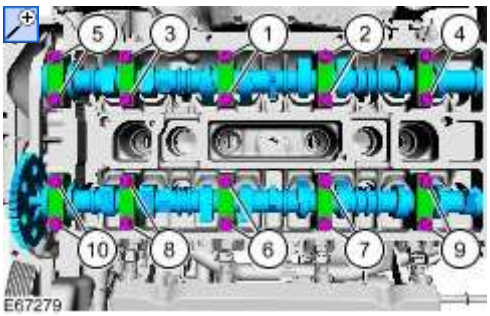




8.

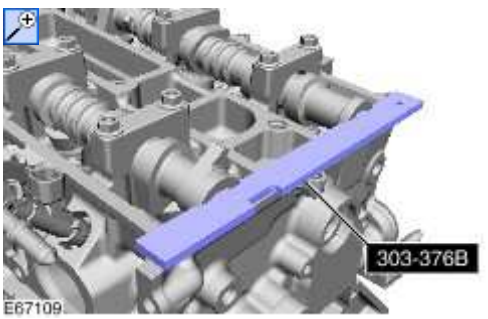


9. CAUTION: Make sure that new cylinder head bolts are installed.
Torque:
Stage 1: 5 Nm
Stage 2: 15 Nm
Stage 3: 45 Nm
Stage 4: 90°
Stage 5: 90°



10. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
NOTE: Install the camshafts approximately at valve overlap position cylinder No. four.
Coat the camshaft bearing caps with oil.

Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)
Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm



11. Install the special tool.

Special Tool(s): 303-376B

12. *Torque:* 10 Nm

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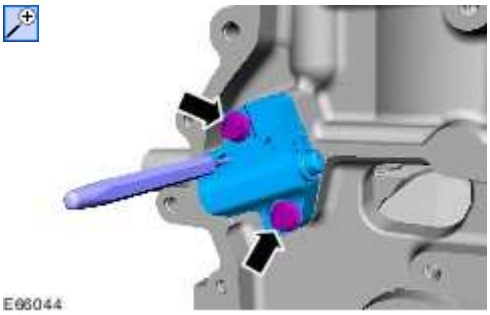
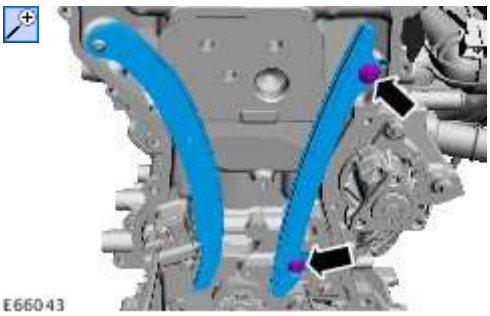
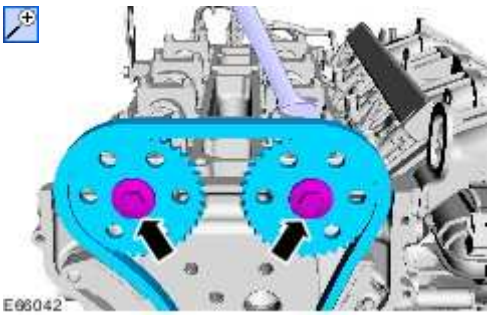
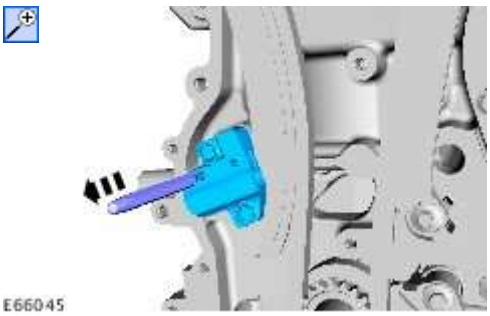




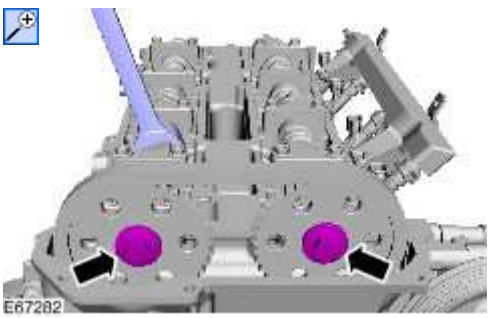
13. *Torque:* 10 Nm



14. NOTE: Only tighten the bolts finger tight at this stage.



15.



16. CAUTION: Use an open-ended wrench to hold the camshafts by the hexagon to prevent the camshafts from turning.
Torque: 72 Nm

17.

- Apply a 3 mm bead of sealant to the engine front cover.

  Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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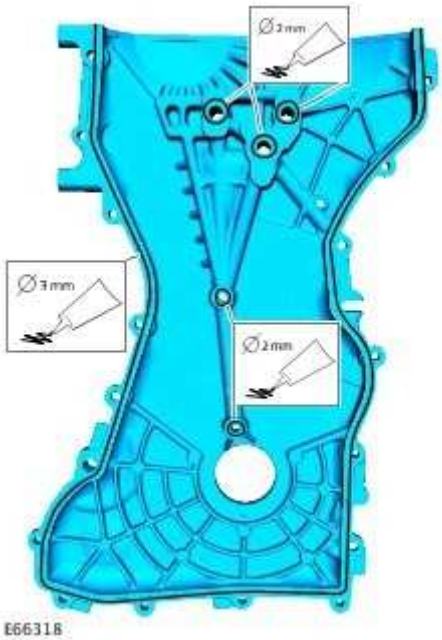

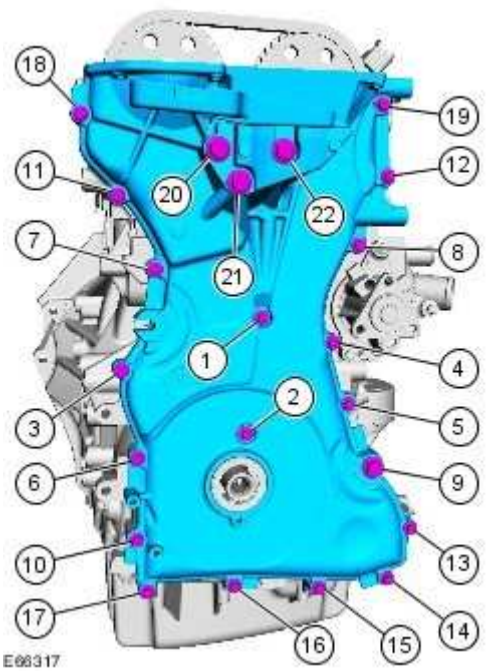

18. *Torque:*
    1-8 10 Nm
    9 48 Nm
    10-19 10 Nm
    20-22 48 Nm

19. CAUTION: Make sure that a new friction washer is installed.
    NOTE: Make sure that a new friction washer is installed.

20. *Special Tool(s):* 303-509

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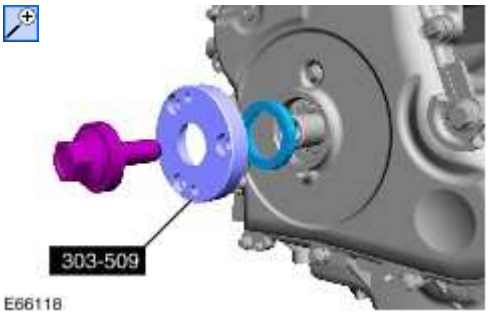
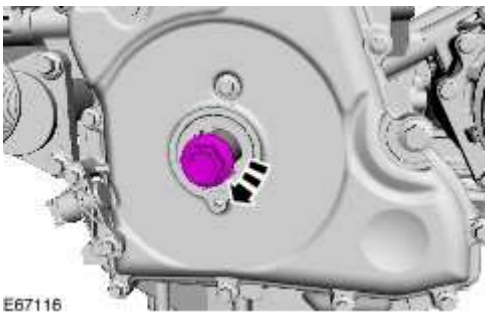


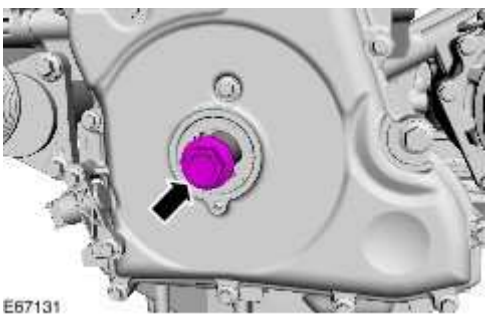
21.

22. Install the special tool.

Special Tool(s): 303-748



23. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until it contacts the special tool.



24.

- Discard the crankshaft pulley retaining bolt.

25. NOTE: Only tighten the bolt finger tight at this stage.
    - Bolt M6 x 18 mm

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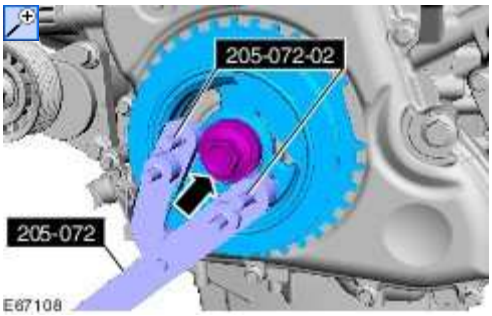
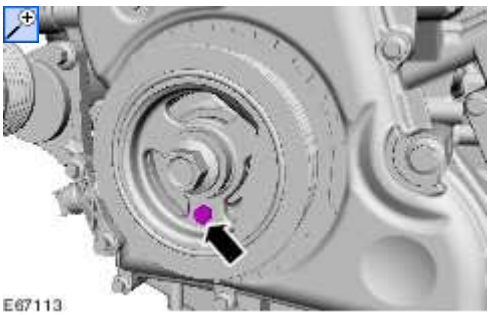


26. CAUTION: Make sure that a new crankshaft pulley bolt is installed.
Special Tool(s): 205-072, 205-072-02
Torque:
Stage 1: 100 Nm
Stage 2: 90°



27.

28. Remove the special tool.

Special Tool(s): 303-748

29. *Torque:* 20 Nm

30. Remove the special tool.

Special Tool(s): 303-376B

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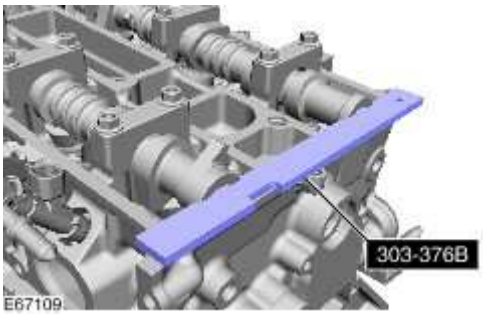
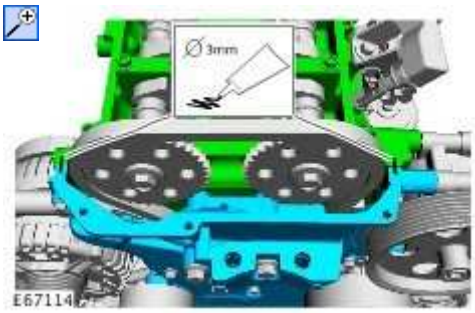
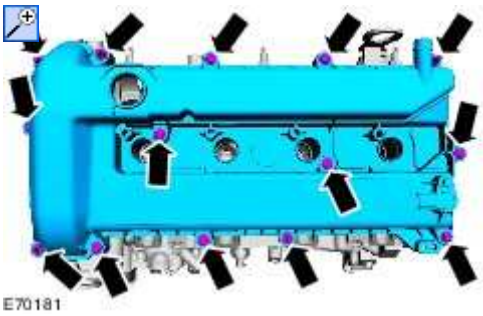




31. Apply a dot of sealant to the areas indicated.

    Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



32. *Torque:* 10 Nm

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Installation

Special Tool(s)

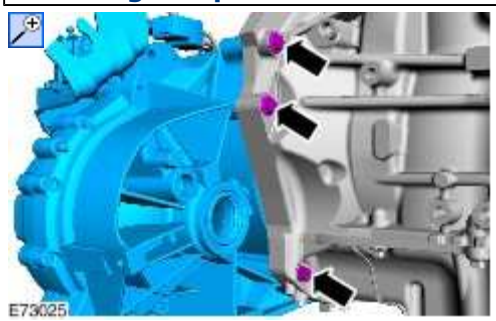
	303-122 Lifting Bracket, Engine

Materials

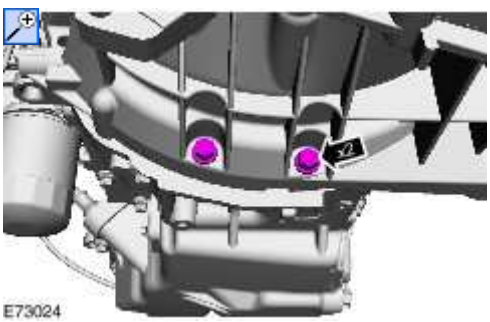
Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Retaining Strap



1. *Torque:* 48 Nm



2. *Torque:* 48 Nm

3. WARNING: Support the engine/transmission on wood blocks and secure with suitable straps.
   General Equipment: Mounting table set
   General Equipment: Retaining Strap

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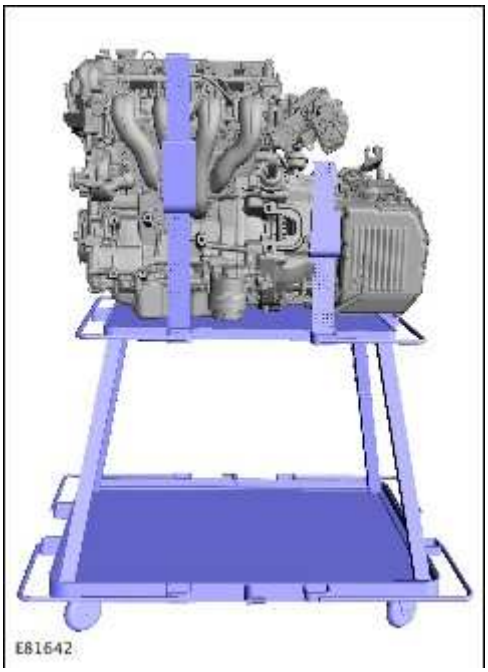
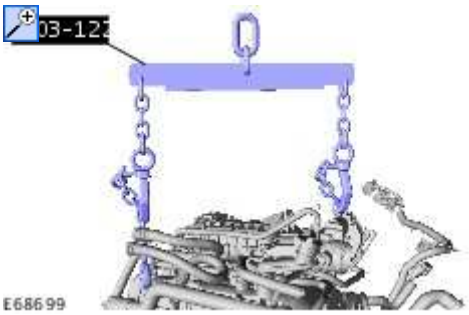
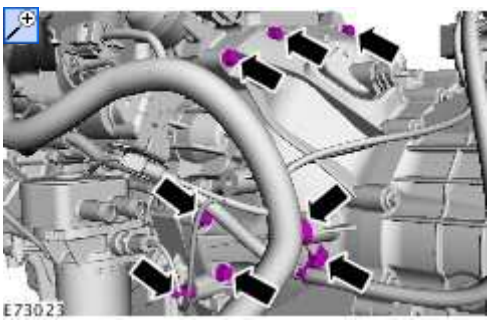




4. *Remove the Special Tool(s):* 303-122
General Equipment: Hydraulic jib crane



5. *Torque:* 48 Nm

6. CAUTION: Make sure that no components catch.
Lower the vehicle to take the load off the engine mountings.

7. *Loosen:* 2 turn(s)

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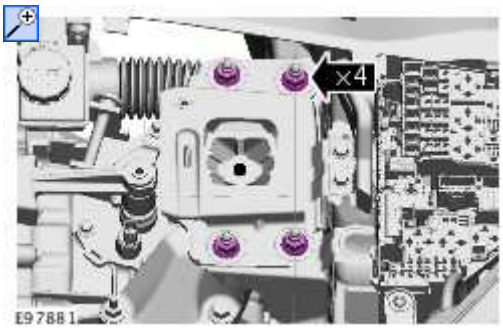
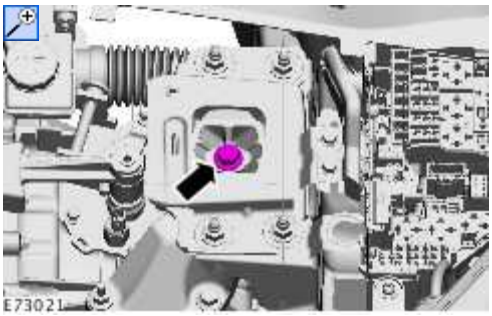
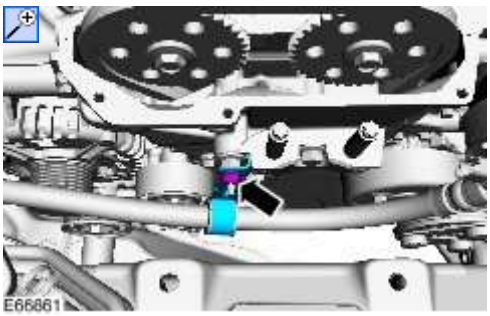
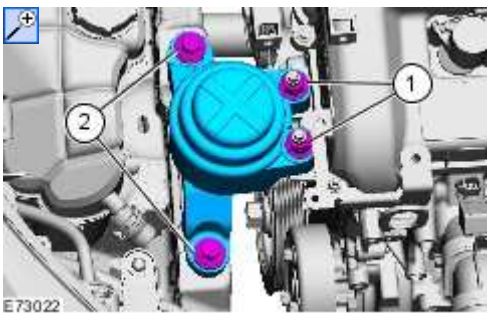




8. *Torque:* 133 Nm

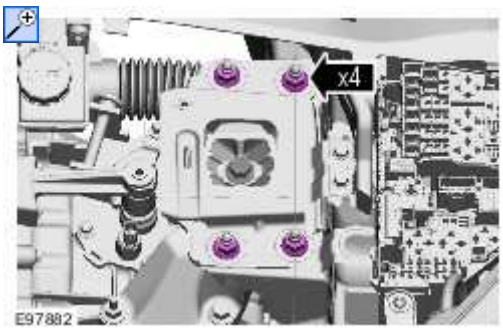


9. *Torque:* 15 Nm



10.
    1. *Torque:* 80 Nm
    2. NOTE: Only tighten the bolts finger tight at this stage.

11. Remove the assembly stand.



12. *Torque:* 80 Nm

13. *Torque:* 90 Nm

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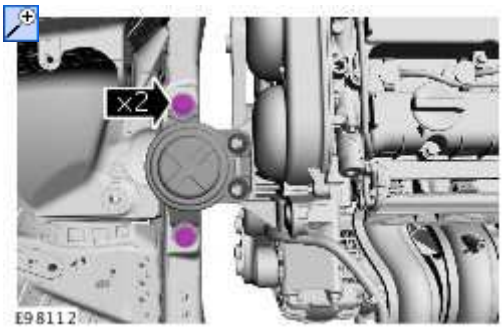
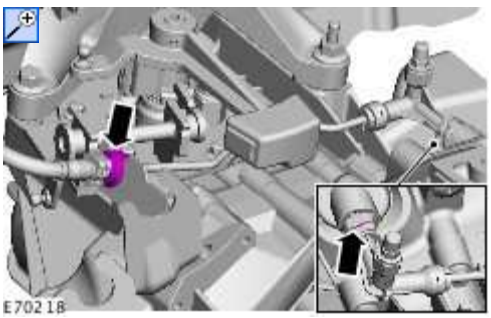
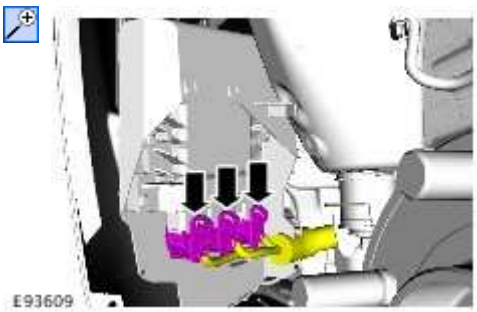




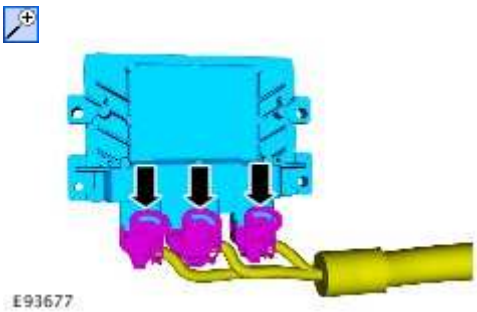
14.

Vehicles with PCM safety plate



15.

Vehicles with PCM security shield



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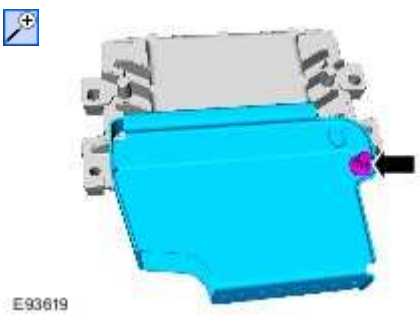

17. Tighten the shear bolt until the head is sheared off.

18. *Torque:* 3 Nm

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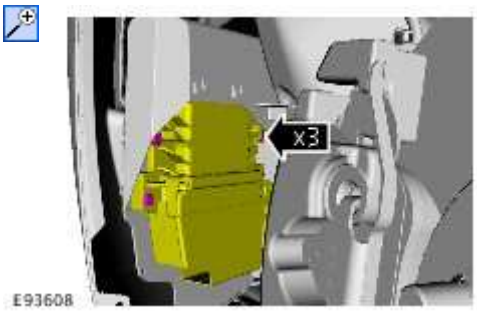
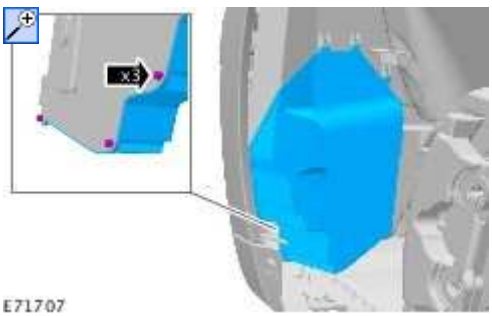
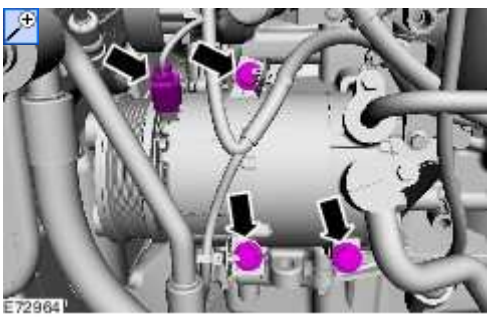


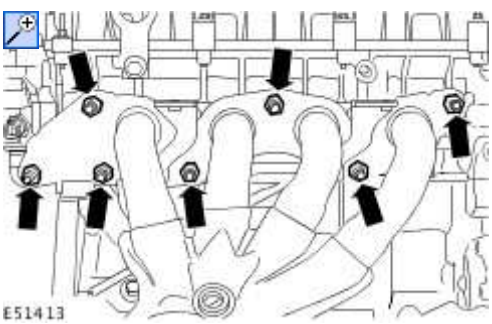
All vehicles



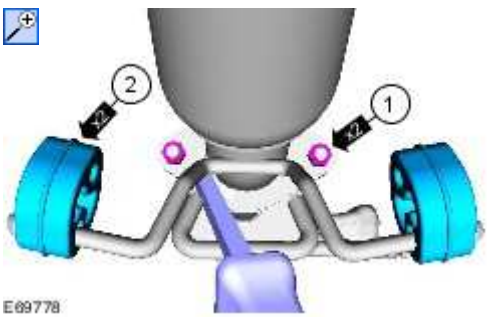
19.



20. *Torque:* 25 Nm



21. CAUTION: No sealant must be used upstream of the catalytic converter.
NOTE: Only tighten the nuts finger tight at this stage.



22. NOTE: The flexible exhaust pipe must not be twisted.
NOTE: Only tighten the nuts finger tight at this stage.
Grease the stud bolt.

Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)

23. *Torque:* 55 Nm

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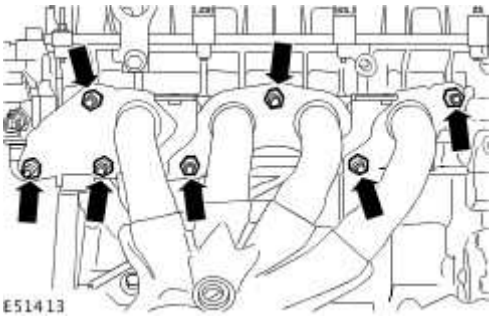
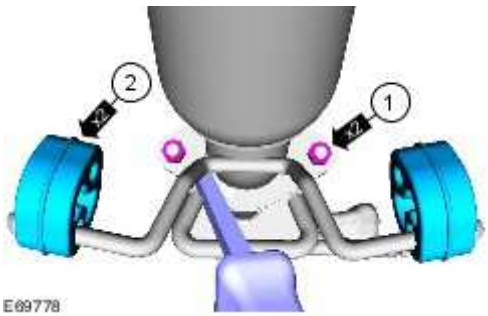
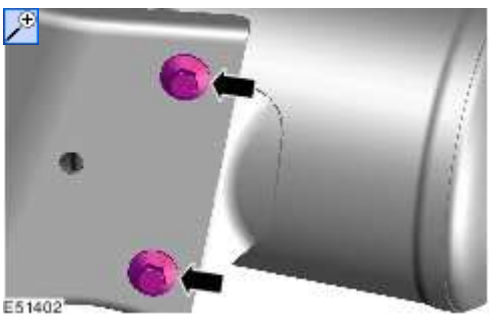
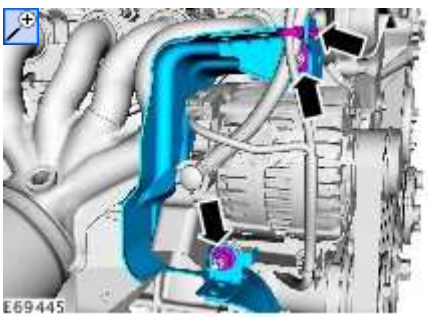




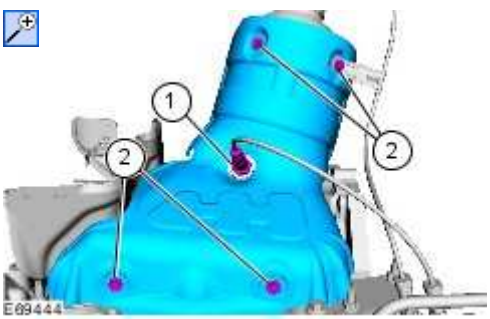
24. NOTE: The flexible exhaust pipe must not be twisted.
Torque: 48 Nm



25. *Torque:* 48 Nm



26. *Torque:* 48 Nm



27.
1. *Torque:* 48 Nm
2. *Torque:* 10 Nm

28. Install the following items:
    1. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    2. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Refer to: Front Subframe (502-00 Uni-

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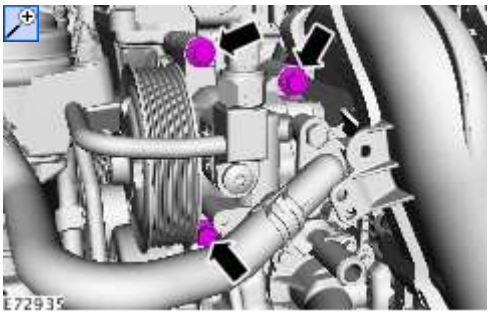
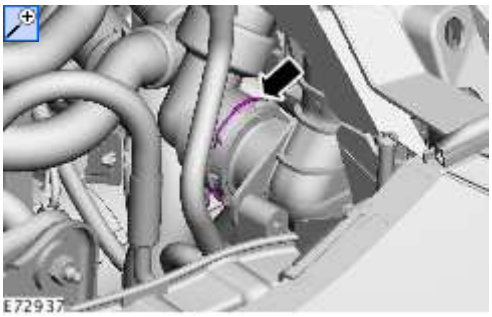
Body, Subframe and Mounting System, Removal and Installation).



29. *Torque:* 25 Nm



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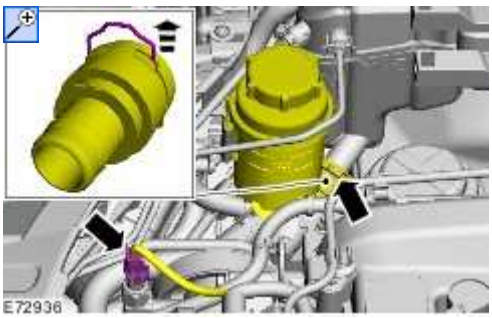

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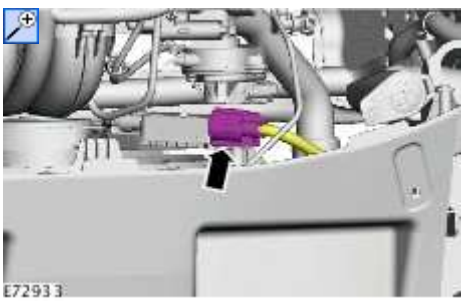

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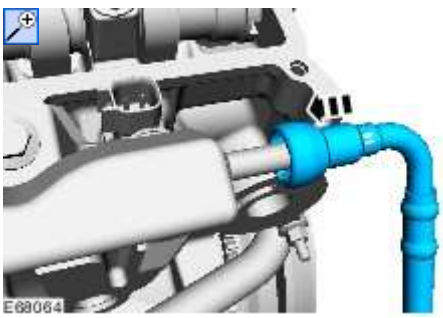

33.

34.

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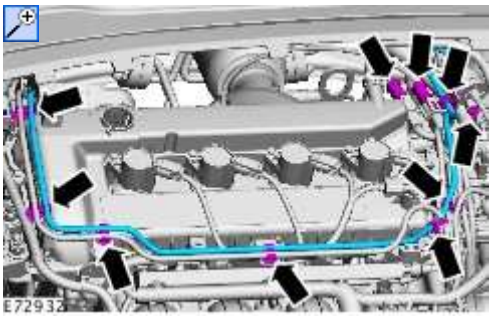
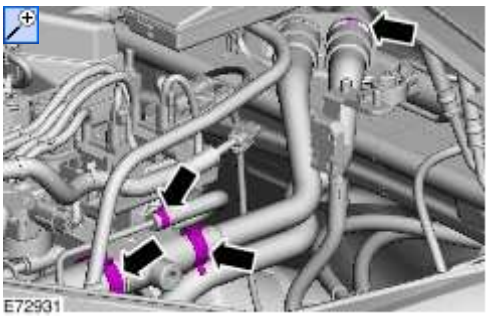
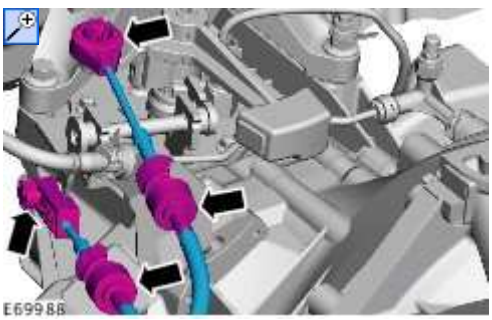
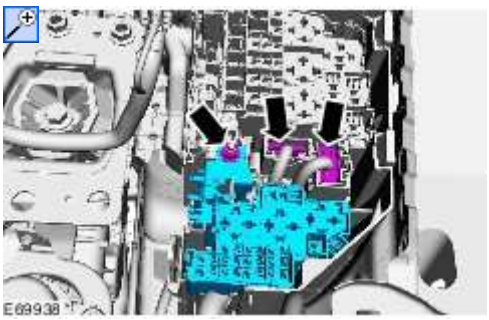




35. *General Equipment:* Hose clamp remover/installer



36. CAUTION: The gearshift cables must not be kinked or twisted.



37. *Torque:* 12 Nm

38.

39.
1. *Torque:* 25 Nm
2. *Torque:* 15 Nm

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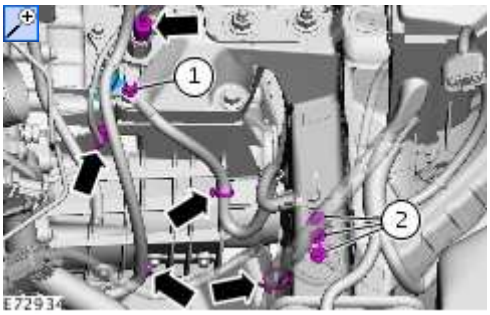

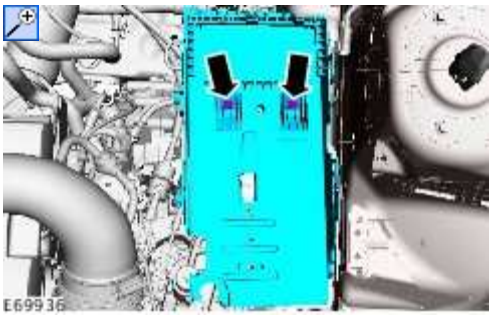

40. *Torque:* 12 Nm

41. *Torque:* 12 Nm

42. Refer to: Gearshift Cable Adjustment - Vehicles With: 5-Speed Manual Transaxle (MTX-75) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).
43. Install the following items:
    1. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
    2. Right-hand headlamp

       Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
    3. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
44.

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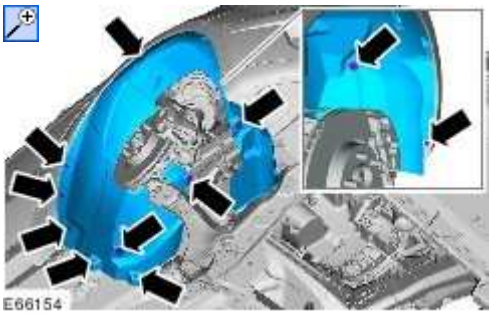
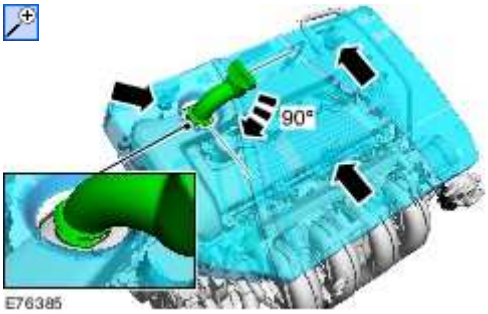


45. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
46. Refer to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures).
47. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
48.



49. Check the toe setting and adjust as necessary on both sides.

    Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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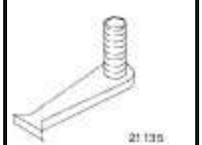
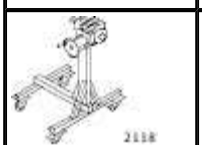
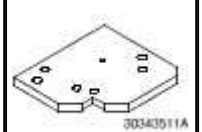
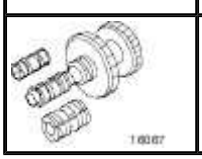
Print

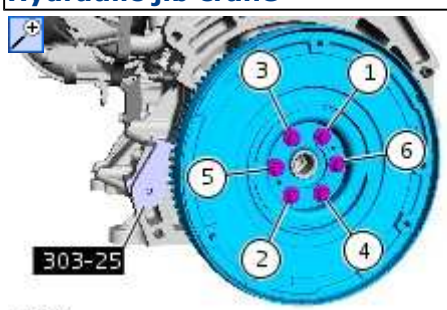
Installation

Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-397 Remover/Installer, Hose Clamp
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06
	308-204 Aligner, Clutch Disc

General Equipment

Hose clamp remover/installer
Hydraulic jib crane



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1. CAUTION: Make sure that new bolts are installed.
   Special Tool(s): 303-254
   Torque:
   Stage 1: 50 Nm
   Stage 2: 80 Nm
   Stage 3: 112 Nm

2. *Special Tool(s):* 308-204
   Torque: 29 Nm

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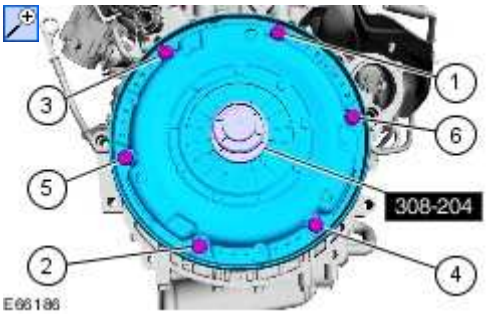
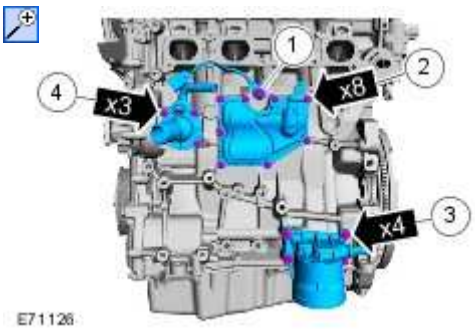
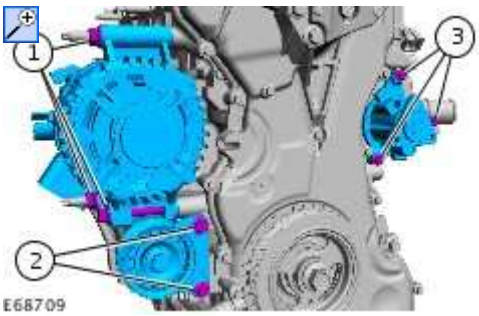




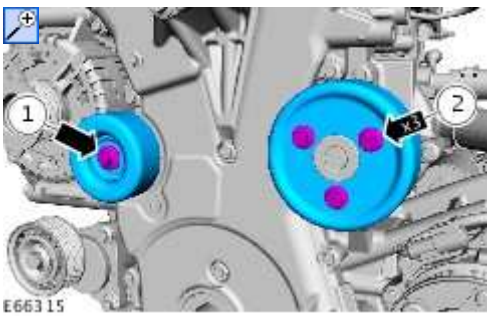
3.

1. *Torque:* 20 Nm
2. *Torque:* 10 Nm
3. *Torque:* 25 Nm
4. *Torque:* 10 Nm



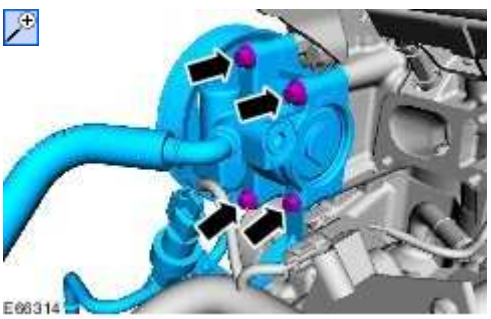
4.

1. *Torque:* 47 Nm
2. *Torque:* 25 Nm
3. *Torque:* 10 Nm



5.

1. *Torque:* 25 Nm
2. *Torque:* 20 Nm



6. *Torque:* 25 Nm

7. *Torque:* 10 Nm

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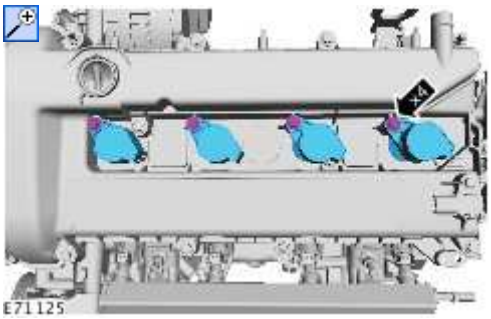
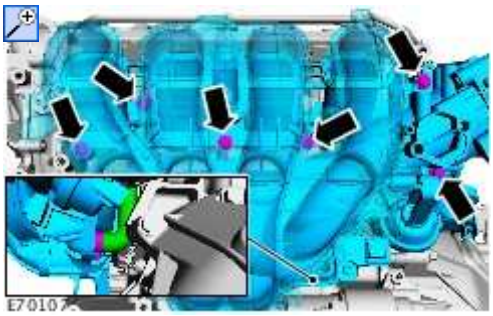
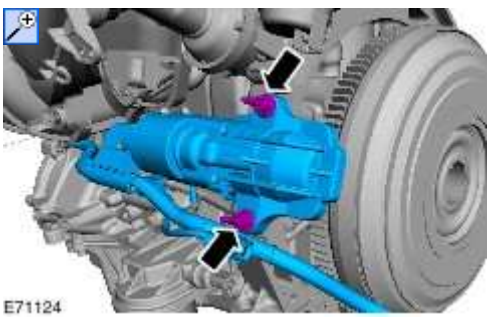


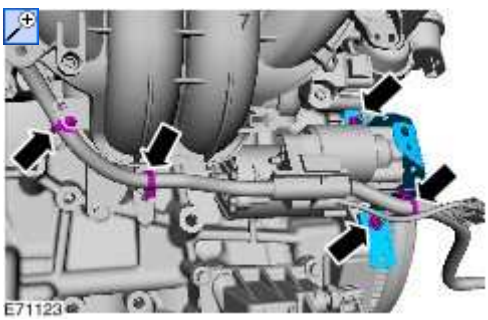


8. *Special Tool(s):* 303-397
   Torque: 18 Nm

9.



10. *Torque:* 40 Nm



11. *Torque:* 20 Nm

12.
    1. *Torque:* 10 Nm
    2. *Torque:* 48 Nm

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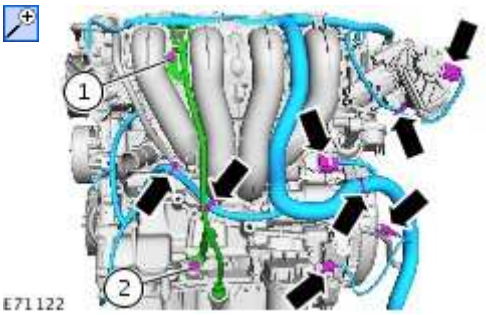
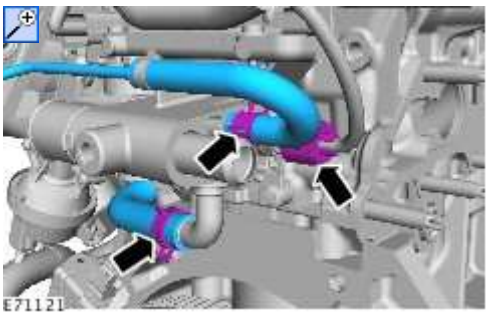
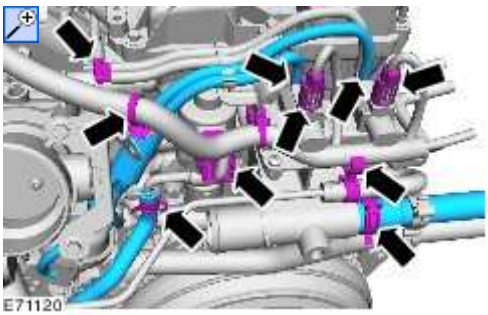
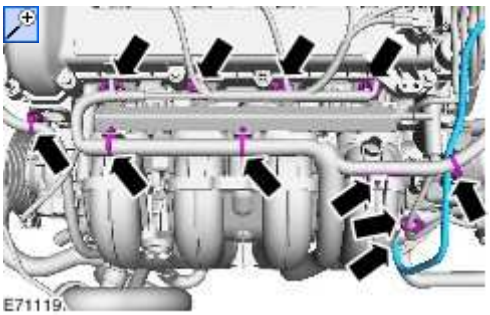




13. *General Equipment:* Hose clamp remover/installer



14. *General Equipment:* Hose clamp remover/installer



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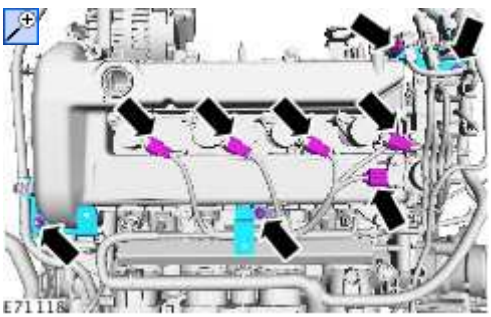

16. *Torque:* 10 Nm

17. *General Equipment:* Hose clamp remover/installer

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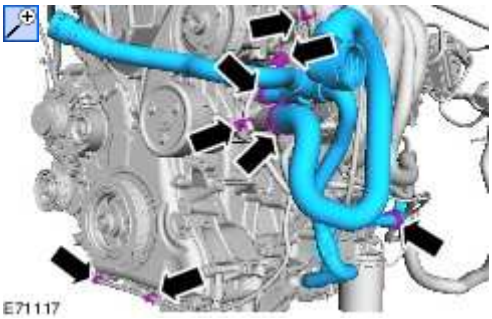
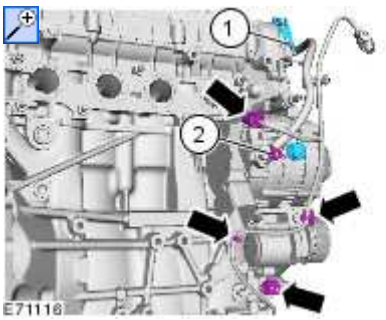
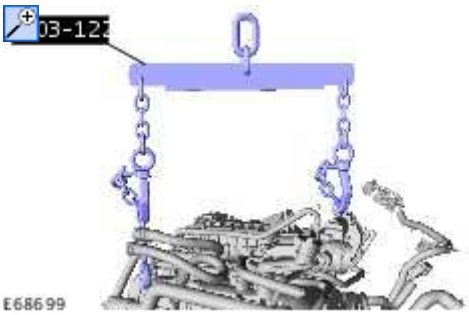


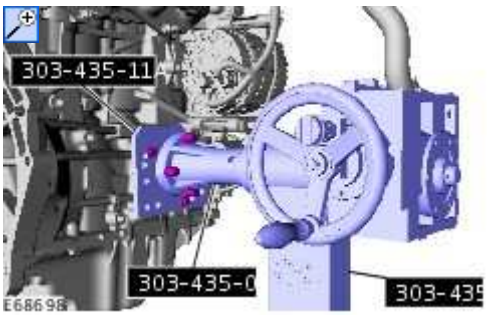


18.
1. *Torque:* 10 Nm
2. *Torque:* 8 Nm



19. Install the special tool.

Special Tool(s): 303-122
General Equipment: Hydraulic jib crane



20. Remove the special tools.

Special Tool(s): 303-435, 303-435-06, 303-435-11A

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Engine Data

Description	
Engine code	TNBA
Firing order	1-4-3-2
Emission level	Stage V
Bore	87.5 mm
Stroke	83.1 mm
Cubic capacity	1999 cm³
Compression ratio	10 : 1
Power output at 6000 rpm	149 kW (203 PS)
Maximum torque at 1750 - 4000 rpm	300 Nm
Maximum engine speed (intermittent)	6800
Maximum engine speed (continous)	6500
Idle speed	760
Number of main bearings	5
Camshaft drive	Chain
Oil consumption	0.5 l/1000 Km

Engine Oil

Viscosity / ambient temperature	Type	Specification
Recommended engine oil		
SAE 5W-30 / below -20°C to over+40°C	Ford Formula E	WSS-M2C913-C
Alternative engine oils (for topping up only)		
SAE 10W-40 / below -20°C to over +40°C	Ford Formula XR+	ACEA A3/B3
SAE 5W-40 / below -20°C to over +40°C	Ford Formula S/SD	ACEA A3/B3

Engine Oil Capacity

Description	Liters
Service fill including filter	5.4
Service fill including filter	5.1

Lubricants, Fluids, Sealers and Adhesives

	Spezifikationen
Sealant, oil pan contact surface to crankshaft rear seal retainer, oil pan to cylinder block, oil pan to front cover, engine front cover to cylinder block/ oil pan	WSE-M4G323-A4
Oil pressure switch and engine front cover blanking plug sealant	WSK-M2G349-A7

Oil Pressure

Description	Bar
Minimum oil pressure at 800 - 850 rpm (normal operating temperature)	1.0
Minimum oil pressure at 4000 rpm (normal operating temperature)	3.2 - 4.5

Valve Clearance

Description	mm
Valve clearance (engine cold), intake	0.19 - 0.31
Valve clearance (engine cold), exhaust	0.29 - 0.41

Cylinder Head

Description	mm

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Maximum mating face distortion (crosswise)	0.1

Crankshaft

Description	mm
Crankshaft axial clearance	0.22 - 0.45

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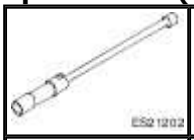
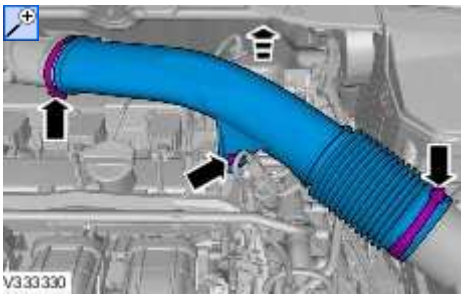
General Procedures

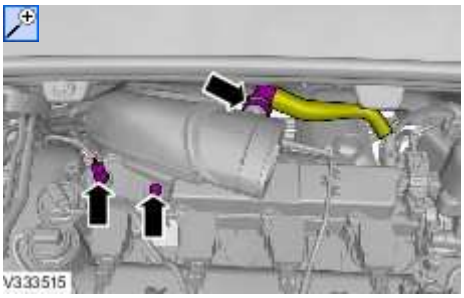
Special Tool(s)

	303-499 Socket, Spark Plug
	310-137 Disconnect Tool, Fuel Line

Adjustment

1.

2. *Torque:* 10 Nm 

3. 

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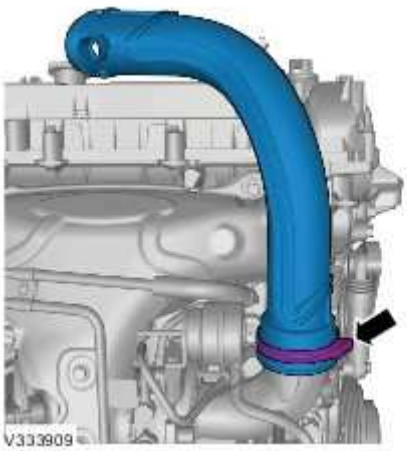
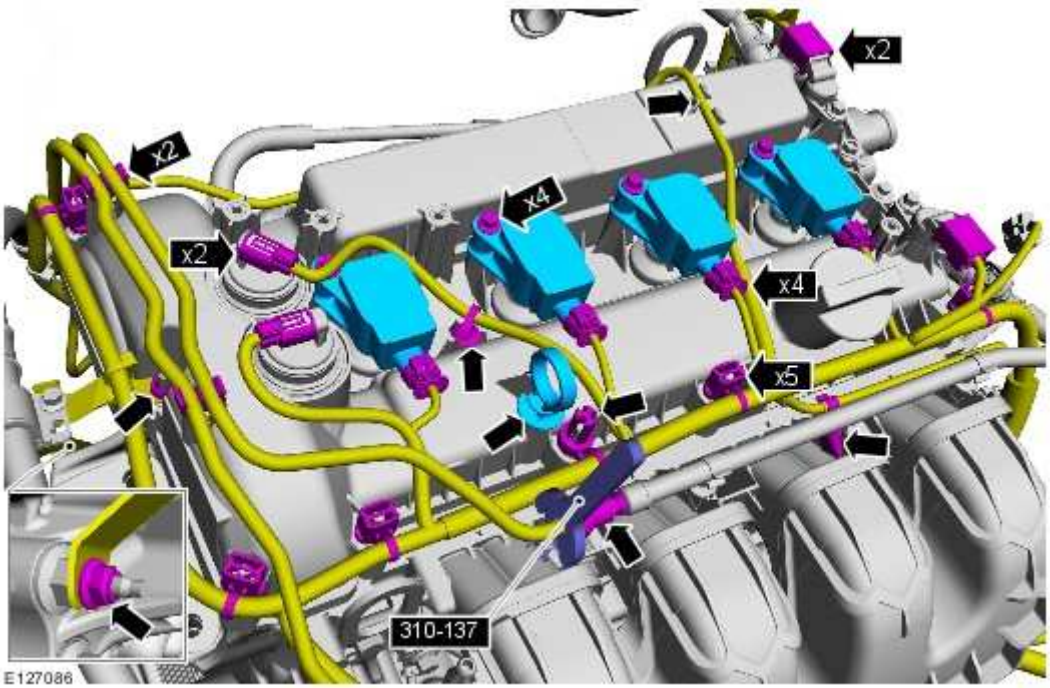


5. *Special Tool (s):* 310-137



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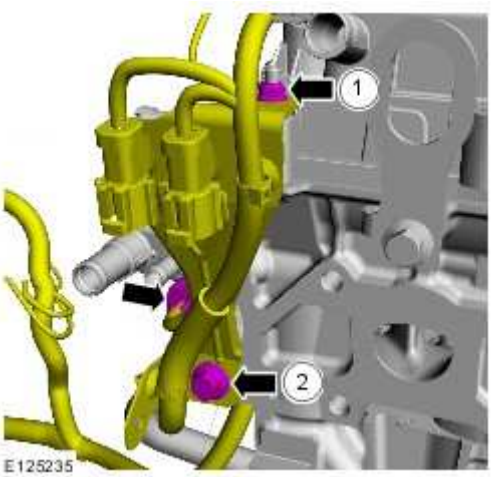

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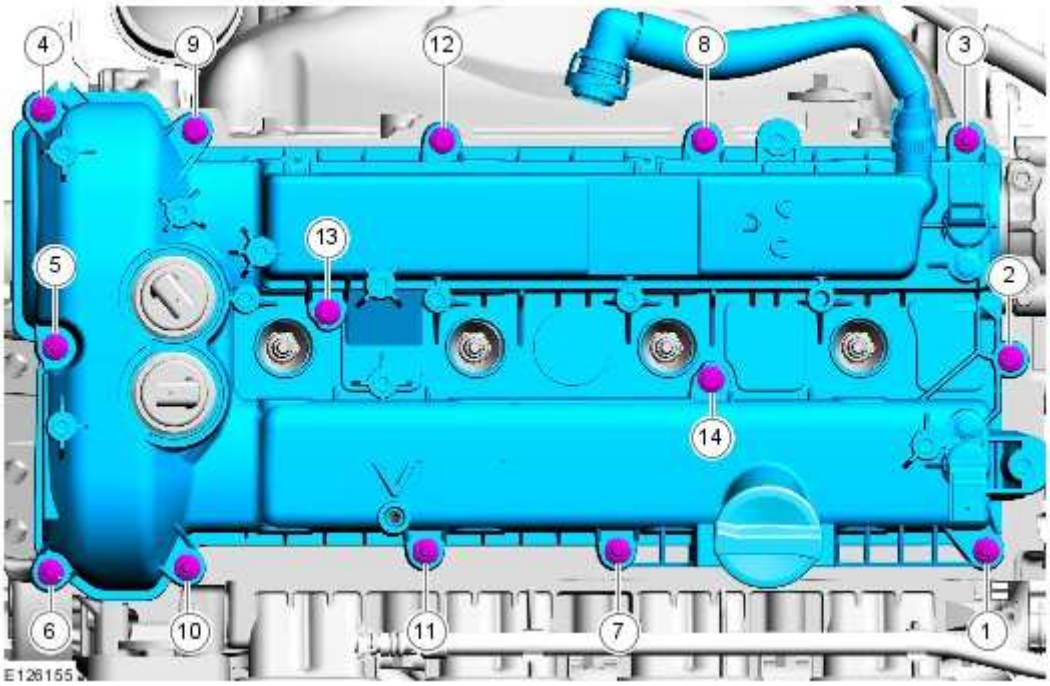
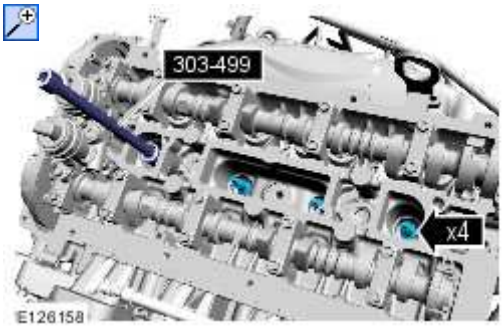
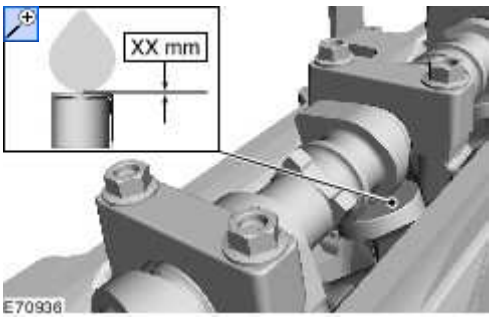




8. *Special Tool(s):* 303-499



9. CAUTION: Only rotate the crankshaft clockwise.
   Rotate the crankshaft until each piston is at top dead center (TDC) and measure the valve clearance(s) using a suitable set of feeler gauges.

10. Measure and note the valve clearance values.

11. Compare the measured valve clearance(s) with the specifications.

    Refer to: Specifications (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Specifications).

12. NOTE: The following steps are only necessary if adjustment is required.

13. Remove the following items:
    - Refer to: Camshafts (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

14.
    - Remove the valve tappet and read the thickness from the underside.

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- The number on the valve tappet indicates the thickness of the bottom of the tappet. However, the number only indicates the digits after the decimal point (example: .650 = 3,650).

15.
    - Calculate the required thickness of the valve tappet with the following formula: X = S + M - V
    - Required thickness of tappet = X
    - Thickness of currently fitted tappet = S
    - Measurement of existing valve clearance (actual value) = M
    - Desired valve clearance = V

16. Install the correct valve tappet.
17. Install the following items:
    - Refer to: Camshafts (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

18. Measure and note the valve clearance values.

19. Compare the measured valve clearance(s) with the specifications.

    Refer to: Specifications (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Specifications).

20. Repeat the procedure as necessary until all valve clearances are within the specified tolerance.
21. Install the following items:
    - Refer to: Timing Chain (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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Removal and Installation

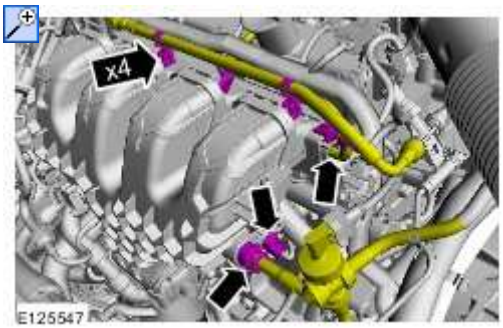
Removal

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

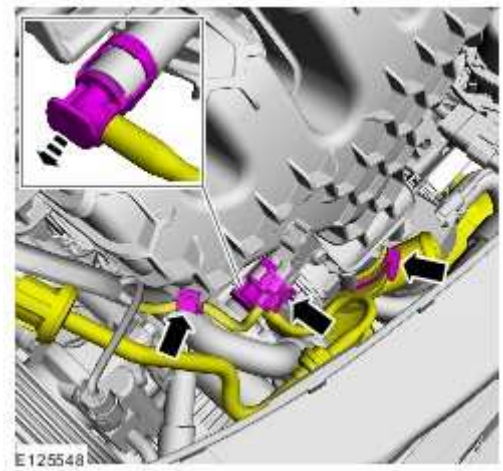
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2.

3.



4.



5. *Torque:* 20 Nm

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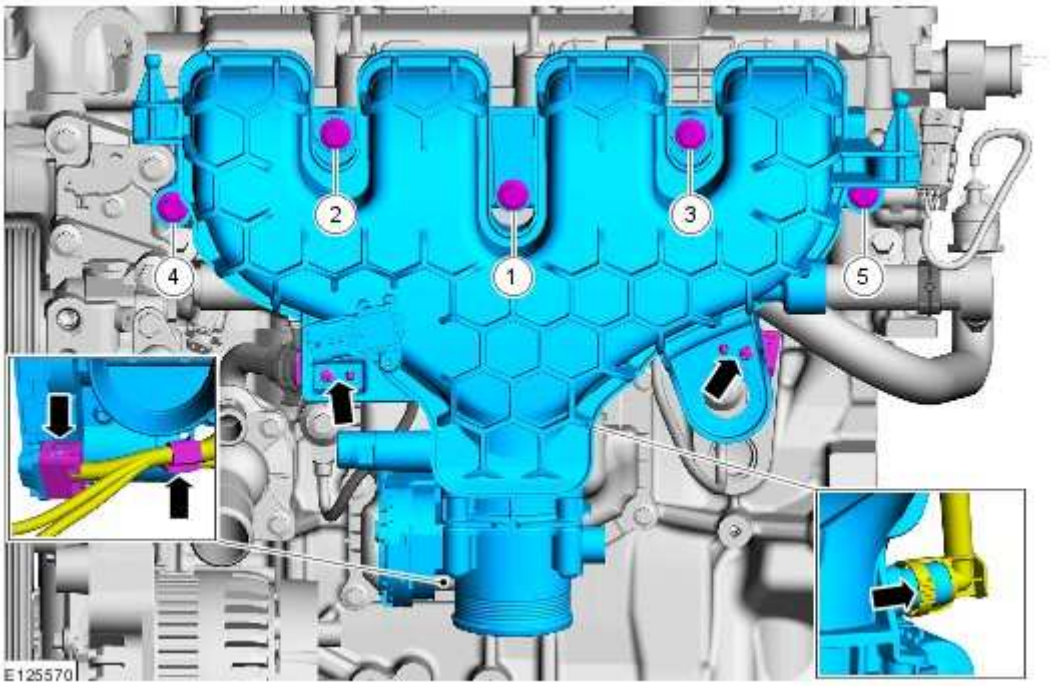

Installation

1. To install, reverse the removal procedure.

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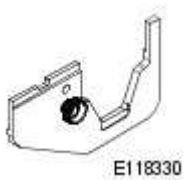
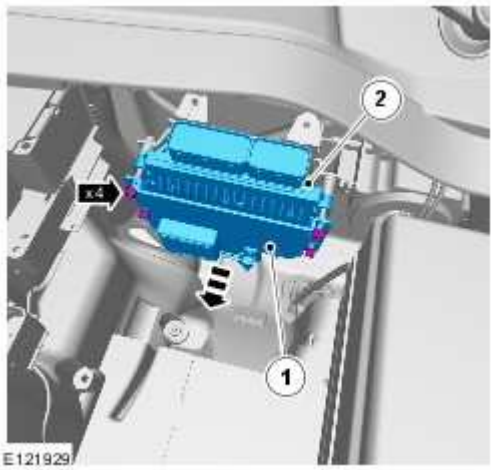
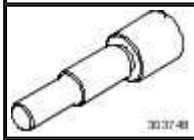
Removal and Installation

Special Tool(s)

 E118330	303-1504 Alignment Tool, Camshaft
 E121929	303-1521 Alignment Tool, Crankshaft Position Sensor
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft
E51251	310-137 Disconnect Tool, Fuel Line

Removal

1. Refer to: Fuel Pump Drive Assembly (303-04B Fuel Charging and Controls - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
2. WARNING: Take extra care when handling th compressed spring.

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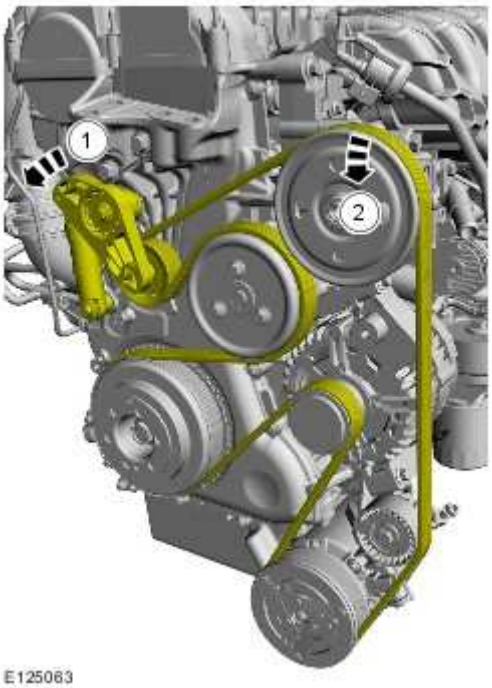

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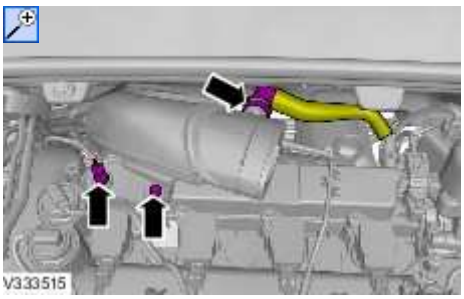

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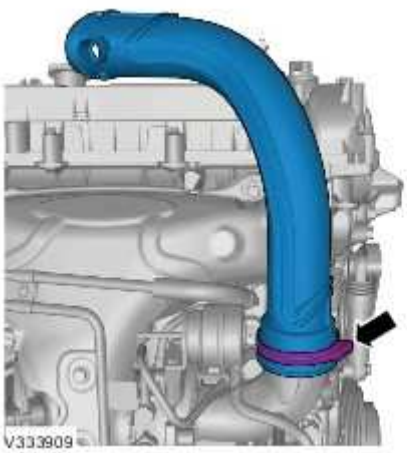

5. *Special T*
(s): 310·
137

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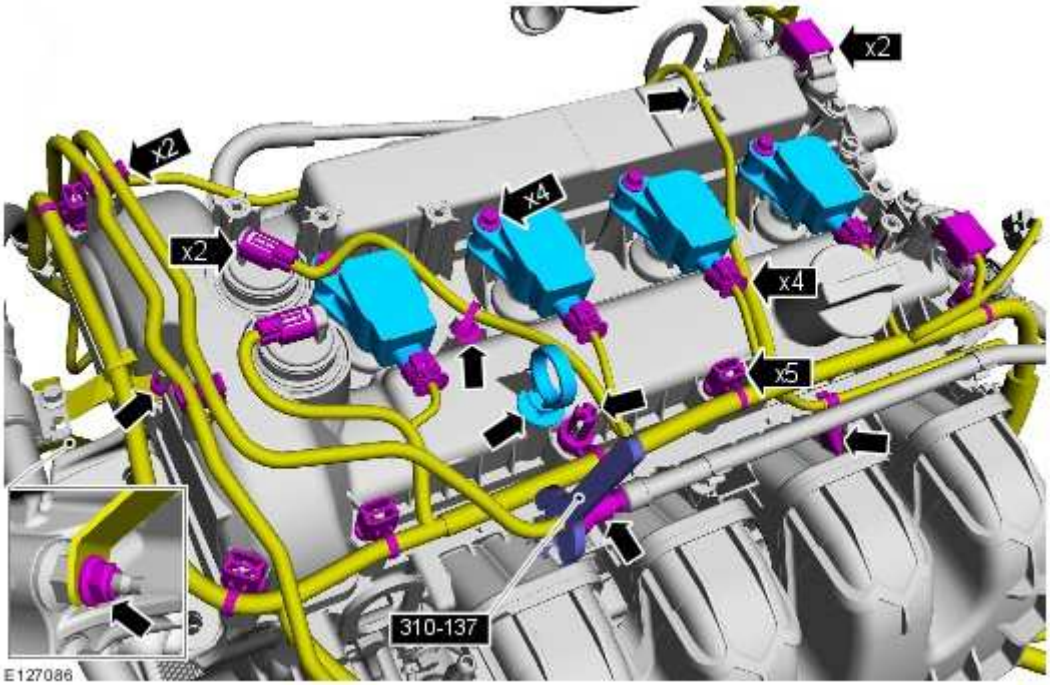

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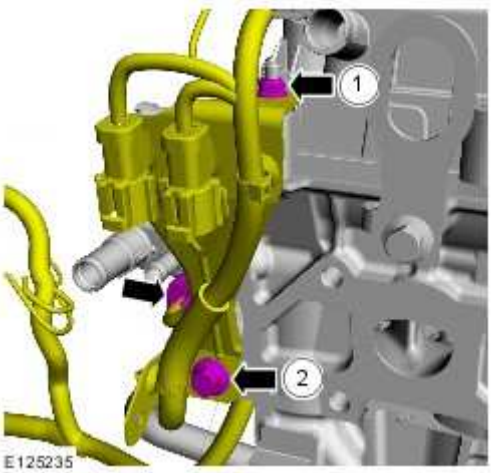

7.

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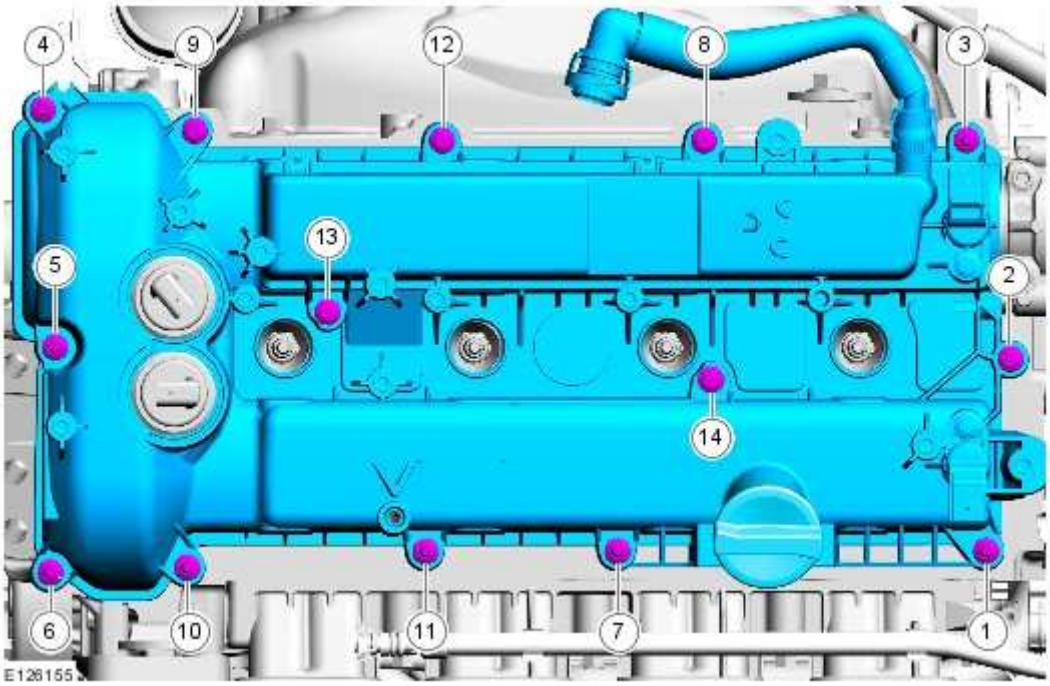
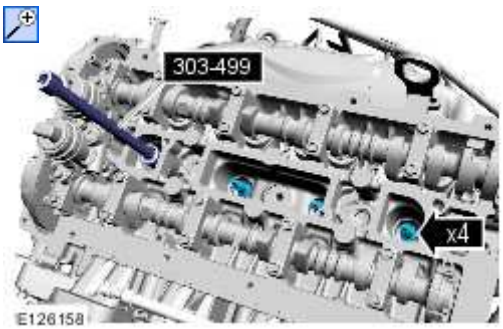
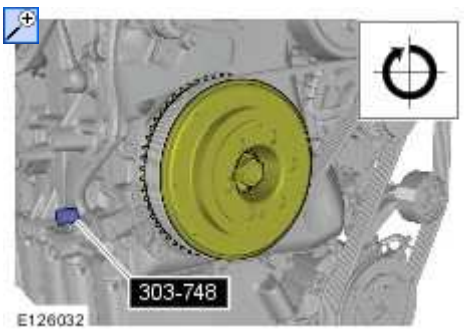




8. *Special Tool(s):* 303-499

9.

2. *Install the Special Tool(s):* 303-748



10. Rotate the crankshaft slowly until the crankshaft stc

Special Tool(s): 303-748

11.

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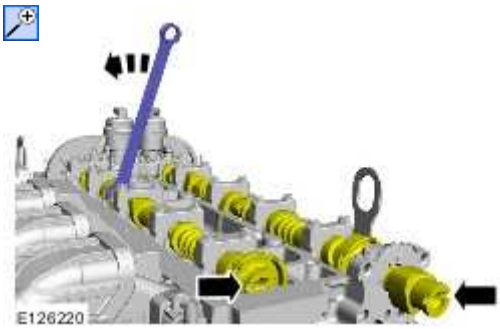
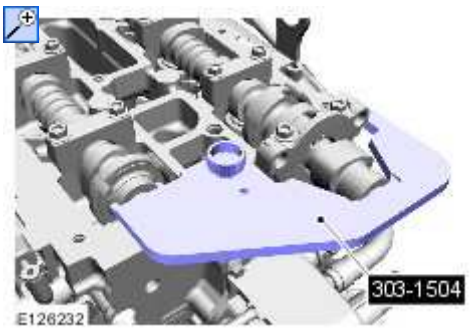


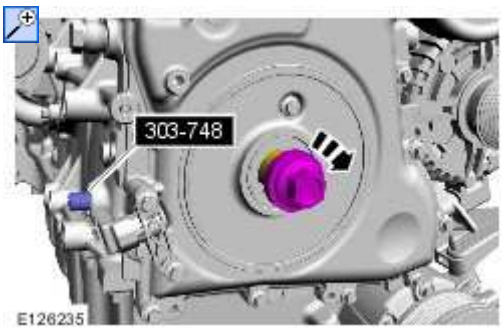
12. CAUTION: Only rotate the camshaft clockwise



13. *Install the Special Tool(s):* 303-1504

Installation

1. Refer to: Crankshaft Front Seal (303-01B Engine - 2 EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



2. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft slowly until the crankshaft stc

Special Tool(s): 303-748

3.

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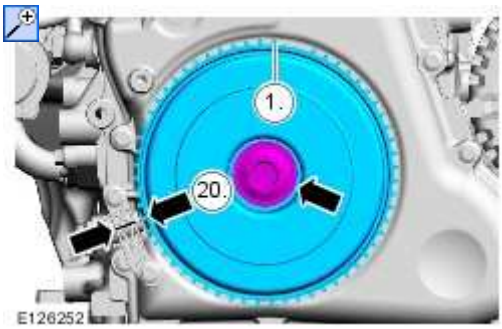
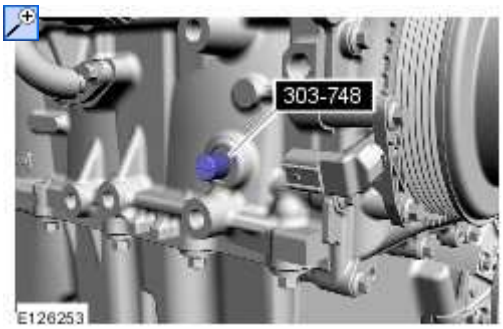
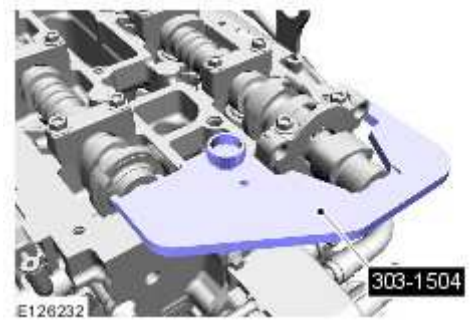


4.

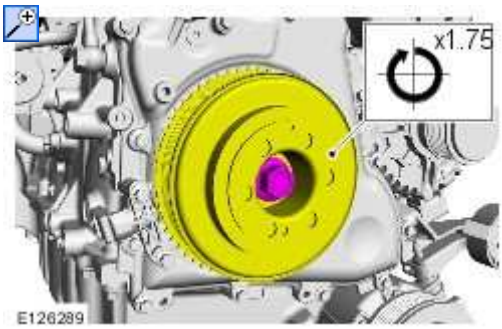
- CAUTION: Make sure that the component aligns with the installation mark
- *Torque:*
  Stage 1: 100 Nm
  Stage 2: 90°



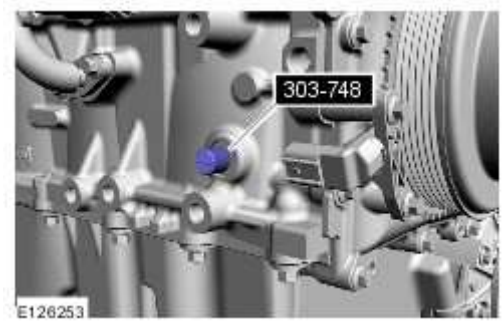
5. *Remove the Special Tool(s):* 303-748



6. *Remove the Special Tool(s):* 303-1504



7. CAUTION: Only rotate the crankshaft clockwise.



8. *Install the Special Tool(s):* 303-748

9. Rotate the crankshaft slowly until the crankshaft stops.

   Special Tool(s): 303-748

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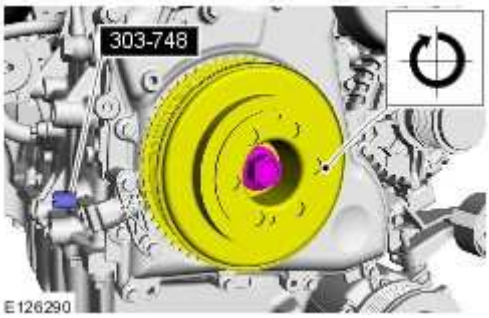
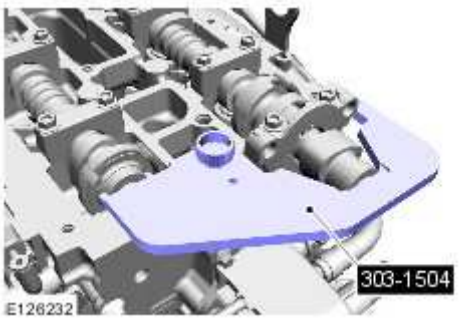
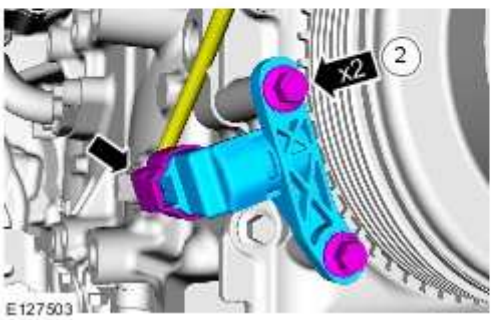


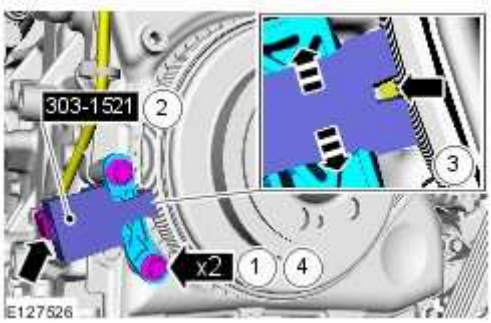
10. NOTE: The special tool can only be installed if the valve timing is correct.
Install the Special Tool(s): 303-1504



11. *Remove the Special Tool(s):* 303-1504

12.
    2. *Loosen:* 2 turn(s)





13.
    1. NOTE: Only tighten the bolts finger tight at this stage.
    2. *Install the Special Tool(s):* 303-1521
    3. CAUTION: Make sure that the component aligns with the installation mark
    4. *Torque:* 7 Nm

14. *Remove the Special Tool(s):* 303-1521

15.
    1. *Remove the Special Tool(s):* 303-748
    2. *Torque:* 20 Nm

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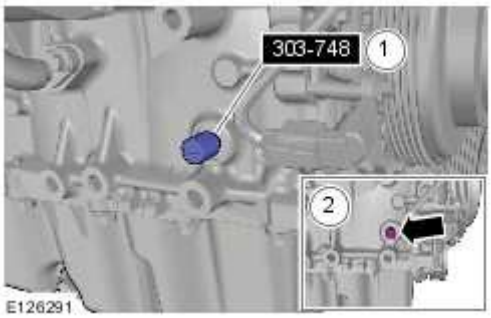
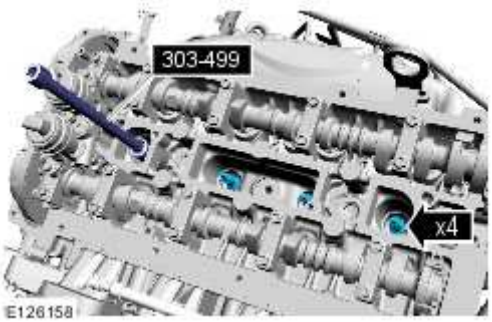
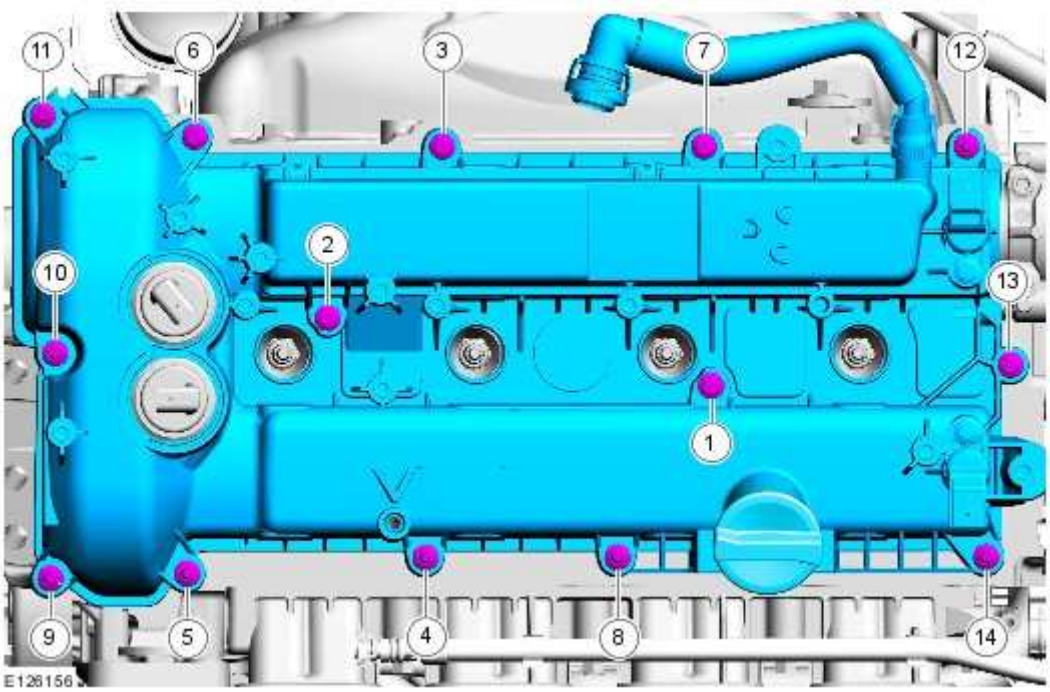
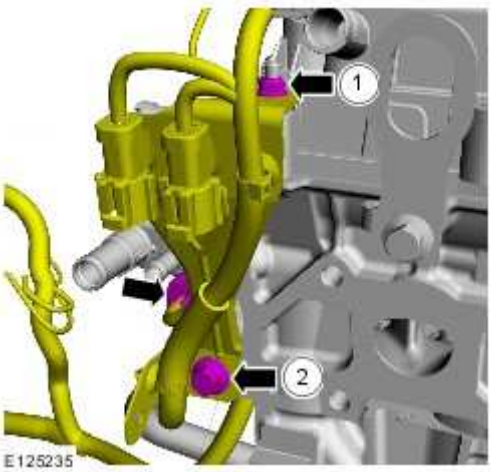




16. *Special Tool(s):* 303-499
Torque: 12 Nm



17. NOTE: The gasket is to be reused unless damage
Torque: Nm



18. *Torque:*
1 10 Nm
2 24 Nm

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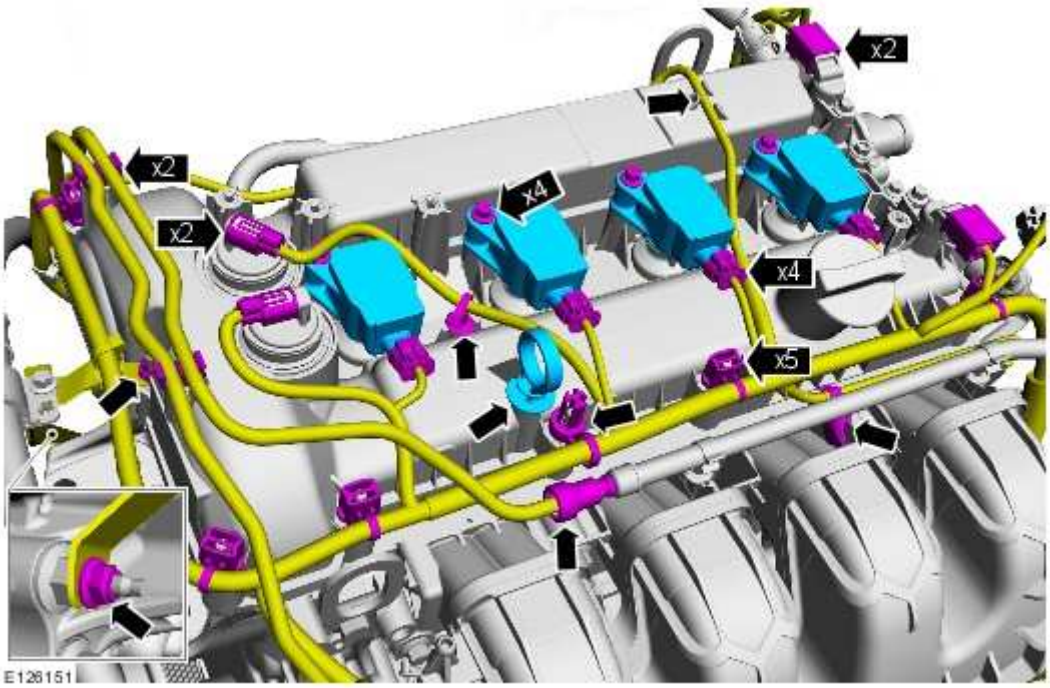
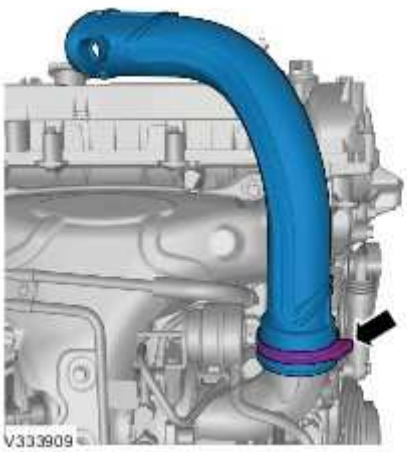
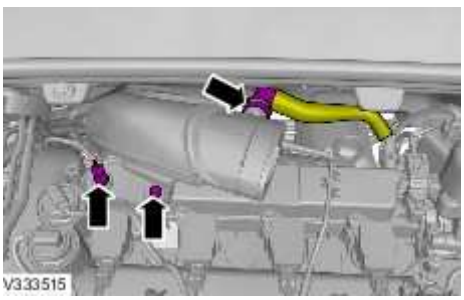
19. *Torque:* Nm



20.





21. *Torque:* 10 Nm

22. WARNING: Take extra care when handling th compressed spring.

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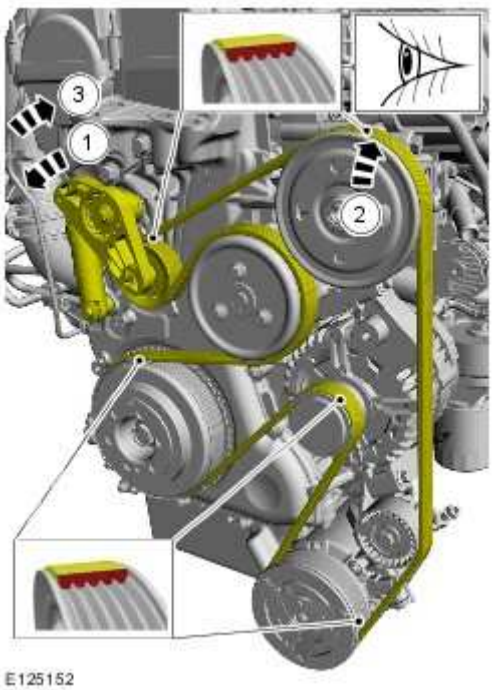

E125152

23. Refer to: Fuel Pump Drive Assembly (303-04B Fuel Charging and Controls - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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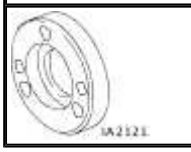
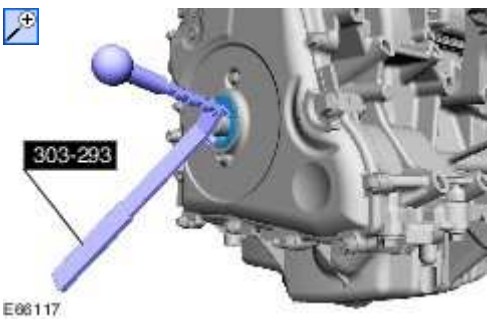
Removal and Installation

Special Tool(s)

	303-293 Remover, Crankshaft Seal
	303-509 Remover, Vibration Damper Hub

Removal

1. Refer to: Crankshaft Pulley (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
2. *Special Tool(s):* 303-293



3.
   - Discard the friction washer.

Installation

1. CAUTION: Make sure that a new friction washer is installed.
2. *Special Tool(s):* 303-509

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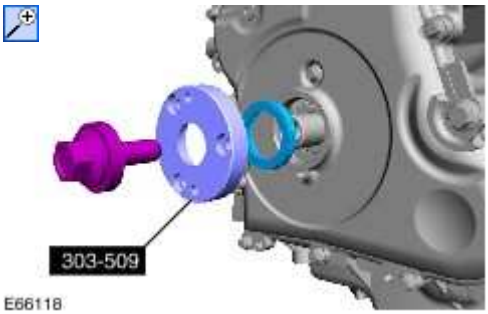

3. Refer to: Crankshaft Pulley (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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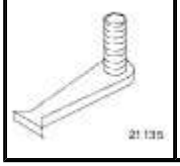
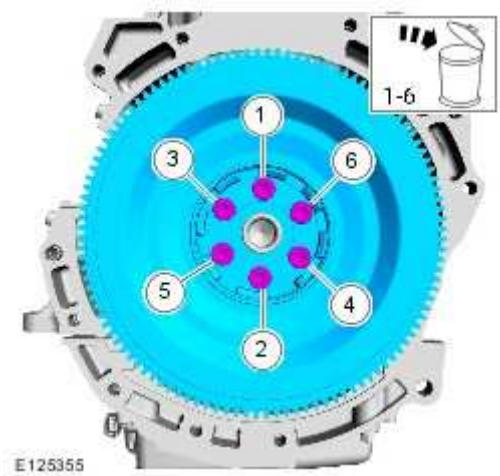
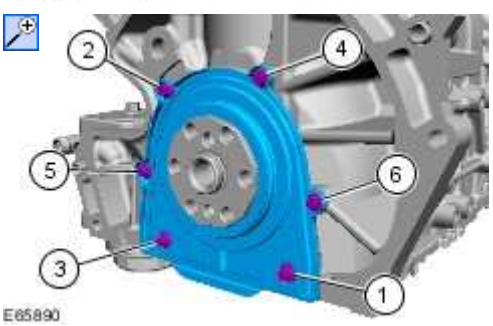
Removal and Installation

Special Tool(s)

	303-254 Locking Tool, Flywheel

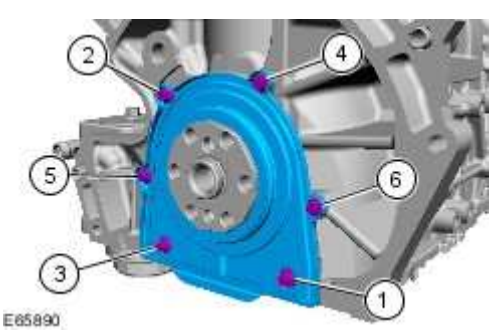
Removal

1. Remove the following items:
   1. Refer to: Transmission - 2.0L EcoBoost SCTi (147kW/203PS) - MI4 (307-01C, Removal).
   2. Refer to: Oil Pan (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
2. 

3. 

NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

Installation

1. 

NOTE: Make sure that a new component is installed.
NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
Torque: 10 Nm

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2. CAUTION: Make sure that new bolts are installed.
   Special Tool(s): 303-254
   Torque: 112 Nm

3. Install the following items:
   1. Refer to: Oil Pan (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
   2. Refer to: Transmission - 2.0L EcoBoost SCTi (147kW/203PS) - MI4 (307-01C, Installation).

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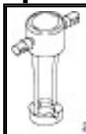
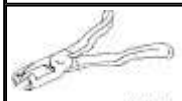
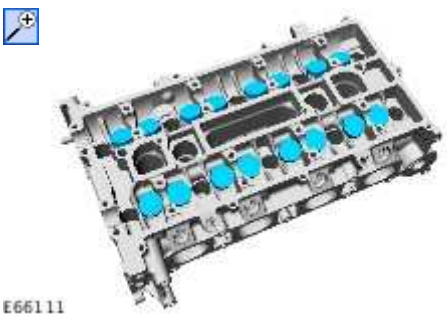
Removal and Installation

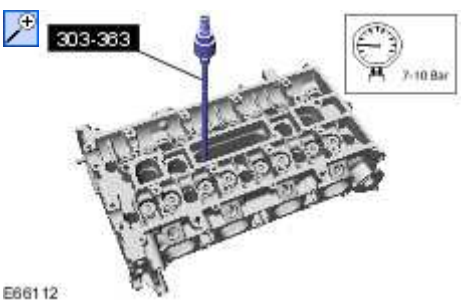
Special Tool(s)

	303-361-02 Adapter for 303-361A
	303-361A Compressor, Valve Spring
	303-362 Installer, Valve Stem Collets
	303-363 Adapter, Air Supply (Cylinder Head)
	303-508 Pliers, Valve Stem Seal

Removal

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

1. Refer to: Camshafts (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
2. 

3. *Special Tool(s):* 303-363


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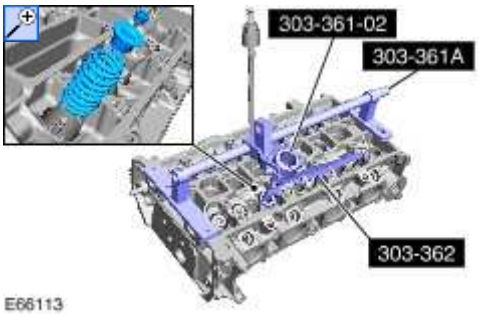
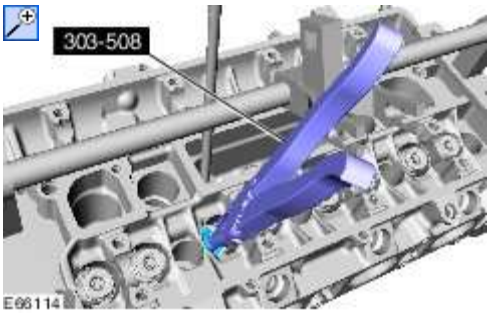


4. *Special Tool(s):* 303-361A, 303-361-02, 303-362



5. *Special Tool(s):* 303-508

Installation

1. To install, reverse the removal procedure.

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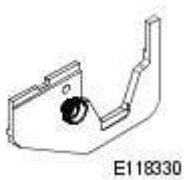
Removal and Installation

Special Tool(s)

 E118330	303-1504 Alignment Tool, Camshaft

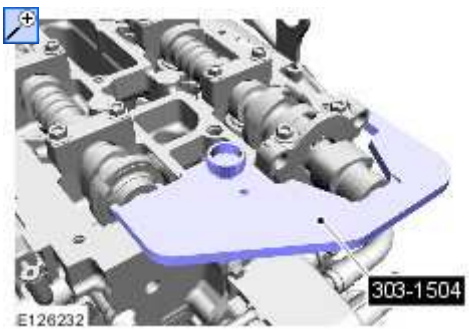
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA

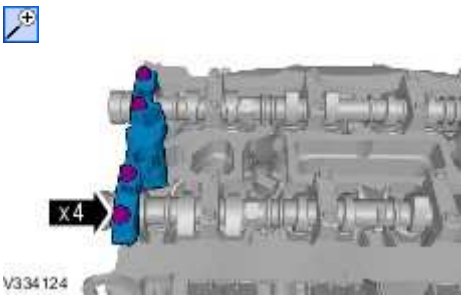
Removal

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

1. Refer to: Timing Chain (303-01B Engine - 2.0L EcoB SCTi (149kW/203PS) - MI4, Removal and Installatio
2. *Remove the Special Tool(s):* 303-1504



3. CAUTION: Note the position of the componen before removal.
Torque: 10 Nm



4. Loosen each bolt 2 turns at a time until all bolts are removed.

Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm

5. CAU
Note the
position

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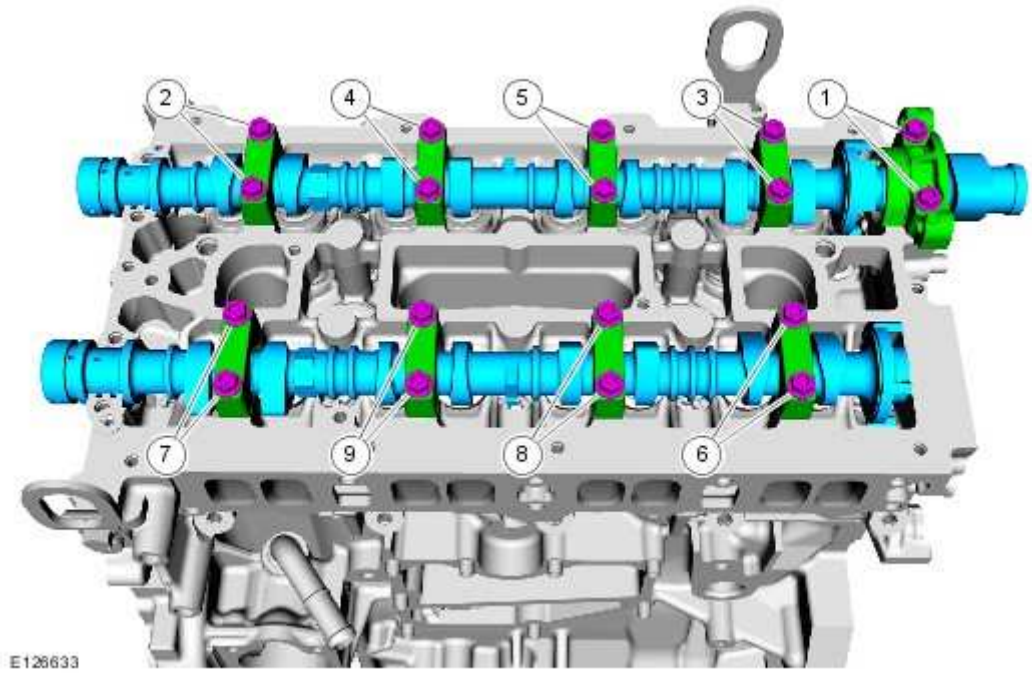
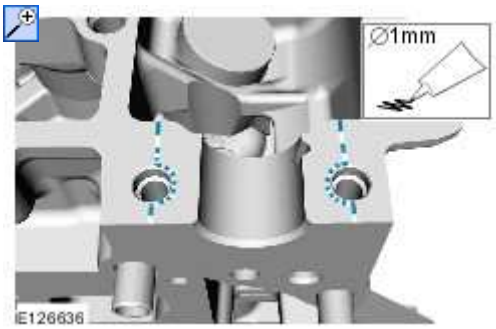
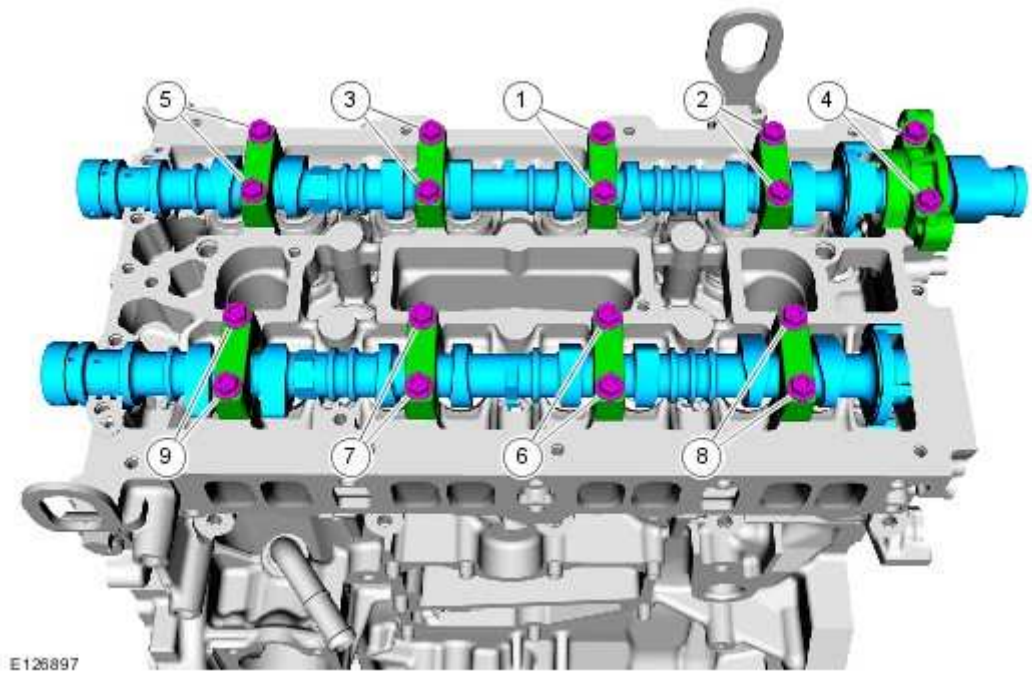


compone
before
removal
Loosen e
2 turns a
until all b
removed

Installation

1. To install, reverse the removal procedure.
2. NOTE: The component must be installed within 10
minutes of applying the sealant.
Material: Flange Sealant - Anaerobic LP (WSK-M2G3
5U7J-M2G348-BA)





3. CAU
Make su
that the
compone
are insta
to the po
noted be
removal
Install th
camshaf
approxim
valve ov
position
No. 4.

4. Tighten
bolt 2 tu
time.

Material:
Oil - 5W-

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	(WSS-M2 C) *Torque:* S 7 Nm S 16 Nm

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Removal and Installation

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

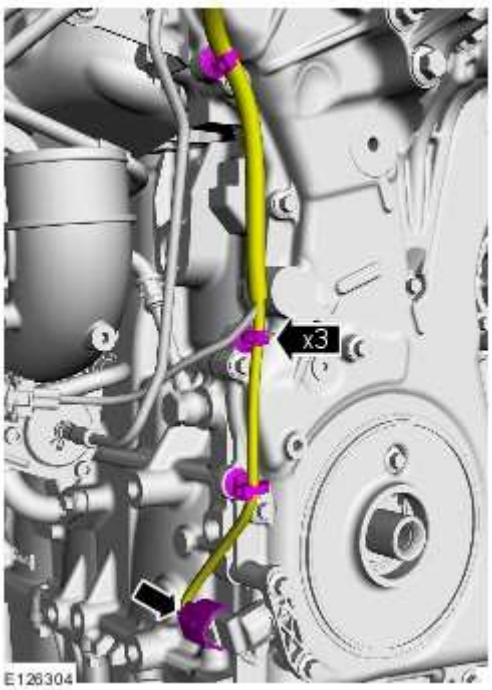
Trolley jack

Removal

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

1. Refer to: Crankshaft Pulley (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

2.



3.

4.

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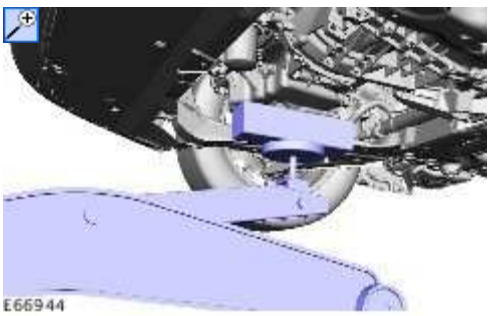
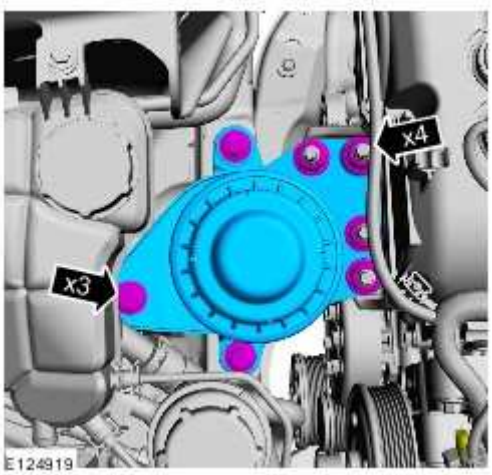
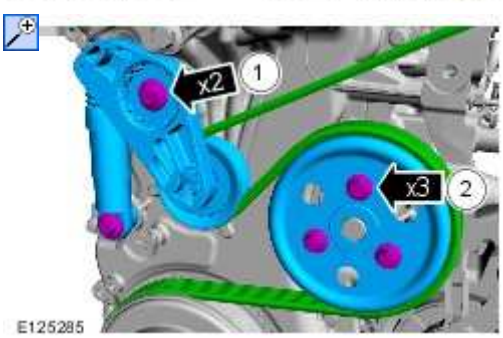


5. *General Equipment:* Trolley jack



6.



7.
1. *Torque:* 24 Nm
2. *Torque:* 20 Nm

8. *Torque:* 24 Nm

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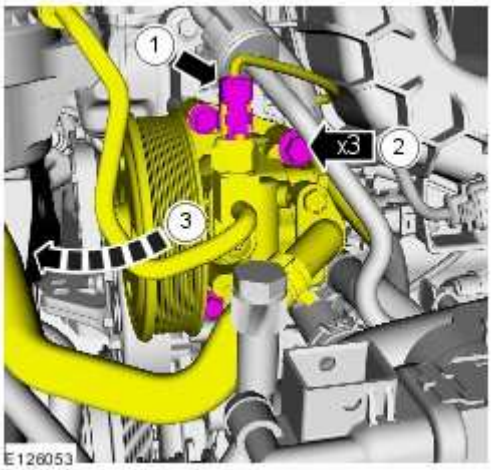
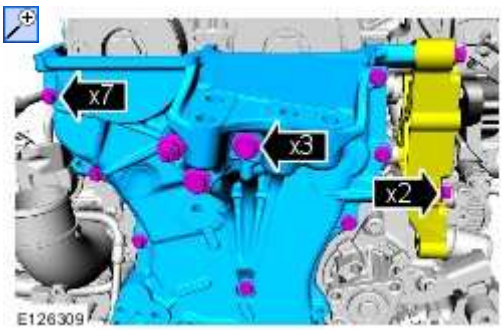
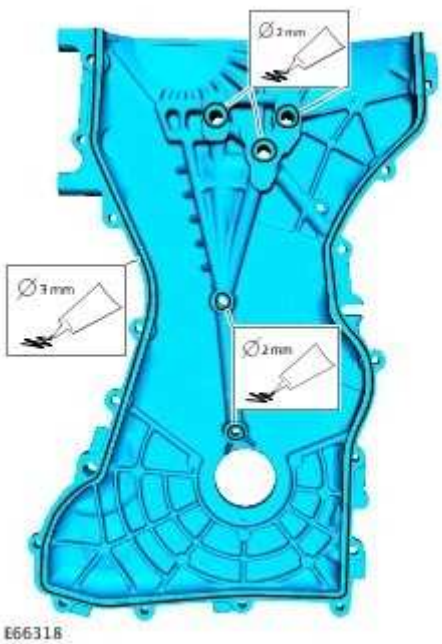




9.

Installation



1. To install, reverse the removal procedure.
2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

3.
   1. NOTE: Install all the bolts finger tight before final tightening.
   2. *Torque:*
      1 - 20 10 Nm

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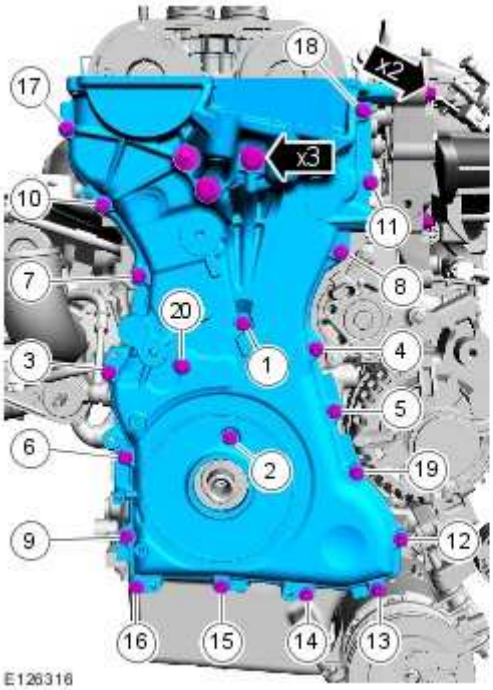
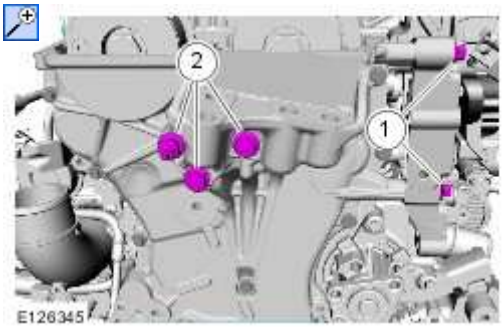
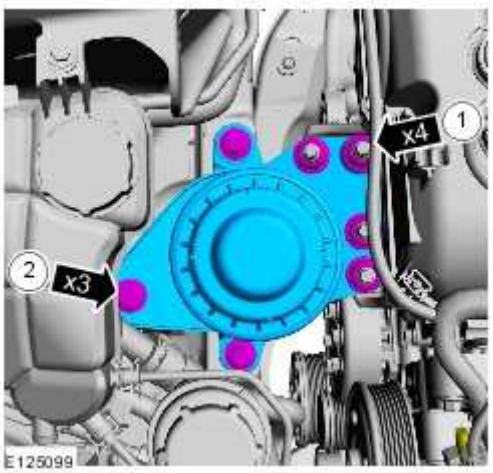
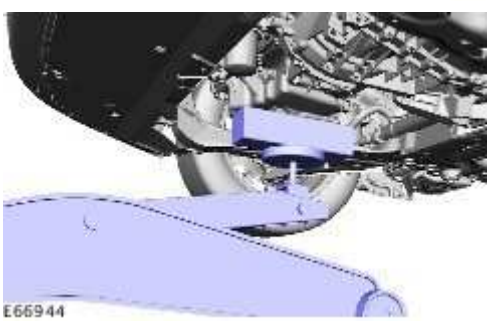




4.
1. *Torque:* 24 Nm
2. *Torque:* 47 Nm



5.
1. *Torque:* 80 Nm
2. NOTE: Only tighten the bolts finger tight at this stage.



6. Remove the following items:
   - *General Equipment:* Trolley jack

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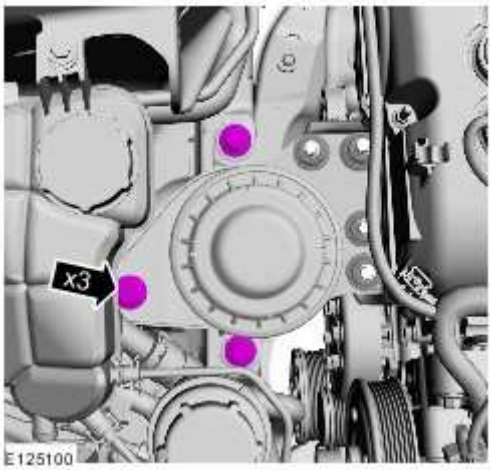
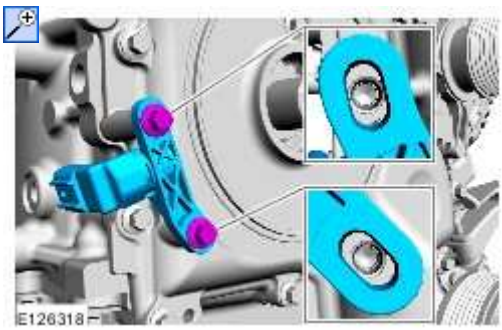


7. *Torque:* 80 Nm



8. *Torque:* 7 Nm

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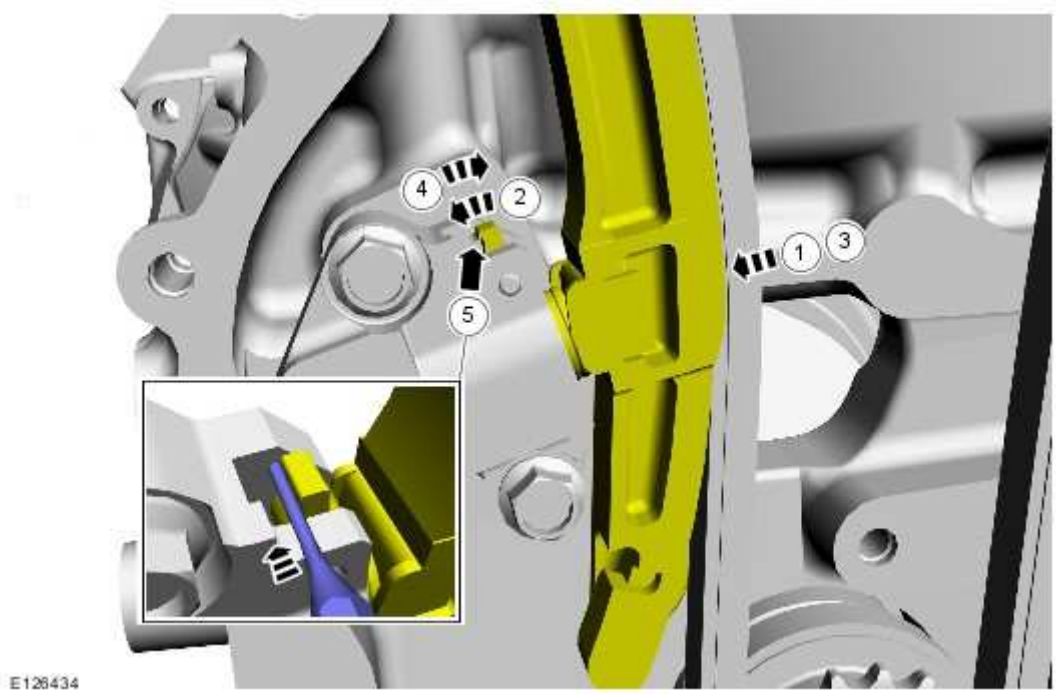
Removal and Installation

General Equipment

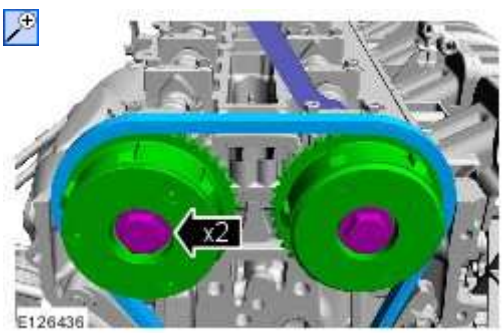
2 mm punch

Removal

1. Refer to: Timing Cover (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



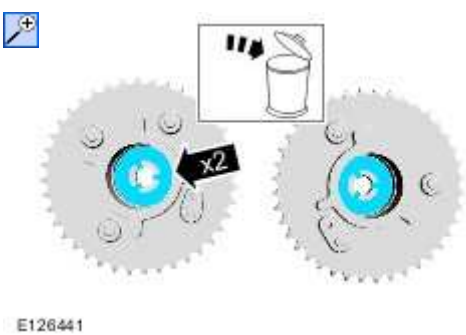
2. *General Equipme*
2 mm punch



3. CAUTIONS:

Note the position of the components before removal.

Use an open-ended wrench to prevent the component from turning.



4.

5.

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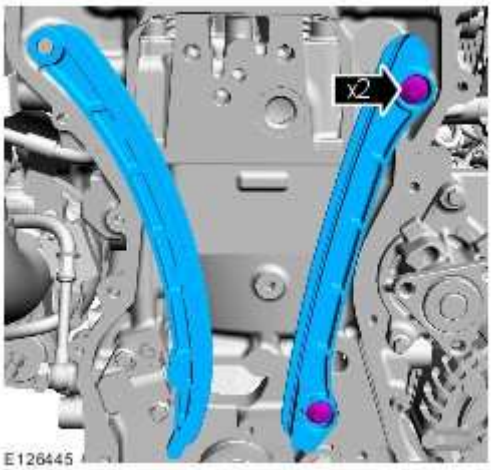
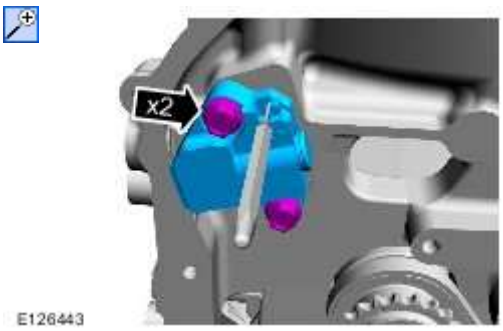
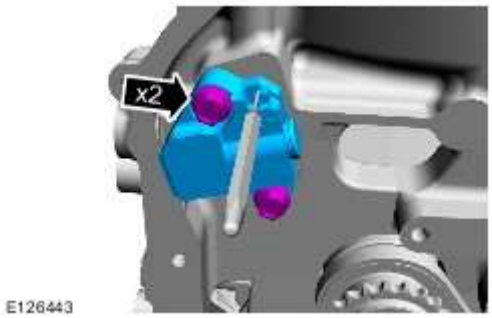


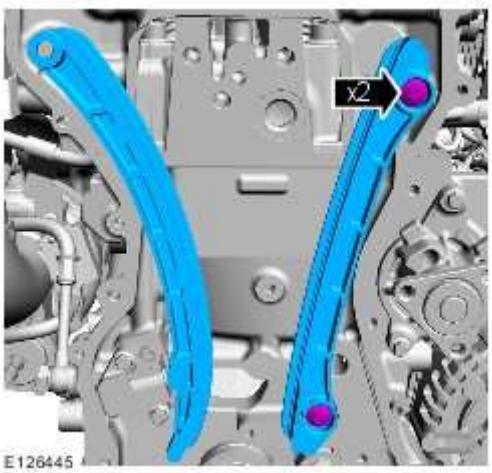


6.

Installation



1. *Torque:* 10 Nm



2. *Torque:* 10 Nm

3. CAUTION: Make sure that a new friction washer is installed.

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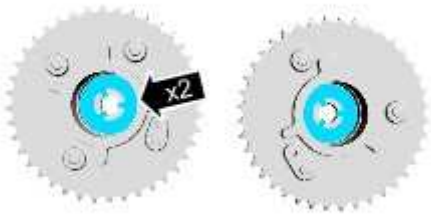
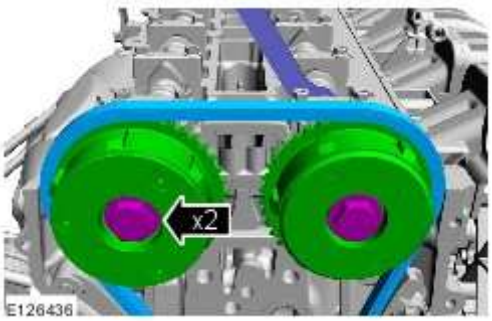
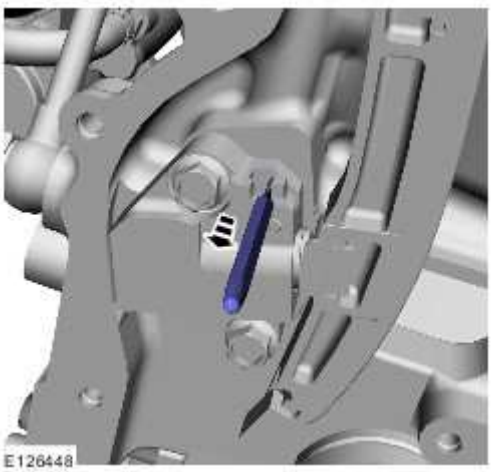


E126310



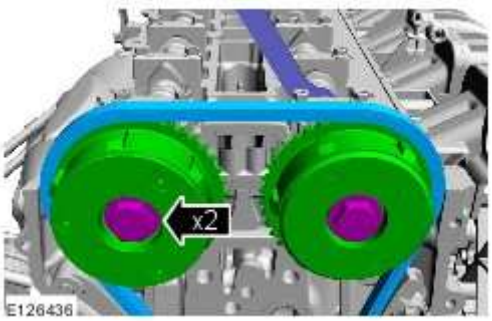
E126436

4. CAUTION: Make sure that the components are installed to the position noted before removal
NOTE: Only tighten the bolts finger tight at this stage.



E126448

5. *General Equipment:* 2 mm punch



E126436

6. CAUTION: Use an open-ended wrench to prevent the component from turning.
Torque: 72 Nm

7. Refer to: Timing Cover (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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Removal and Installation

Removal and Installation

1. Refer to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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Removal and Installation

Special Tool(s)

	303-699 Wrench, Oil Filter

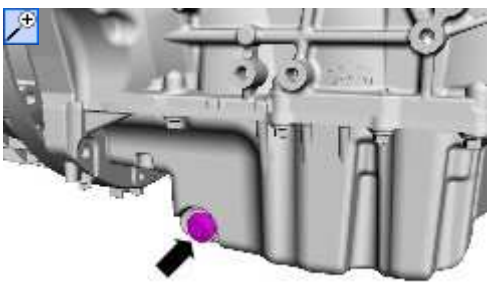
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

Removal

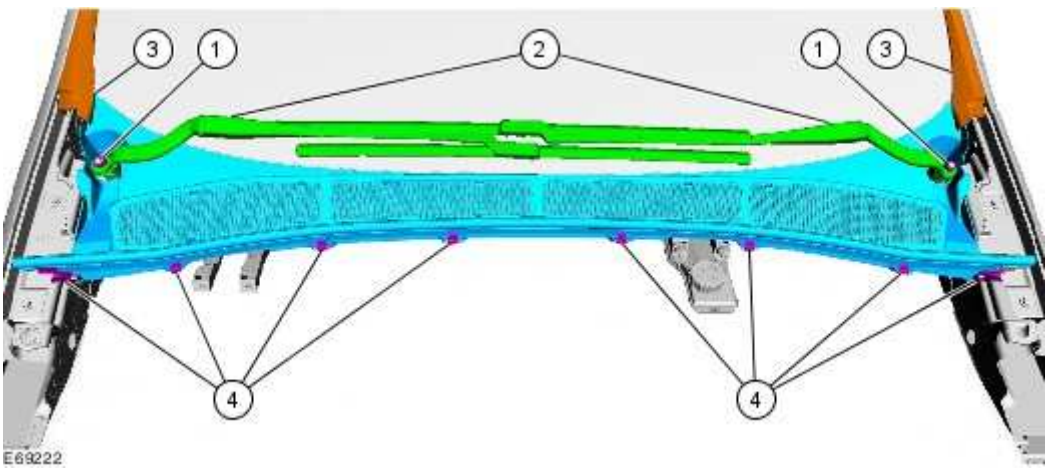
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Cooling System Draining and Vacuum Fillin (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).



E68761

2. WARNING: Be prepared to collect escaping fluid.
   Torque: 27 Nm



E69222

3.
   1. *Torq* 22 N

4.

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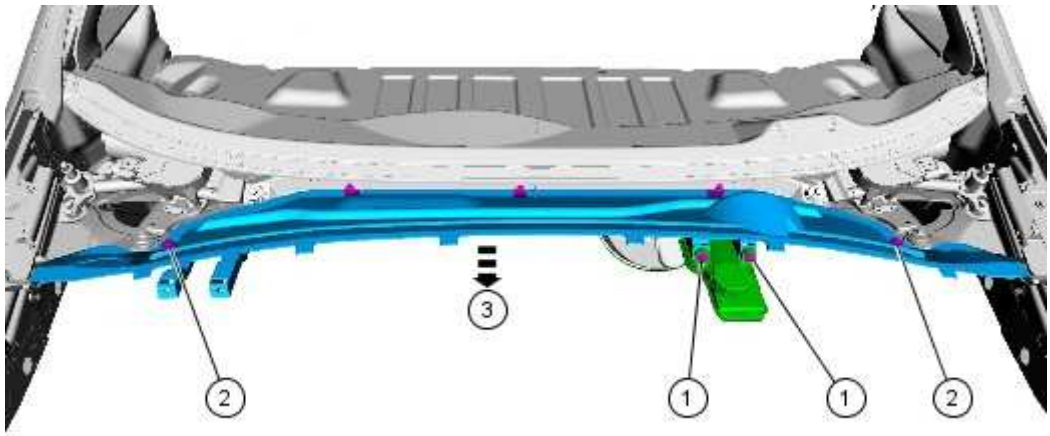
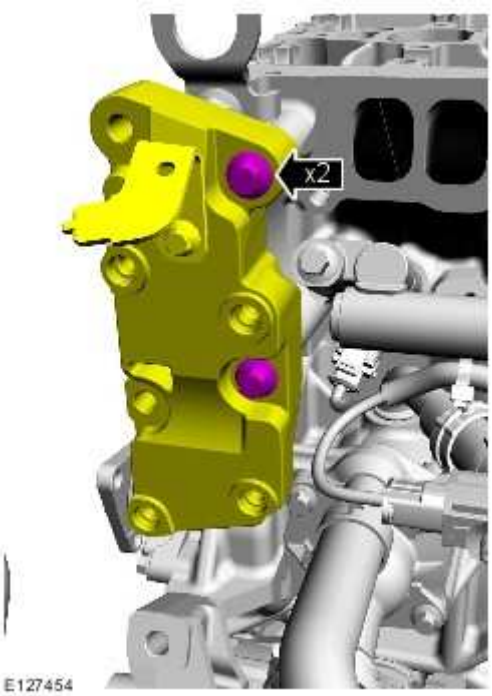


E69223

5. Remove the following items:
    1. Refer to: Camshafts (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
    2. Refer to: Intake Manifold (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
    3. Refer to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



E127454

6. *Torque:* 24 Nm

7.
    1. *Torque:* 24 Nm
    2. *Torque:* 10 Nm

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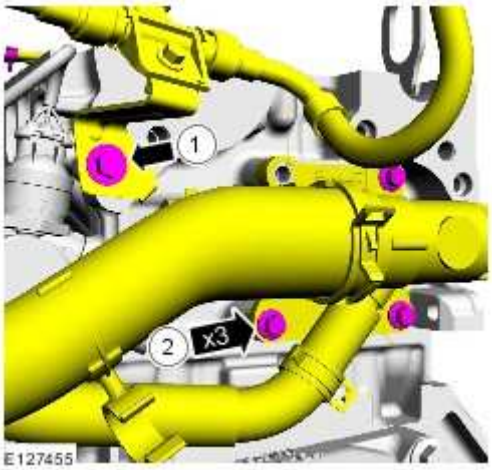
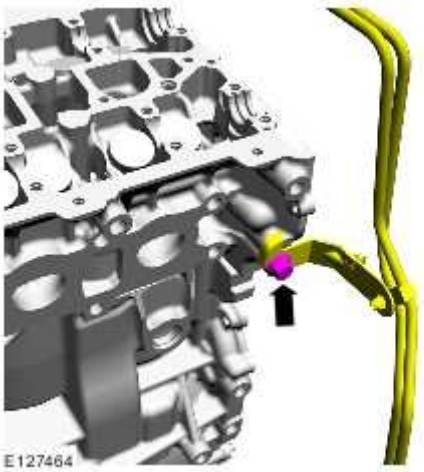
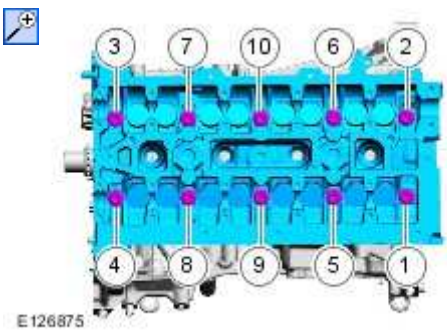


8. *Torque:* 24 Nm





9. *Torque:*
   Stage 1: 7 Nm
   Stage 2: 15 Nm
   Stage 3: 55 Nm
   Stage 4: 90°
   Stage 5: 90°

Installation

1. To install, reverse the removal procedure.
2. NOTE: Make sure that a new component is installed.
   Special Tool(s): 303-699

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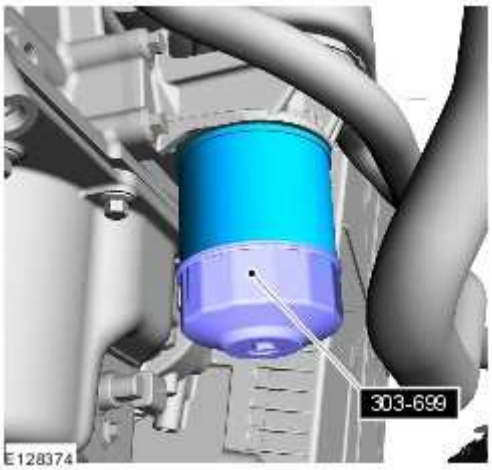

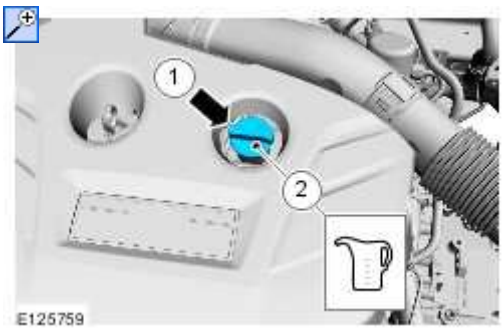

3. Refer to: Specifications (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Specifications
Material: Engine Oil - 5W-30 (WSS-M2C913-C)

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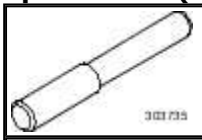
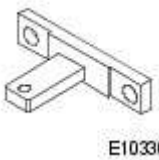
Removal and Installation

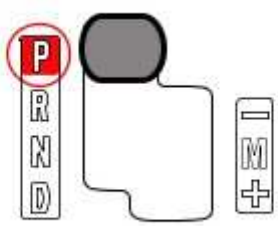
Special Tool(s)

	303-735 Alignment Peg, Camshaft
 E103300	308-761 Locking Tool, Flywheel

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal



E125708

1.

2. Refer to: Air Cleaner (303-12B Intake Air Distributio and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

3. WARNING: Take extra care when handling the compressed spring.

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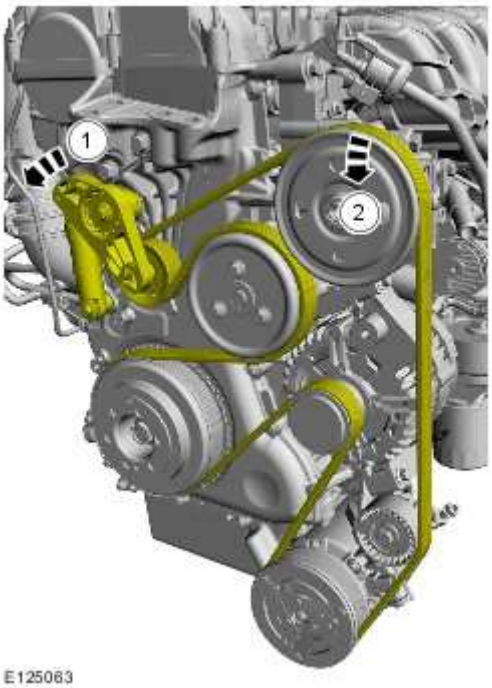
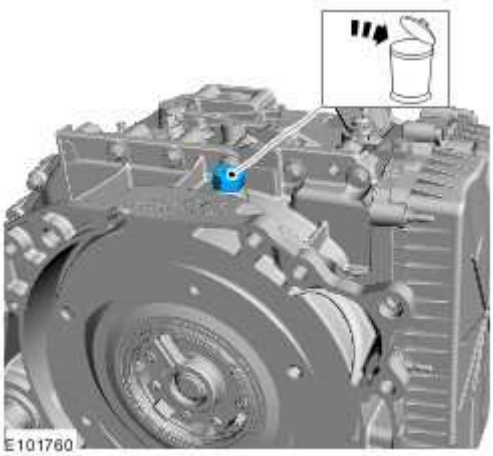
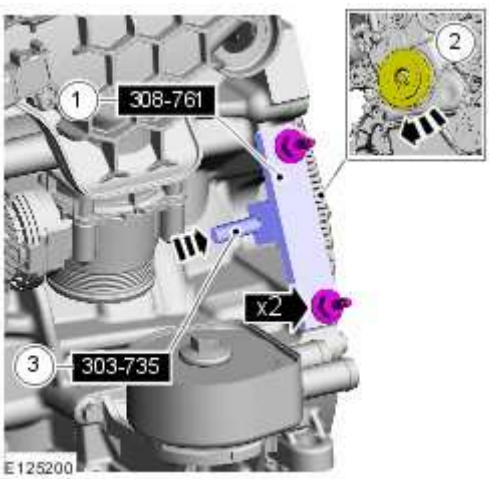


4. Refer to: Starter Motor (303-06B Starting System - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
5.



6.
   1. *Install the Special Tool(s):* 308-761
      Torque: 15 Nm
   2. CAUTION: Only rotate the crankshaft clockwise.
   3. *Install the Special Tool(s):* 303-735



7. NOTE: Make sure that a new component is installed.

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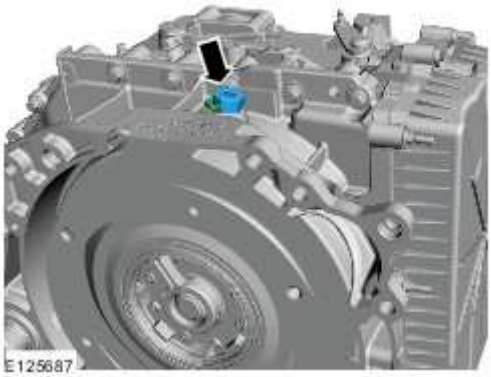
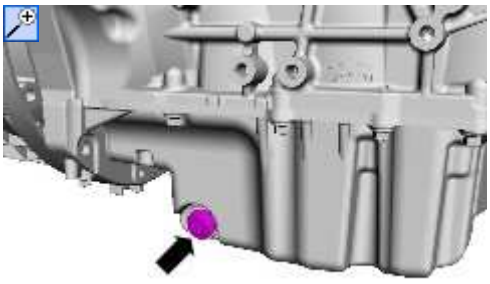
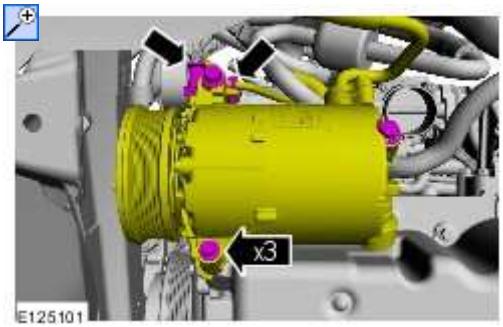


8. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



9. WARNING: Be prepared to collect escaping fluid.
Torque: 27 Nm



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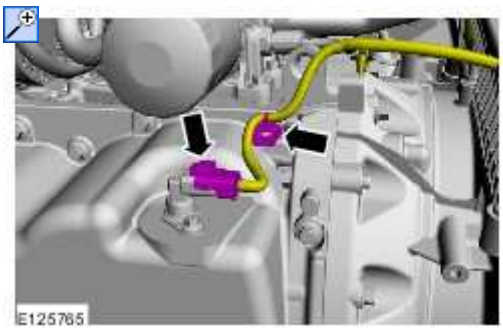

11.

12. *Loosen:* 5 turn(s)

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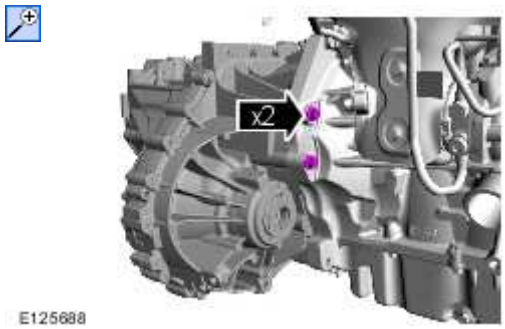

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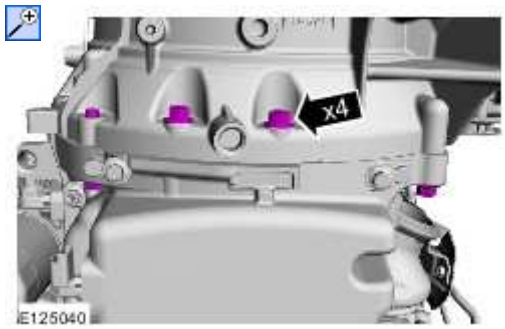
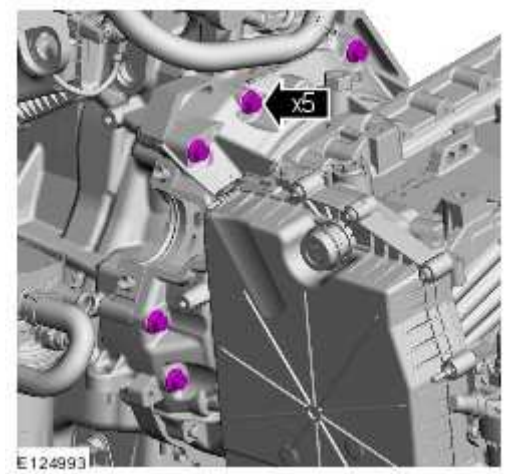


14. *Loosen:* 5 turn(s)



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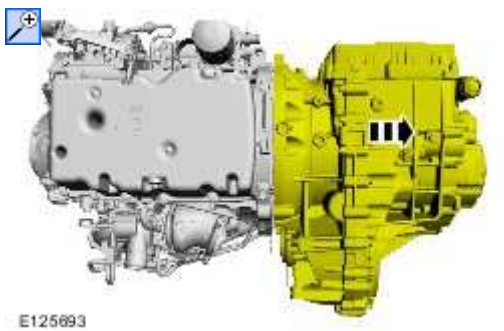

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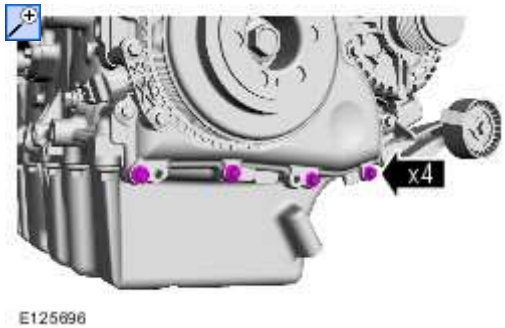

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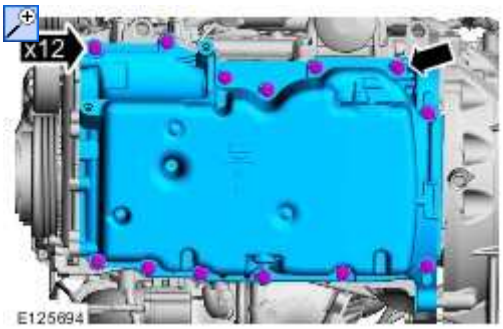
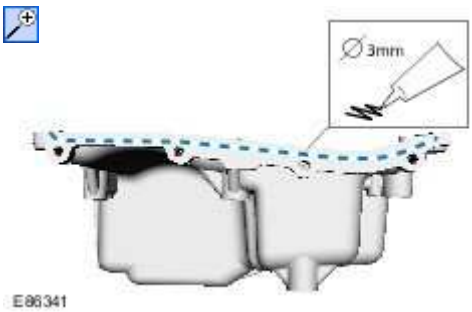
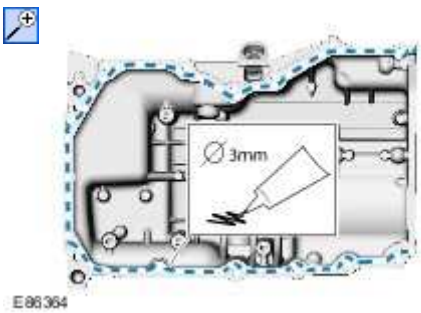


17.

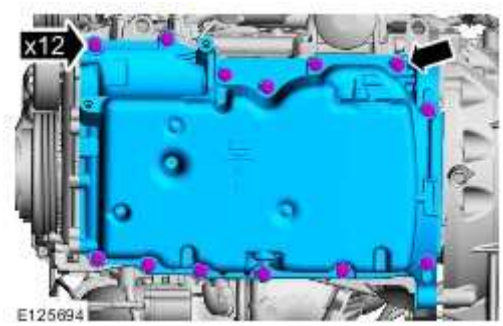
Installation



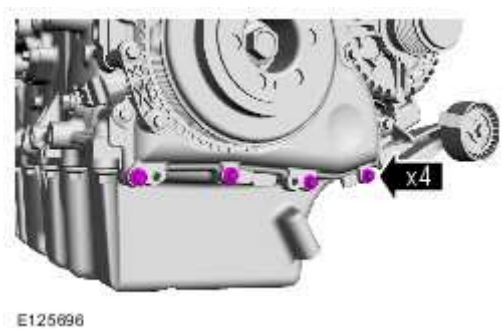
1. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



3. NOTE: Only tighten the bolts finger tight at this stage.



4. *Torque:* 10 Nm

5. *Torque:* 20 Nm

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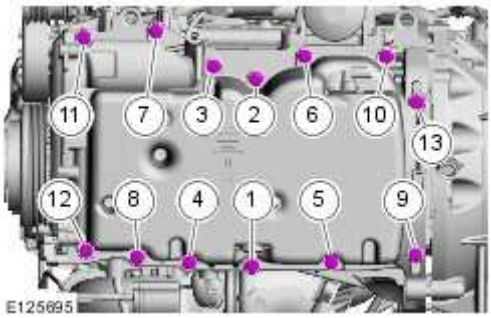
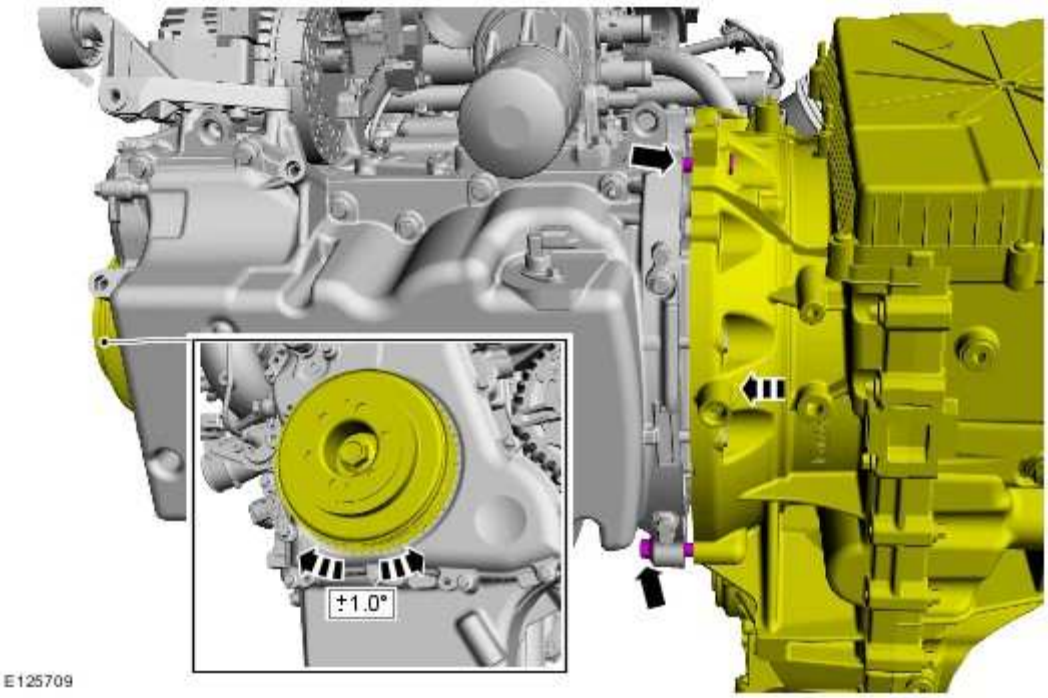
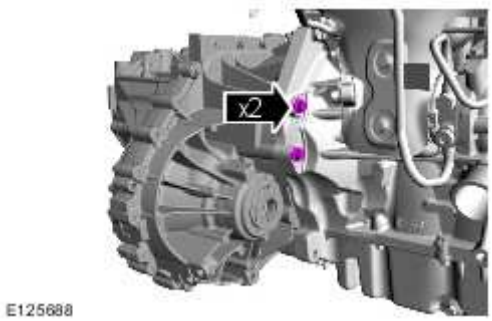
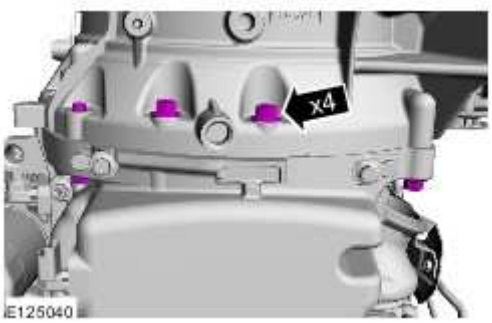




6. Tighten the bolts by one turn at a time and check in between the cranksha is not getting blocked.



7. *Torque:* 48 Nm



8. *Torque:* 48 Nm

9. *Torque:* 24 Nm

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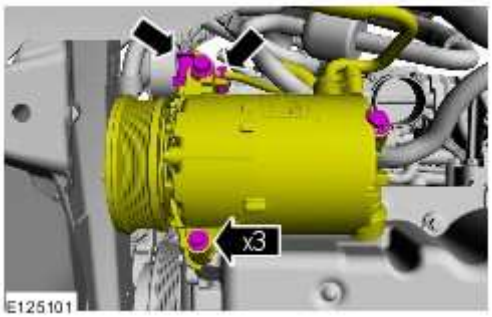

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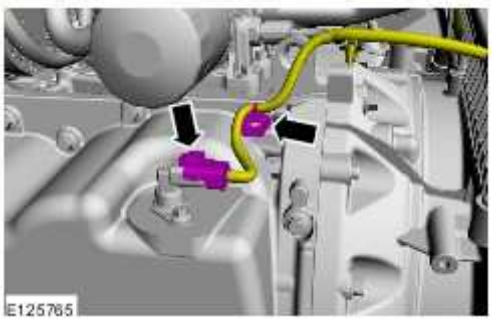
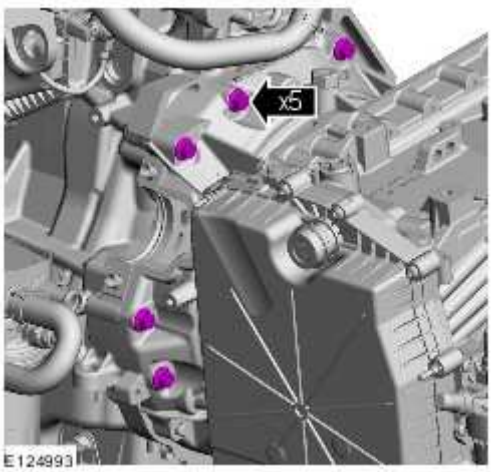


11. *Torque:* 48 Nm



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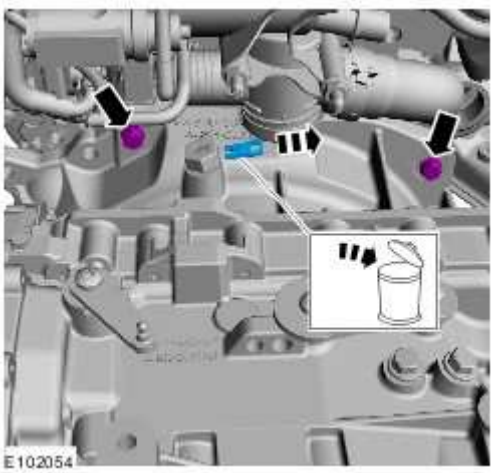

13. WARNING: Take extra care when handling the compressed spring.

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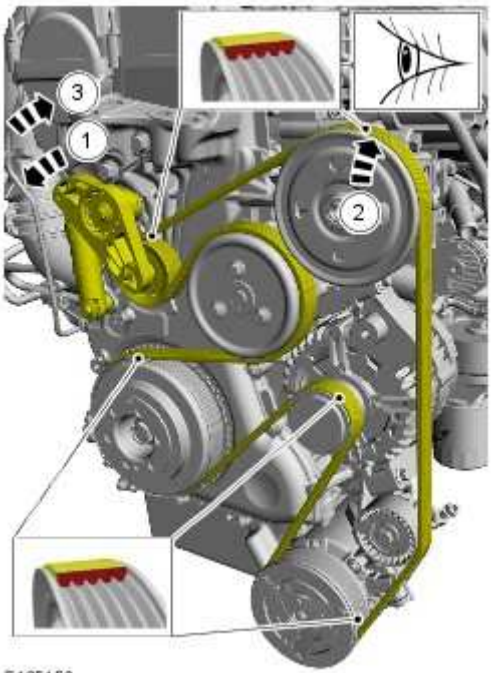
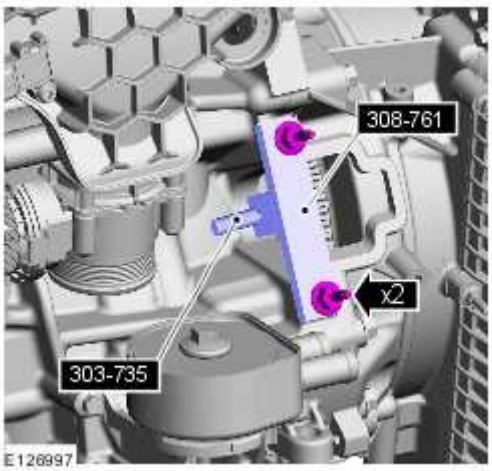
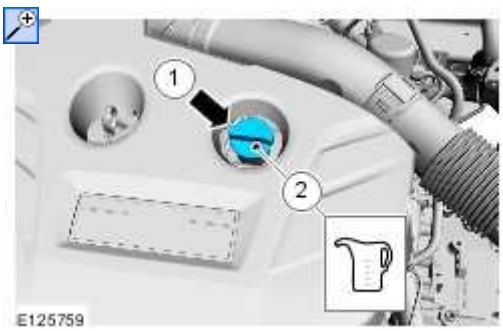




14. *Remove the Special Tool(s):* 303-735, 308-761

15. Refer to: Starter Motor (303-06B Starting System - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

16. Refer to: Air Cleaner (303-12B Intake Air Distributio and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



17.

2. Refer to: Specifications (303-01B Engine - 2.(EcoBoost SCTi (149kW/203PS) - MI4, Specifications).
Material: Engine Oil - 5W-30 (WSS-M2C913-C

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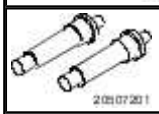
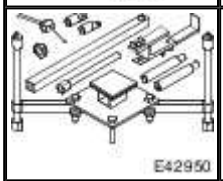
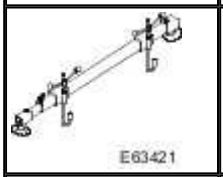
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
	303-290B Support Bar, Engine
	303-290B-16 Adapter for 303-290B

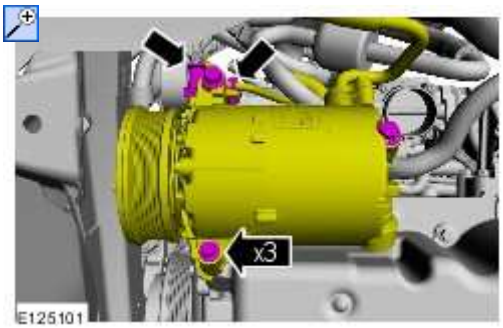
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

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

1. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



2. *Torque:* 24 Nm

3. *Install the Special*

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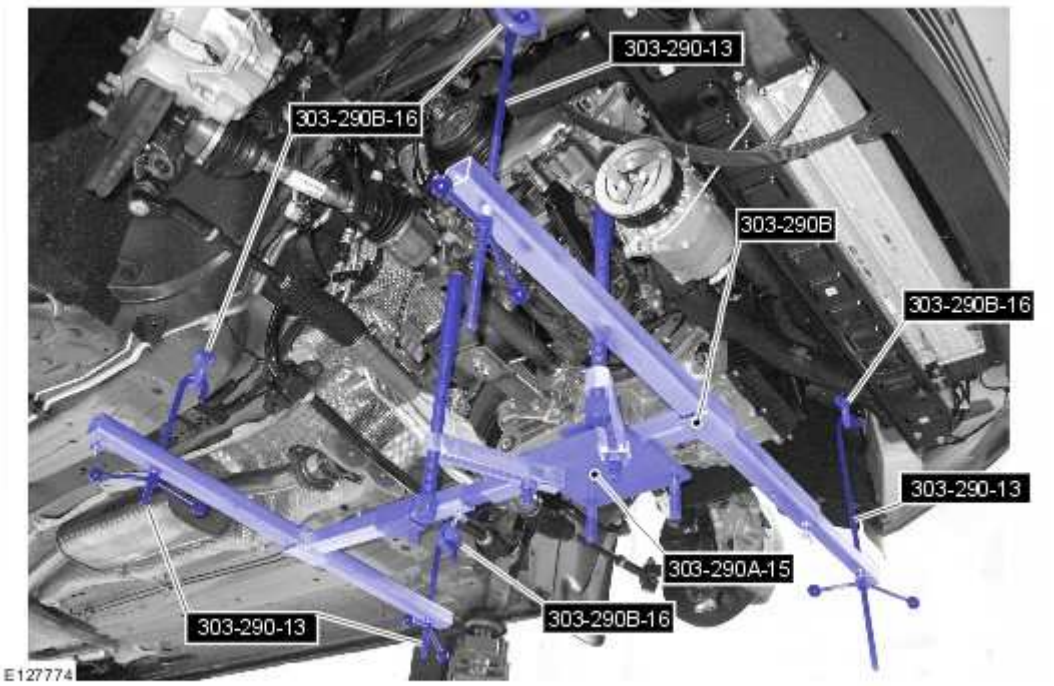
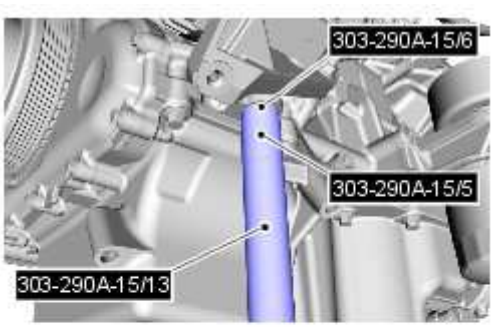
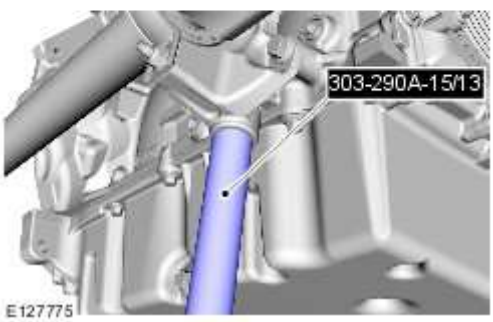
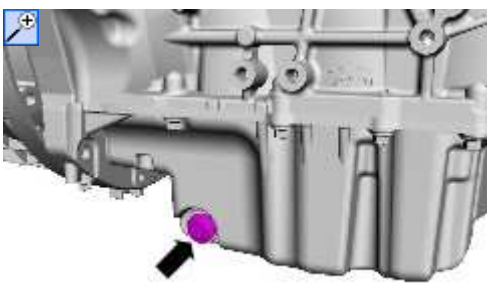


Tool (s): 303-290B, 303-290-13, 303-290A-15, 303-290B-16



4. *Install the Special Tool(s):* 303-290A-15





5. WARNING: Be prepared to collect escaping fluid.
Torque: 27 Nm

6. Refer to: Timing Chain (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal

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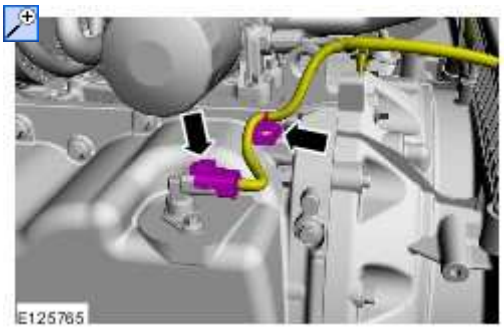
and Installation).

7.



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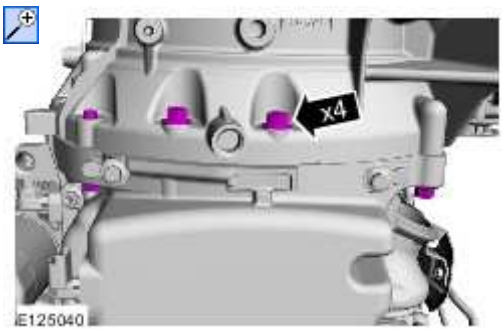

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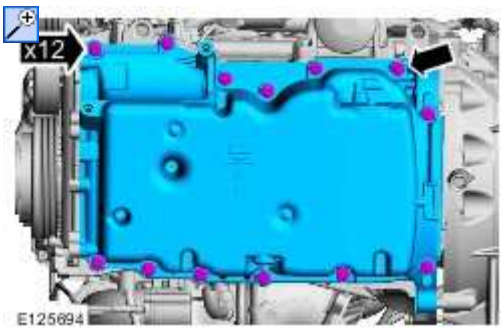
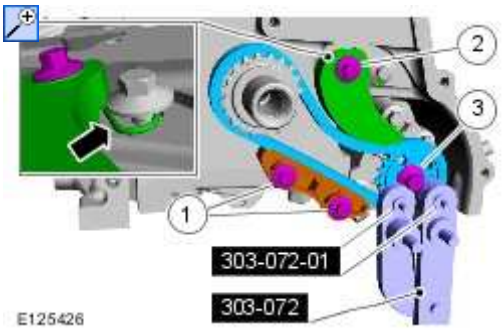
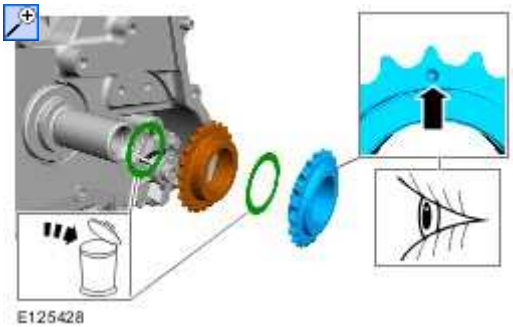


10. WARNING: Take extra care when handling the compressed spring.
    1. *Torque:* 10 Nm
    2. *Torque:* 10 Nm
    3. *Special Tool(s):* 205-072, 205-072-01
       Torque: 25 Nm



11. CAUTION: Make sure that a new friction washer is installed.



12. *Torque:*
    Stage 1: 10 Nm
    Stage 2: 20 Nm

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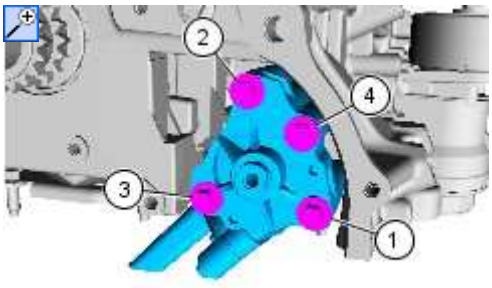
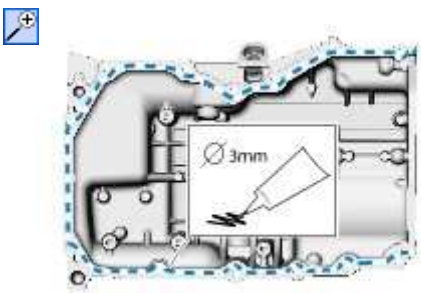


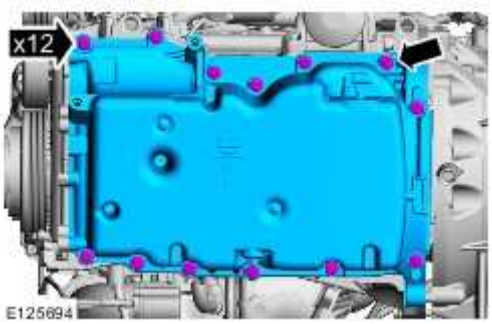
E68033

Installation

1. To install, reverse the removal procedure.
2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

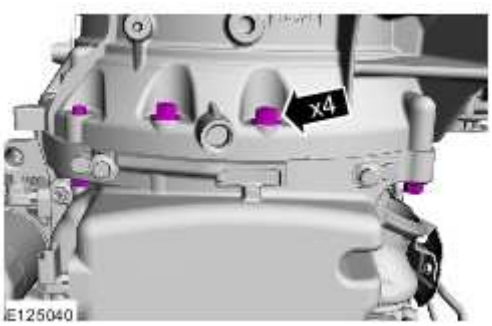


E68364



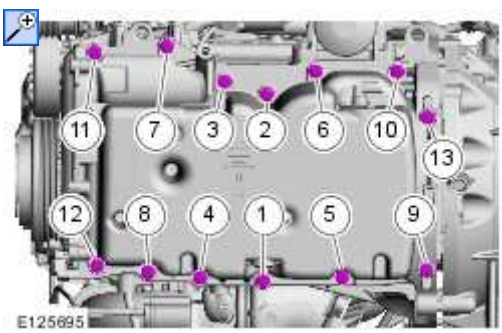
E125694

3. NOTE: Only tighten the bolts finger tight at this stage.



E125040

4. *Torque:* 48 Nm



E125695

5. *Torque:* 20 Nm

6.
   2. Refer to: Specifications (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4,

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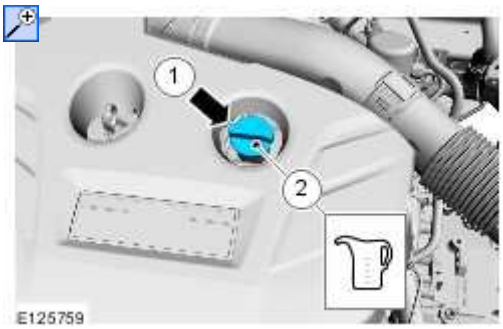

Specifications).
Material: Engine Oil - 5W-30 (WSS-M2C913-C)

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Print

Removal

Special Tool(s)

	303-122 Lifting Bracket, Engine
	310-137 Disconnect Tool, Fuel Line

General Equipment

3.5 mm drill bit
Cable ties
Center punch
Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Retaining Strap
Transmission jack

1.

2. Refer to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).
3. Remove the following items:
   1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
   2. Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

4.

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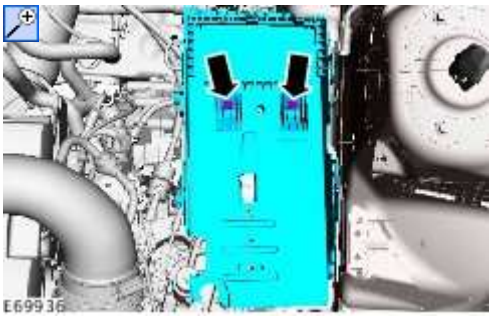

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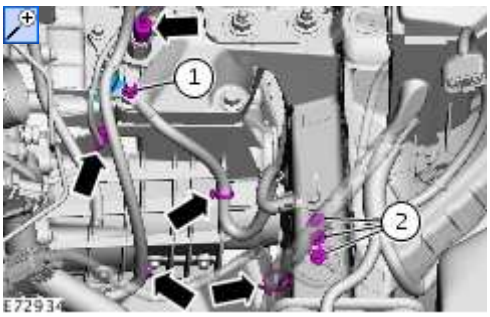

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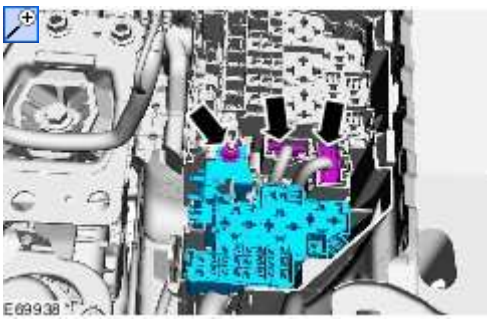
7.



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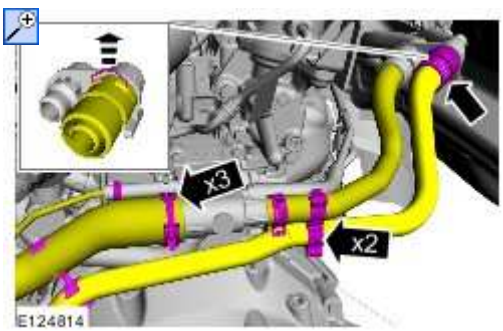

9. WARNING: Be prepared to collect escaping fluids.
General Equipment: Hose clamp remover/installer

10. *Special Tool(s):* 310-137

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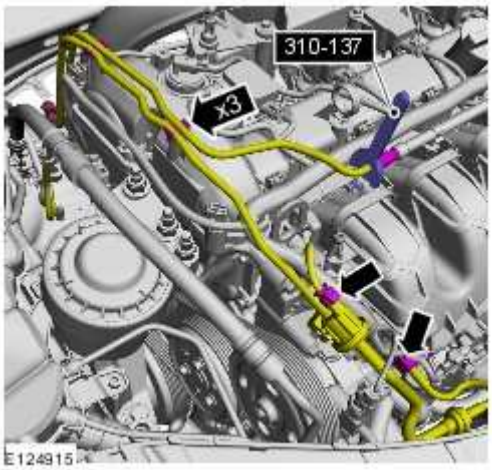

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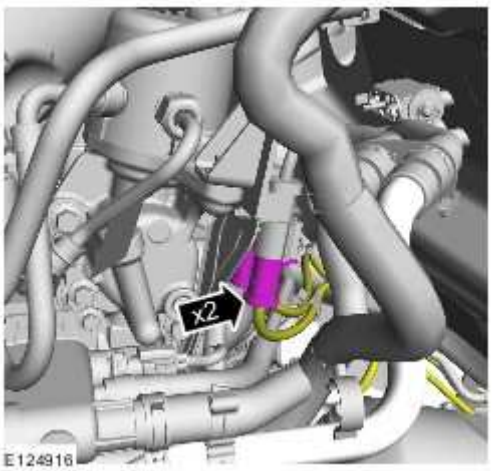

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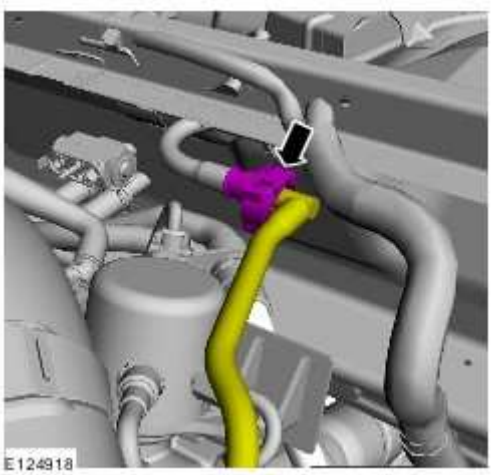

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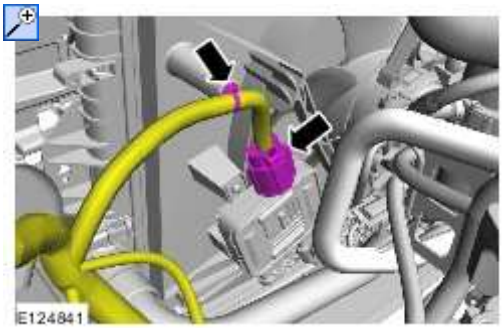

14. WARNING: Be prepared

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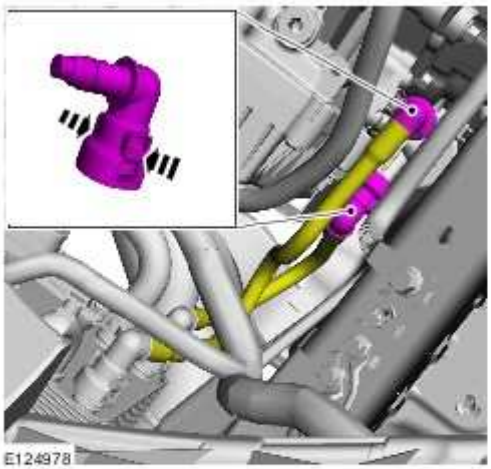
to collect escaping fluids.



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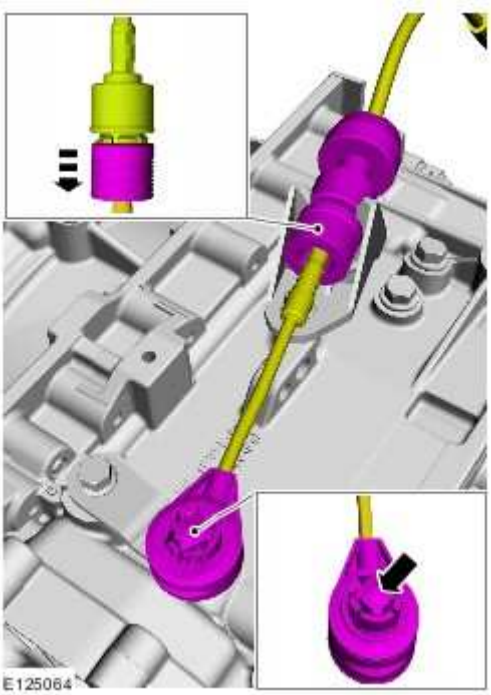

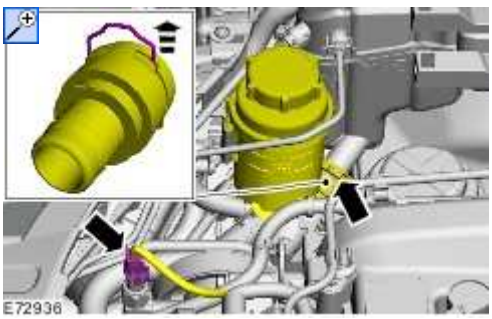

16. WARNING: Be prepared to collect escaping fluids.

17. WARNING: Take extra care when handling the compressed spring.

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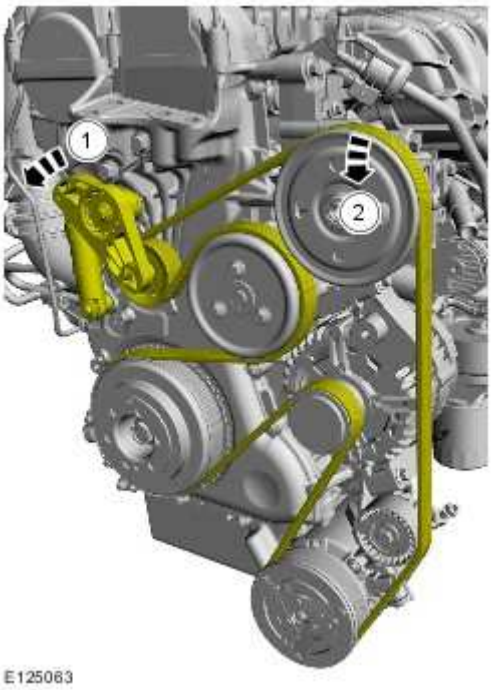

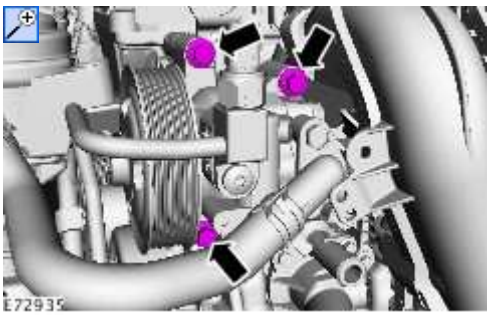

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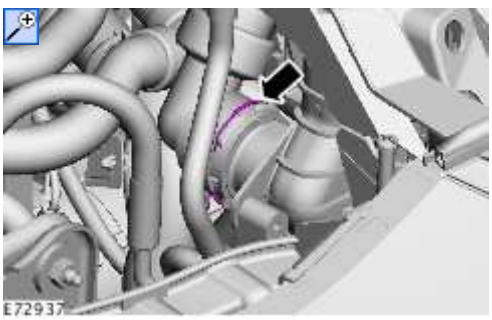
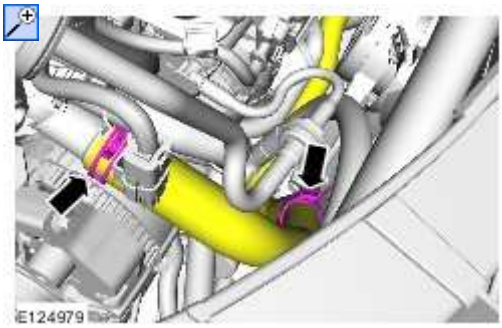


19. WARNING: Be prepared to collect escaping fluids.



20. WARNING: Be prepared to collect escaping fluids.

21. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

22. Remove the following items:
    1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

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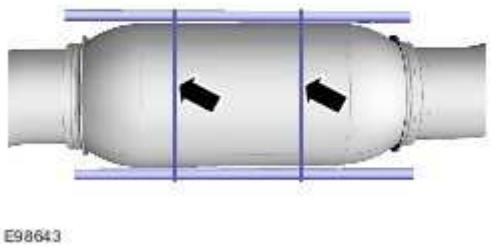
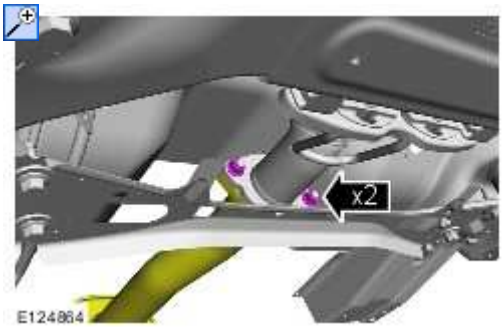
2. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

23. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.
General Equipment: Cable ties

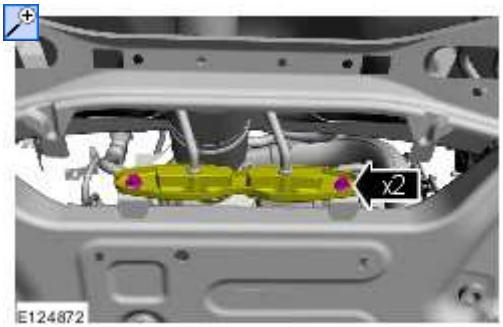

E98643

24. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.



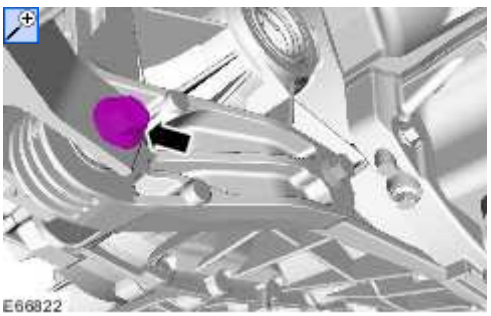
E124864

25.

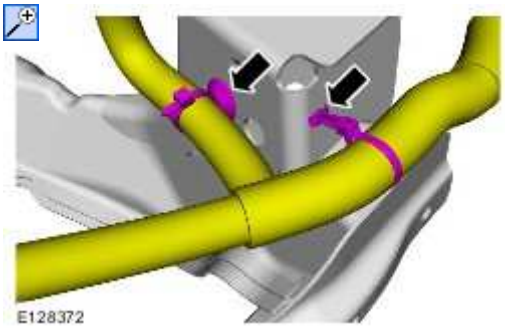


E124872

26.


E66822

27.


E128372

28.

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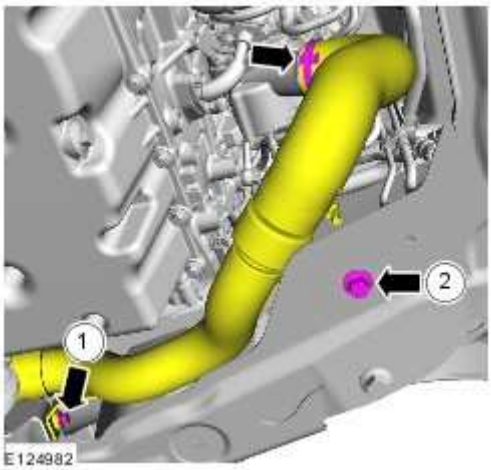
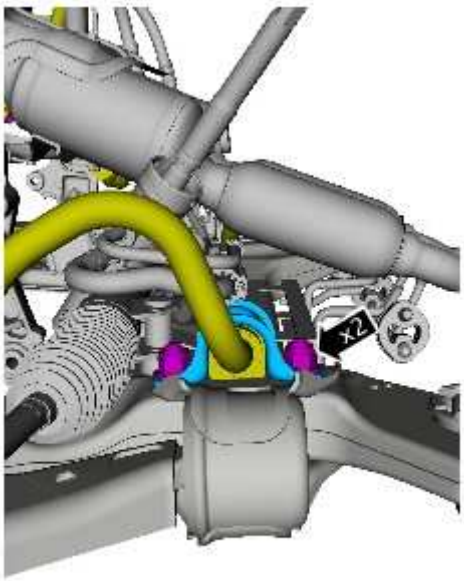


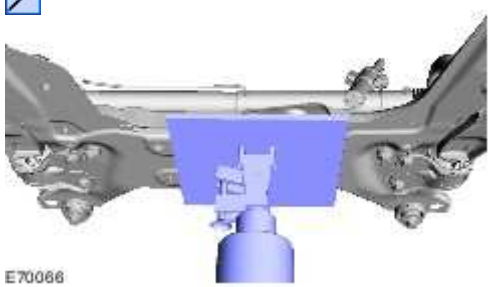
E124982

29. On both sides.



E93312

30. NOTE: This step requires the aid of another technician.
General Equipment: Transmission jack


E70066

31. *General Equipment:* Cable ties

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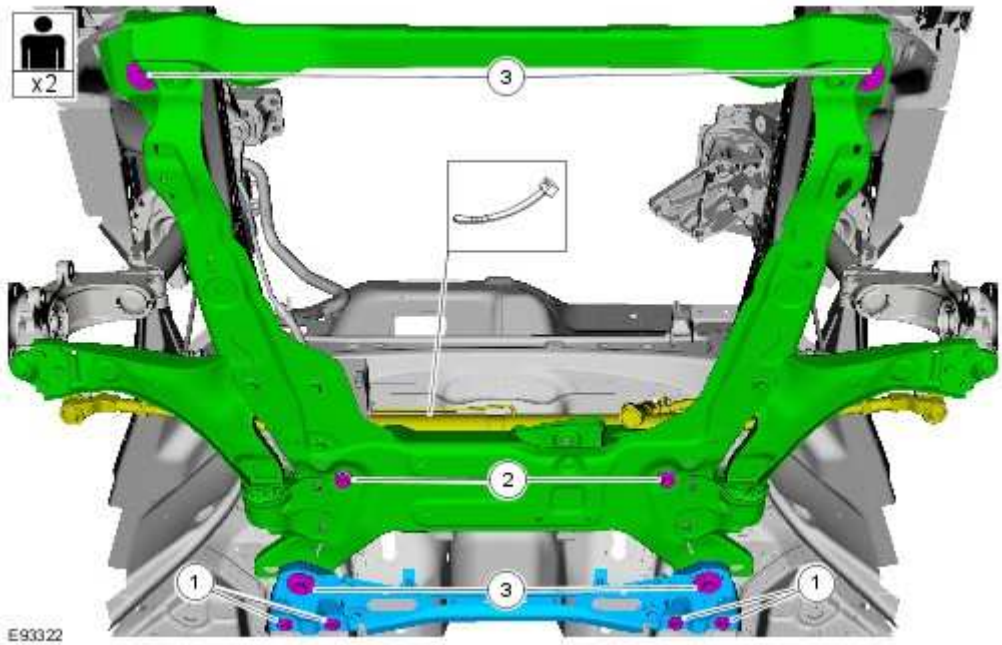
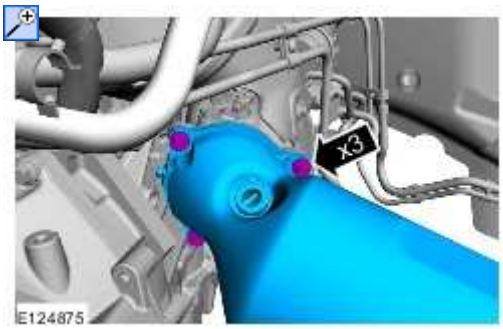
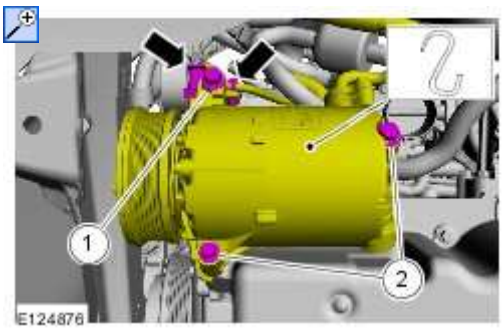


32.



33.



34.

1. *Loosen:* 4 turn(s)
2. *General Equipment:* Cable ties

35.

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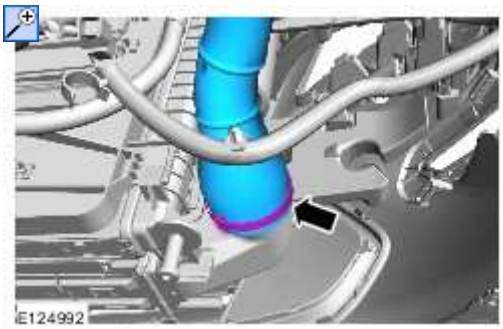

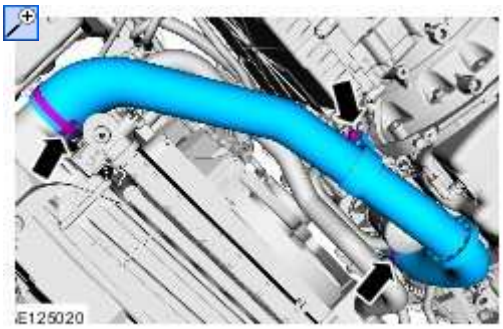

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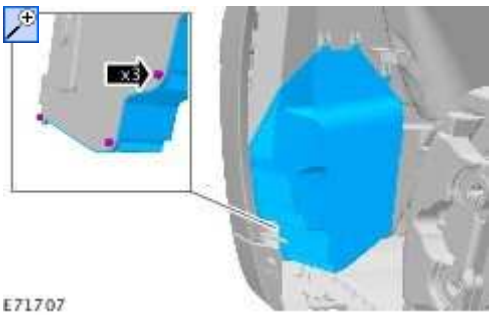
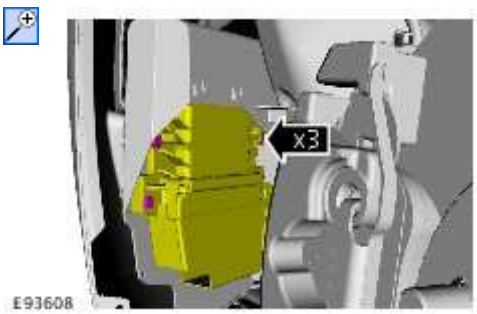


37.

Vehicles with PCM security shield



38.

39. *General Equipment:* Center punch *General Equipment:* 3.5 mm drill bit

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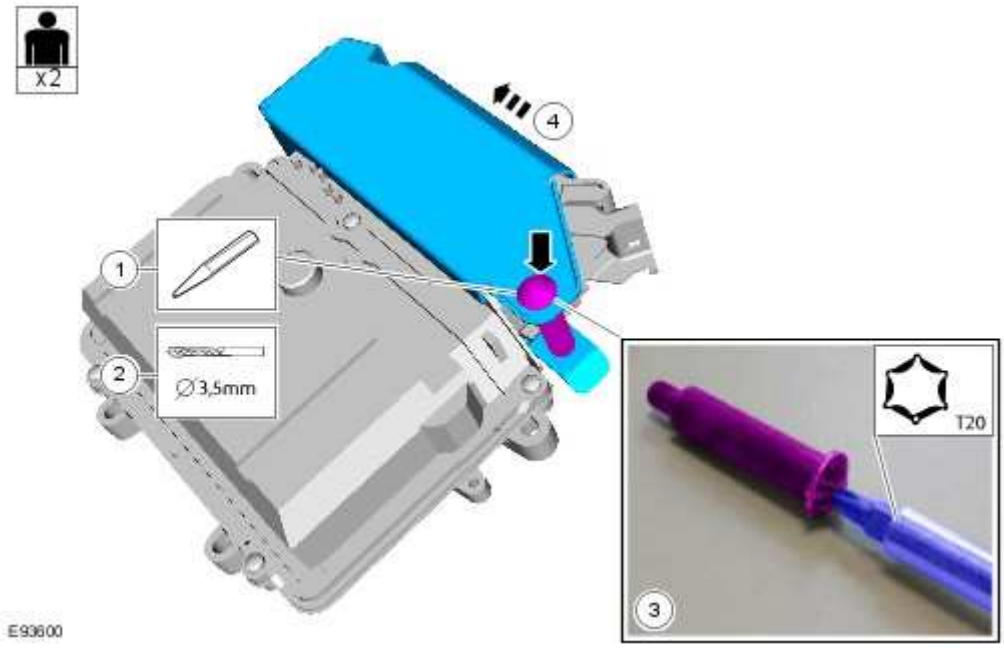
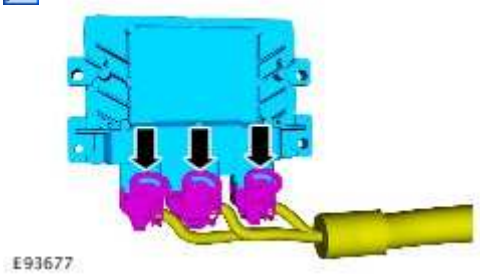
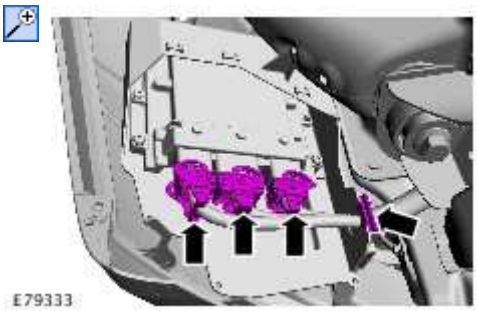


40.

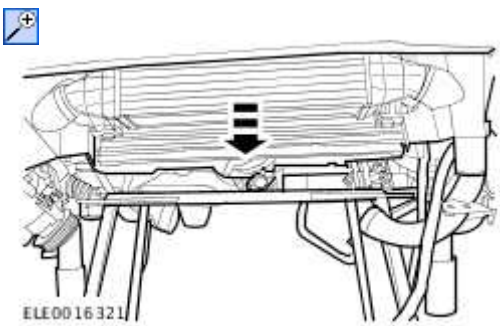


Vehicles without PCM security shield

41.



All vehicles



42. WARNING: Make sure that the engine and transmission assembly is on wooden blocks and secured with suitable retaining straps.
General Equipment: Mounting table set
General Equipment: Retaining Strap

43.

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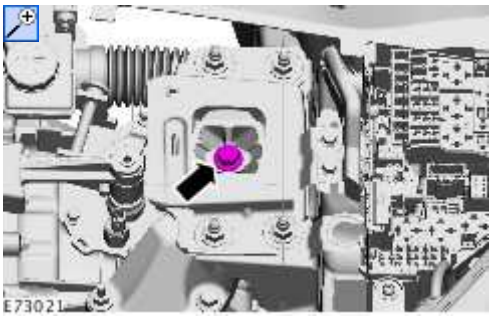
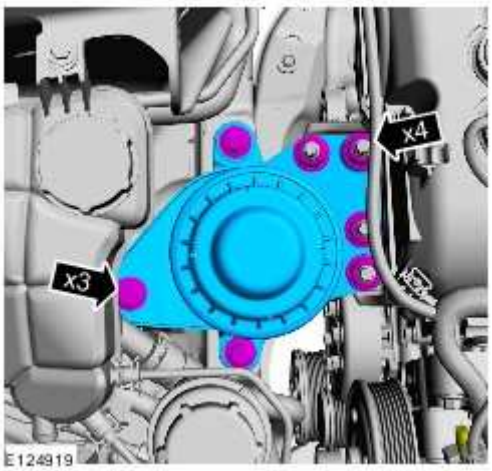
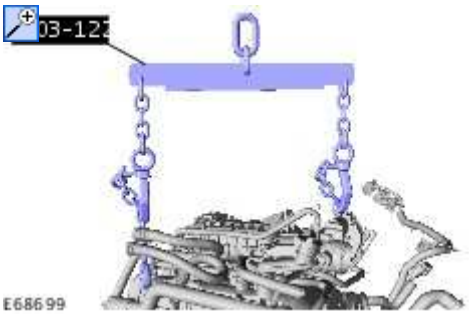




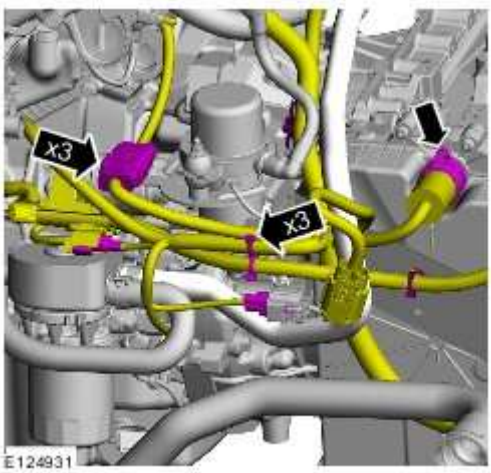
44.

45. CAUTION: Make sure that no components catch.
Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



46. *Install the Special Tool(s):* 303-122
General Equipment: Hydraulic jib crane

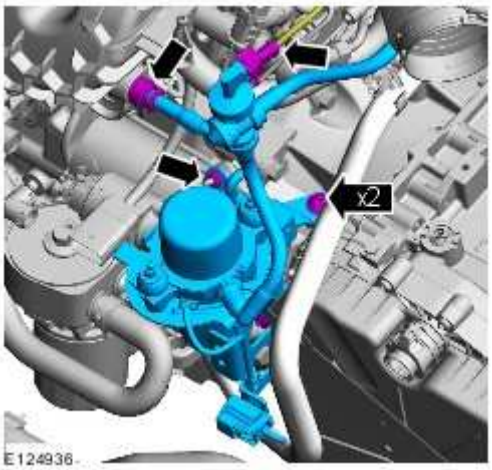
47. Remove the following items:
- *General Equipment:* Mounting table set
General Equipment: Retaining Strap



48.

49.

http://vnx.su



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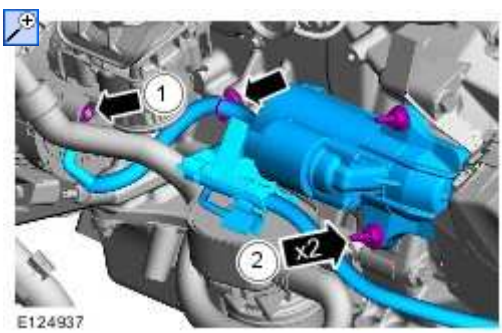

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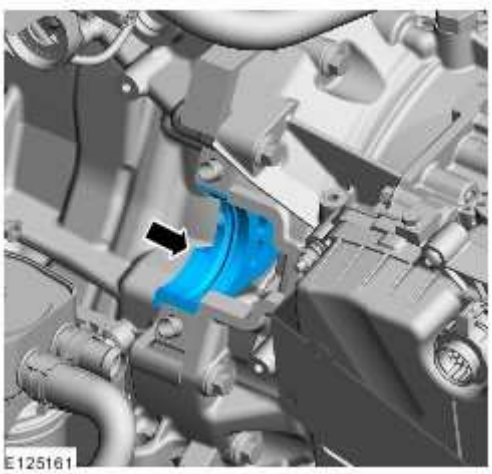

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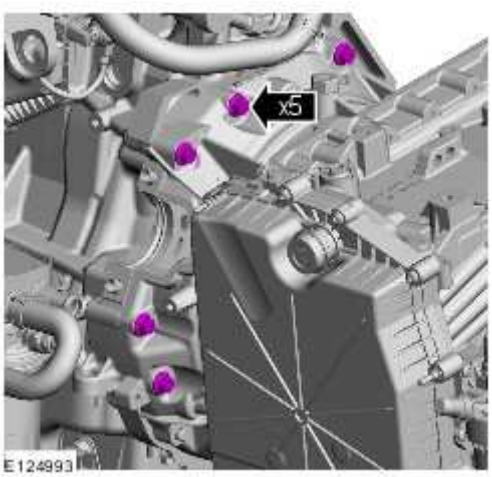
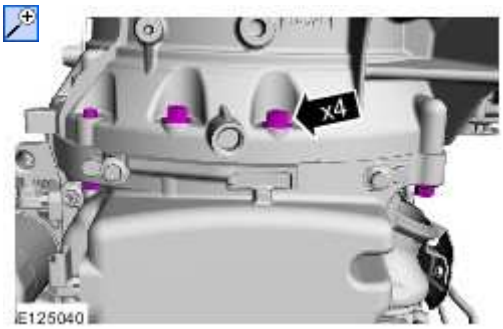
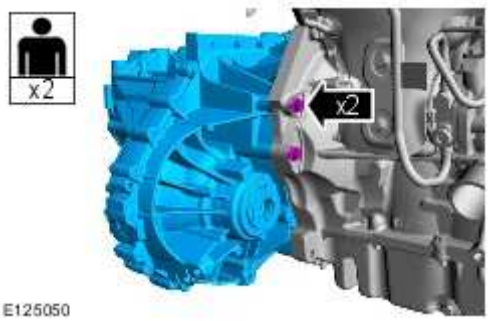


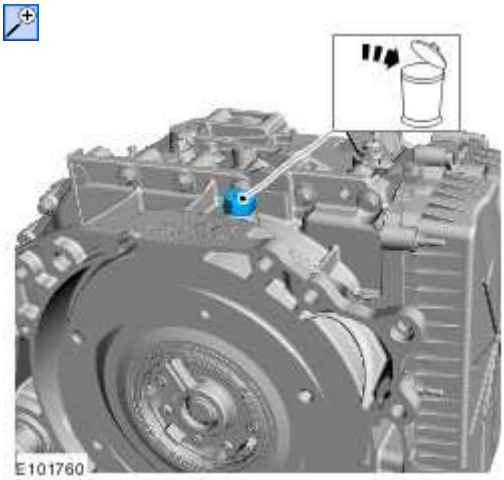
53.

http://vnx.su





54. NOTE: This step requires the aid of another technician.



55.

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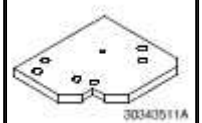
Print

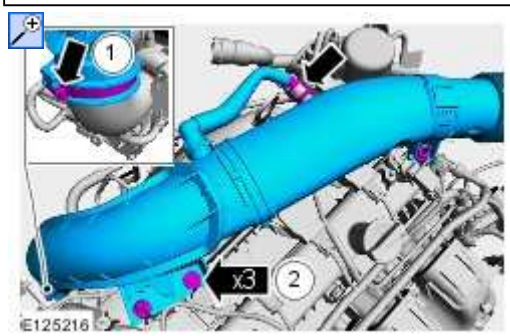
Removal

Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-397 Remover/Installer, Hose Clamp
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06

General Equipment

Knife



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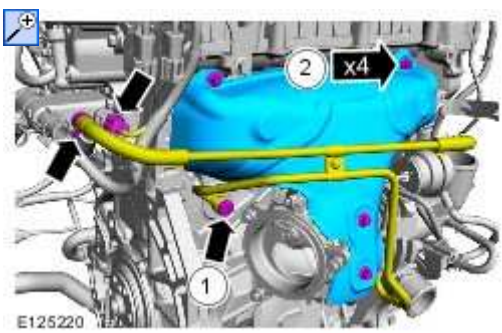
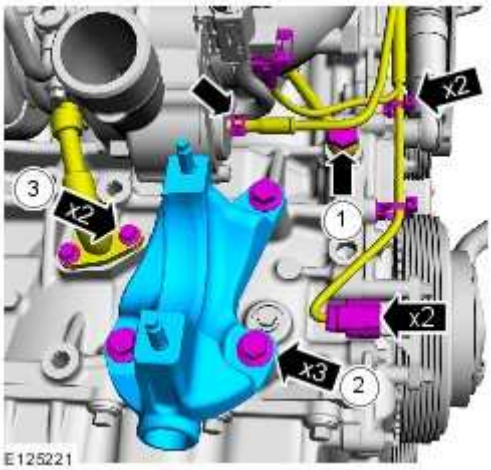
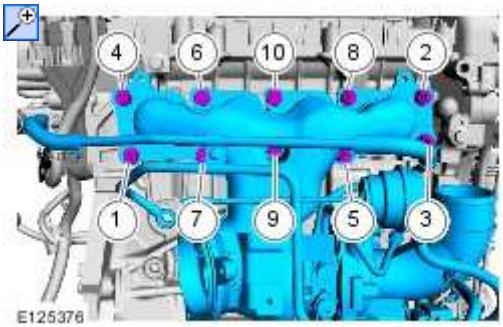


2. *Special Tool(s):* 303-397

3. *Special Tool(s):* 303-397

http://vnx.su





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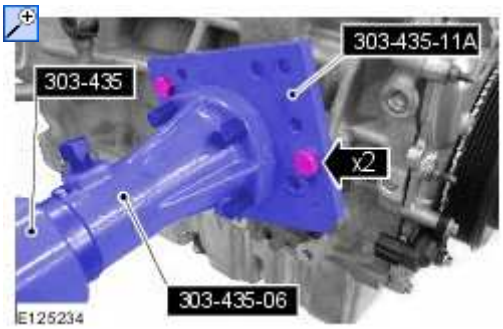
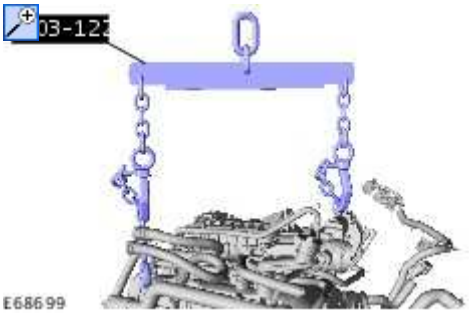
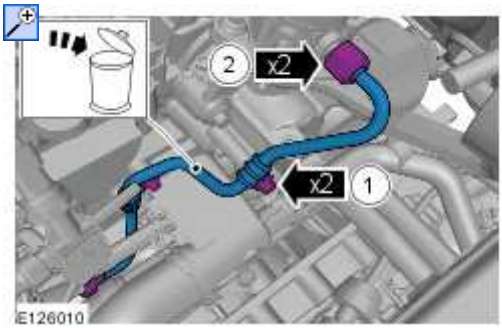


5. *Install the Special Tool(s):* 303-435, 303-435-06, 303-435-11A



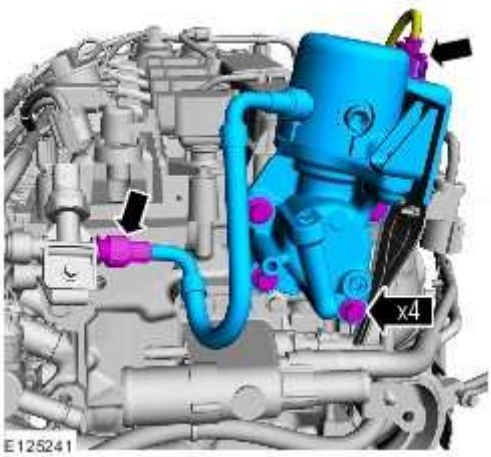
6. *Remove the Special Tool(s):* 303-122



7.

8.

http://vnx.su



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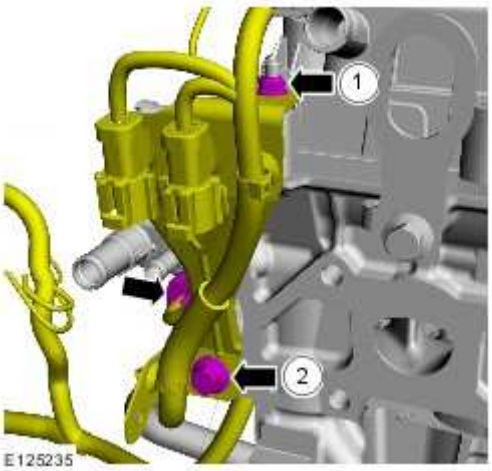

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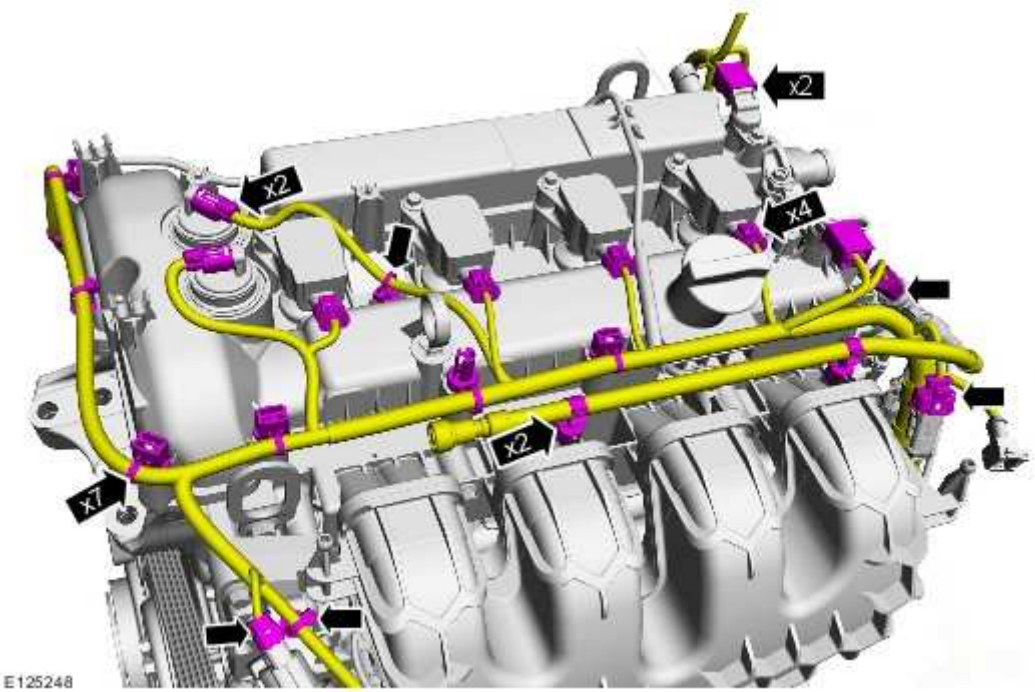
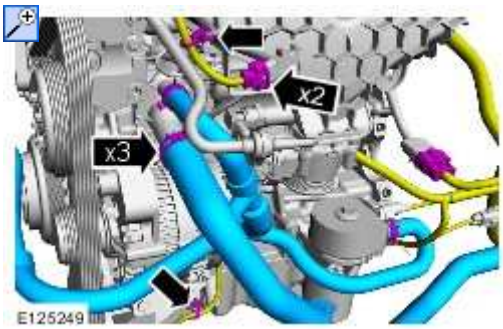


11. *Special Tool(s):* 303-397

http://vnx.su



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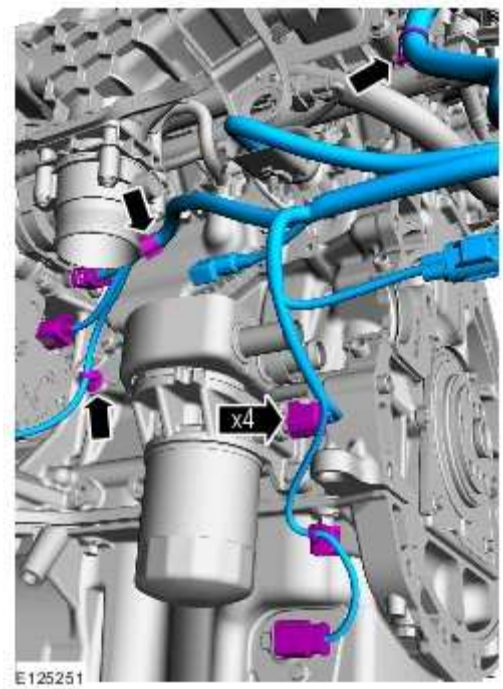
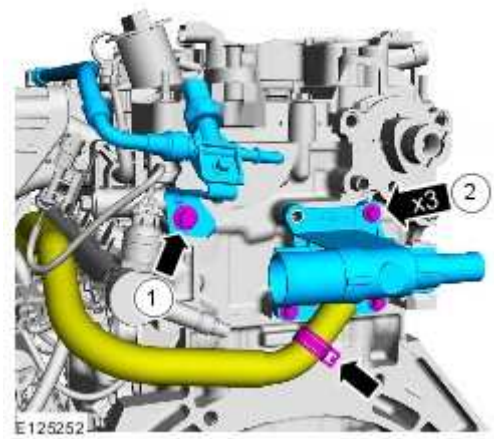


13. *Special Tool(s):* 303-397



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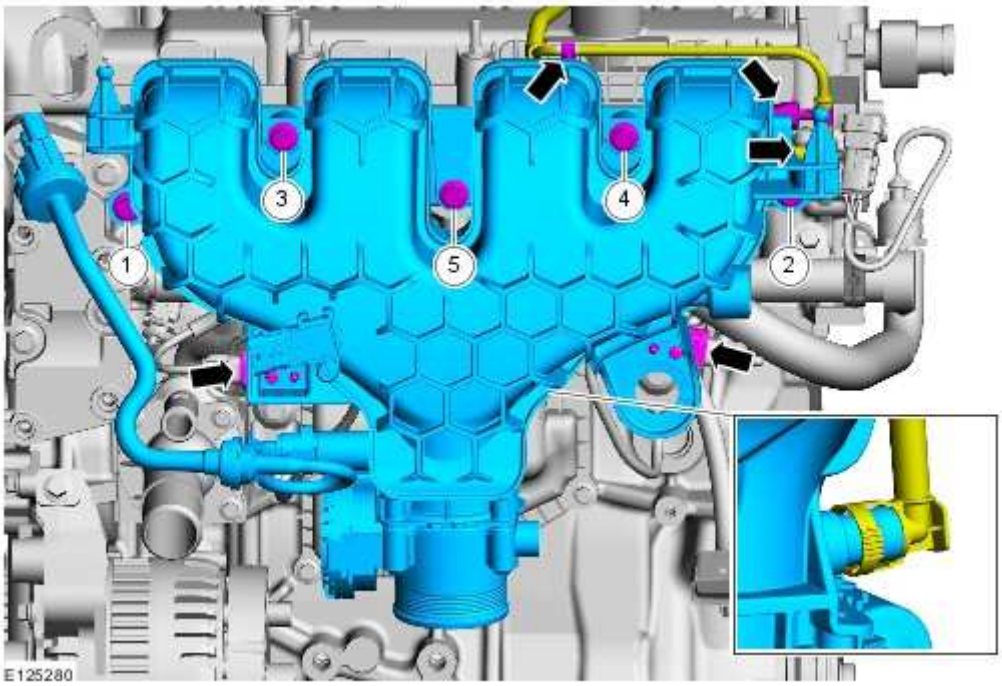
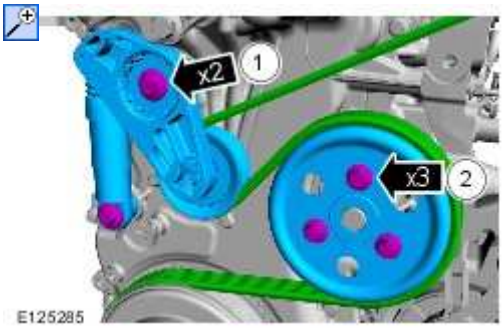
http://vnx.su





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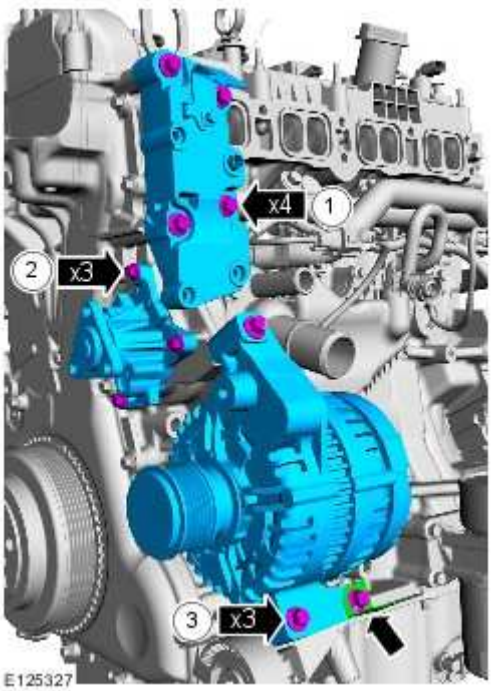
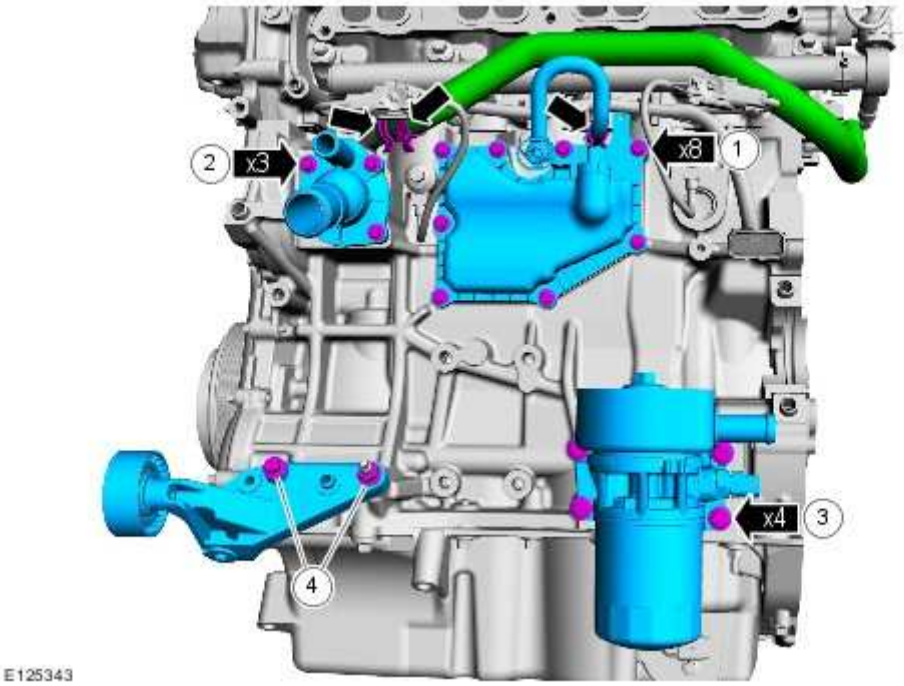


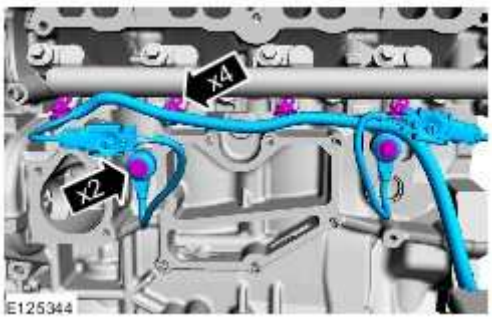
16.

17. *Special Tool (s):* 303-

http://vnx.su



E125343



E125344

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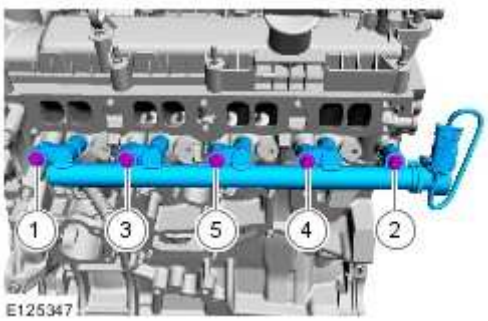

E125347

19. CAUTION: Take extra care when handling the components.
NOTE: Only use moderate force.

E125877

20. CAUTIONS:

Take extra care when handling the components.

Make sure that the area around the component is clean and free of foreign material.
NOTE: Only use moderate force.

21. CAUTION: Take extra care when handling the components.

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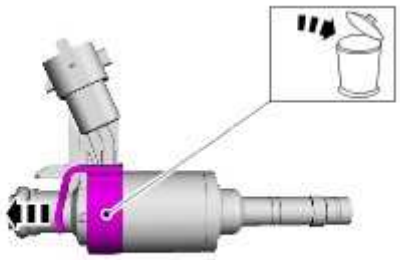
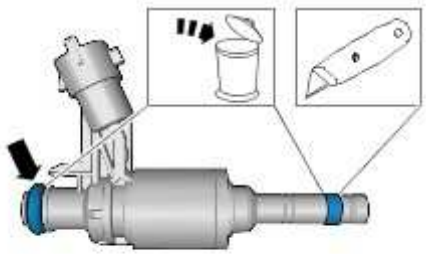


E128137



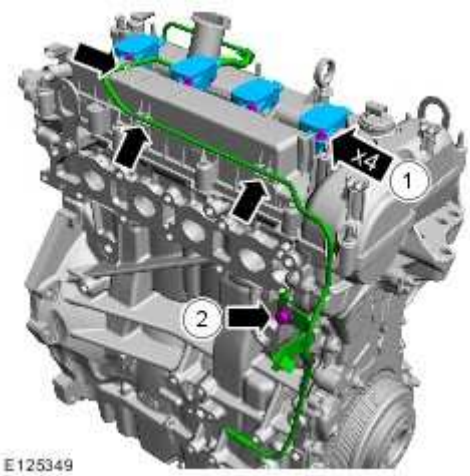
E125876

22. CAUTIONS:

Take extra care when handling the components.

Make sure that the area around the component is clean and free of foreign material.

General Equipment: Knife



E125349

23.

E125355

24.

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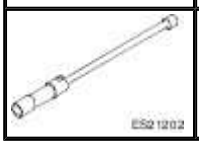
Disassembly

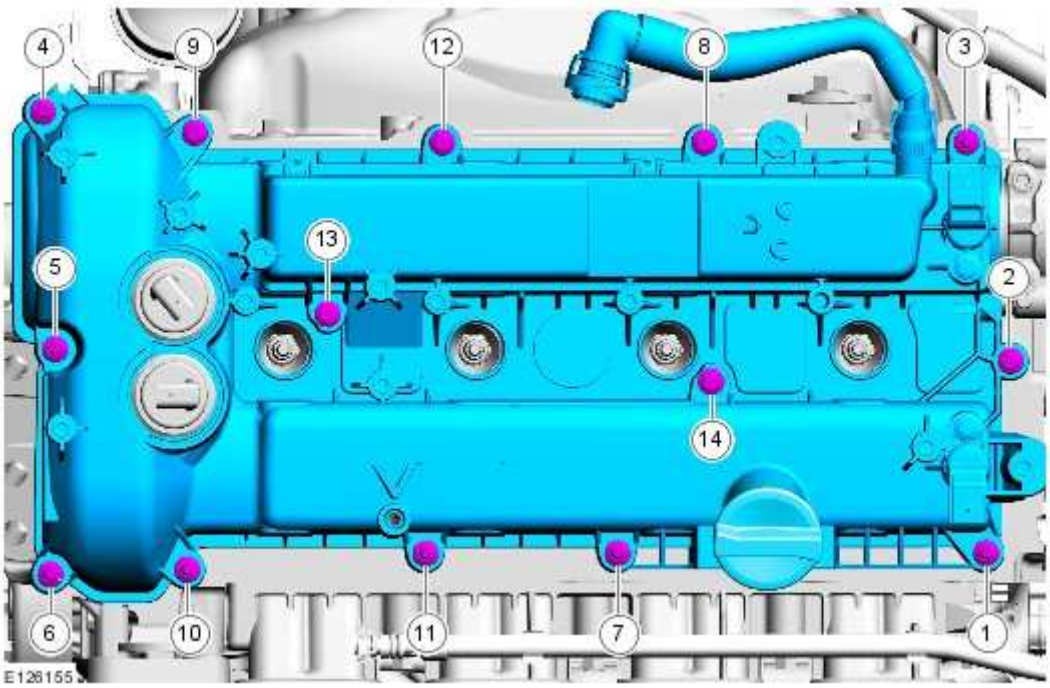
Special Tool(s)

	303-293 Remover, Crankshaft Seal
	303-499 Socket, Spark Plug

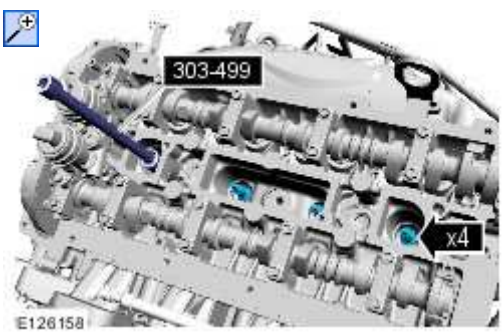
General Equipment

2 mm punch
Fluid container

1.



2. *Special Tool(s):* 303-499



3.

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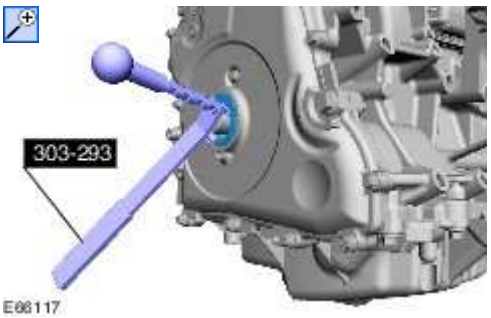
4.

5. *Special Tool(s):* 303-293



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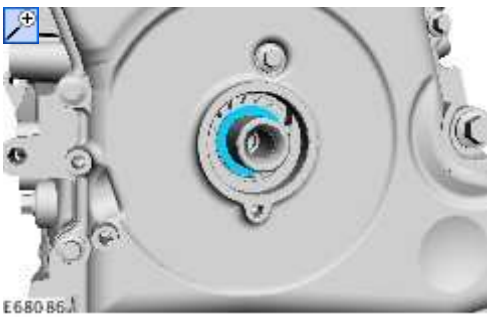

7.

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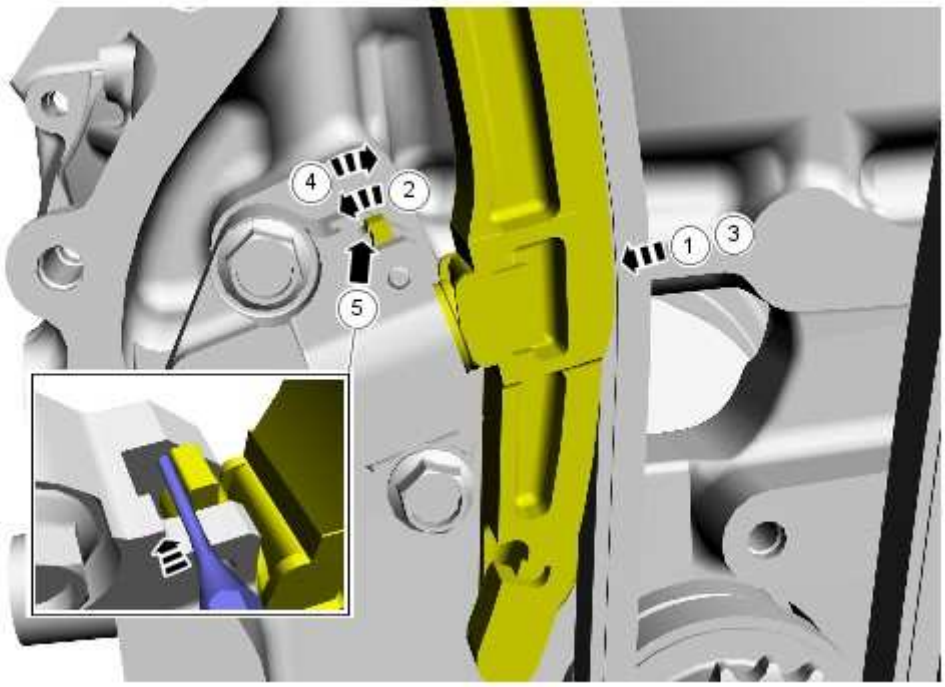
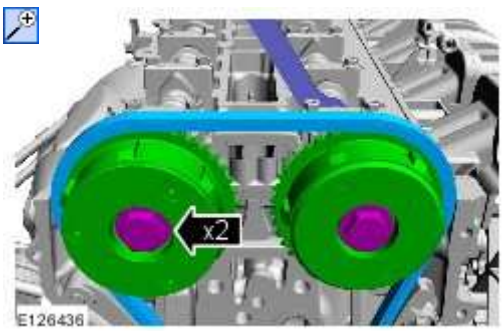
E126874



E126434

8. *General Equipme*
mm punc



E126436

9. CAUTIONS:

Note the position of the components before removal.

Use an open-ended wrench to prevent the component from turning.

10.

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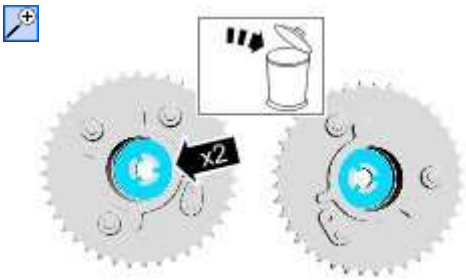

E126441

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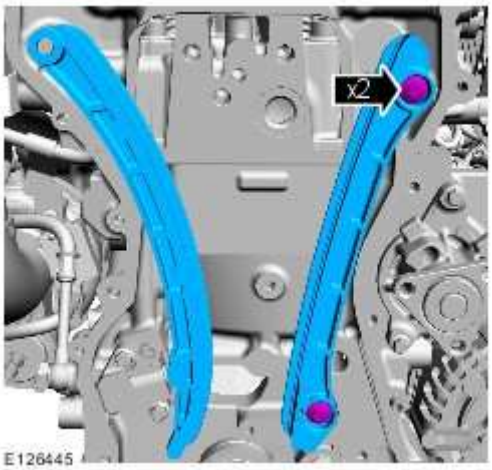

E126445

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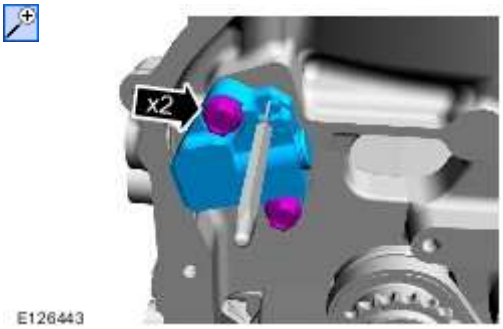
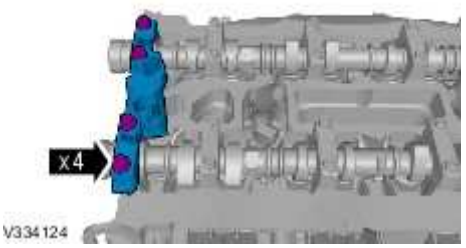


E126443

13. CAUTION: Note the position of the componen before removal.

E126615

14. Loosen each bolt 2 turns at a time until all bolts are removed.

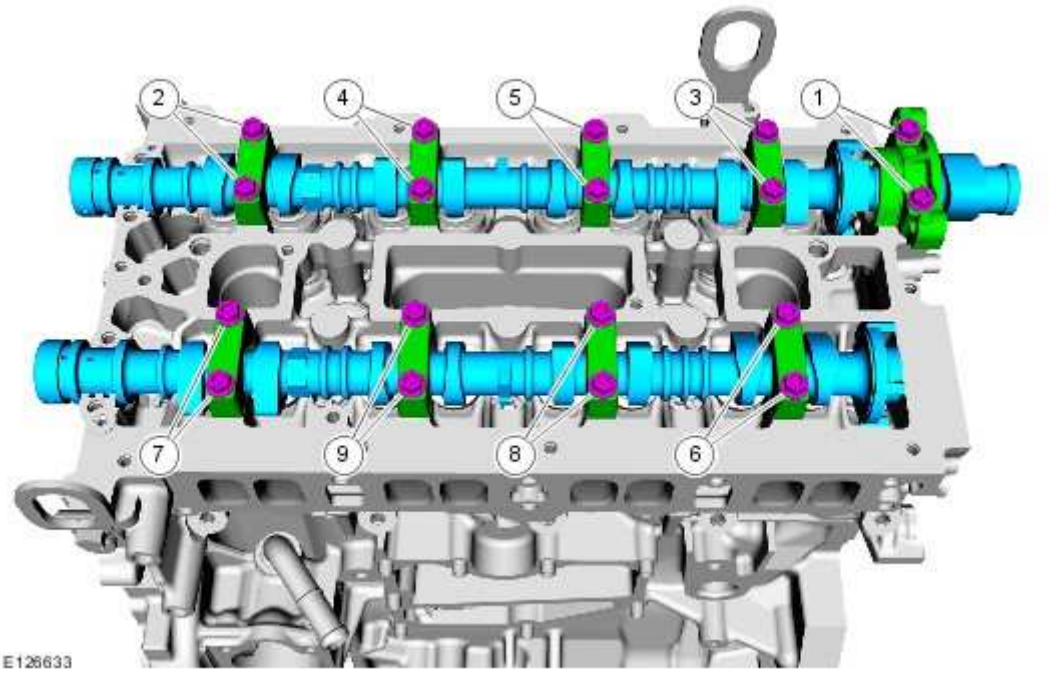


V334124

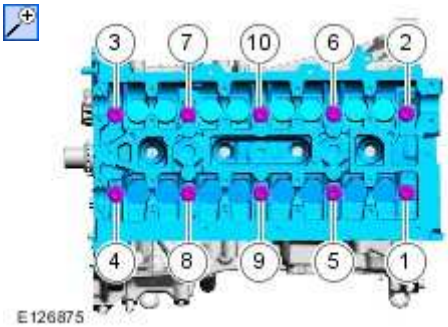
15. CAL

http://vnx.su

Note the
position
compone
before
removal
Loosen e
2 turns a
until all b
removed

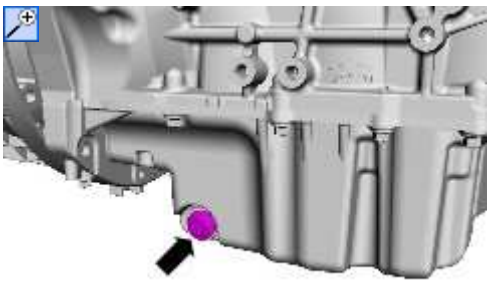


E126633

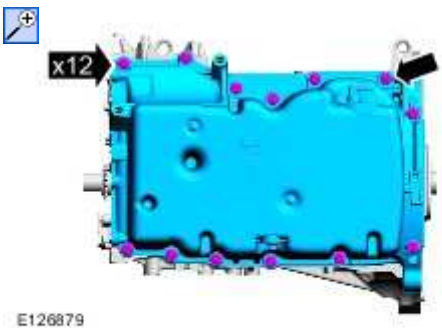


E126875

16.


E68761

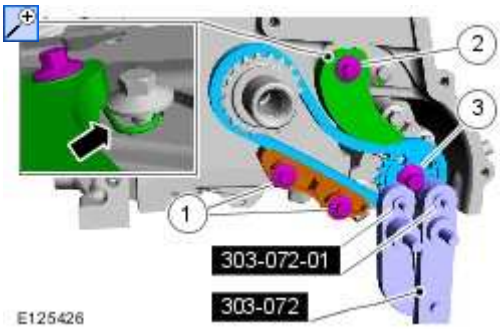
17. WARNING: Be prepared to collect escaping flu
General Equipment: Fluid container



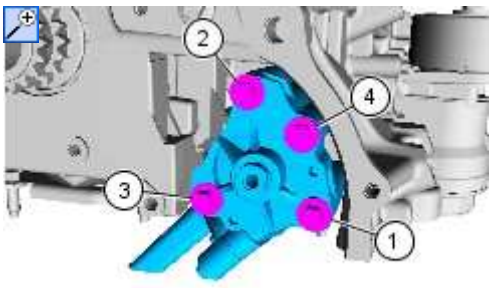
E126879

18.

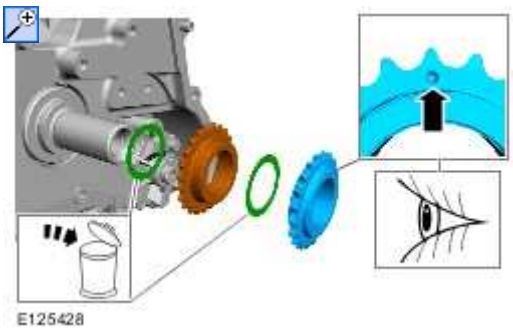
http://vnx.su



19. WARNING: Take extra care when handling th compressed spring.



20.



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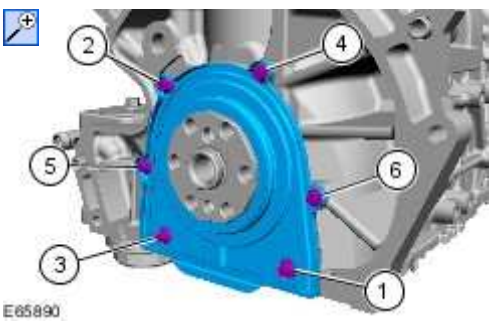
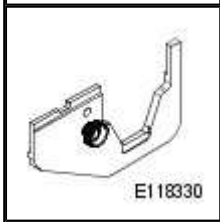
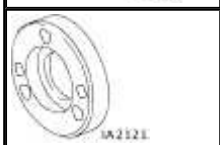
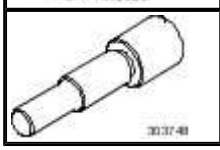


22.

http://vnx.su

Assembly

Special Tool(s)

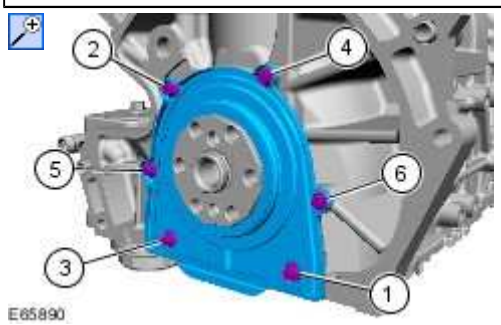
	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	303-1504 Alignment Tool, Camshaft
	303-499 Socket, Spark Plug
	303-509 Remover, Vibration Damper Hub
	303-748 Locking Tool, Crankshaft

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

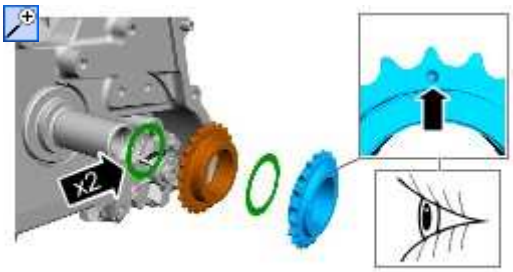
2 mm punch
Round-ended steel rule



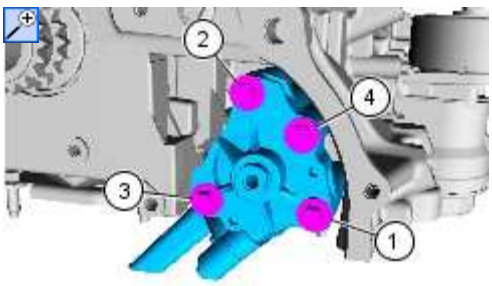
1. NOTE: Make sure that a new component is installe
   NOTE: New crankshaft rear seal carriers are suppli
   with an alignment sleeve which must be removed
   installation.
   Torque: 10 Nm

2. CAUTION: Make sure that a new friction wash
   installed.

http://vnx.su

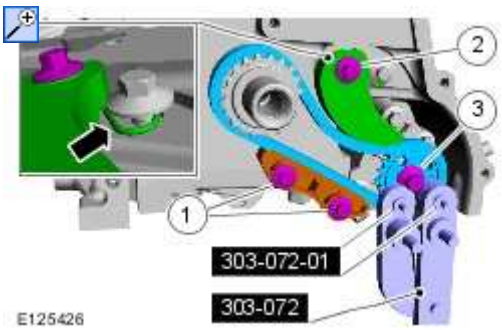


E126883



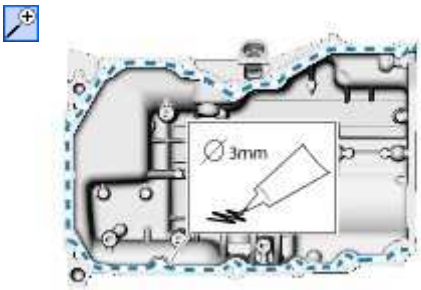
E68033

3. *Torque:*
   Stage 1: 10 Nm
   Stage 2: 20 Nm



E125426

4. WARNING: Take extra care when handling th compressed spring.
   1. *Torque:* 10 Nm
   2. *Torque:* 10 Nm
   3. *Special Tool(s):* 205-072, 205-072-01
      Torque: 25 Nm



E86364

5. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U M4G323-AA)

6.
   1. CAUTION: Make sure that the compone are aligned.
      NOTE: Only tighten the bolts finger tight at stage.
      General Equipment: Round-ended steel rule
   2. *Torque:* 20 Nm

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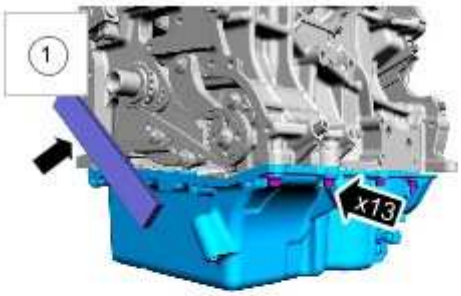
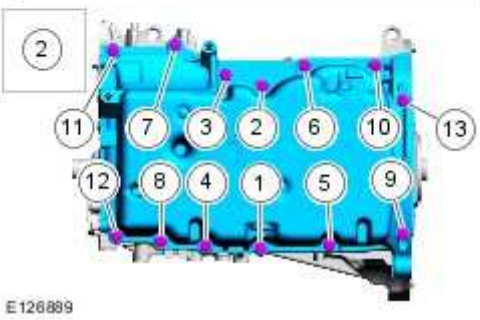
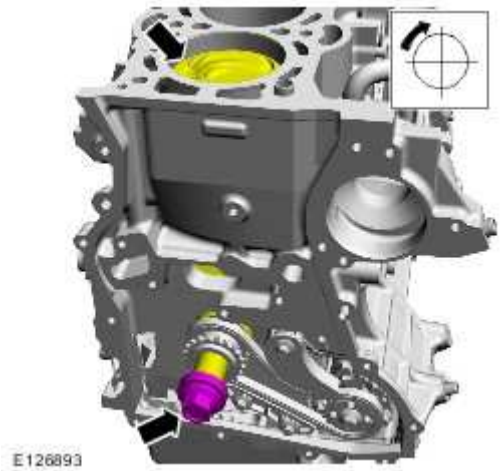
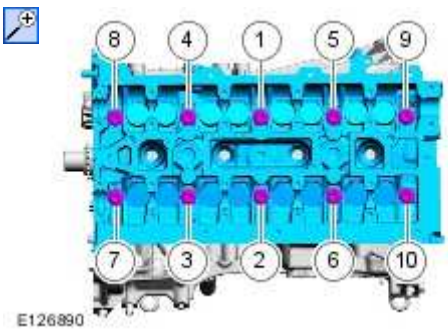




E126889


E126893

7. CAUTION: Only rotate the crankshaft clockwis
Rotate the crankshaft until piston No. 1 is approxim
mm before top dead center (TDC).



E126890

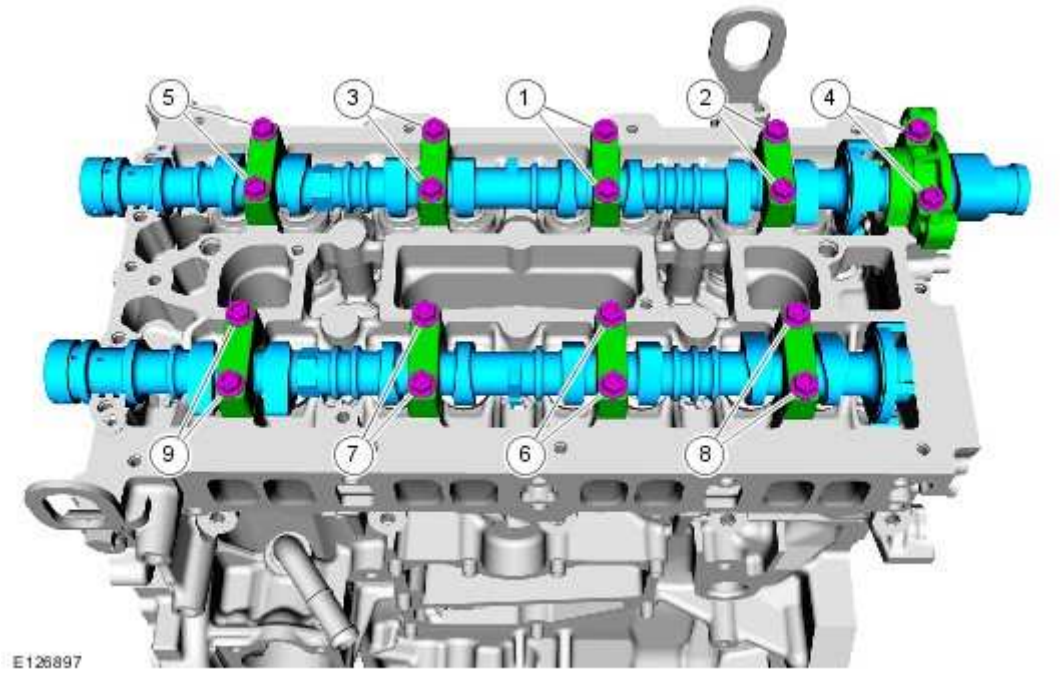
8. Install

Torque:

Stage 1: 7 Nm
Stage 2: 15 Nm
Stage 3: 55 Nm
Stage 4: 90°
Stage 5: 90°

9. CAU
Make su
that the
compone
are insta
to the p
noted be
removal
Install th

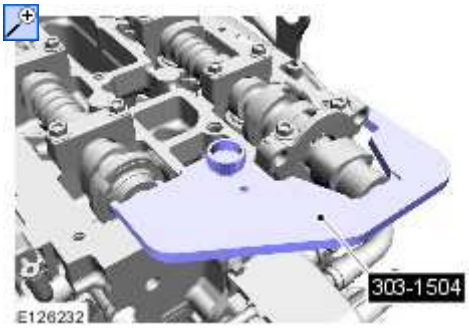
http://vnx.su



camshaf
approxin
valve ov
position
No. 4.

10. Tighten
bolt 2 tu
time.

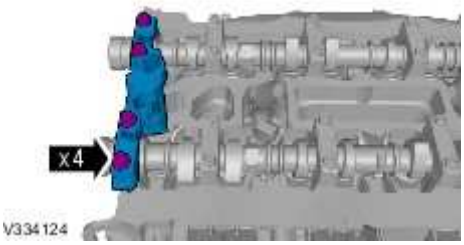
Material:
Oil - 5W-
(WSS-M2
C)
Torque:
S
7 Nm
S
16 Nm



11. *Install the Special Tool(s):* 303-1504

12. Tighten each bolt 2 turns at a time.

Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm



13. CAUTION: Make sure that the components ar
installed to the position noted before removal.
Torque: 10 Nm

14. *Torque:* 10 Nm

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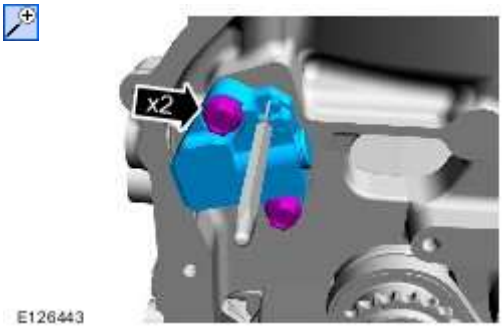
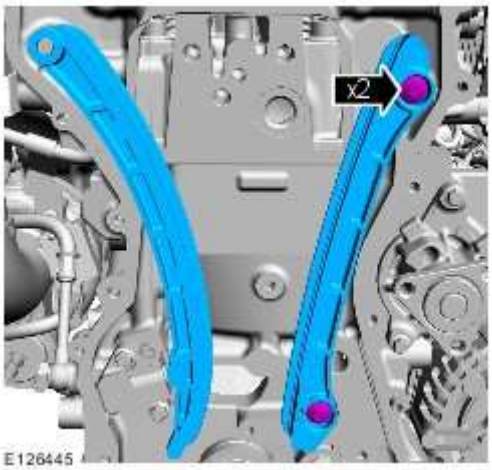
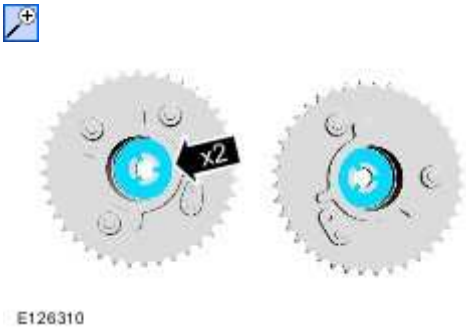
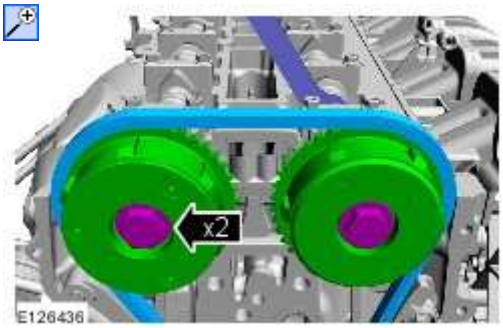




15. *Torque:* 10 Nm



16. CAUTION: Make sure that a new friction wash
installed.



17. CAUTION: Make sure that the components ar
installed to the position noted before removal.
NOTE: Only tighten the bolts finger tight at this st

18. *General Equipment:* 2 mm punch

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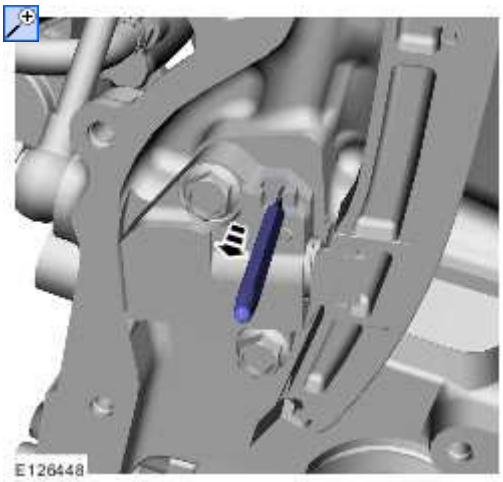
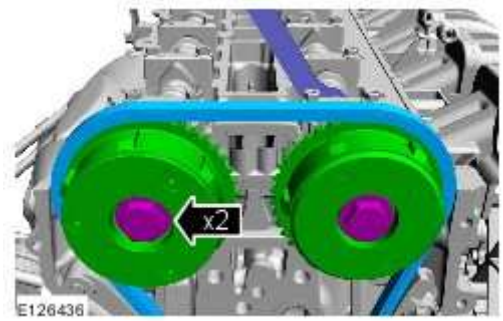
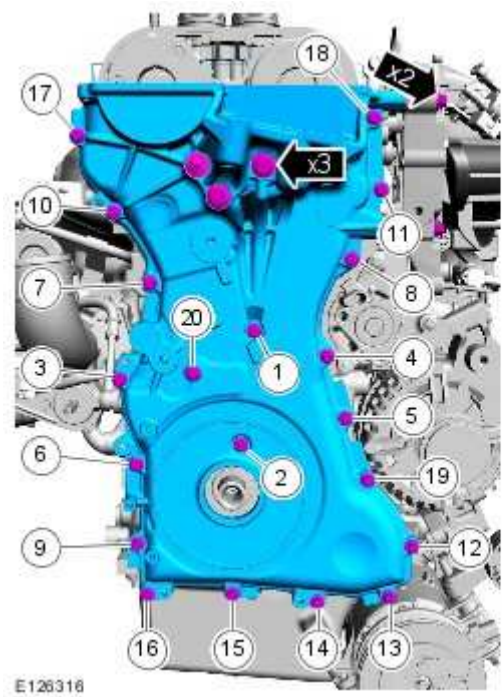
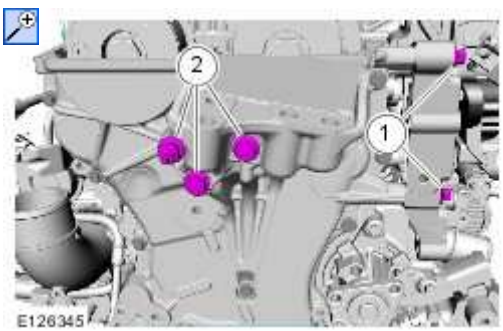




19. CAUTION: Use an open-ended wrench to prev
the component from turning.
Torque: 72 Nm



20.
1. NOTE: Install all the bolts finger ti
before final tightening.
2. *Torque:*
1 - 20 10 Nm



21.
1. *Torque:* 24 Nm
2. *Torque:* 47 Nm

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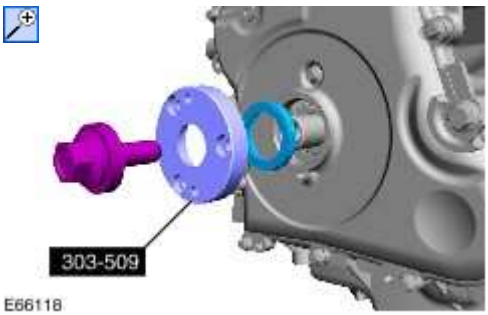
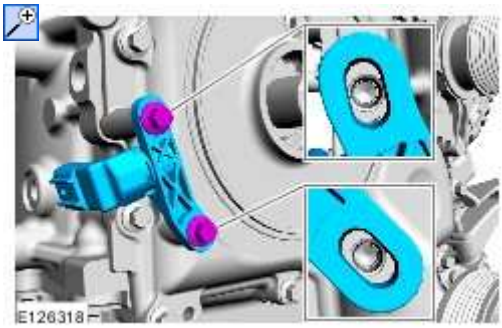
22. CAUTION: Make sure that a new friction wash installed.

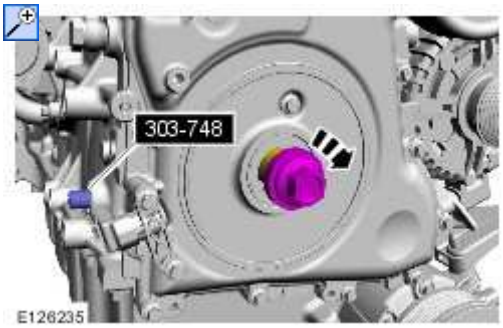


23. *Special Tool(s):* 303-509



24. *Torque:* 7 Nm

25. *Install the Special Tool(s):* 303-748

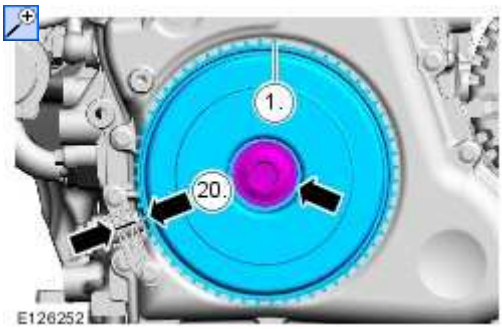


26. CAUTION: Only rotate the crankshaft clockwi
Rotate the crankshaft slowly until the crankshaft stc

Special Tool(s): 303-748

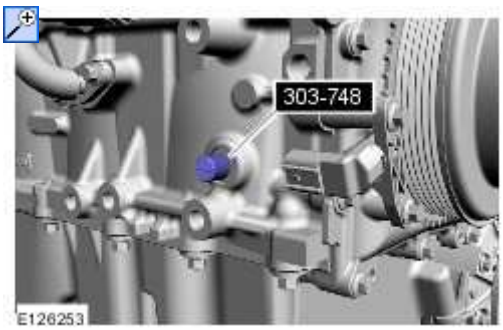
27.

http://vnx.su

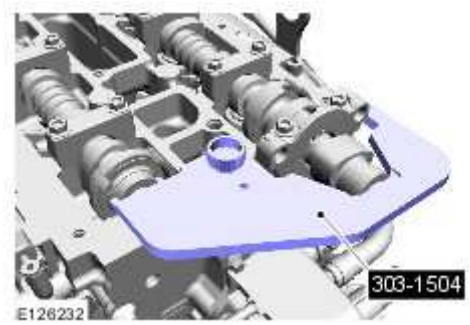


28.

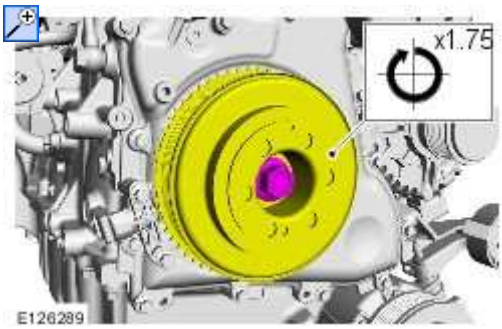
- CAUTION: Make sure that the compone aligns with the installation mark.
- *Torque:*
  Stage 1: 100 Nm
  Stage 2: 90°



29. *Remove the Special Tool(s):* 303-748



30. *Remove the Special Tool(s):* 303-1504



31. CAUTION: Only rotate the crankshaft clockwi

32. *Install the Special Tool(s):* 303-748

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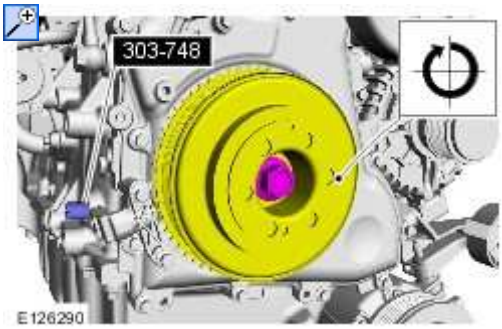
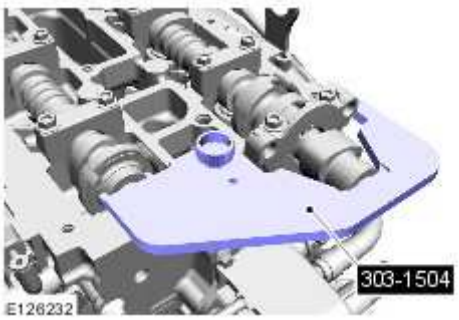


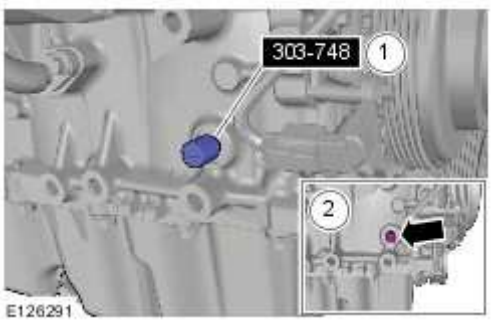
33. Rotate the crankshaft slowly until the crankshaft st

Special Tool(s): 303-748

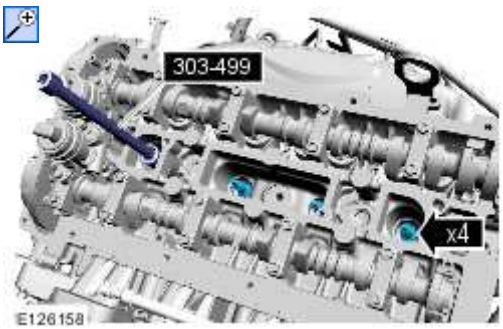


34. NOTE: The special tool can only be installed if the timing is correct.
Install the Special Tool(s): 303-1504

35. *Remove the Special Tool(s):* 303-1504



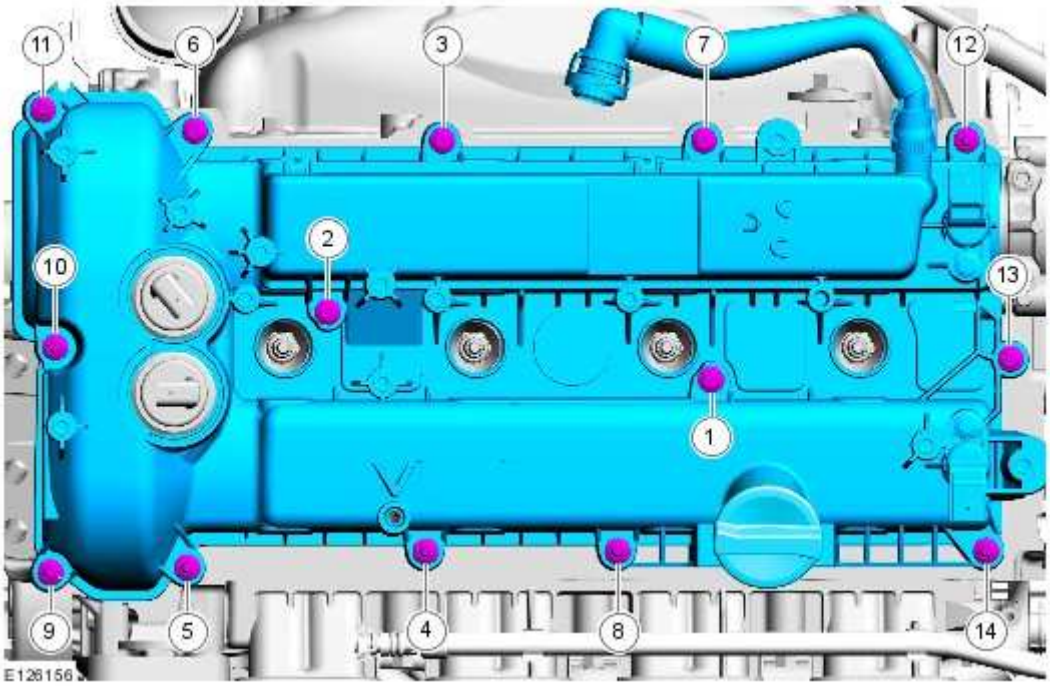
36.
1. *Remove the Special Tool(s):* 303-748
2. *Torque:* 20 Nm



37. *Special Tool(s):* 303-499
Torque: 12 Nm

38. NOTE: T
gasket is
be reuse
unless
damage

http://vnx.su

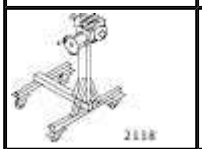
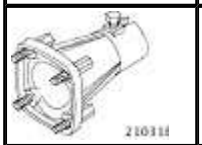
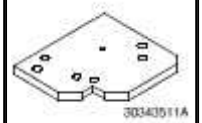
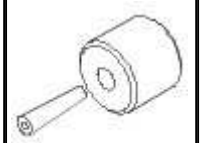


Torque:

http://vnx.su

Installation

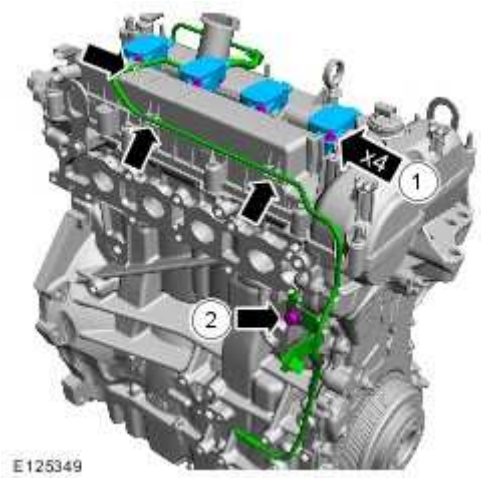
Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-397 Remover/Installer, Hose Clamp
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06
 E42916	310-128 Installer Set, Teflon Seal

1. CAUTION: Make sure that new bolts are installed.
   Special Tool(s): 303-254
   Torque: 112 Nm

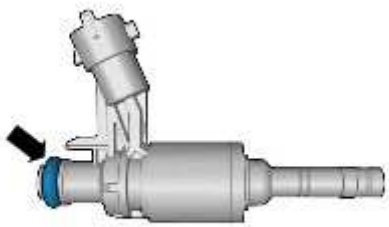
2.
   1. *Torque:* 8 Nm

http://vnx.su



E125349

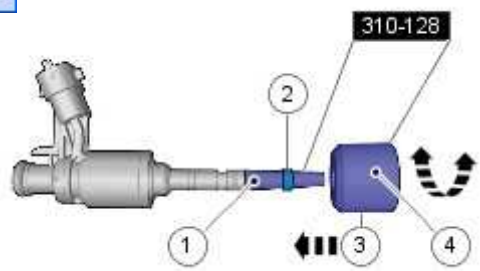
2. *Torque:* 24 Nm


E125882

3. CAUTIONS:

Take extra care when handling the componer

Make sure that the area around the compone is clean and free of foreign material.
NOTE: Make sure that a new component is install



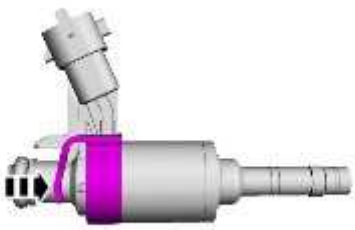
E125878

4. CAUTIONS:

Take extra care when handling the componer

Make sure that the area around the compone is clean and free of foreign material.

1. *Special Tool(s):* 310-128
2. NOTE: Make sure that a new component is installed.
3. *Special Tool(s):* 310-128


E128139

5. CAUTION: Take extra care when handling the components.
NOTE: Make sure that a new component is install

E125881

6. CAUTIONS:

Take extra care when handling the componer

Make sure that the area around the compone is clean and free of foreign material.
NOTE: Only use moderate force.

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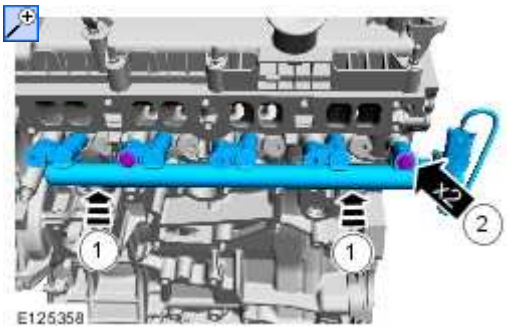
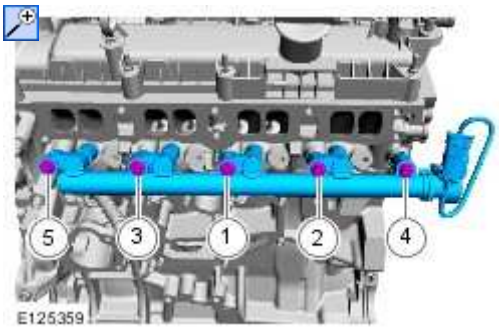


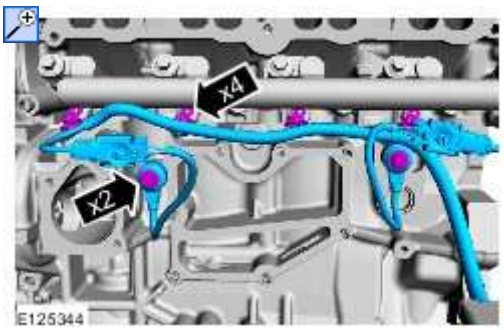
7.

1. ⚠CAUTION: Only use moderate force.
2. NOTE: Only tighten the bolts finger tight at this stage.

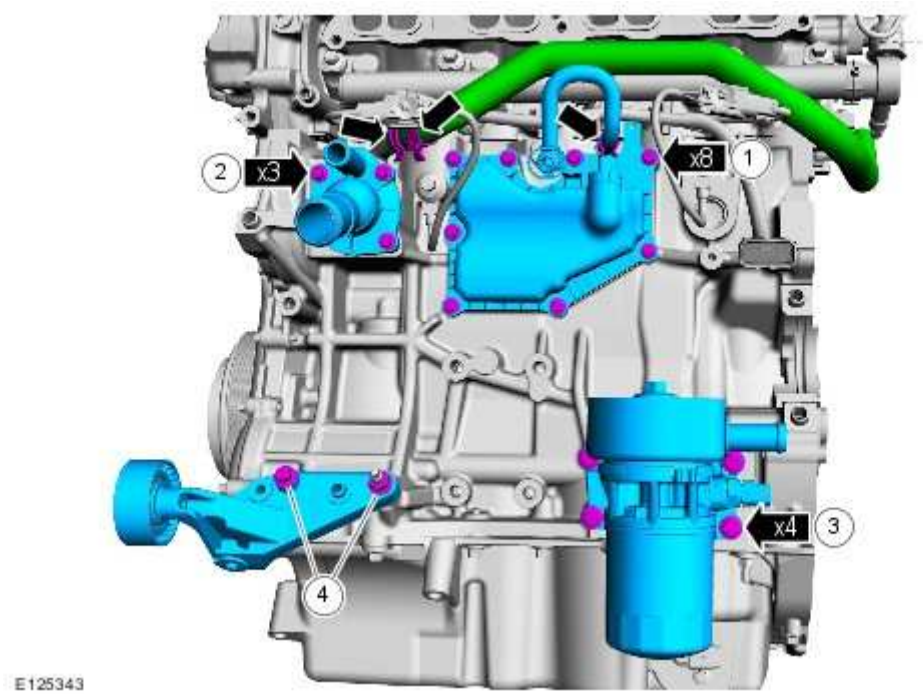


8. NOTE: Only tighten the bolts finger tight at this stage.

9. *Torque:*
   Stage 1: 8 Nm
   Stage 2: Loosen: 3 turn(s)
   Stage 3: 8 Nm
   Stage 4: 26°



10. *Torque:* 20 Nm



11.
1. *To*
   10
2. *To*
   10
3. *To*
   25
4. *To*
   24
- *Sp*
  To
  30
  39

12.
1. *Torque:* 24 Nm
2. *Torque:* 10 Nm
3. *Torque:* 24 Nm

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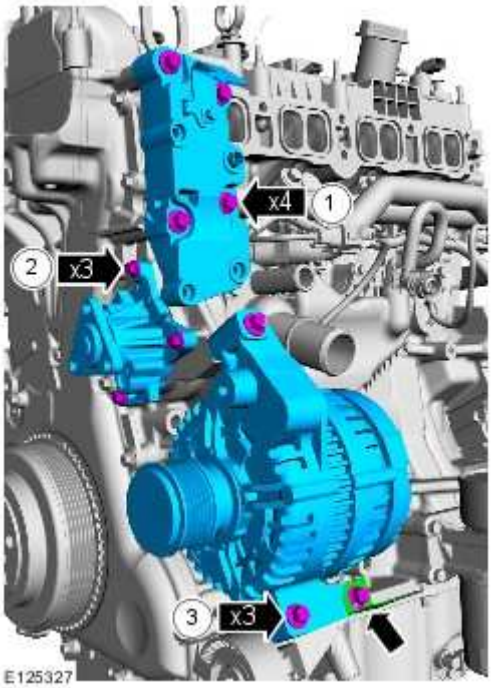
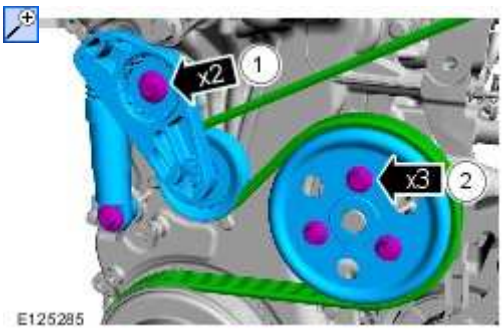
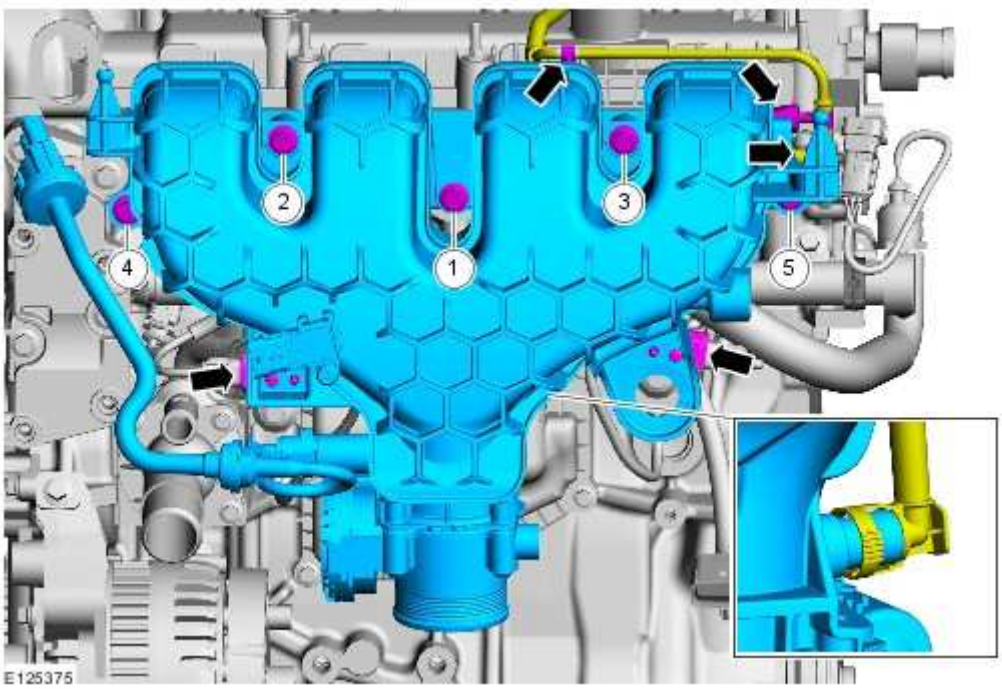




13.

1. *Torque:* 24 Nm
2. *Torque:* 20 Nm



14. *Torque:* Nm

15.

1. *Torque:* 24 Nm
2. *Torque:* 10 Nm
   - *Special Tool(s):* 303-397

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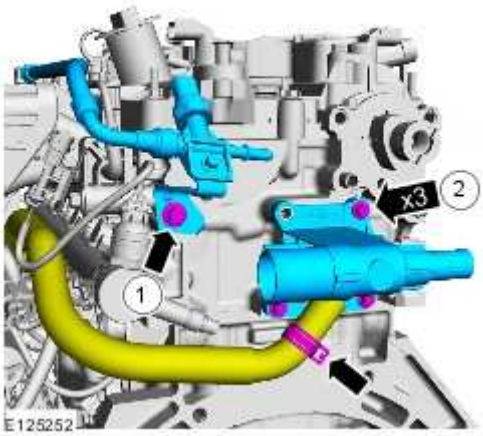
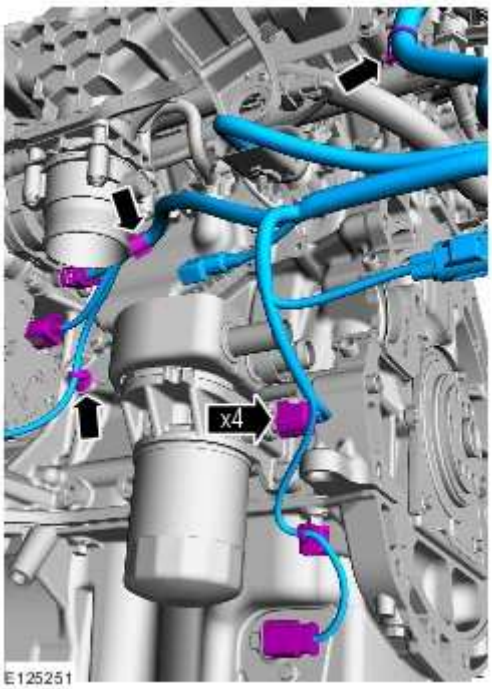
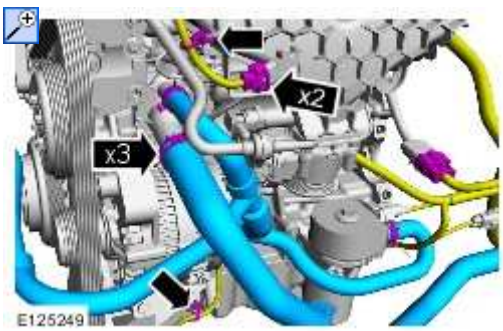


16.



17. *Special Tool(s):* 303-397



18.

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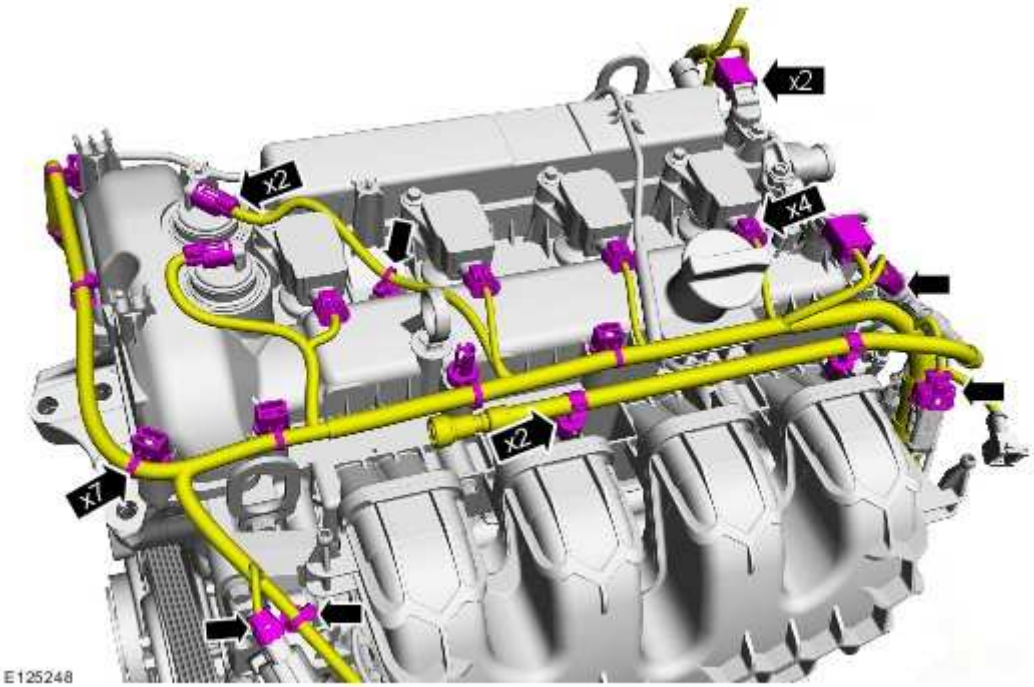
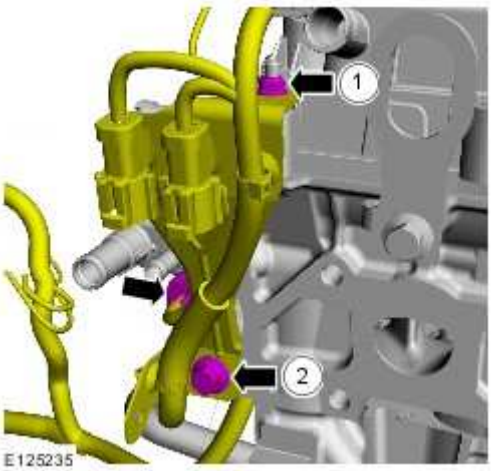
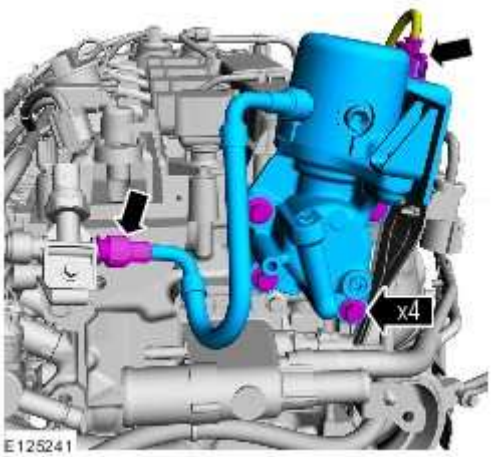




19. *Torque:*
    1 10 Nm
    2 24 Nm



20.
    1. *Torque:* 10 Nm
    2. *Torque:* 10 Nm
    3. *Torque:* 20 Nm

21. NOTE: Make sure that a new component is installe
    NOTE: Only tighten the nuts and bolts finger tight
    this stage.

22. *Torque:*
    1 7 Nm

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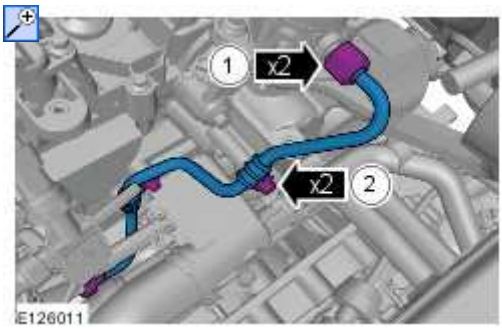
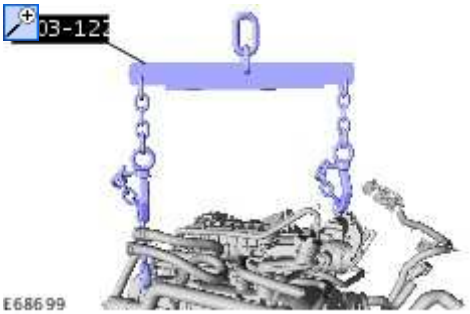
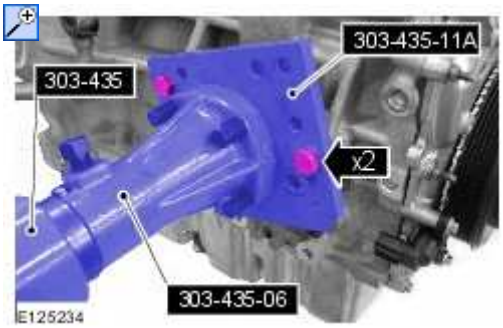


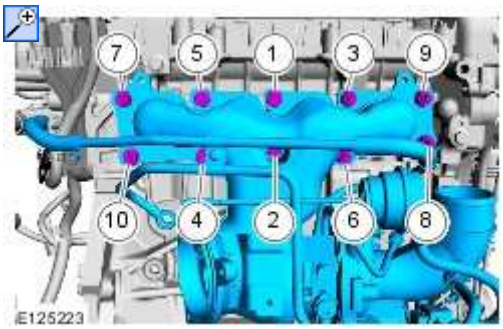
2 10 Nm
1
Stage 1: 10 Nm
Stage 2: 45°



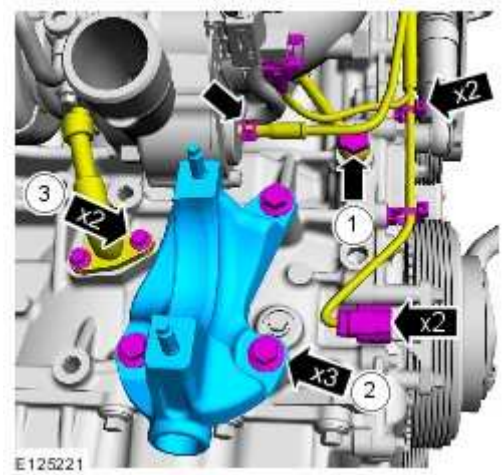
23. *Install the Special Tool(s):* 303-122



24. *Remove the Special Tool(s):* 303-435, 303-435-06, 435-11A



25. *Torque:* 50 Nm



26.

1. *Torque:* 25 Nm
2. *Torque:* 48 Nm
3. *Torque:* 10 Nm
   - *Special Tool(s):* 303-397

27.

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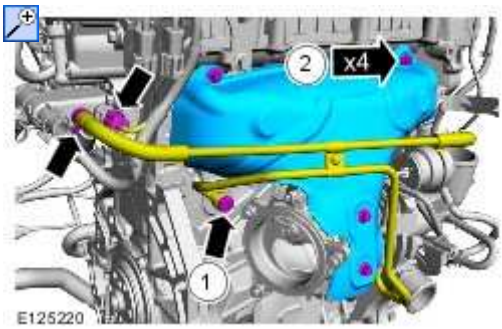
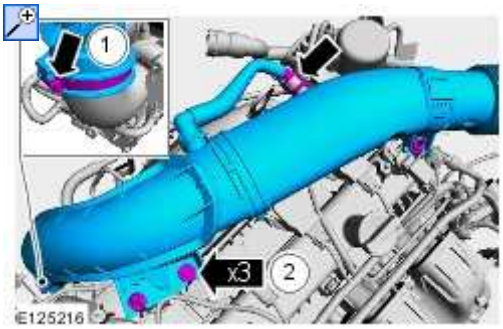


1. *Torque:* 28 Nm
2. *Torque:* 10 Nm
   - *Special Tool(s):* 303-397



28.

1. *Torque:* 4 Nm
2. *Torque:* 10 Nm

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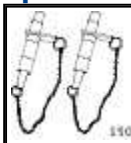
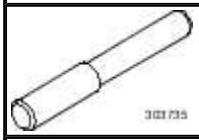
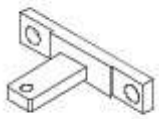
Installation

Special Tool(s)

	205-316A Alignment Pins, Subframe
	303-122 Lifting Bracket, Engine
	303-735 Alignment Peg, Camshaft
 E116734	308-720 Setting Gauge, Clutch Claws
 E103300	308-761 Locking Tool, Flywheel

Materials

Name	Specification
Grease K-PAG	WSA-M1C246-A / 8U7J-M1C246-AA

General Equipment

Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Retaining Strap
Transmission jack

1.

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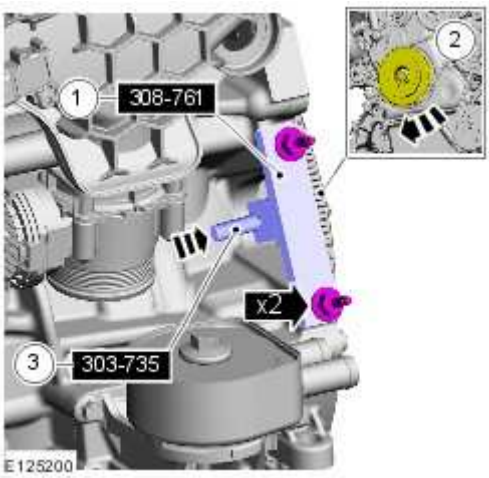
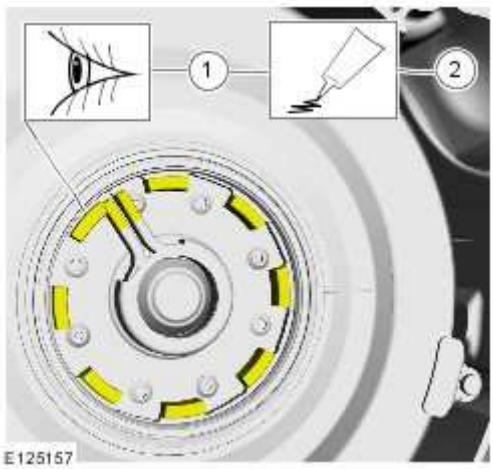
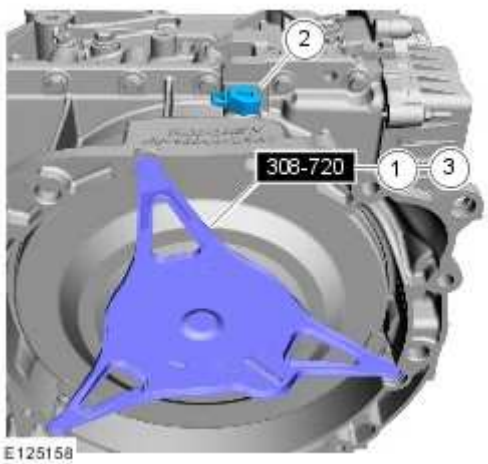


2.
   1. *Install the Special Tool(s):* 308-761
      Torque: 15 Nm
   2. CAUTION: Only rotate the crankshaft clockwise.
   3. *Install the Special Tool(s):* 303-735



3. If neccessary.

   Material: Grease K-PAG (WSA-M1C246-A / 8U7J-M1 AA)



4.
   1. *Install the Special Tool(s):* 308-720
   2. NOTE: Make sure that a new component is installed.
   3. *Remove the Special Tool(s):* 308-720

5. NOTE: This step requires the aid of another techn
   Torque: 48 Nm

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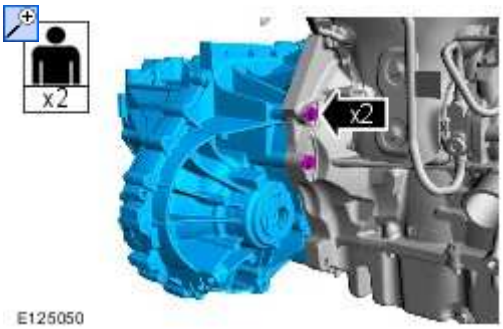
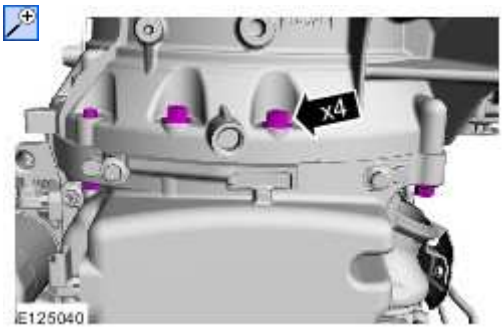
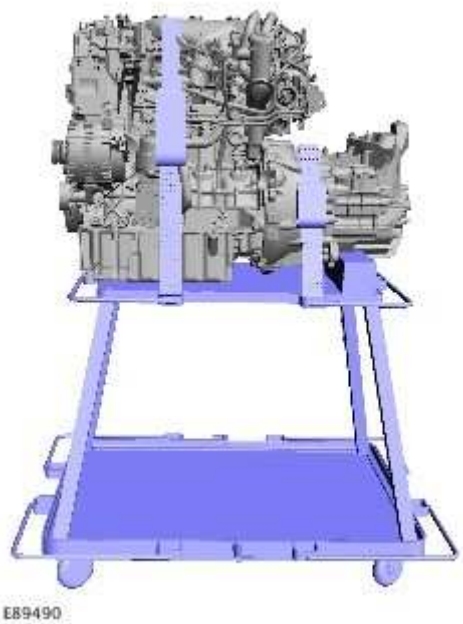
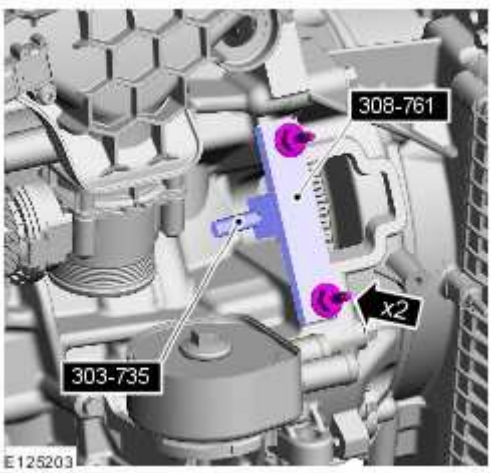




6. *Torque:* 48 Nm



7. *General Equipment:* Mounting table set
   General Equipment: Retaining Strap



8. *Remove the Special Tool(s):* 303-735, 308-761

9. *Remove the Special Tool(s):* 303-122

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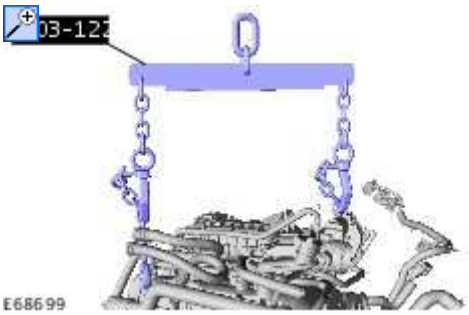
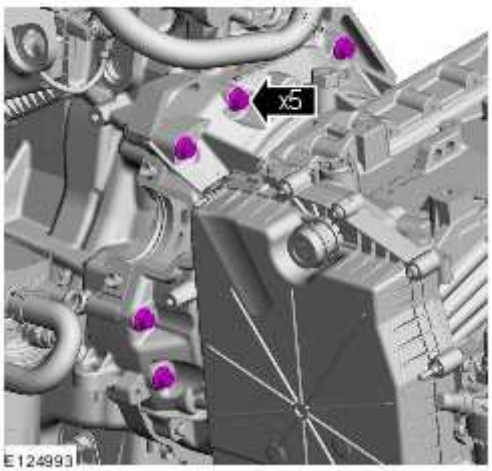
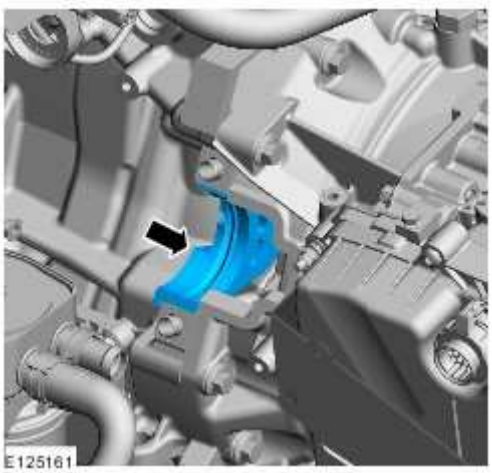


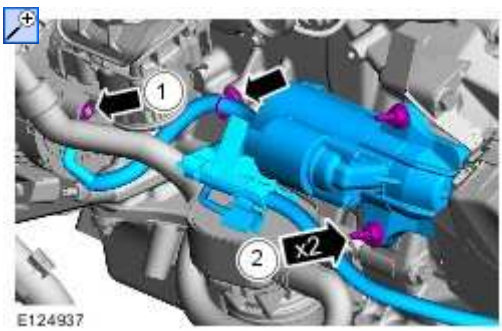
General Equipment: Hydraulic jib crane



10. *Torque:* 48 Nm



11.



12.
1. *Torque:* 15 Nm
2. *Torque:* 40 Nm

13. *Torque:*
1 10 Nm
2 24 Nm

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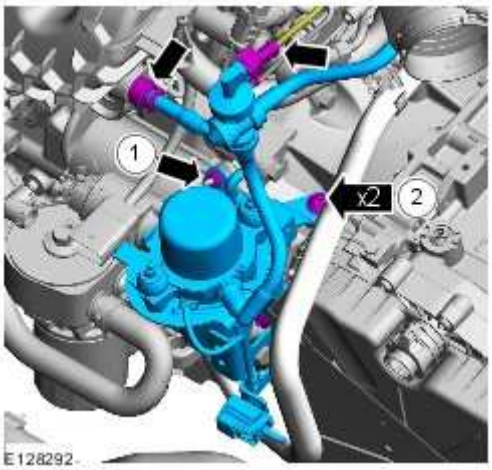
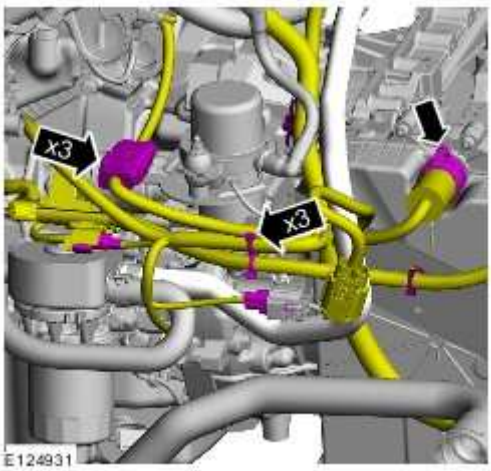
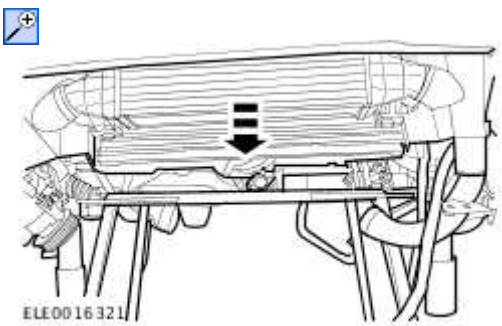
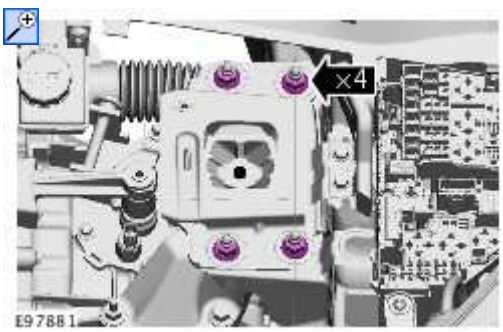


14.





15. CAUTION: Make sure that no components cat



16. *Loosen:* 2 turn(s)

17. *Torque:* 133 Nm

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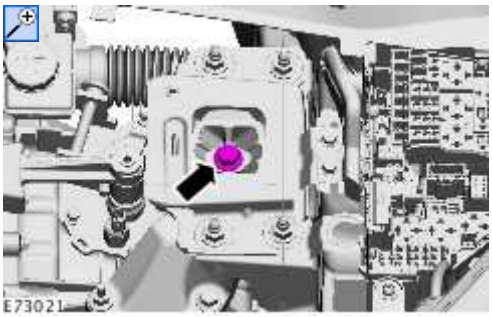
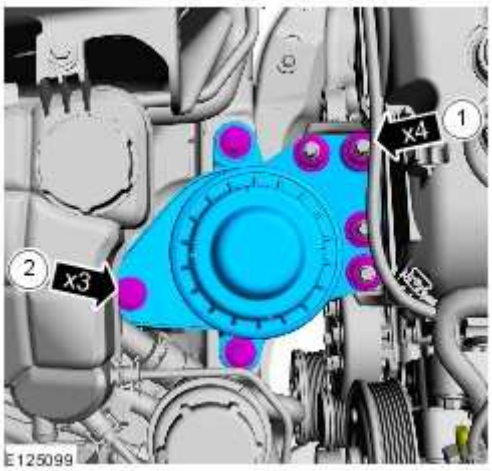
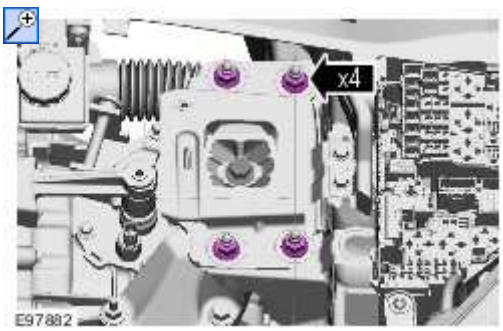


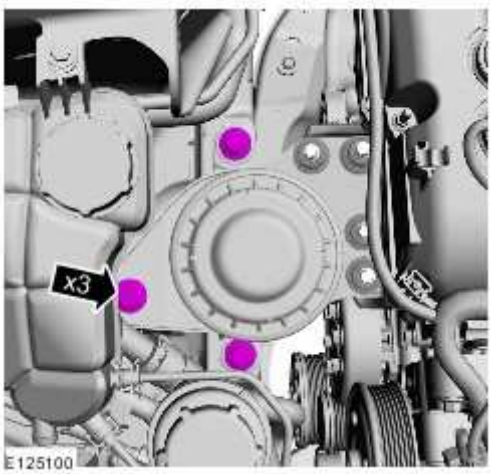


18.
1. *Torque:* 80 Nm
2. NOTE: Only tighten the bolts finger tight at stage.

19. Remove the following items:
- *General Equipment:* Retaining Strap
  General Equipment: Mounting table set



20. *Torque:* 80 Nm



21. *Torque:* 80 Nm

Vehicles with PCM security shield

22.

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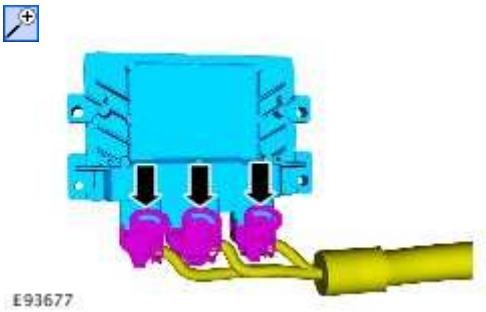
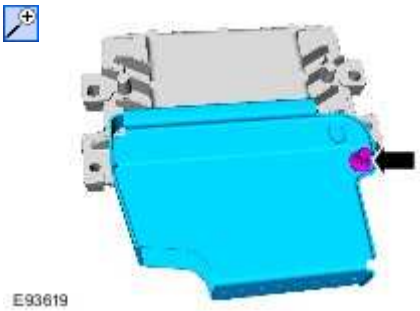
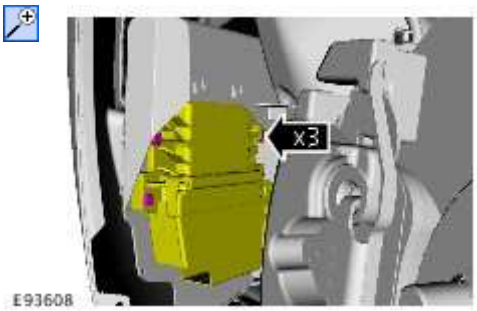


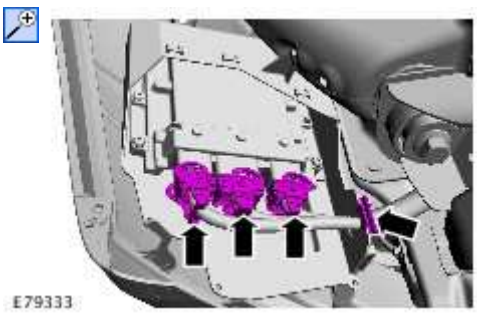


23.



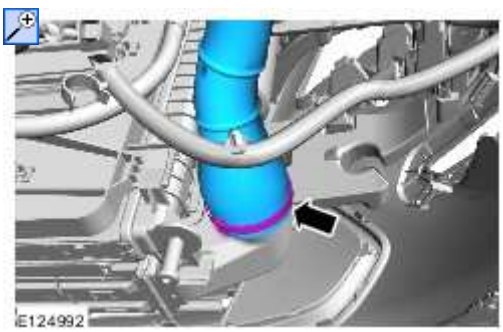
24. *Torque:* 3 Nm

Vehicles without PCM security shield



25.

All vehicles



26.

27. *Torque:* 9 Nm

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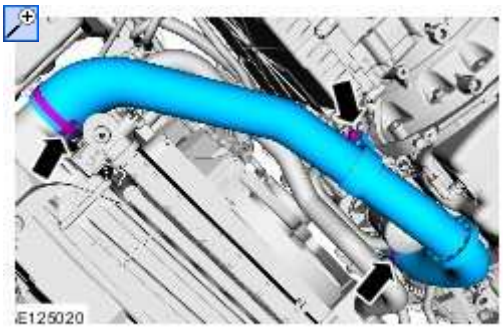
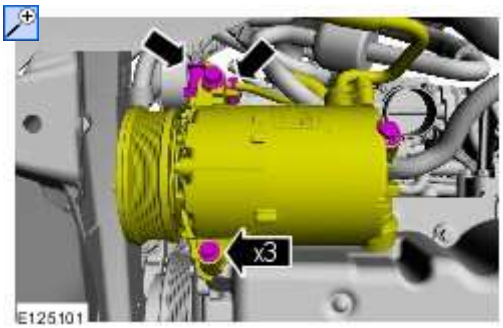
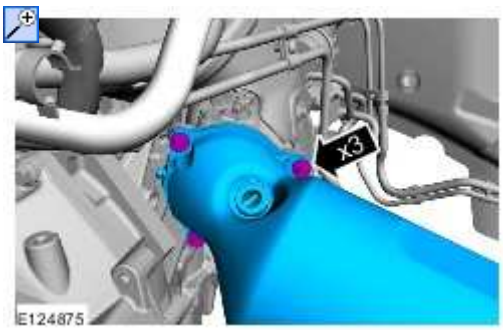


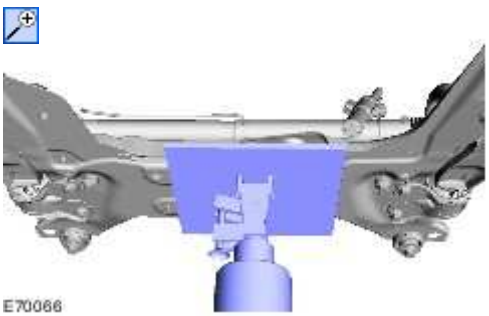


28. *Torque:* 24 Nm



29. *Torque:* 24 Nm

30. *Torque:* 48 Nm



31. CAUTION: Make sure that no components cat
NOTE: This step requires the aid of another techni
General Equipment: Transmission jack

32.

1. Insert the washer, with inside diameter 22 mn outside diameter 44 mm and height 5 mm, int front subframe above the alignment hole.
2. Insert the alignment pin through the front sub

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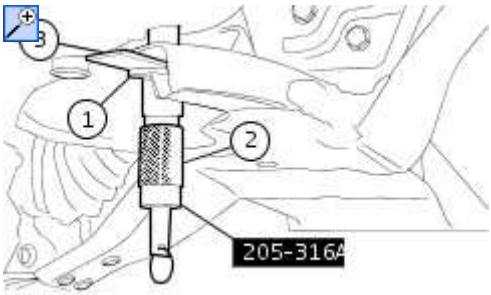
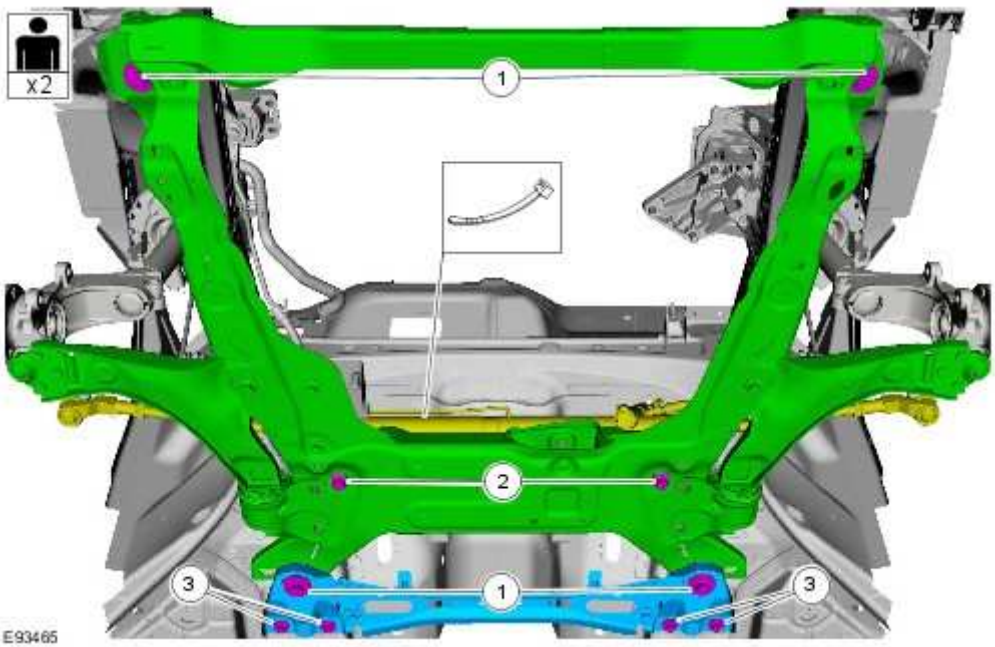


E002 1863

alignment holes and the washer.

Special Tool(s): 205-316A

3. Slide the locking plates on top of the washer a the groove of the special tool and tighten the alignment pin sleeve.



E93465

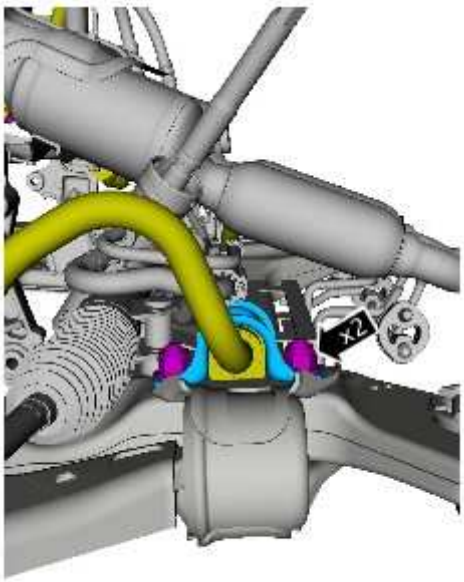
33.

1. NOTE: sure th compo are ins *Torque*

   150 Nm

   90°
2. *Torque*
3. *Torque*

34. *Remove the S Tool(s):* 205-



E93312

35. On both sides.

Torque:

Stage 1: 140 Nm
Stage 2: 45°

36.

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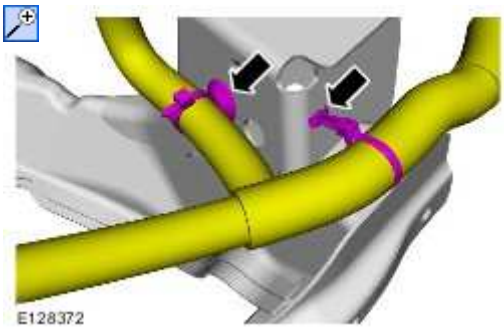
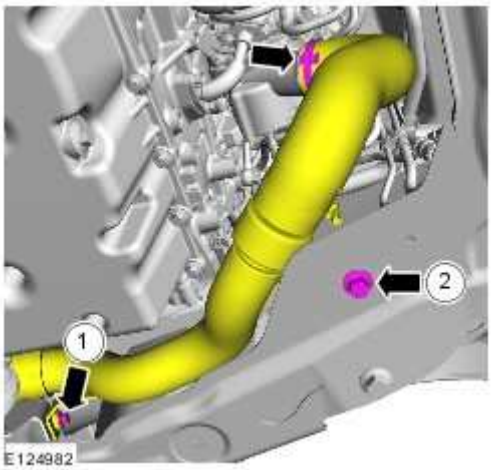
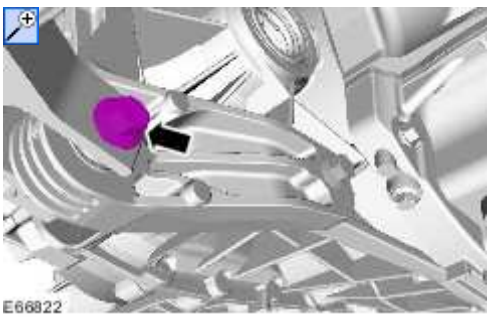
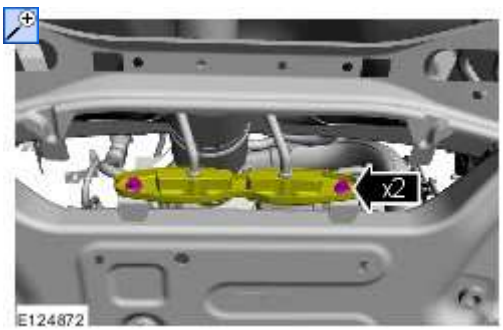




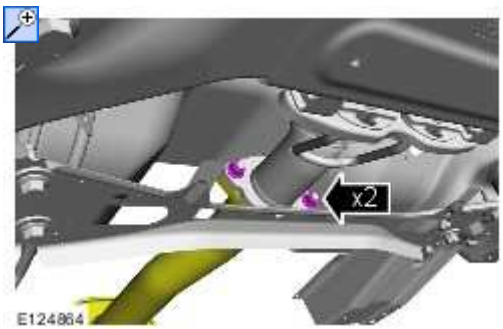
37.
1. *Torque:* 24 Nm
2. *Torque:* 80 Nm



38. *Torque:* 85 Nm



39. *Torque:* 24 Nm



40. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.
Torque: 48 Nm

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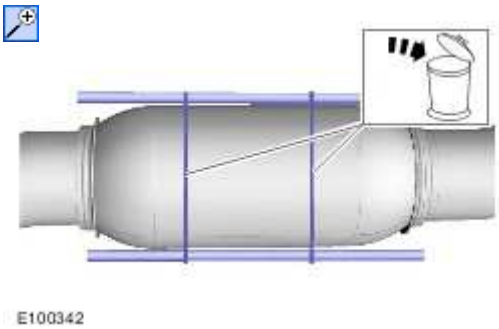
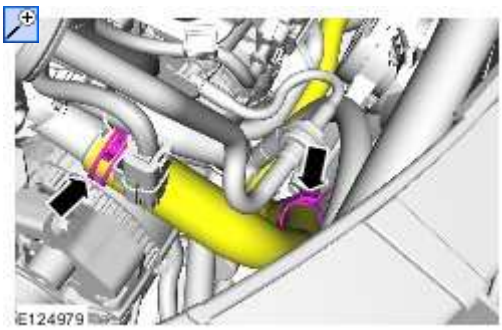
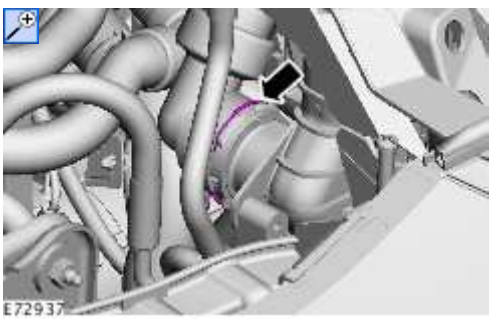

E100342

41. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.

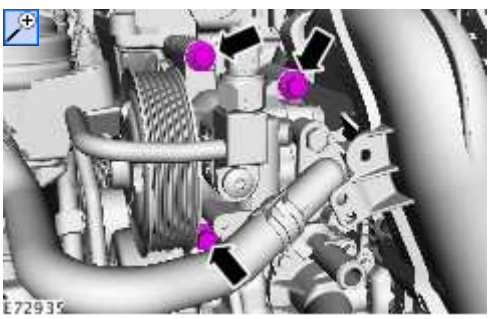
42. Install the following items:
    1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    2. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).


E124979

43. WARNING: Be prepared to collect escaping flu


E72937

44. WARNING: Be prepared to collect escaping flu


E72935

45. *Torque:* 24 Nm

46. WARNING: Take extra care when handling th compressed spring.

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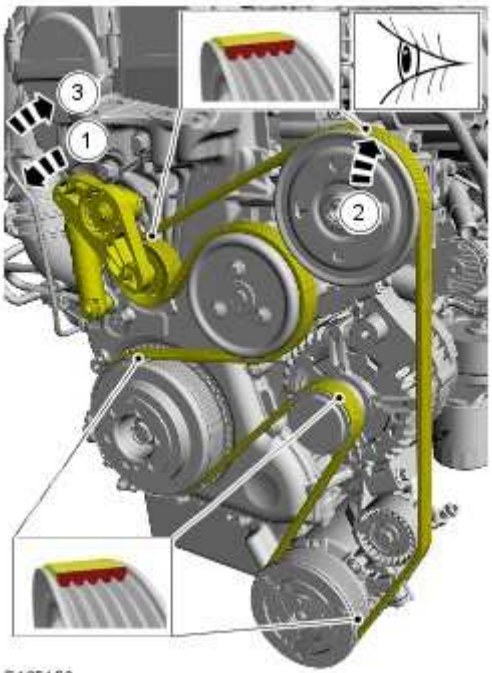
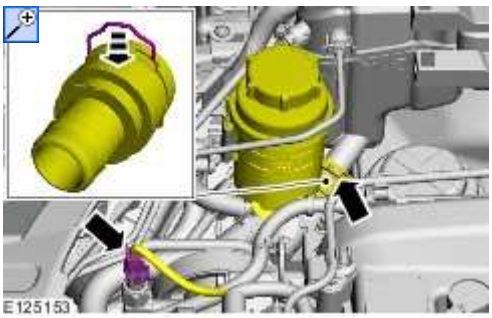
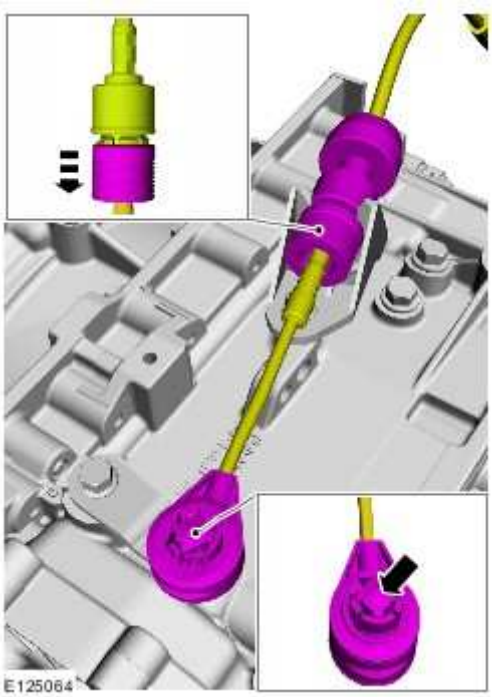


E125152


E125153

47. WARNING: Be prepared to collect escaping flu


E125064

48.

49. WARNING: Be prepared to c
escaping fluids.

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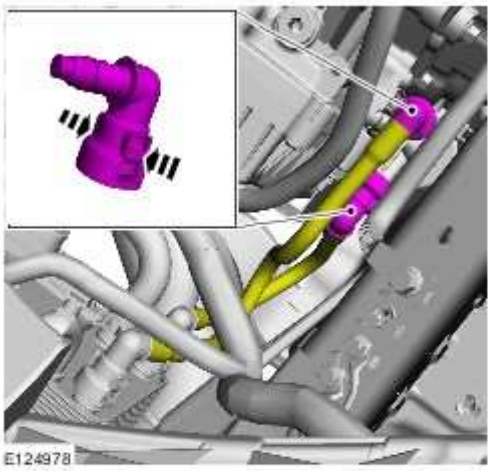
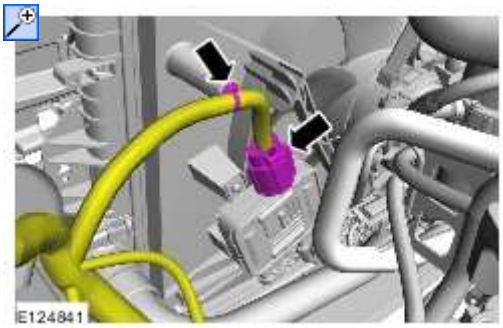
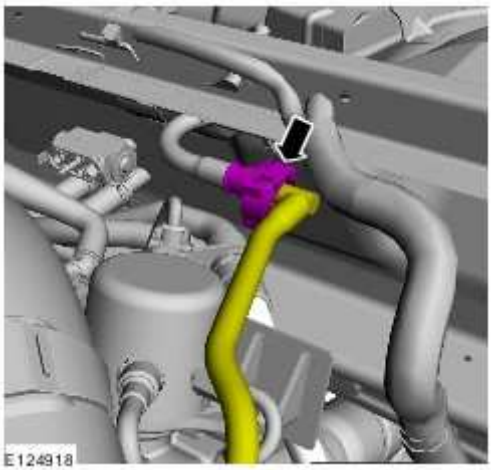


50.



51.



52.

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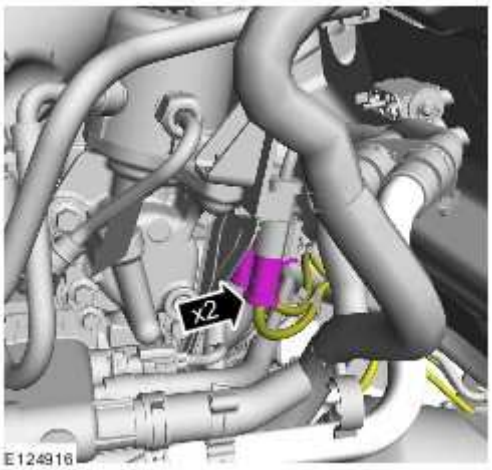

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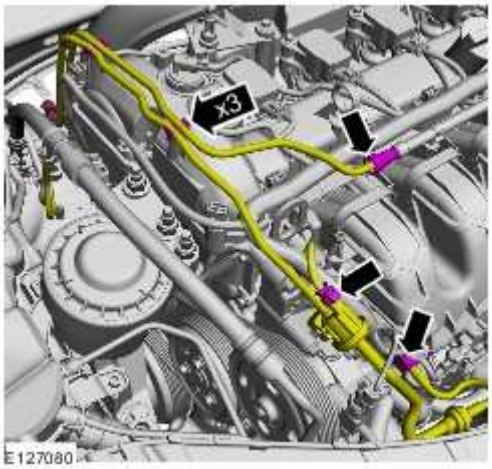
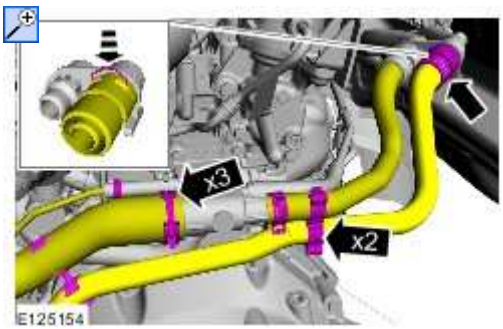
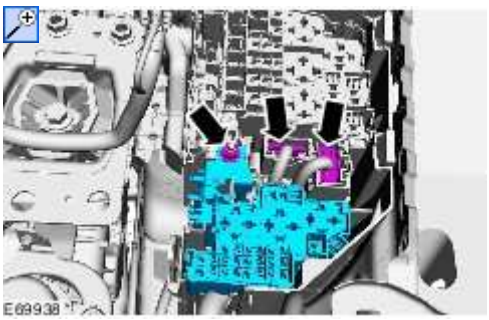




54. WARNING: Be prepared to collect escaping flu
General Equipment: Hose clamp remover/installer



55.

56.

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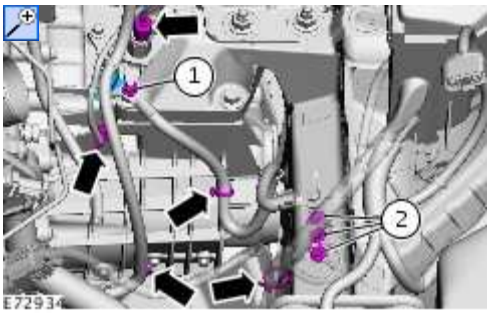
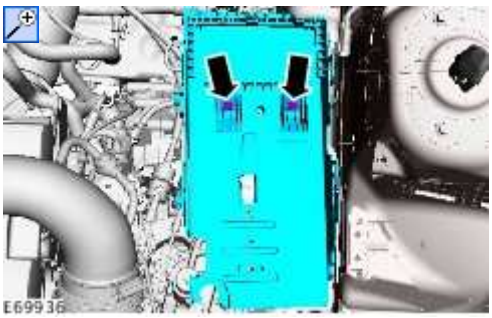


57.
1. *Torque:* 25 Nm
2. *Torque:* 15 Nm



58. *Torque:* 12 Nm

59. *Torque:* 12 Nm

60. Install the following items:
    1. Refer to: Battery (414-01 Battery, Mounting a Cables, Removal and Installation).
    2. Refer to: Air Cleaner (303-12B Intake Air Distı and Filtering - 2.0L EcoBoost SCTi (149kW/20 MI4, Removal and Installation).
61. Refer to: Cooling System Draining and Vacuum Fillin 03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/2(MI4, General Procedures).
62.

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Engine data

Specification	
Code	SEWA
Firing order	1-3-4-2
Emission level	Stage IV
Bore	87.5 mm
Stroke	94 mm
Engine Capacity	2,261 cm³
Compression ratio	10.6 : 1
Power output at 6500 rpm	118 kW (161 PS)
Torque at 1500 rpm	182 Nm
Maximum torque at 4000 rpm	208 Nm
Maximum engine speed (for a short period)	6675 rev/min
Maximum engine speed (continuous)	6450 rev/min
Engine idle speed	700 ± 50 rpm
Number of crankshaft main bearings	5
Camshaft drive	Timing chain
Maximum oil consumption	0.5 L/1000 Km

Engine oil

Viscosity/ambient temperature	Type	specification
Recommended engine oil		
SAE 5W-30 / below -20°C to over +40°C	Ford Formula E	WSS-M2C913-C
Alternative engine oils (for topping up only)		
SAE 10W-40 / -20°C below -20°C to over +40°C	Ford Formula XR+	ACEA A3, B3
SAE 5W-40 / below -20°C to over +40°C	Ford Formula S/SD	ACEA A3, B3

Capacities

	Liters
Initial fill including oil filter	4.6
Service fill including oil filter	4.3
Service fill without oil filter	3.9

Lubricants, Fluids, Sealants and Adhesives

	Specification
Sealant, oil pan contact surface to crankshaft rear seal retainer, oil pan to cylinder block, oil pan to front cover, engine front cover to cylinder block/ oil pan	WSE-M4G323-A4
Oil pressure switch and engine front cover blanking plug sealant	WSK-M2G349-A7

Valve clearances

Specification	
Valve clearance (engine cold) - intake valves	0,22 - 0,28
Valve clearance (engine cold) - exhaust valves	0,27 - 0,33

Cylinder head

CAUTION: The cylinder head sealing surfaces must not be re-worked.

Specification	mm
Maximum distortion, mating face	0,1

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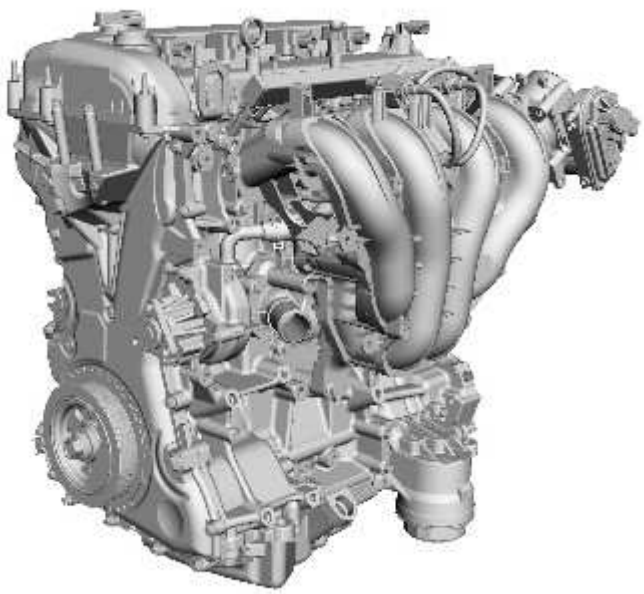
Description and Operation

2.3L Duratec-HE (MI4)



E83417

Apart from a few changes, the 2.3L Duratec-HE (MI4) engine is largely based on the 2.0L Duratec-HE engine already used in the S-MAX/Galaxy 2006.5 (03/2006-).

Key features of the engine include:

- Direct ignition coils
- Electronic throttle valve
- Mechanical thermostat
- variable Manifold Runner Control
- Dual-mass flywheel
- High-performance oil pump

Differences from the 2.0L Duratec-HE (MI4) engine variant fitted to the S-MAX/Galaxy 2006.5 (03/2006-) MI4) are:

- Variable camshaft timing (VCT)
- Integral dipstick
- Balance shafts

Variable camshaft timing (VCT)

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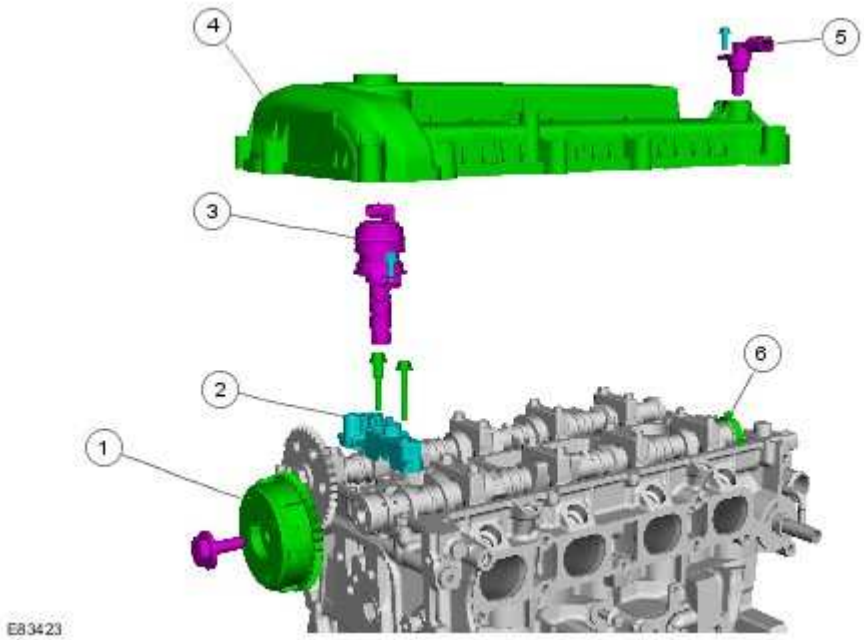

Item	Part Number	Description
1	-	Control unit - variable camshaft timing
2	-	Camshaft bearing cap
3	-	VCT oil control solenoid
4	-	Valve cover
5	-	Camshaft Position Sensor
6	-	Camshaft sensor ring

This system is an electronically controlled camshaft adjuster that allows variable timing for the inlet camshaft.

The valves are driven by a timing chain which drives the inlet camshaft timing control unit. This unit drives the associated camshafts. The timing chain is tensioned using a conventional timing chain tensioner.

The inlet camshaft is fitted with a sensor ring for the active camshaft position (CMP) sensor.

This CMP sensor is mounted inside the valve cover.

Timing chain replacement does not require the variable camshaft timing control unit to be disconnected.

To ensure trouble-free operation of the variable camshaft timing system and optimum engine performance, it is essential to adhere precisely to the valve timing adjustment procedure.

A special tool is needed to fix the camshafts in the adjustment position.

Remember that this special tool must not be used to keep the camshaft from rotating when mounting the camshaft sprocket. They may only be kept from rotating by using the hexagon, which has been specially provided for this purpose.

Advantages of variable camshaft timing (VCT)

- Lower fuel consumption due to improved volumetric efficiency
- Enhanced engine power and torque
- Improved idling characteristics

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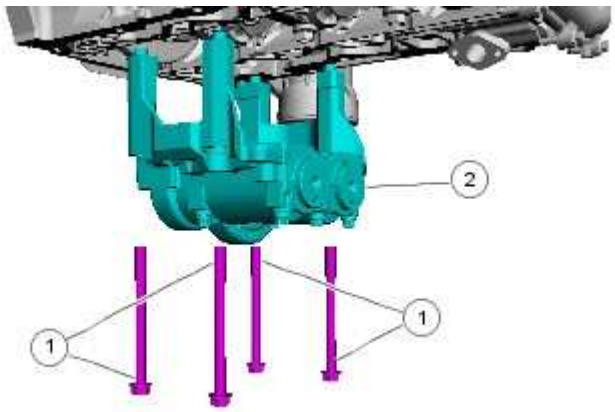

E83476

Item	Part Number	Description
1	-	Bolts - Balancer shafts
2	-	Balancer shaft unit

The 2.3L Duratec-HE has a modular balancer shaft unit with two balancer shafts. The balancer shaft unit is incorporated in the oil pan and mounted beneath the cylinder block.

The balancer shafts are driven by the crankshaft via sprockets and rotate at twice the crankshaft speed.

The balancer shaft unit must not be removed and stripped down in Service.

Advantages of the balancer shaft unit:

- Reduces the 2nd order forces of inertia
- The modular design minimises impact on engine construction

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Diagnosis and Testing

Special Tool(s)

	Socket, Spark Plug 303-499

General Equipment

Use a compression tester

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.
4. **4.** If the concern persists, check the symptoms and continue with the Symptom Chart.

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Leaking oil. • Fuel leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts	• Fuse(s) • Loose or corroded connector(s) • Control unit • Damaged or worn switch(es)

Symptom Chart

Symptom chart

Symptom	Possible Sources	Action
Loss of oil	* Oil leaks on components that are either coated in oil themselves or on components local to them.	* CHECK for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if an oil leak is not evident. INSTALL new gaskets or components as required.
	* Internal or external leak at the oil cooler.	* CHECK whether there is an oil film on the coolant in the coolant expansion tank. INSTALL a new oil cooler or oil cooler seal.
	* Leak on the crankshaft oil seal	* INSTALL a new crankshaft oil seal. REFER to: Kurbelwellendichtring vorn (303-01 Motor - 2.0L Duratec-HE (MI4), Removal and Installation), Kurbelwellendichtring hinten (303-01 Motor - 2.3L Duratec-HE (MI4), Removal and Installation).

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	* Leaks from oil carrying components or basic engine.	* CHECK for cracks in oil-carrying components of the basic engine by means of a UV leak test. INSTALL new components or seals as necessary.
Oil Consumption	* Use of the wrong type of engine oil.	* DETERMINE the last type of engine oil used and compare with the specification. Change the engine oil to the specification. REFER to: Spezifikationen (303-01 Motor - 2.3L Duratec-HE (MI4), Specifications).
	* Faulty positive crankcase ventilation (PCV) system. - Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes oil to enter the combustion chamber. - The PCV oil separator is damaged. Oil can enter the combustion chamber through the intake manifold.	* CHECK if the PCV system is operating correctly and repair as necessary.
	* Damaged gaskets or mating surfaces. - Damaged cylinder head gasket or warped mating faces. - Worn valve stem oil seals. Engine oil can enter the combustion chamber between the valve stem and the valve guide.	* CHECK the gaskets and mating surfaces for damage. - Remove the cylinder head. CHECK the condition of the mating faces and the cylinder head gasket and CHECK the evenness of the cylinder head and cylinder block mating faces. - INSTALL new valve stem oil seals. REFER to: Ventilschaftdichtringe (303-01 Motor - 2.0L Duratec-HE (MI4), Removal and Installation).
	* Piston ring or cylinder liner wear.	* INSTALL a new cylinder block if necessary.
	* Damaged cylinder liners or excessive clearance of engine components. - Pistons - Piston rings (clearance in groove and end gap). - Cylinder liners	* CHECK the running surfaces and clearances of the individual engine components. INSTALL a new cylinder block if necessary.
Coolant consumption	* Cooling system components.	* Check the cooling system components. REFER to: Kühlsystem (303-03 Kühlsystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Diagnosis and Testing).
	* Oil cooler	* INSTALL a new oil cooler.
	* Damaged gaskets or warped mating faces.	* CHECK the cylinder head gasket for damage. CHECK the cylinder head for distortion.
	* Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	* DETERMINE the damaged engine component(s) and install new component (s) as necessary.
Engine will not	* Battery or battery cable	* CHECK the battery, battery holder and

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crank		battery cable(s). REFER to: Batterie (414-01 Batterie, Befestigung und Batteriekabel, Removal and Installation).
	* Starter motor or cables.	* CHECK the starting system. REFER to: Anlasssystem (303-06 Anlasssystem - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
Engine cranks but will not start.	* Fuel tank is empty.	* CHECK the fuel level.
	* Intake Air Distribution and Filtering	* CHECK the intake air system.
	* Engine management	* CHECK the engine management system.
	* Ignition system	* CHECK the ignition system.
	* Incorrect valve timing.	* CHECK and adjust valve timing. REFER to: Ventilspiel einstellen (303-01 Motor - 2.3L Duratec-HE (MI4), General Procedures).
	* Timing chain or timing chain sprockets damaged or broken	* CHECK the timing chain and timing chain sprockets. INSTALL new components as necessary. REFER to: Steuerkette (303-01 Motor - 2.3L Duratec-HE (MI4), Removal and Installation).
Very poor power output or fuel consumption too high or engine running rough	* Fuel system	* CHECK the fuel system.
	* Intake Air Distribution and Filtering	* CHECK the intake air system.
	* Restricted exhaust system.	* CHECK the exhaust system. REFER to: Auspuffsystem - 2.3L Duratec-HE (MI4) (309-00 Auspuffsystem - Allgemeine Informationen - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Description and Operation).
	* Engine management	* CHECK the engine management system.
	* Ignition system is faulty	* CHECK the ignition system.
	* Incorrect valve timing, timing chain or timing chain sprockets damaged	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01 Motor - 2.3L Duratec-HE (MI4)) Ventilspiel einstellen (General Procedures), Steuerkette (Removal and Installation).
	* Incorrect ignition timing	* CHECK the electronic engine controls.
Noisy running	* Engine auxiliary components loose or damaged.	* CHECK engine auxiliary components for damage or looseness. CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01 Motor - 2.3L Duratec-HE (MI4)) Ventilspiel einstellen (General Procedures), Steuerkette (Removal and Installation).
Noisy running, misfiring, backfiring or knocking	* Incorrect fuel	* DETERMINE which type of fuel was last put in the tank (note the country specific fuel specifications).
	* Water in fuel or fuel contaminated.	* CHECK the fuel system for water or other contamination.
	* Incorrect valve timing, timing chain or timing chain sprockets damaged	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: (303-01 Motor - 2.3L Duratec-HE (MI4))

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		Ventilspiel einstellen (General Procedures), Steuerkette (Removal and Installation).
Noisy running or valve train noise	* Valve clearance too large due to faulty valve tappets or worn valve train components.	* ADJUST valve clearance. REFER to: Ventilspiel einstellen (303-01 Motor - 2.3L Duratec-HE (MI4), General Procedures).
	* Timing chain damaged.	* INSTALL a new timing chain. REFER to: Steuerkette (303-01 Motor - 2.3L Duratec-HE (MI4), Removal and Installation).
	* Timing chain incorrectly tensioned	* CHECK the timing chain tension. INSTALL a new timing chain if required. REFER to: Steuerkette (303-01 Motor - 2.3L Duratec-HE (MI4), Removal and Installation).
Noisy running or engine noise	* Engine components - Pistons - Piston rings - Connecting rod big end, main bearing or thrust bearing journals - Connecting rods bent or damaged.	* CHECK the engine components for wear or damage. Make sure all components are within specification. INSTALL a new cylinder block if necessary. REFER to: Spezifikationen (303-01 Motor - 2.3L Duratec-HE (MI4), Specifications).

Oil Leaks - Engine

NOTE: Before renewing gaskets or oil seals, make sure that the cause of the fault is clearly established.
If the oil leak cannot be identified clearly by a visual inspection, carry out an UV test:

Ultraviolet (UV) Testing

1. **1.** Clean the engine and transmission with a suitable cleaning fluid.
2. **2.** Pour the UV-test fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.

WARNING: Vehicles with manual transaxle, shift the transaxle into Neutral. Failure to observe this instruction can lead to injuries.

3. **3.** Start the engine and let it run for about five minutes.
4. **4.** Stop the engine.

NOTE: If no leak is found, perform a road test. Drive the vehicle under different loads and then re-check the engine for leaks.

5. **5.** Check the engine for oil leaks using a suitable UV lamp.
6. **6.** Rectify any leaks found and check the engine for oil leaks.

Measure the compression pressure

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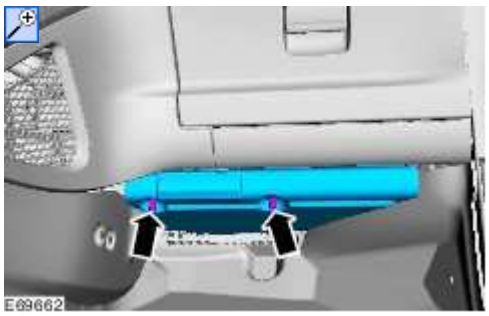
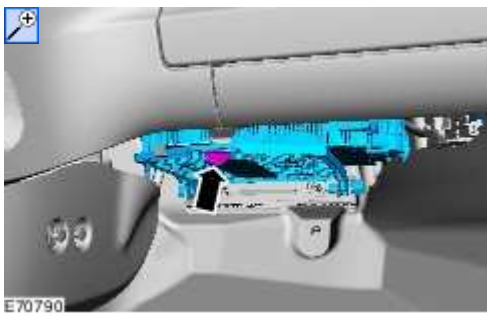


1. **1.** Remove the central junction box cover.

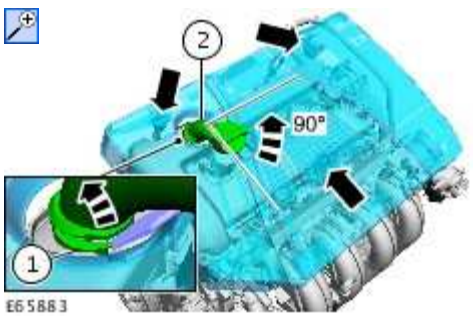


2. **2.** Detach the central junction box (CJB).

3. **3.** Open the CJB and remove fuse 23 - fuel pump relay.

NOTE: The engine will start, run for a few seconds and then stop.

4. **4.** Start the engine.



5. **5.** Detach the engine cover.

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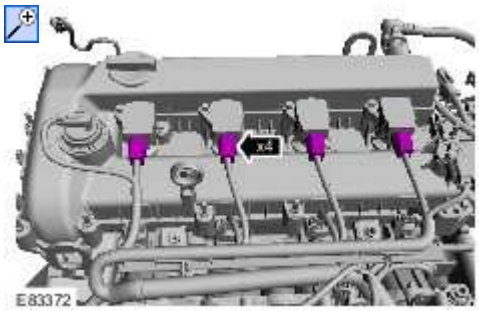
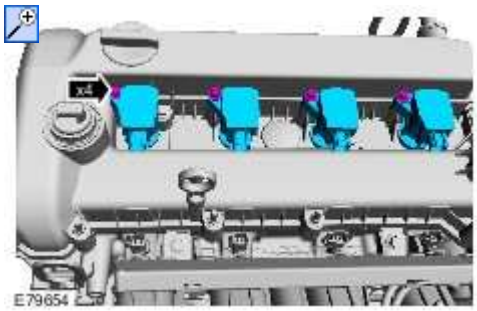
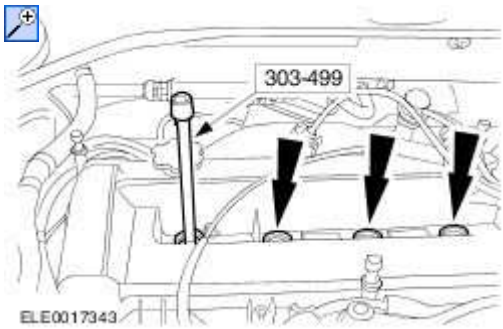


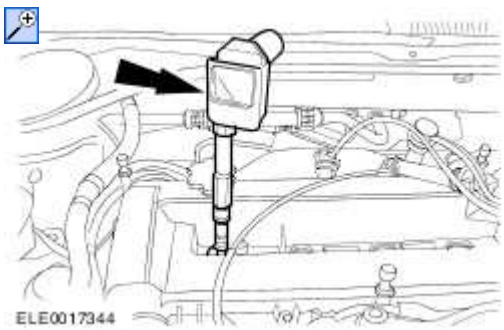
6. **6.** Disconnect the ignition coil-on-plug electrical connectors.



7. **7.** Remove the ignition coil-on-plug



8. **8.** Remove the spark plugs using the special tool.



NOTE: Operate the starter motor with wide open throttle until the reading on the compression tester stops rising.

9. **9.** Perform the measurement on each cylinder according to the instructions provided by the manufacturer of the measuring device. Use a compression tester with a suitable adapter.

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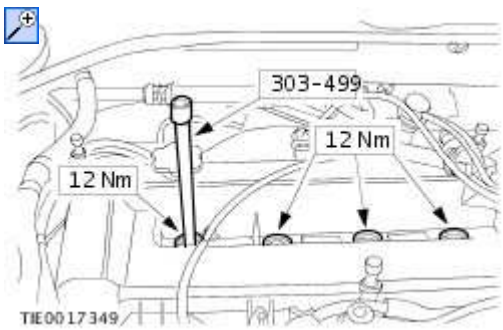
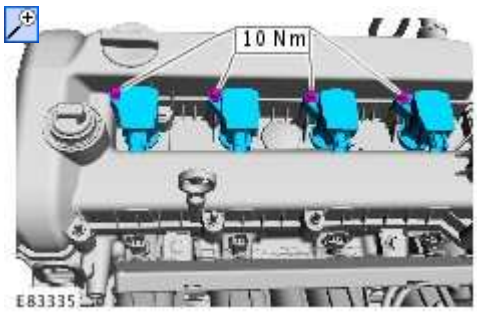
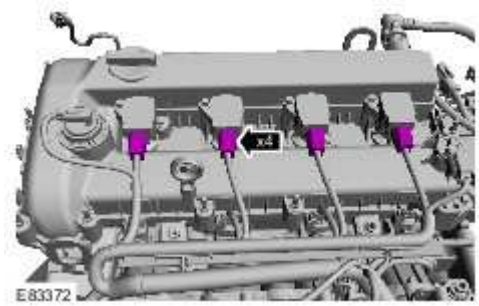


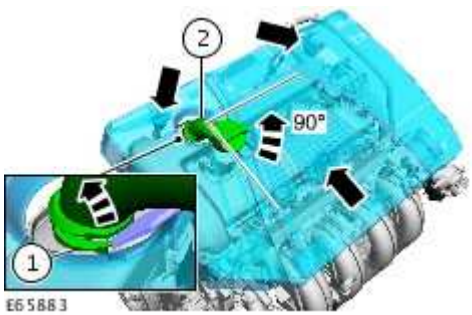
10. **10.** Install the spark plugs using the special tool.



11. **11.** Install the ignition coil-on-plug.



12. **12.** Connect the ignition coil-on-plug electrical connectors.



13. **13.** Install the engine cover.

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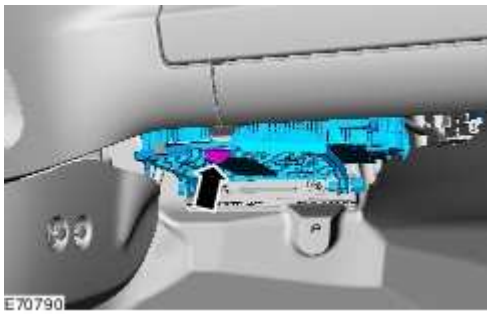
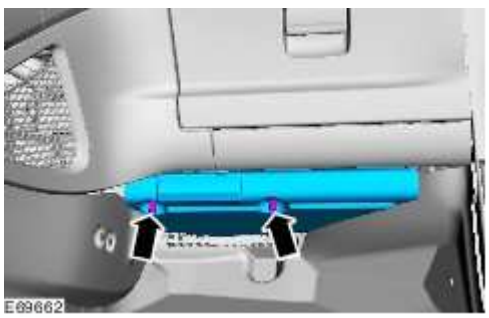
14. **14.** Install fuse 23 (fuel pump relay) and close the central junction box (CJB).



15. **15.** Attach the CJB.



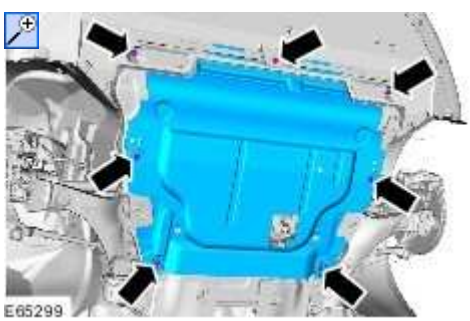
16. **16.** Install the central junction box cover.

17. **17.** Reset the PCM fault memory.

Measuring the oil pressure

1. **1.** Raise vehicle. REFER to: (100-02 Jacking and Lifting)

   Jacking (Description and Operation),
   Lifting (Description and Operation).



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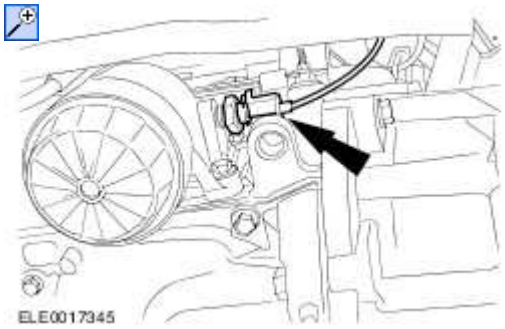
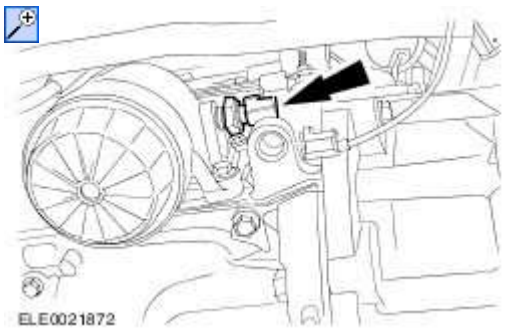
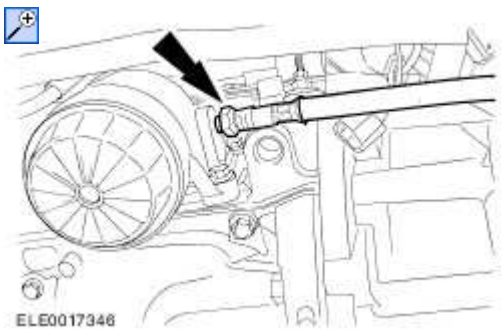
2. **2.** Remove the engine undershield.



3. **3.** Pull off the oil pressure switch connector.

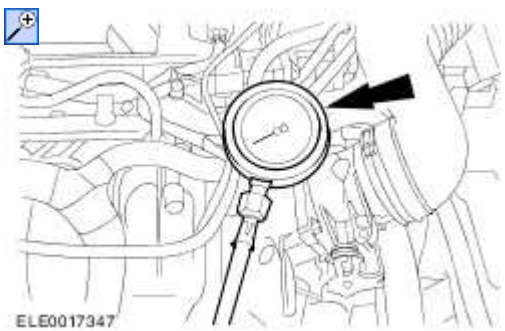


4. **4.** Remove the oil pressure switch.



5. **5.** Attach the oil pressure gauge with the oil pressure gauge connector to the oil pressure switch bore, and position it to allow reading from above.

6. **6.** Lower the vehicle.



7. NOTE: Measure the oil pressure at the specified engine speed. Measure the oil

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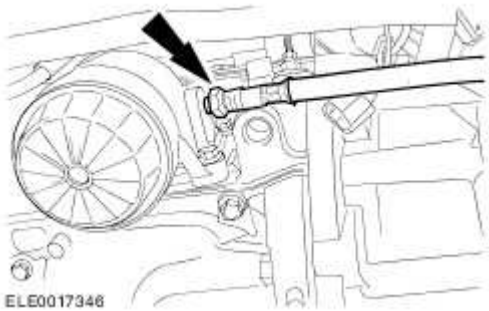
pressure at an oil temperature of 100 °C.
NOTE: Oil pressure at 1500 rev/min: 1.3 - 2.7 bar.
NOTE: Oil pressure at 3000 rev/min: 2.3 -5.2 bar.
7. Check the oil pressure

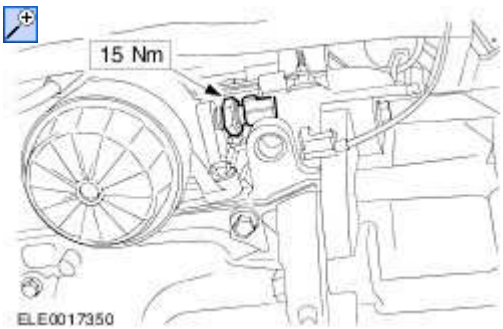
8. **8.** Raise vehicle. REFER to: (100-02 Jacking and Lifting)

   Jacking (Description and Operation),
   Lifting (Description and Operation).

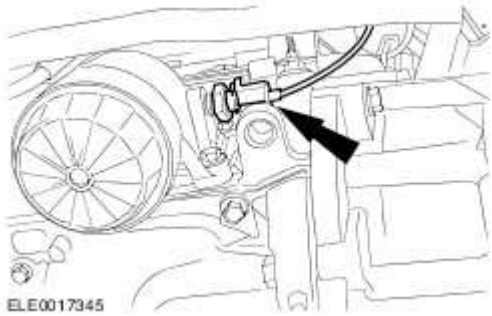


9. **9.** Detach the oil pressure gauge and connector from the oil pressure switch bore.

10. **10.** Coat the oil pressure switch with adhesive.



11. **11.** Install the oil pressure switch.



12. **12.** Push on the oil pressure switch connector.

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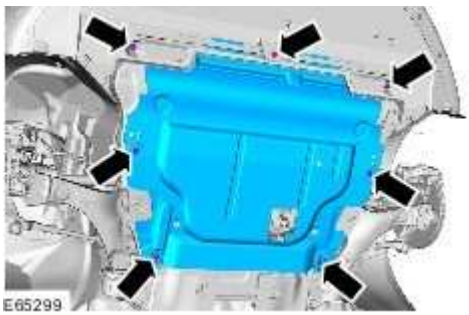

13. **13.** Install the engine undershield.

14. **14.** Lower the vehicle.

Valve train analysis - static (engine off)

Remove the cylinder head cover.

Check all valve train components for damage and wear. Ensure that only original components are installed and that all bolts and nuts have been tightened to the correct tightening torque.

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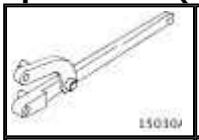
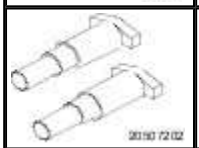
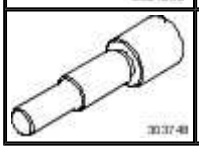
Print

General Procedures

Special Tool(s)

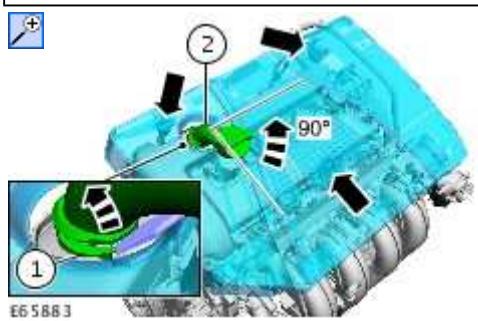
	205-072 Universal Flange Holding Wrench
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

General Equipment

Schlitzschraubendreher



1. *General Equipment:* Schlitzschraubendreher

2.

3.

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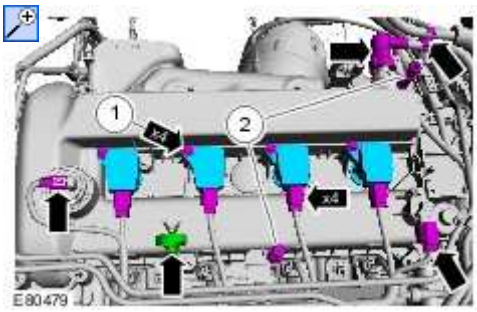
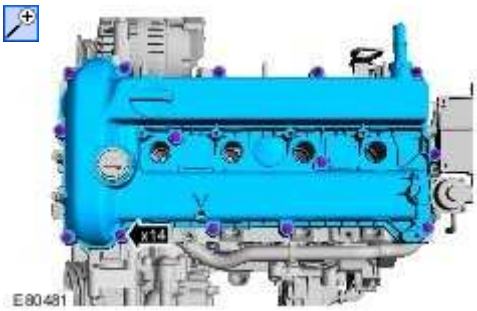
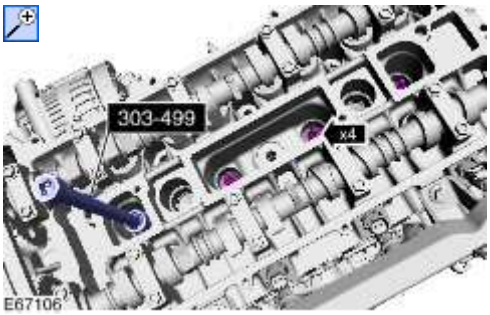
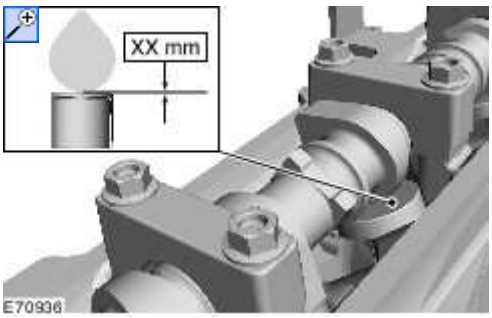




4. NOTE: The gasket is to be reused unless damaged.



5. *Special Tool(s):* 303-499



6. CAUTION: Only rotate the crankshaft clockwise.
   Rotate the crankshaft until the cam pair of the cylinder to be adjusted are pointing upwards. Using a suitable feeler gauge, measure the valave clearance.

7. Make a note of each cylinder number with the corresponding valve clearance.

8. Compare the measured valve clearance(s) with the specifications.

   Refer to: Spezifikationen (303-01B Motor - 2.3L Duratec-HE (MI4), Specifications).

9. NOTE: Only carry out the following steps when the valve clearance(s) require adjustment.

10. CAUTION: Only rotate the crankshaft clockwise.
    Rotate the crankshaft until piston No. one is approximately 45 degrees before top dead center (TDC).

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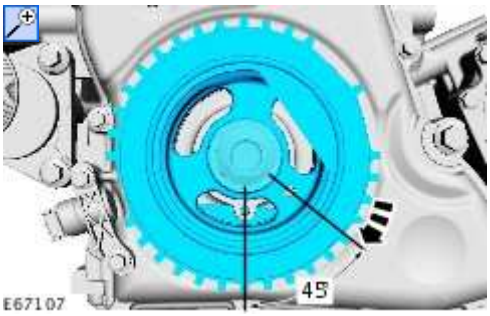
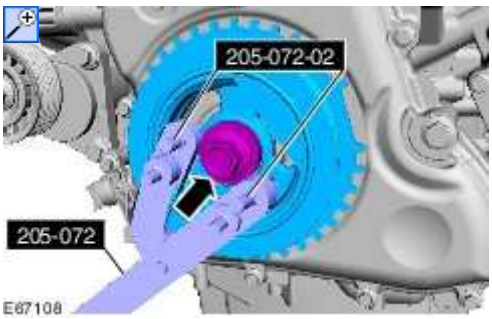
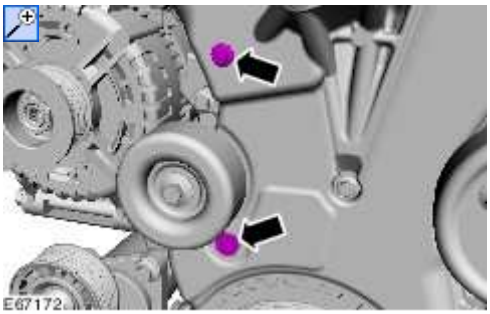




11. *Special Tool(s):* 205-072, 205-072-02



12.

13.

14.

1. Release the chain tensioner using a 2 mm drift.
2. Tension the timing chain.
3. NOTE: Only tighten the bolt finger tight at this stage.
   Secure the timing chain guide using an M6 x 25 mm bolt.

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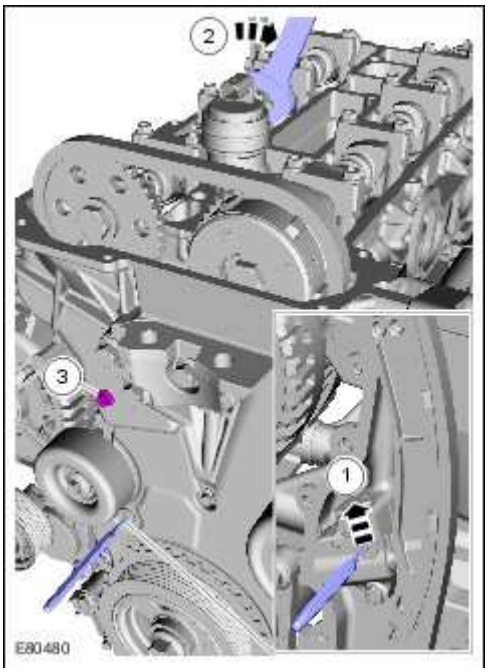
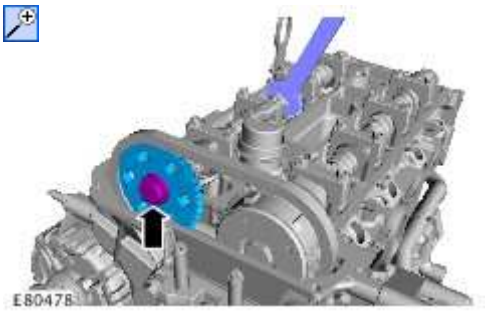
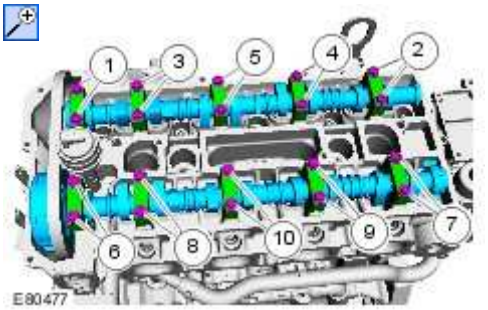




15. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.



16. CAUTION: Note the position of each component before removal.

17.

- Remove the valve tappet and read the thickness from the underside.
- The number on the valve tappet indicates the thickness of the bottom of the tappet. However, the number only indicates the digits after the decimal point (example: .650 = 3,650).

18.

- Calculate the required thickness of the valve tappet with the following formula: **X = S + M - V**
- Required thickness of tappet = **X**
- Thickness of currently fitted tappet = **S**
- Measurement of existing valve clearance (actual value) = **M**
- Desired valve clearance = **V**

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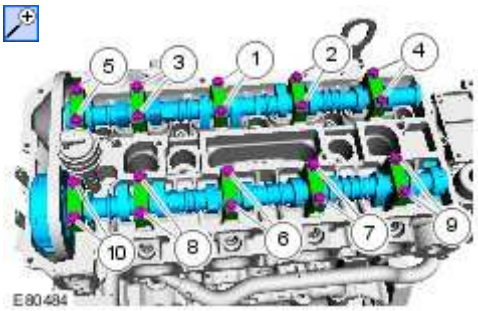
19. Install the correct valve tappet.

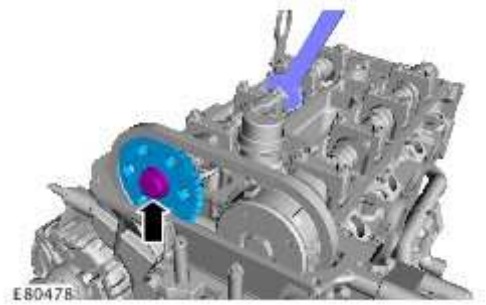


20. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
Coat the camshaft bearing caps with oil.

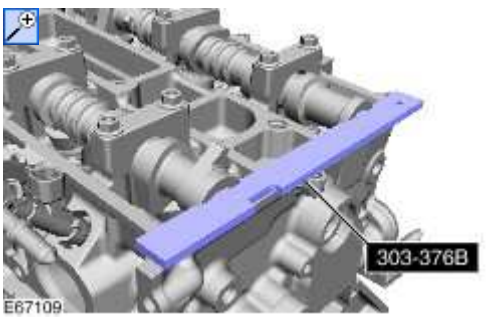
Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

21. Install the camshafts approximately at valve overlap position cylinder No. 4.

Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm

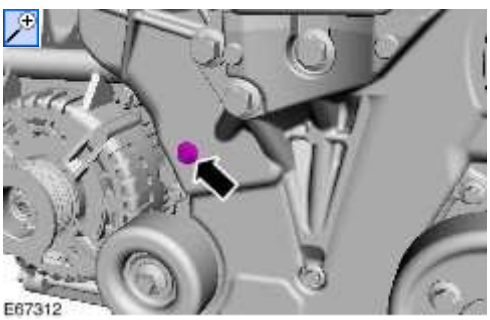


22. NOTE: The camshaft sprocket bolt must not be tightened at this stage.
NOTE: Make sure that the camshaft sprocket can rotate on the camshaft.



23. Attach the special tool.

Special Tool(s): 303-376B



24.

25. Attach the special tool.

Special Tool(s): 303-748

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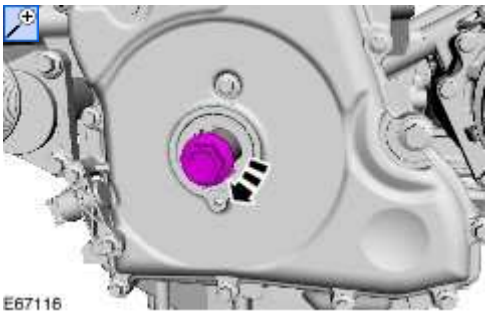
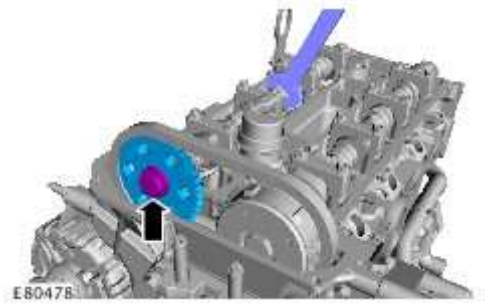
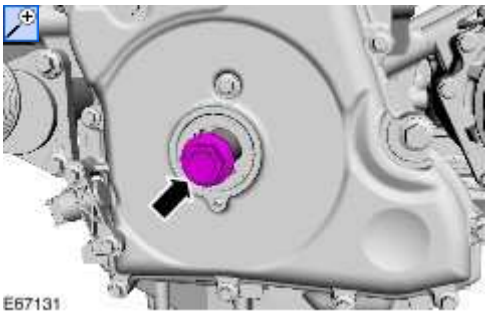


26. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.

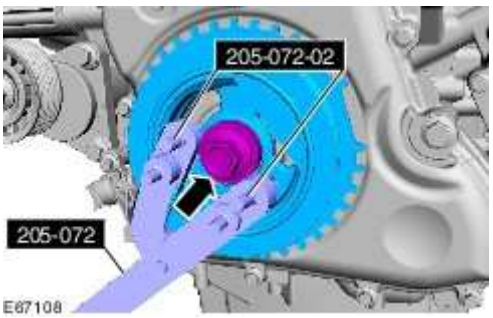


27. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.
Torque: 72 Nm



28.

29. Tighten the M6 x 18 mm bolt finger-tight only.



30. CAUTION: Make sure that a new bolt is installed.
Special Tool(s): 205-072, 205-072-02
Torque:
Stage 1: 100 Nm
Stage 2: 90°

31.

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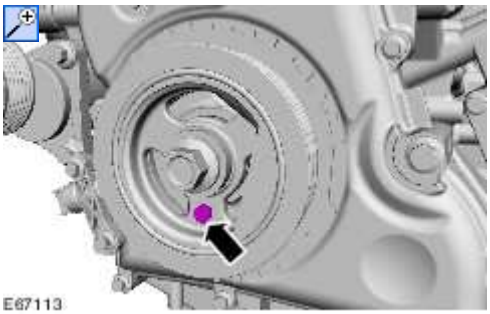
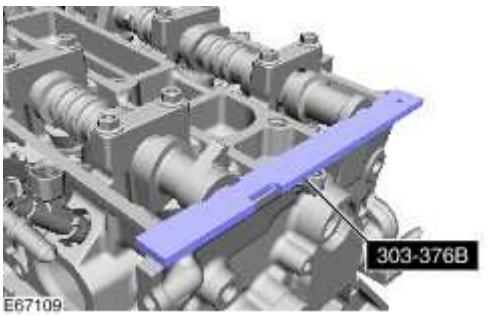


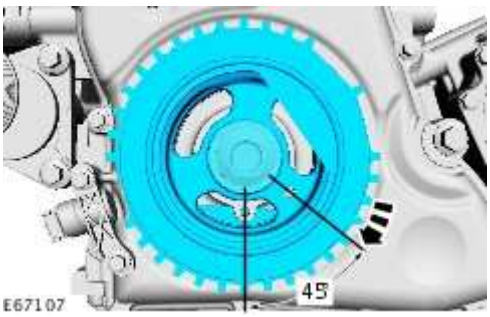


32. Remove the special tool.

    Special Tool(s): 303-376B

33. Remove the special tool.

    Special Tool(s): 303-748



34. CAUTION: Only rotate the crankshaft clockwise.
    Rotate the crankshaft one and three quarters until piston No. 1 is approximately 45 degrees before top dead center (TDC).

35. Attach the special tool.

    Special Tool(s): 303-748

36. CAUTION: Only rotate the crankshaft clockwise.
    Turn the crankshaft until it stops against the special tool.

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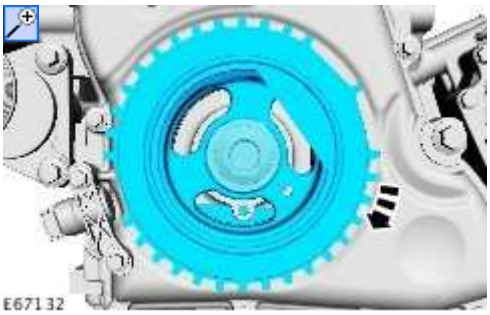
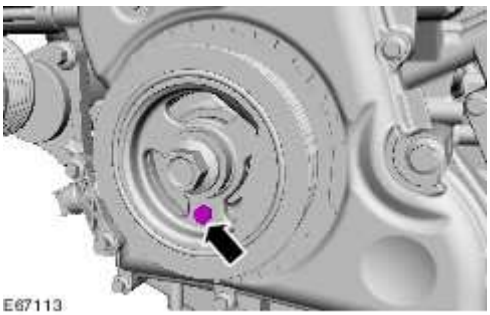
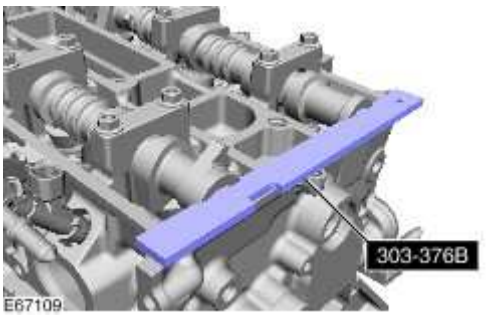


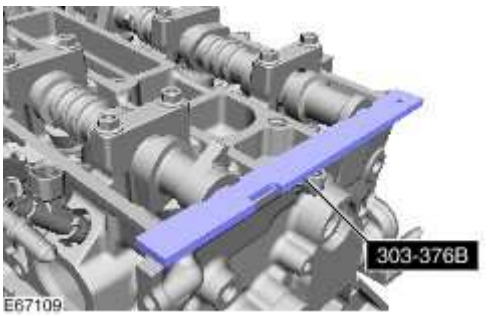


37. NOTE: The bolt can only be installed if the valve timing is correct.
Tighten the M6 x 18 mm bolt finger-tight only.



38. NOTE: The special tool can only be installed if the valve timing is correct.
Attach the special tool.

Special Tool(s): 303-376B



39. Remove the special tool.

Special Tool(s): 303-376B

40. Remove the special tool.

Special Tool(s): 303-748

41.

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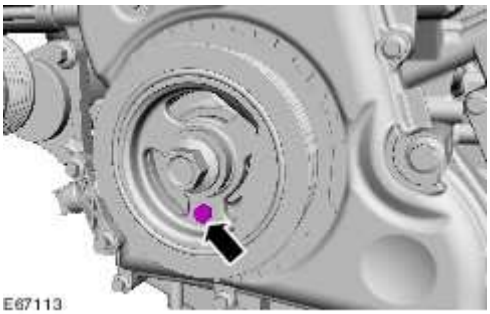
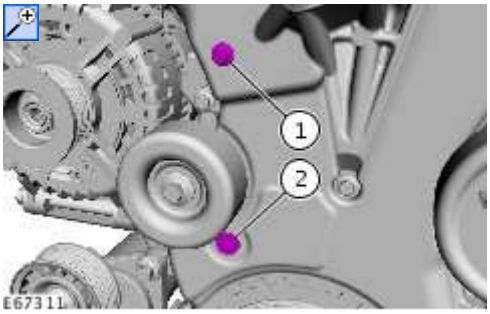


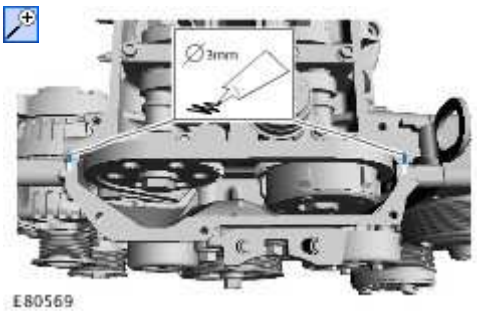
42. *Torque:* 20 Nm



43.
    1. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 10 Nm
    2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 12 Nm

44. CAUTION: Only rotate the crankshaft clockwise.
    Check that the valve clearance on all cylinders meets the specified tolerances.

45. If necessary, repeat the steps until the valve clearance on each cylinder meets the specified tolerance.



46. Apply sealant. (bead diameter 3mm)

    Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

47. *Torque:* 10 Nm

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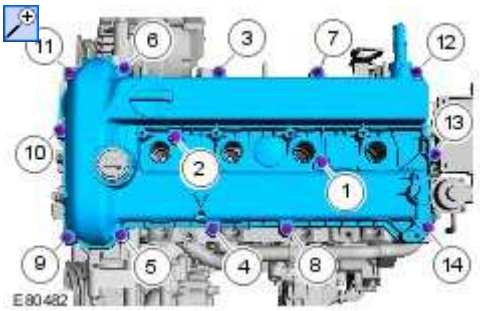
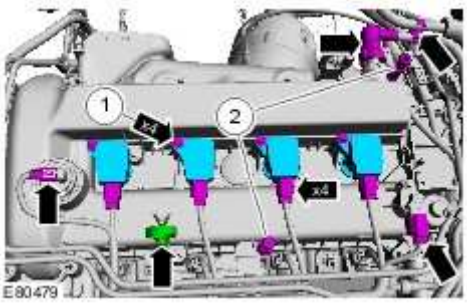
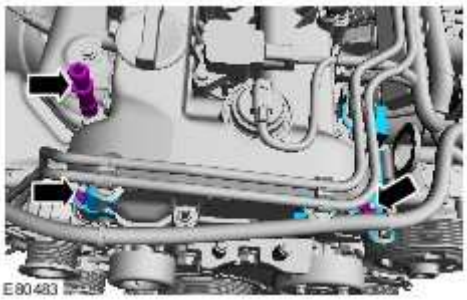


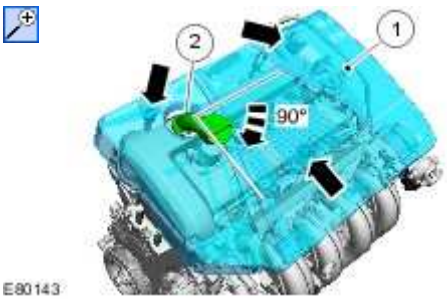


48.

1. *Torque:* 10 Nm
2. *Torque:* 10 Nm



49. *Torque:* 10 Nm



50.

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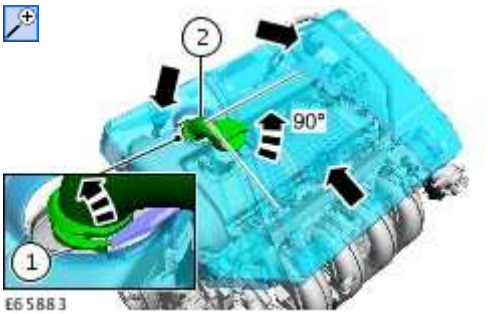
Removal and Installation

General Equipment

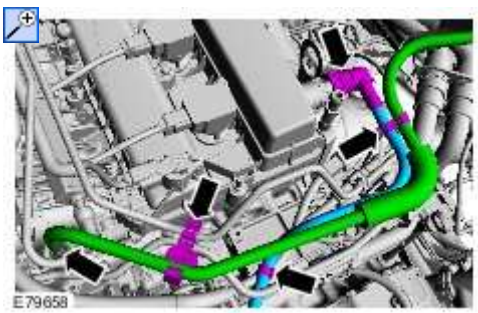
Schlitzschraubendreher
Trolley jack

Removal

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

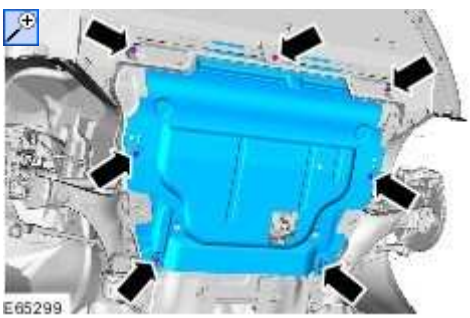


1. *General Equipment:* Schlitzschraubendreher



2.

3. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
4. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



6.

7.
   1. *Torque:* 48 Nm
   2. *Torque:* 80 Nm

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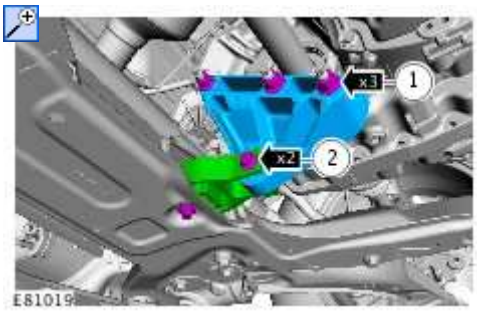
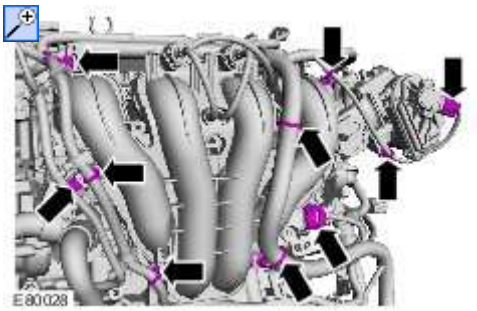
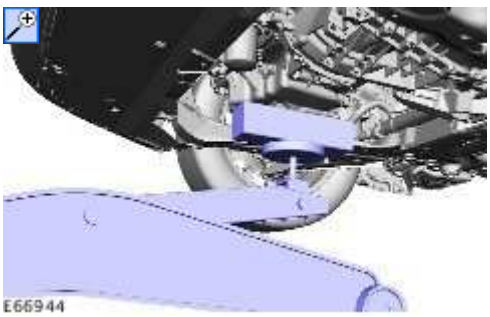




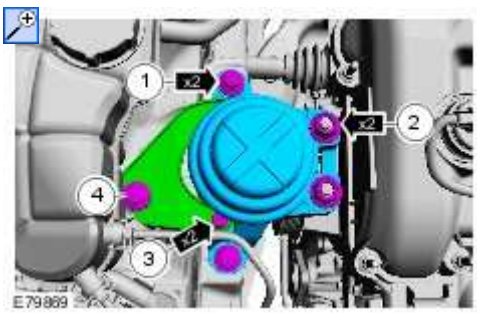
8.

9. Remove the right-hand head lamp unit.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



10. *General Equipment:* Trolley jack



11.
   1. *Torque:* 90 Nm
   2. *Torque:* 80 Nm
   3. *Torque:* 25 Nm
   4. *Torque:* 90 Nm

12. *Torque:* 18 Nm

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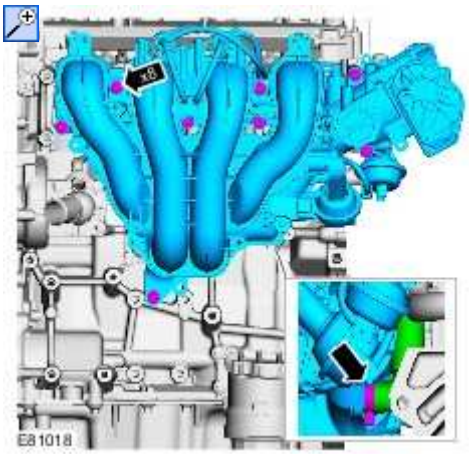

Installation

1. To install reverse the removal procedure.
2. NOTE: During initialisation the pedals must be in the rest position.
   Turn the ignition key to position II and then wait one minute in order to initialise the throttle valve.
3. Turn the ignition key to the OFF position.

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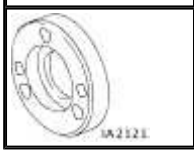
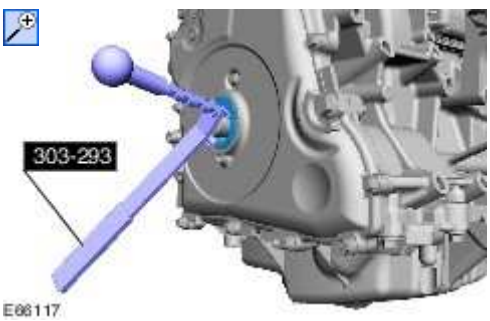
Removal and Installation

Special Tool(s)

	303-293 Remover, Crankshaft Seal
	303-509 Remover, Vibration Damper Hub

Removal

1. Refer to: Crankshaft Pulley (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
2. *Special Tool(s):* 303-293



3.
   - Discard the friction washer.

Installation

1. CAUTION: Make sure that a new friction washer is installed.
2. *Special Tool(s):* 303-509

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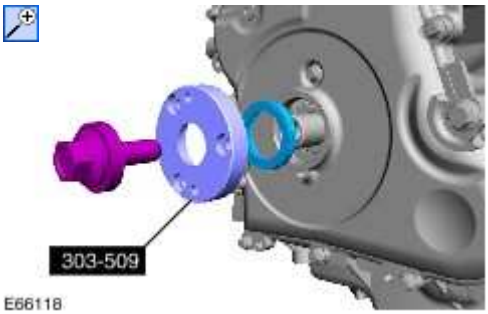

3. Refer to: Crankshaft Pulley (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

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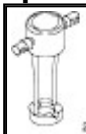
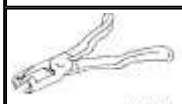
Removal and Installation

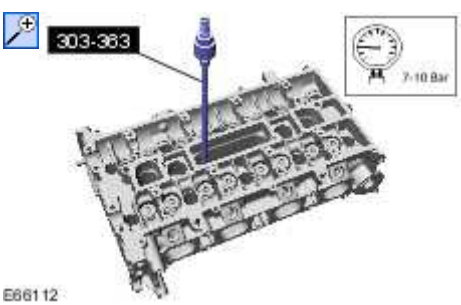
Special Tool(s)

	303-361-02 Adapter for 303-361A
	303-361A Compressor, Valve Spring
	303-362 Installer, Valve Stem Collets
	303-363 Adapter, Air Supply (Cylinder Head)
	303-508 Pliers, Valve Stem Seal

Removal

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

1. Refer to: Camshafts (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
2.

3. *Special Tool(s):* 303-363


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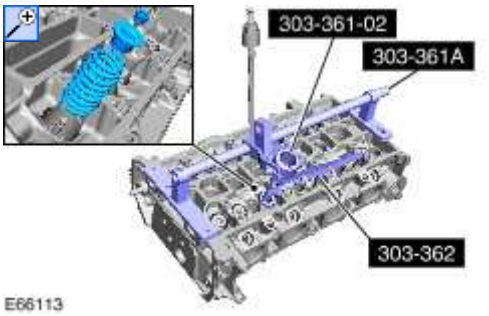
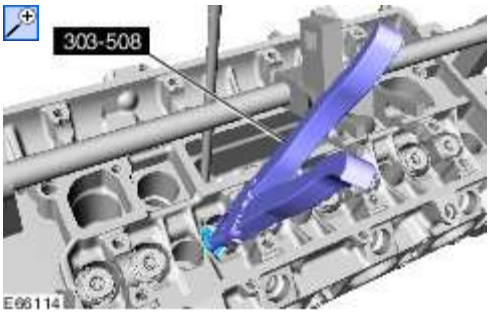


4. *Special Tool(s):* 303-361A, 303-361-02, 303-362



5. *Special Tool(s):* 303-508

Installation

1. To install, reverse removal procedure

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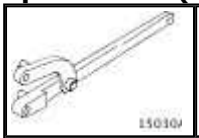
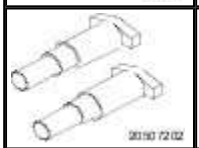
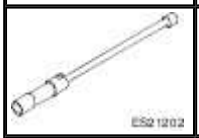
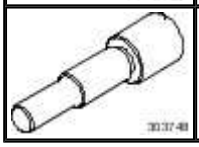
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

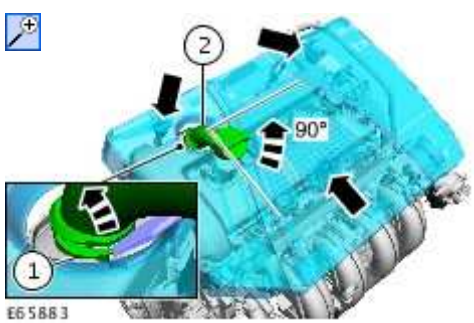
Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

General Equipment

Schlitzschraubendreher

Removal



1. *General Equipment:* Schlitzschraubendreher
2. Remove drive belt.

   Refer to: Antriebsriemen - Zusatzaggregate (303-05A Antrieb - Zusatzaggregate - 2.0L Duratec-HE (MI4), Removal and Installation).
3.

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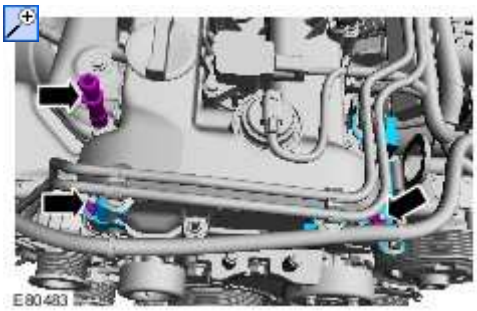
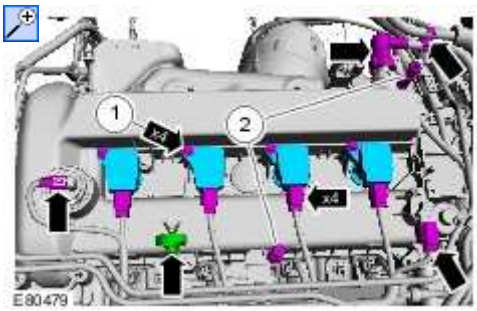
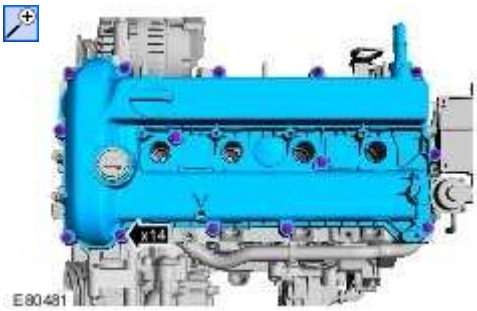
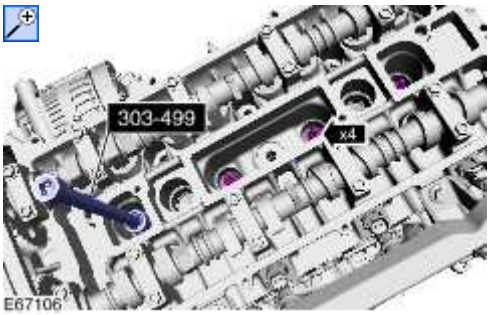




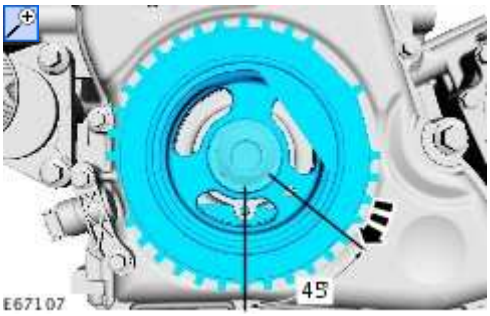
4.



5. NOTE: The gaskets are to be reused unless damaged.



6. *Special Tool(s):* 303-499



7. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until piston No. one is approximately 45 degrees before top dead center (TDC).

8. *Special Tool(s):* 205-072, 205-072-02

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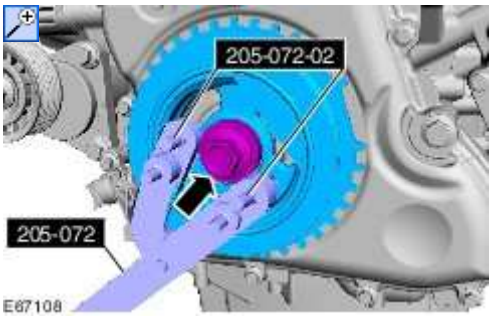
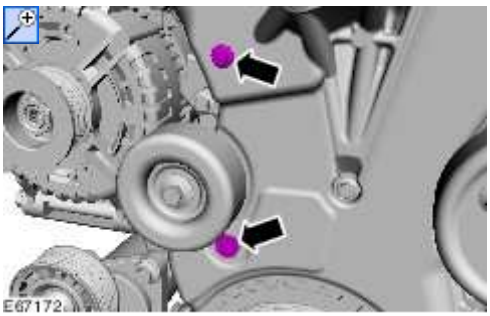
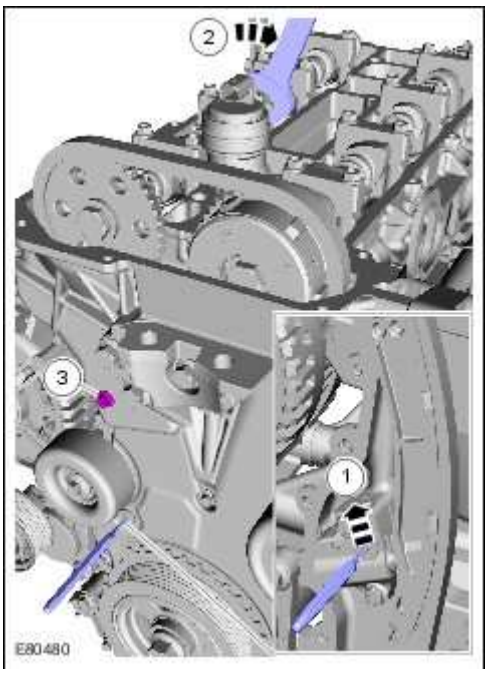


9.



10.

11.



1. Release the chain tensioner using a 2 mm drift.
2. Tension the timing chain.
3. Secure the timing chain guide using an M6 x 25 mm bolt.

12. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.

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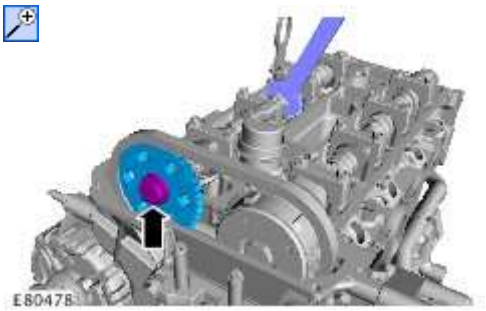
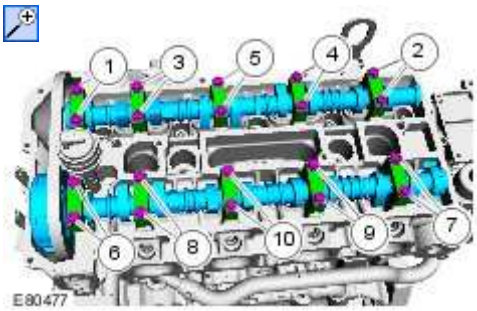
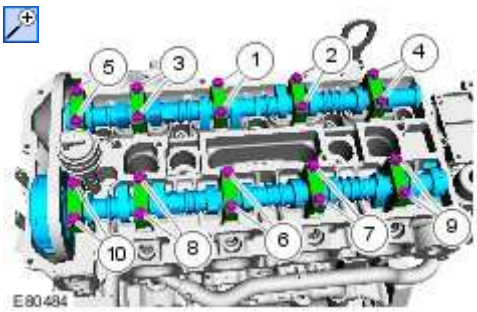




13. CAUTION: Note the position of each component before removal.

Installation



1. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
   Coat the camshaft bearing caps with oil.

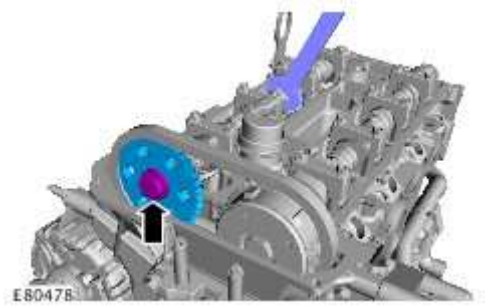
   Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

2. Install the camshafts approximately at valve overlap position cylinder No. 4.

   Torque:
   Stage 1: 7 Nm
   Stage 2: 16 Nm

3. NOTE: This step is only required when installing a new component.
   Adjust the valve clearences.

   Refer to: Ventilspiel einstellen (303-01B Motor - 2.3L Duratec-HE (MI4), General Procedures).



4. NOTE: The camshaft sprocket bolt must not be tightened at this stage.
   NOTE: Make sure that the camshaft sprocket can rotate on the camshaft.

5. Attach the special tool.

   Special Tool(s): 303-376B

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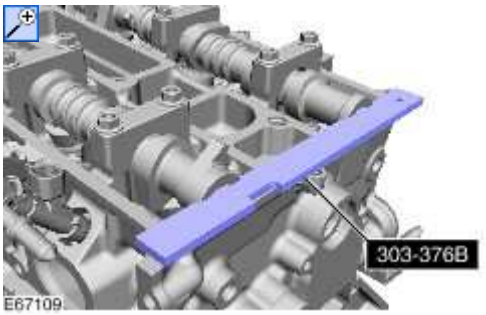
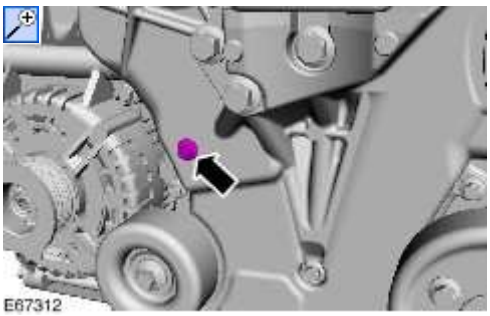
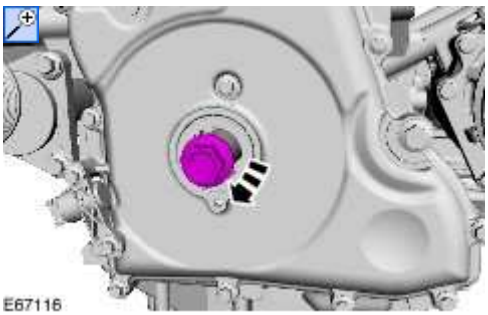


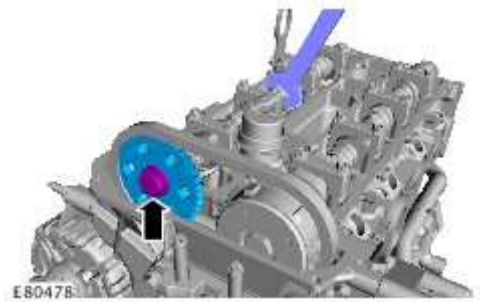
6.



7. Attach the special tool.



8. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.



9. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.
Torque: 72 Nm

10.

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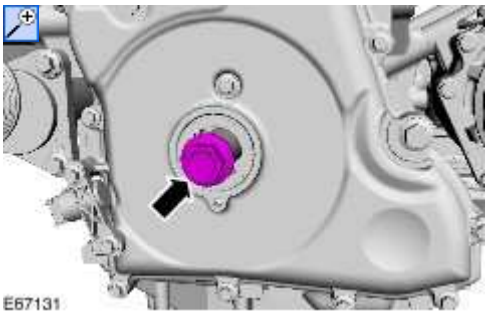
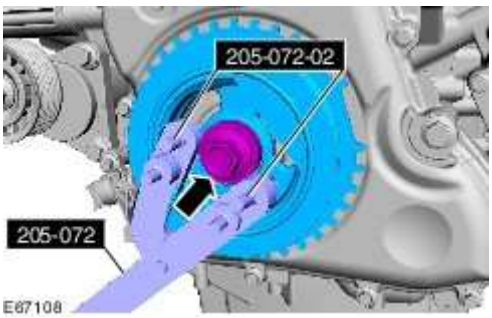
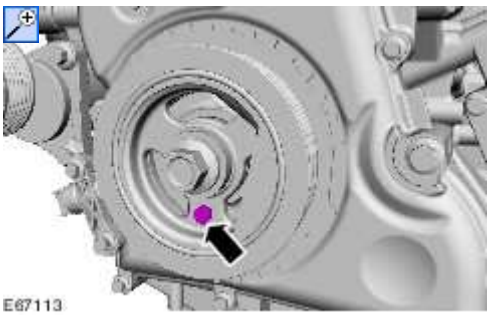


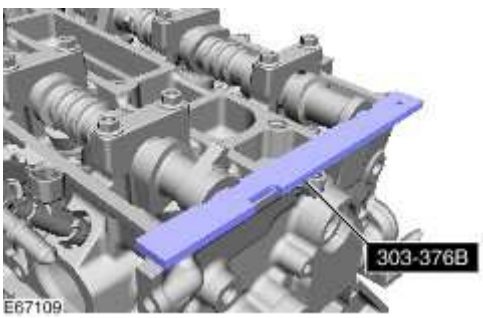
11. Tighten M6 x 18 mm bolt hand-tight only.



12. CAUTION: Make sure that a new bolt is installed.
Special Tool(s): 205-072, 205-072-02
Torque:
Stage 1: 100 Nm
Stage 2: 90°



13.



14. Remove the special tool.

Special Tool(s): 303-376B

15. Remove the special tool.

Special Tool(s): 303-748

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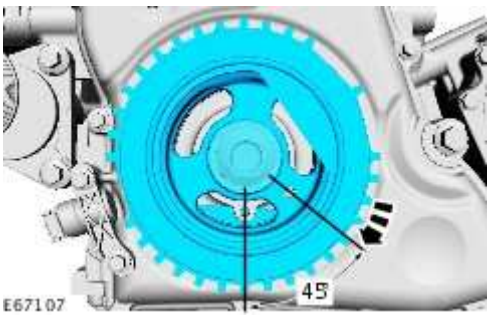
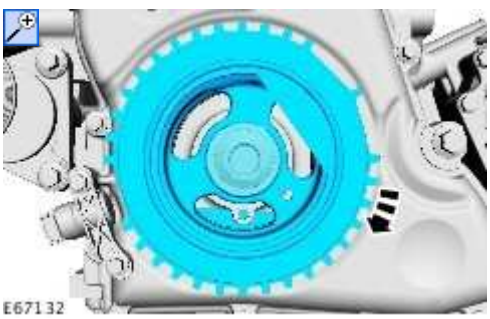


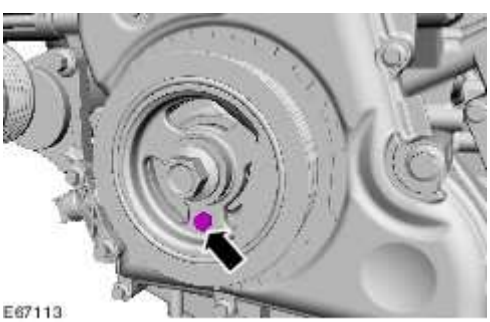
16. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft one and three quarters until piston No. 1 is approximately 45 degrees before top dead center (TDC).

17. Attach the special tool.

Special Tool(s): 303-748



18. CAUTION: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.



19. NOTE: The bolt can only be installed if the valve timing is correct.
    - Tighten M6 x 18 mm bolt hand-tight only.

20. NOTE: The special tool can only be installed if the valve timing is correct.
Attach the special tool.

Special Tool(s): 303-376B

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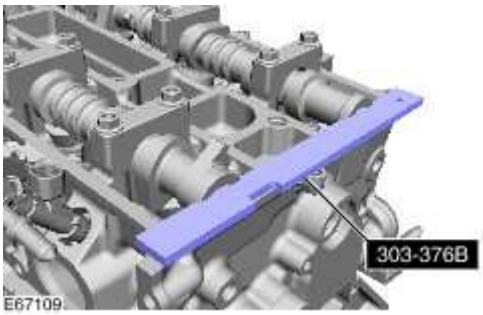
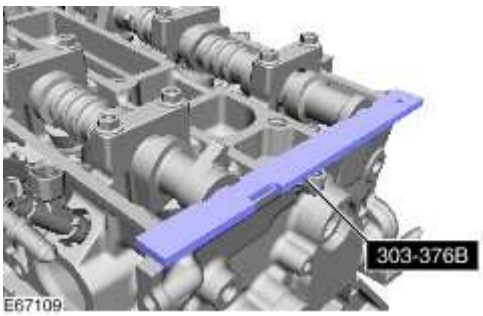


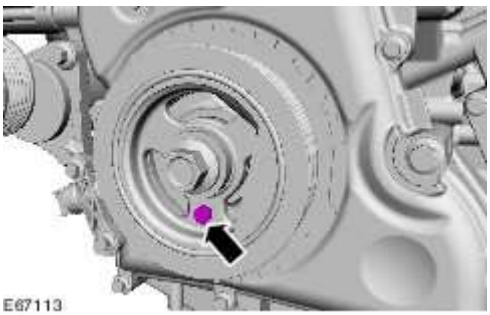


21. Remove the special tool.

    Special Tool(s): 303-376B

22. Remove the special tool.

    Special Tool(s): 303-748



23.

24. *Torque:* 20 Nm

25.
    1. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 10 Nm
    2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
       Torque: 12 Nm

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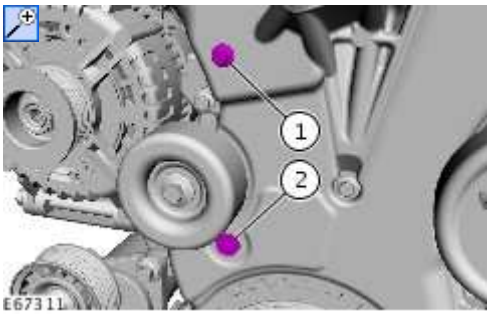
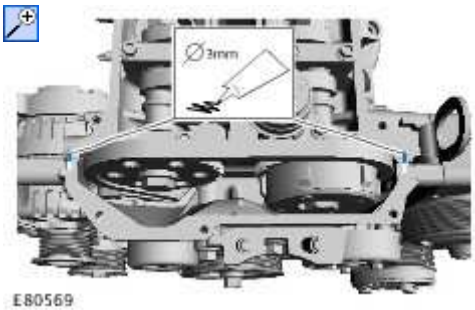


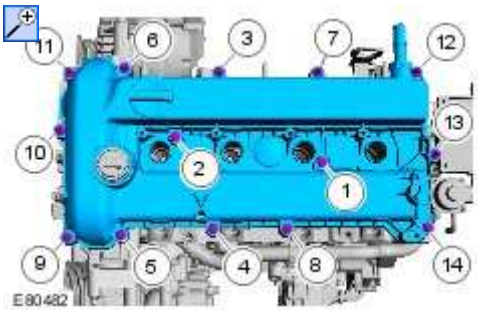
26. CAUTION: Only rotate the crankshaft clockwise.
Check that the valve clearance on all cylinders meets the specified tolerances.

27. If necessary, repeat the steps until the valve clearance on each cylinder meets the specified tolerance.

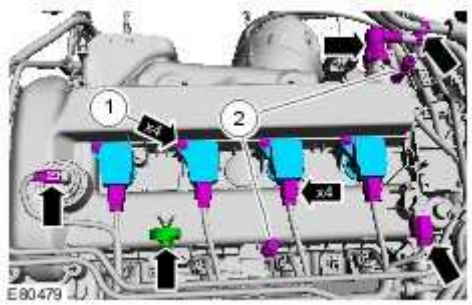


28. Apply sealant. (bead diameter 3mm)

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



29. *Torque:* 10 Nm



30.
1. *Torque:* 10 Nm
2. *Torque:* 10 Nm

31. *Torque:* 10 Nm

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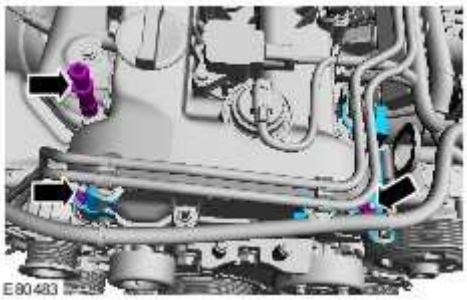

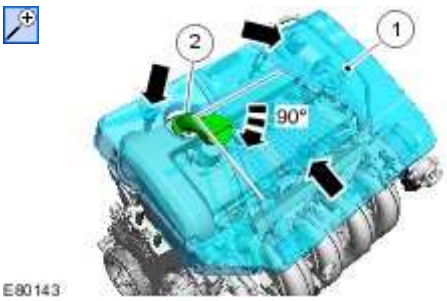

32.

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Removal and Installation

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

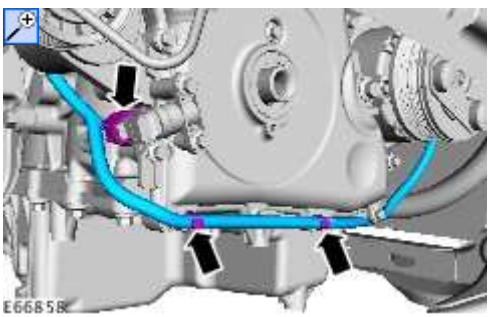
Trolley jack

Removal

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

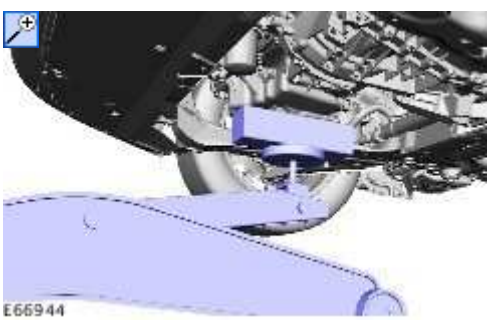
1. Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

2. Refer to: Crankshaft Pulley (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



3.

4.



5. *General Equipment:* Trolley jack

6.

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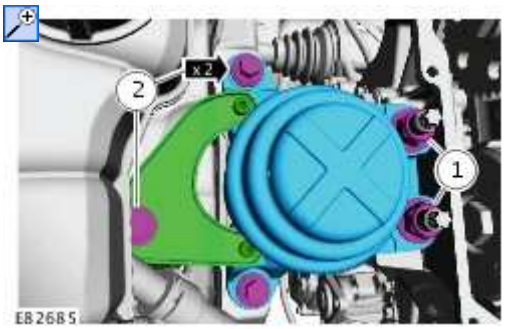
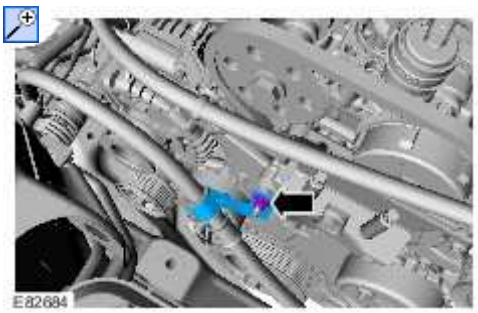
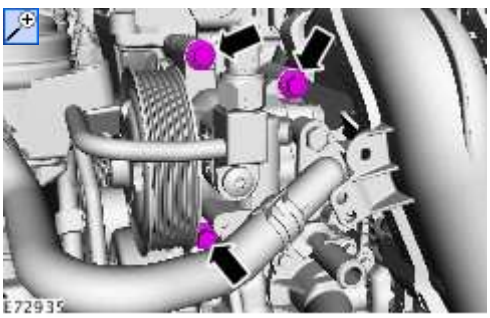
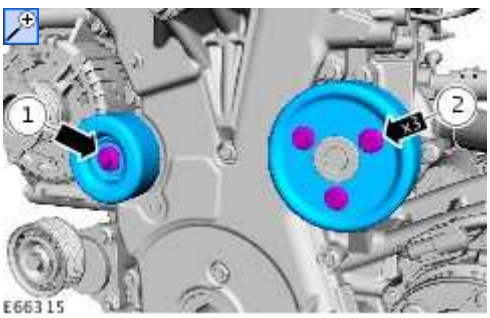




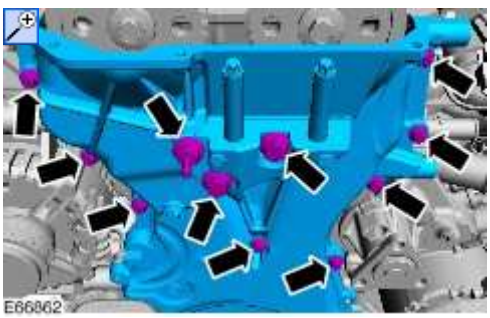
7. *Torque:* 15 Nm



8. *Torque:* 25 Nm



9.
   1. *Torque:* 25 Nm
   2. *Torque:* 20 Nm



10.

Installation

1. To install reverse the removal procedure.
2.
   - Apply sealant to the engine front cover (bead diameter: 3 mm).

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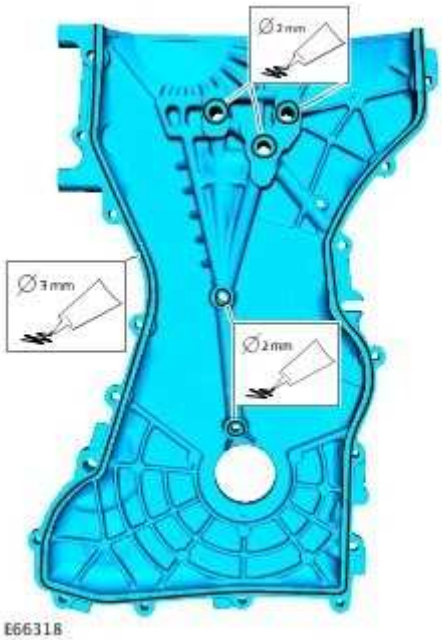
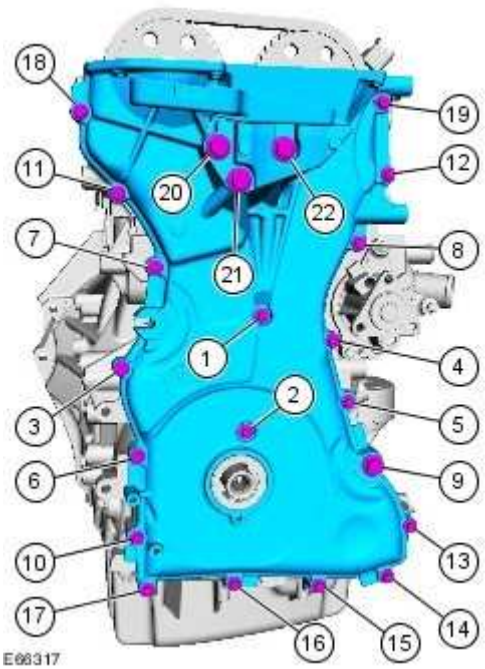
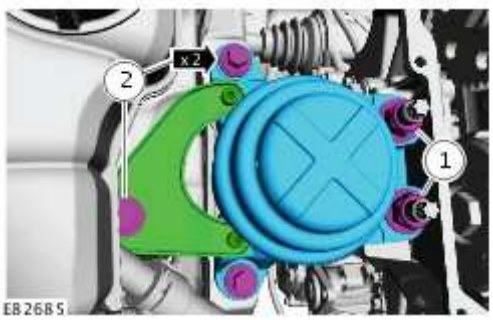


Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



3. *Torque:*
   1-8 10 Nm
   9 48 Nm
   10-19 10 Nm
   20-22 48 Nm



4.
   1. *Torque:* 80 Nm
   2. NOTE: Only tighten the bolts finger tight at this stage.
   3. Remove the trolley jack.

5. *Torque:* 90 Nm

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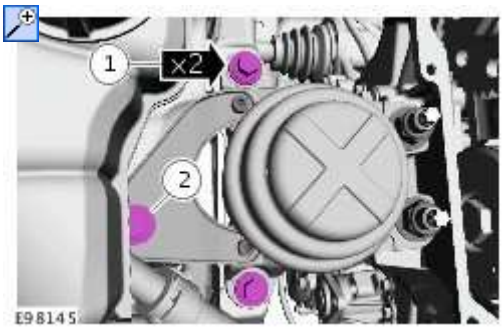

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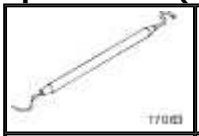
Removal and Installation

Special Tool(s)

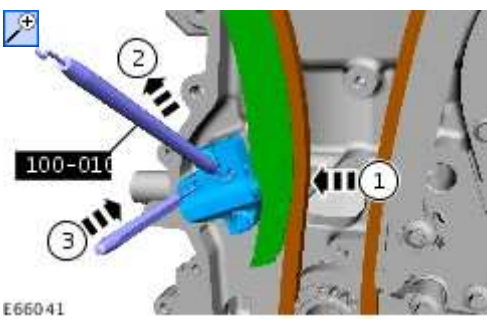
	100-010 Remover, O-Ring Seal
	303-376B Alignment Plate, Camshaft

General Equipment

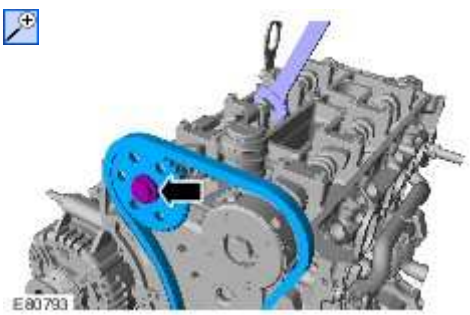
2 mm punch

Removal

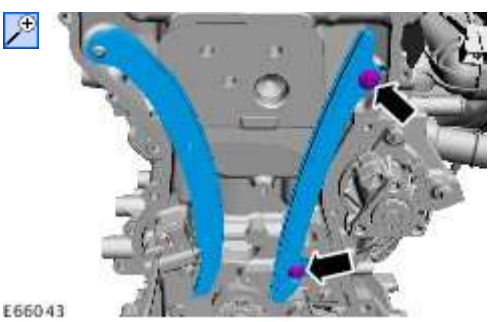
1. Refer to: Engine Front Cover (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



2.
   2. *Special Tool(s):* 100-010
   3. *General Equipment:* 2 mm punch



3. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.



4.

5.

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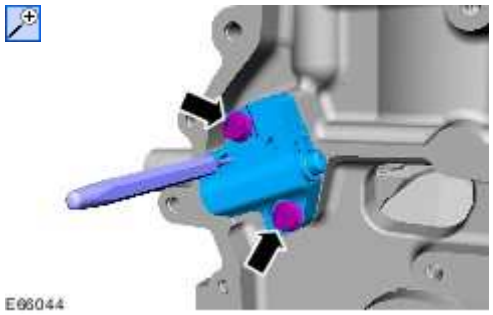
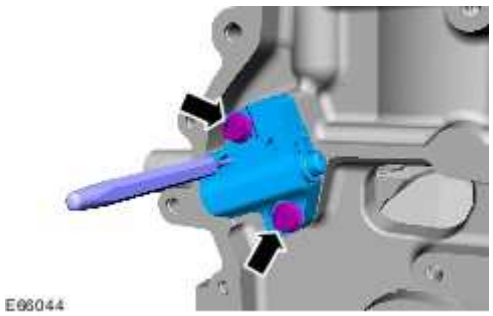
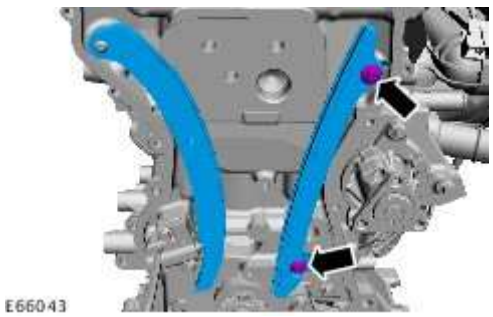


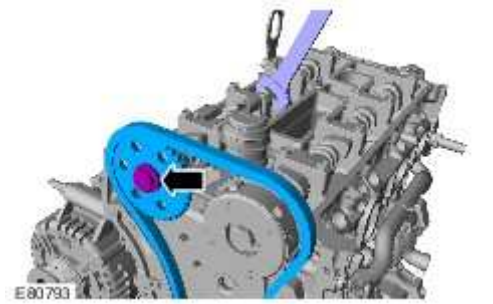
Installation



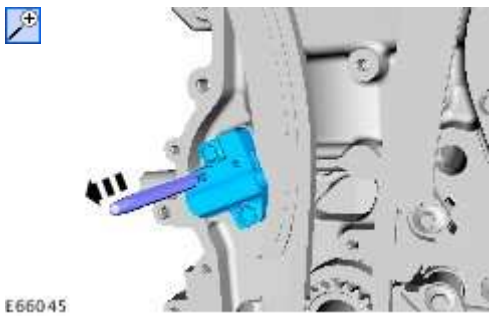
1. *Torque:* 10 Nm



2. *Torque:* 10 Nm



3. NOTE: The camshaft sprocket bolt must not be tightened at this stage.



4.

5. CAUTION: Only rotate the camshaft clockwise.
Turn the camshafts to cylinder no. 4 valve overlap position.

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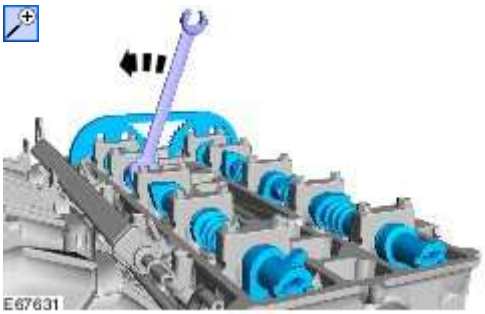
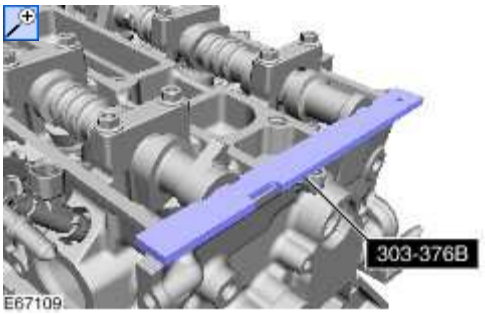
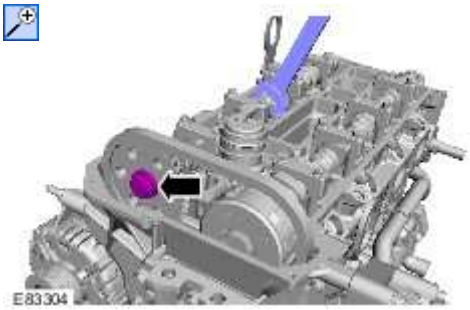




6. Attach the special tool.

   Special Tool(s): 303-376B



7. CAUTION: Counterhold the camshaft at the hexagon with a wrench to prevent the camshaft from rotating.
   Torque: 72 Nm

8. Refer to: Engine Front Cover (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

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Removal and Installation

Special Tool(s)

	310-137 Disconnect Tool, Fuel Line

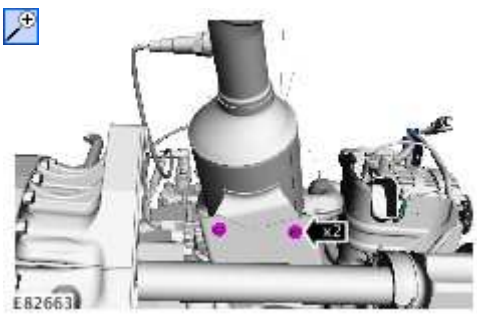
Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA

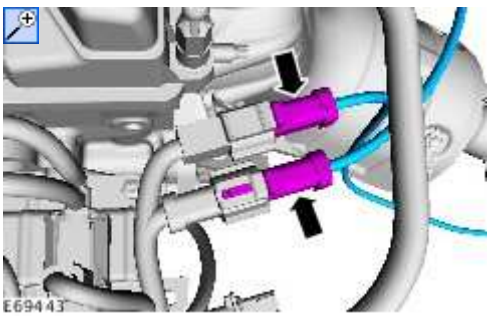
Removal

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

1. Refer to: Generator - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (414-02 Generator and Regulator, Removal and Installation).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
3. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



4. *Torque:* 48 Nm



5.

6. *Torque:*
   1 48 Nm
   2 10 Nm

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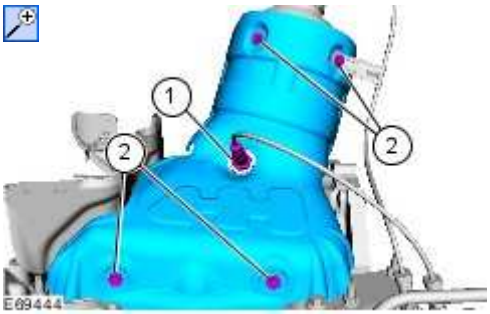
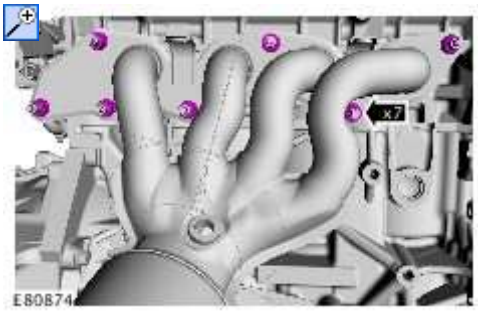
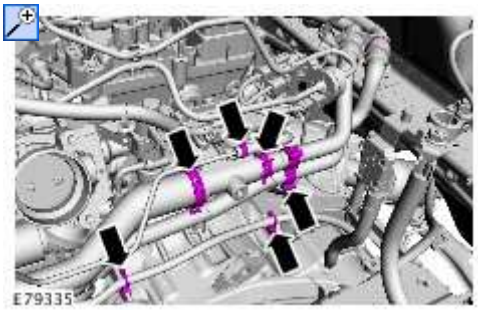




7. CAUTION: Jointing compound must not be used forward of the catalytic converter.
   Torque: 55 Nm

8. Remove the following items:
   1. Refer to: Intake Manifold (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   2. Refer to: Timing Chain (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



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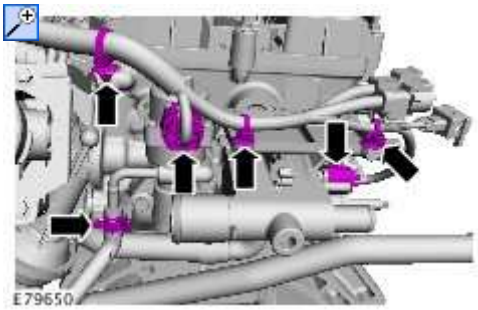

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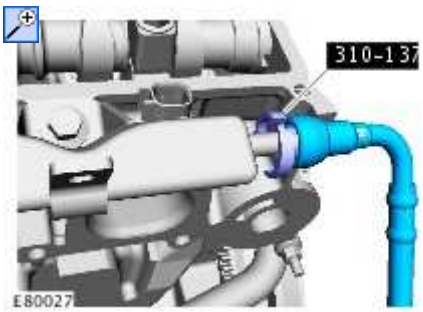

11. *Special Tool(s):* 310-137

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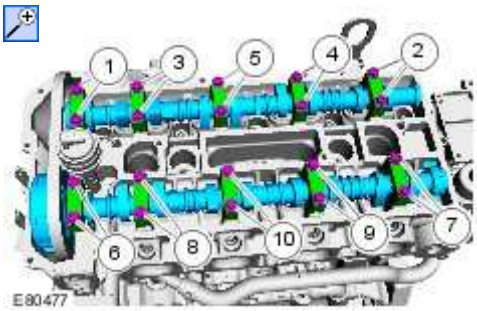
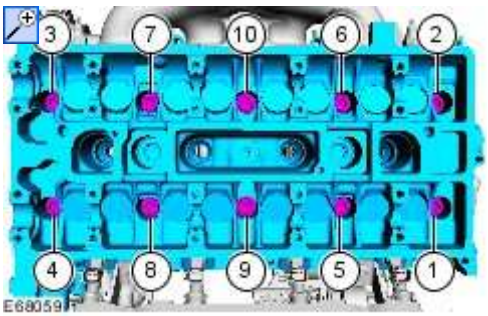
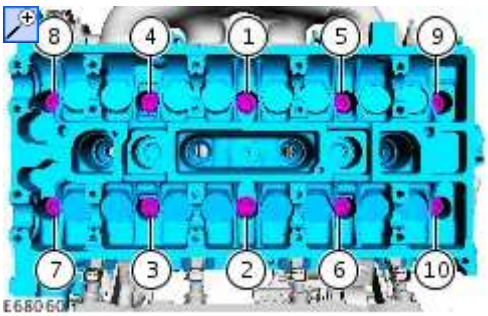


12. CAUTION: Note the position of each component before removal.



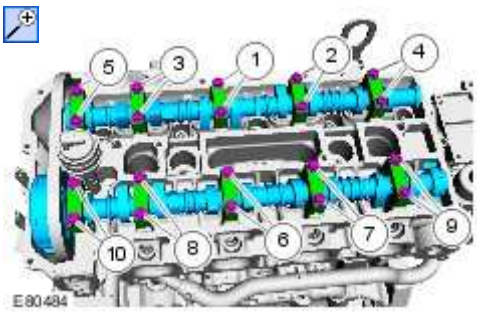
13. Remove and discard the cylinder head bolts.

Installation



1. To install reverse the removal procedure.
2. Install new cylinder head bolts.

   Torque:
   Stage 1: 5 Nm
   Stage 2: 15 Nm
   Stage 3: 45 Nm
   Stage 4: 90°
   Stage 5: 90°



3. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
   Apply hypoid gear oil to the camshaft bearing caps.

   Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

4. Install the camshafts approximately at valve overlap position cylinder No. 4.

   Torque:
   Stage 1: 7 Nm
   Stage 2: 16 Nm

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Removal and Installation

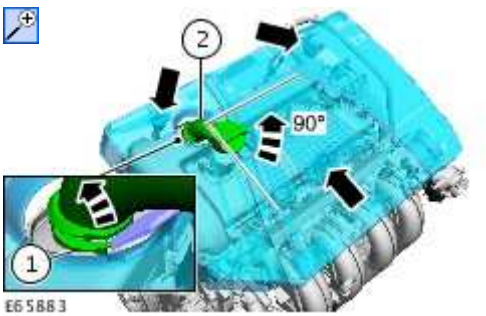
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

Schlitzschraubendreher

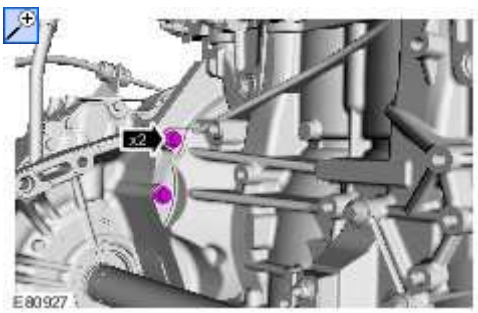
Removal



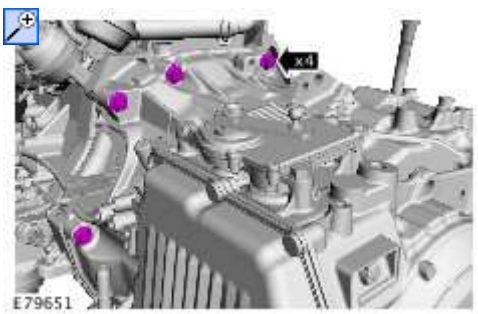
1. *General Equipment:* Schlitzschraubendreher

2. Refer to: Luftfilter (303-12A Ansaugsystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Removal and Installation).
3. Refer to: Batterie abklemmen (414-01 Batterie, Befestigung und Batteriekabel, General Procedures).

Vehicles With Automatic Transmission (front wheel drive)



4. Undo the right-hand bolts on the transmission five turns.



5. Undo the left -hand bolts on the transmission five turns.

Vehicles With Manual Transmission (front wheel drive)

6. Undo the right-hand bolts on the transmission five turns.

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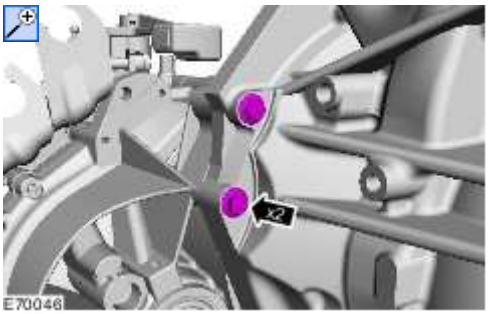
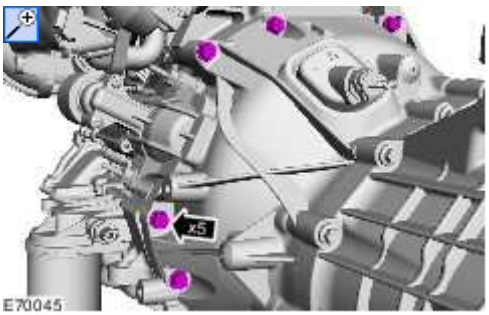
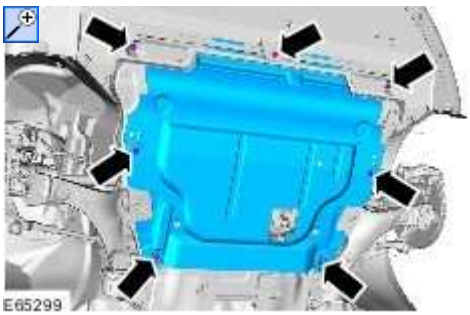




7. Undo the left -hand bolts on the transmission five turns.

All Vehicles



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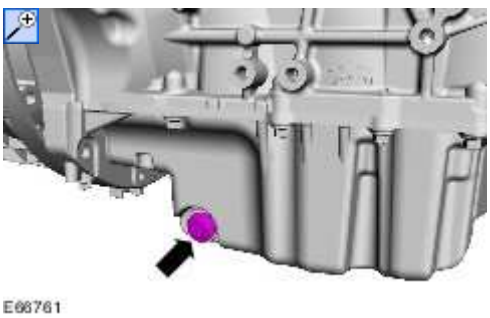
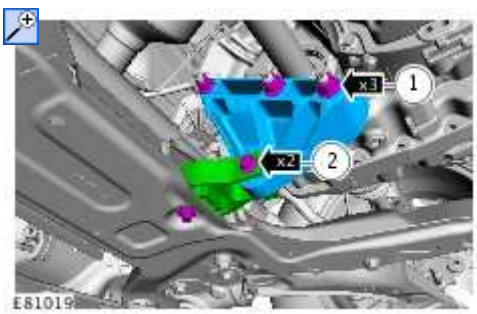


9. NOTE: Reuse the oil seal if it is not damaged.

Vehicles With Automatic Transmission (front wheel drive)



10.

11. Refer to: Anlasser (303-06A Anlasssystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Removal and Installation).

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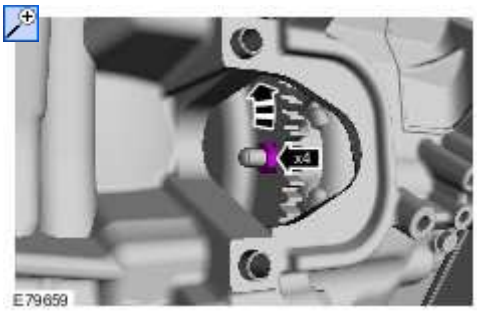
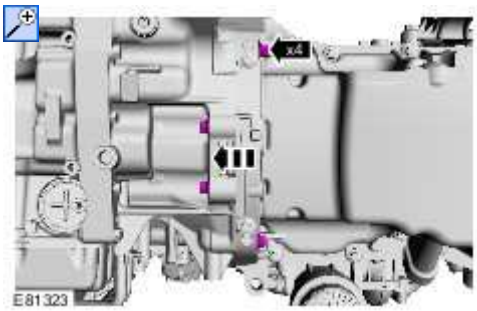


12.

All Vehicles



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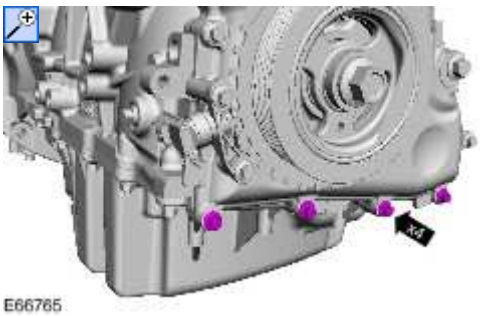

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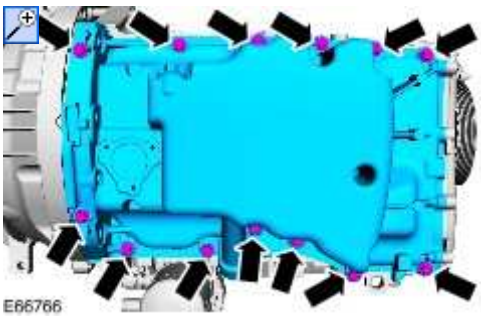
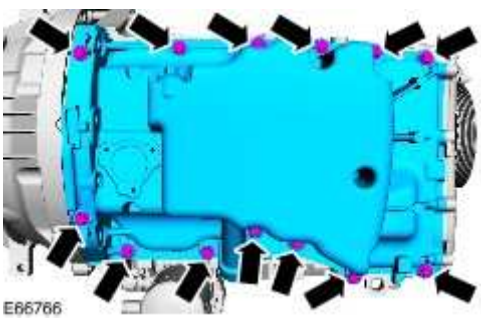


15.

Installation



1. NOTE: Only tighten the bolts finger tight at this stage.
   Apply sealant to the oil pan (bead diameter: 3 mm).

   Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

2. *Torque:* 10 Nm

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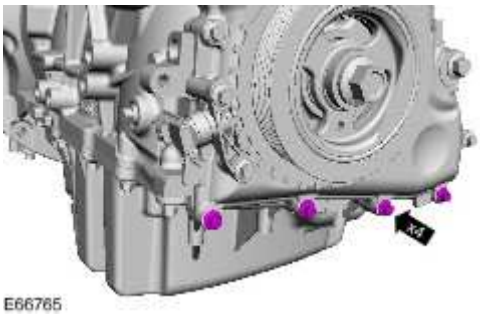
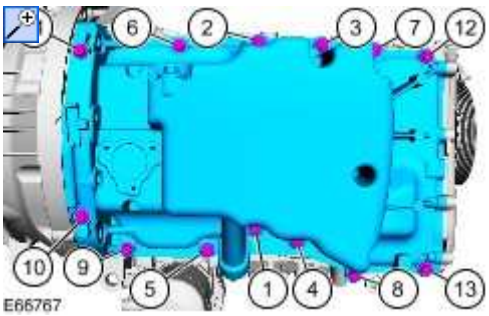
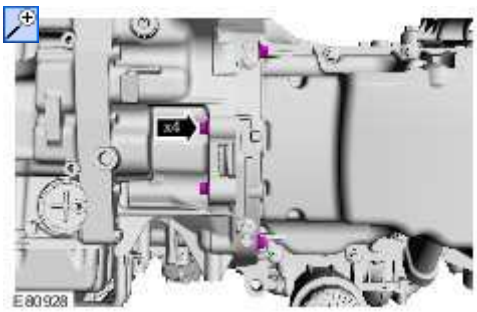


E66765



E66767

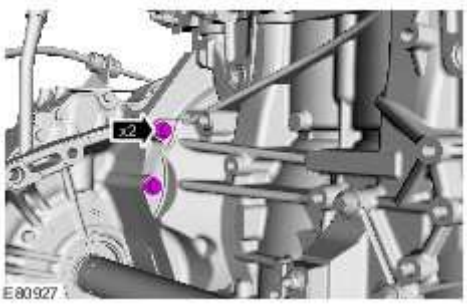
3. *Torque:* 25 Nm



E80928

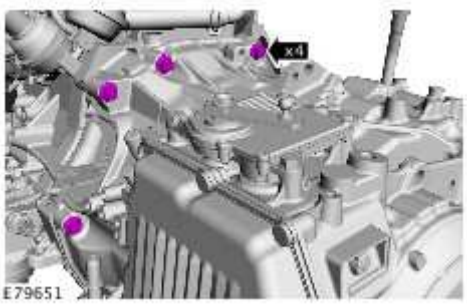
4. *Torque:* 48 Nm

Vehicles With Automatic Transmission (front wheel drive)



E80927

5. *Torque:* 48 Nm



E79651

6. *Torque:* 48 Nm

7. *Torque:* 36 Nm

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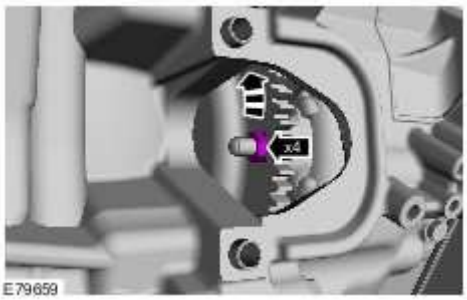
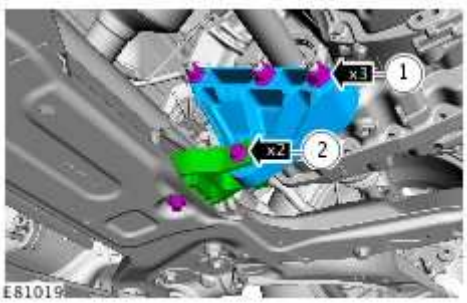
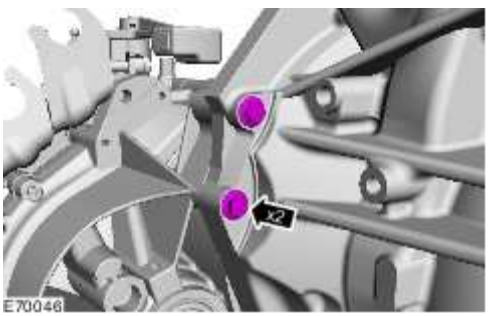


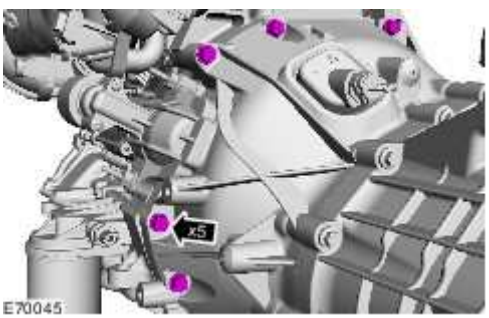
8. Refer to: Anlasser (303-06A Anlasssystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Removal and Installation).
9.
   1. *Torque:* 48 Nm
   2. *Torque:* 80 Nm



Vehicles With Manual Transmission (front wheel drive)

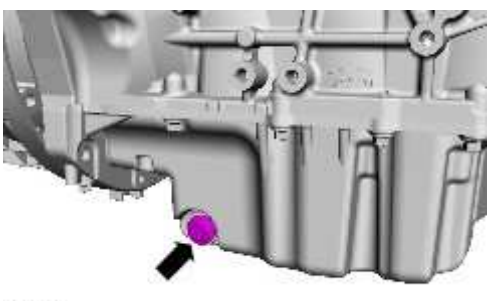


10. *Torque:* 48 Nm



11. *Torque:* 48 Nm

All Vehicles



12. *Torque:* 25 Nm
13.

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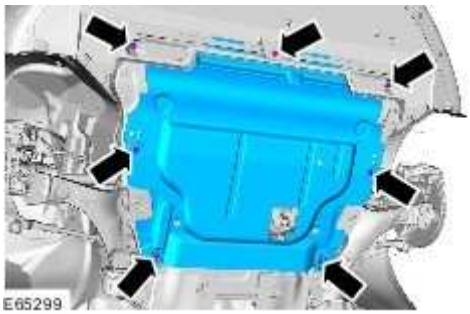
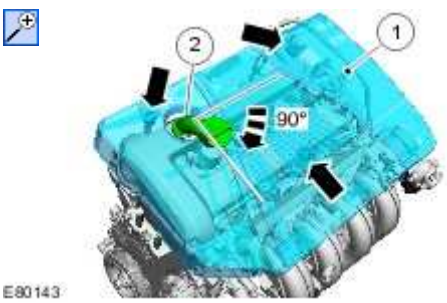


14. Refer to: Batterie abklemmen (414-01 Batterie, Befestigung und Batteriekabel, General Procedures).
15. Refer to: Luftfilter (303-12A Ansaugsystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Removal and Installation).
16.



17. Fill the engine with engine oil.

    Refer to: Spezifikationen (303-01B Motor - 2.3L Duratec-HE (MI4), Specifications).
    Material: Engine Oil - 5W-30 (WSS-M2C913-B)

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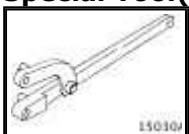
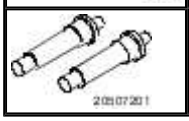
Removal and Installation

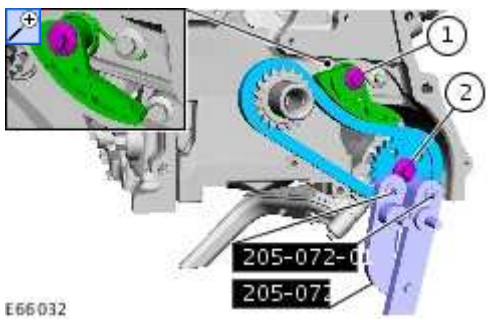
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072

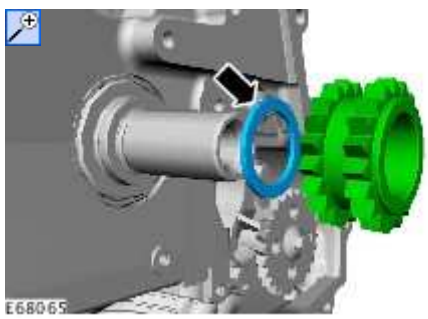
Removal

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

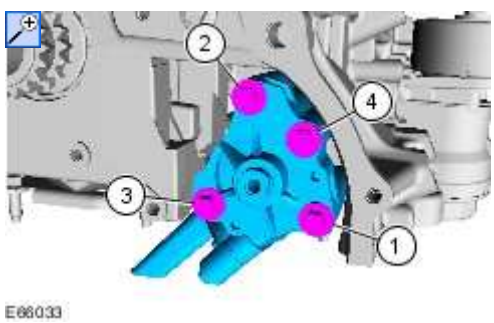
1. Remove the following items:
    1. Refer to: Timing Chain (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
    2. Refer to: Oil Pan (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



2.
    1. *Torque:* 10 Nm
    2. *Special Tool(s):* 205-072, 205-072-01
    Torque: 25 Nm



3. CAUTION: Make sure that a new friction washer is installed.



4. *Torque:*
    Stage 1: 10 Nm
    Stage 2: 23 Nm

Installation

1. To install, reverse removal procedure

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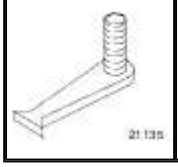
Removal and Installation

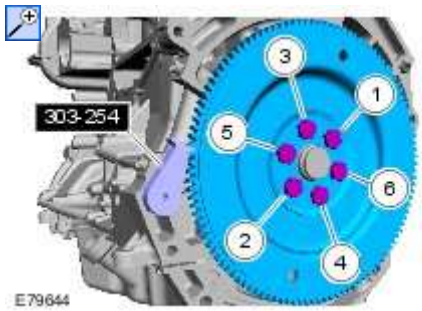
Special Tool(s)

	303-254 Locking Tool, Flywheel

Removal

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

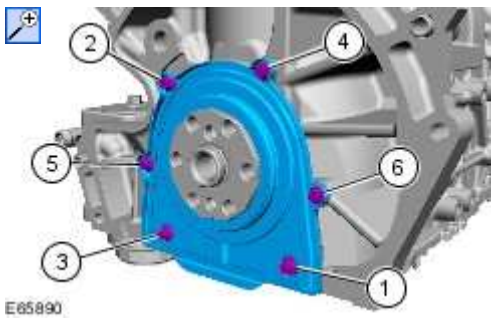
1. Refer to: Transmission - 2.3L Duratec-HE (118kW/160PS) - MI4 (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).



2. Discard the driving plate bolts.

   Special Tool(s): 303-254
   Torque:
   Stage 1: 50 Nm
   Stage 2: 80 Nm
   Stage 3: 112 Nm

3. Refer to: Oil Pan (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



4. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Torque: 10 Nm

Installation

1. To install reverse the removal procedure.

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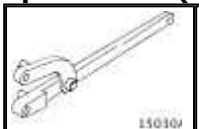
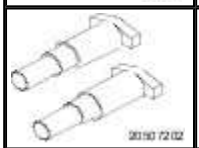
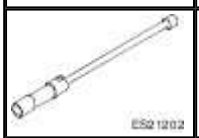
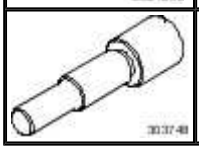
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-499 Socket, Spark Plug
	303-748 Locking Tool, Crankshaft

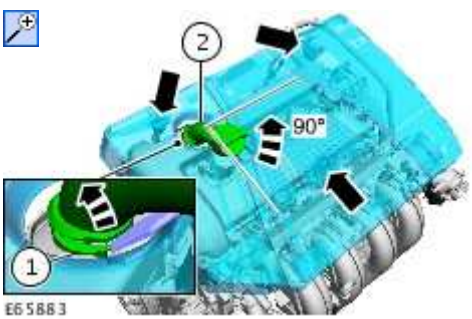
Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

Schlitzschraubendreher

Removal



1. Remove the auxiliary drive belt.

   Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
2. *General Equipment:* Schlitzschraubendreher
3.

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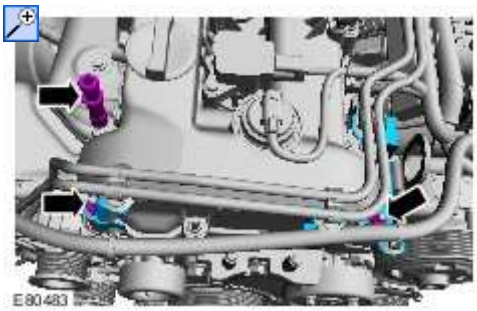
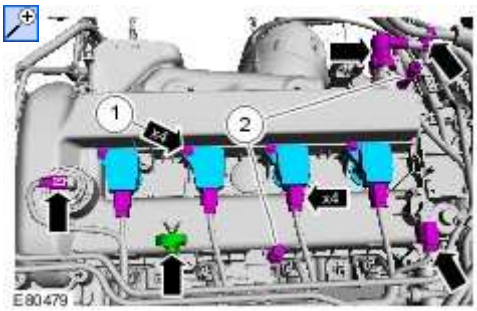
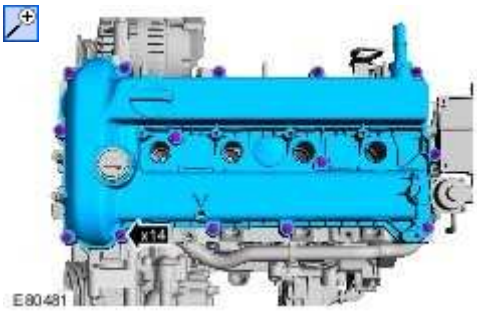
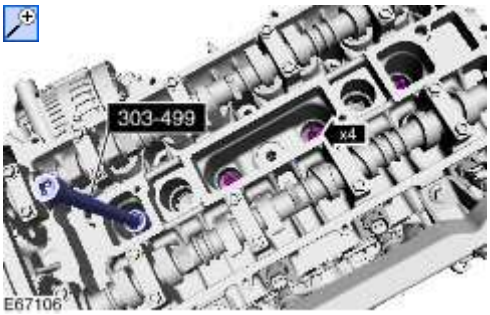




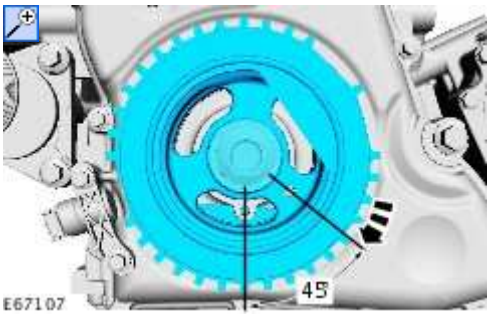
4.



5. NOTE: The gaskets are to be reused unless damaged.



6. *Special Tool(s):* 303-499



7. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until no. 1 piston is at about 45° before TDC.

8. *Special Tool(s):* 205-072, 205-072-02

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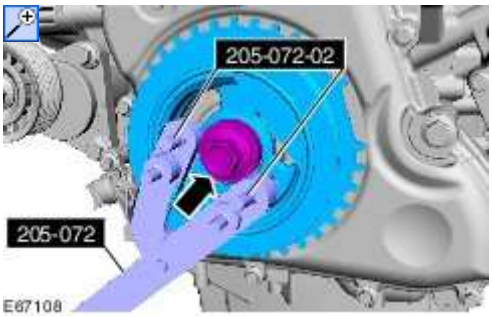
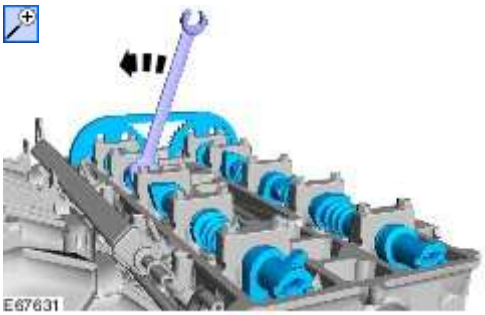


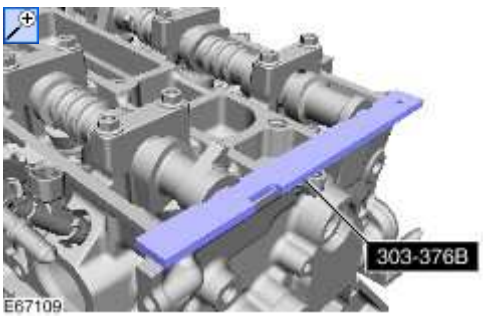
Installation

1. Install the crankshaft oil seal.

   Refer to: Crankshaft Front Seal (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).



2. WARNING: Only rotate the camshaft clockwise.
   Turn the camshafts to cylinder no. 4 valve overlap position.



3. Attach the special tool.

   Special Tool(s): 303-376B

4.

5. Attach the special tool.

   Special Tool(s): 303-748

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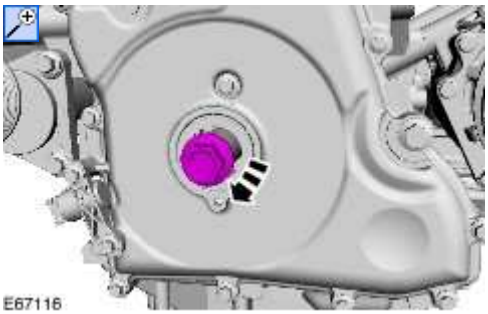
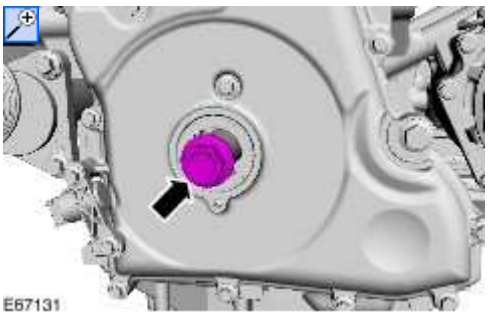
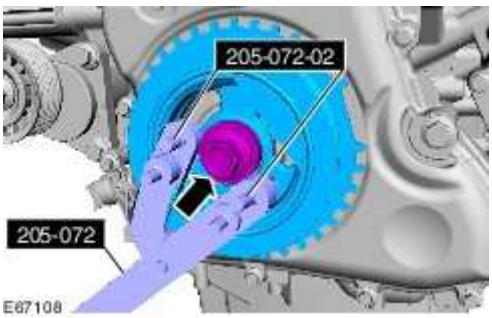


6. WARNING: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.

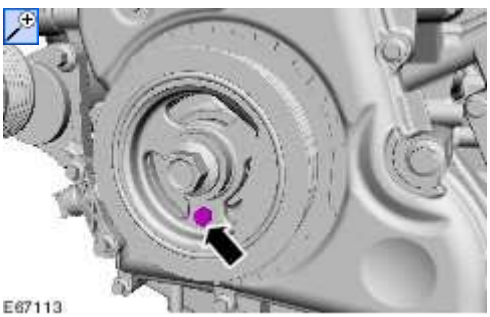


7.

8. NOTE: Only tighten the bolt finger tight at this stage.
   - Bolt M6 x 18 mm



9. CAUTION: Make sure that a new bolt is installed.
Special Tool(s): 205-072, 205-072-02
Torque:
Stage 1: 100 Nm
Stage 2: 90°



10.

11. Remove the special tool.

Special Tool(s): 303-376B

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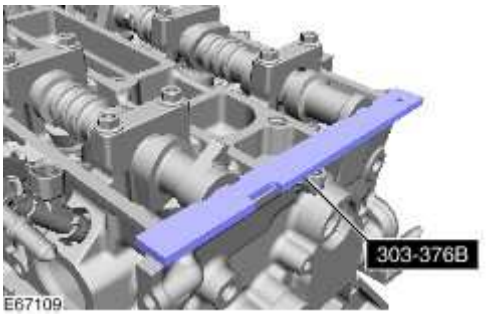
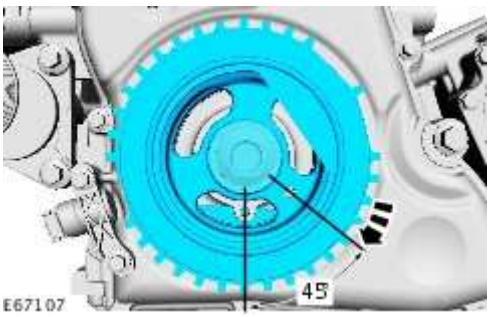


12. Remove the special tool.

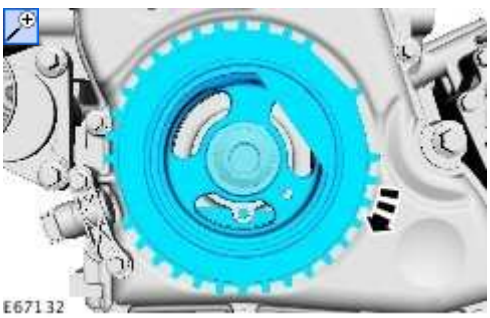
    Special Tool(s): 303-748



13. WARNING: Only rotate the crankshaft clockwise.
    Turn the crankshaft one and three quarters of a turn until no. 1 piston is at about 45° before TDC.

14. Attach the special tool.

    Special Tool(s): 303-748



15. WARNING: Only rotate the crankshaft clockwise.
    Turn the crankshaft until it stops against the special tool.

16. NOTE: Only tighten the bolt finger tight at this stage.
    NOTE: The bolt can only be installed if the valve timing is correct.
    - Bolt M6 x 18 mm

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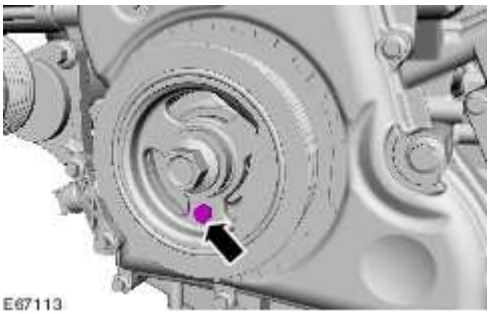
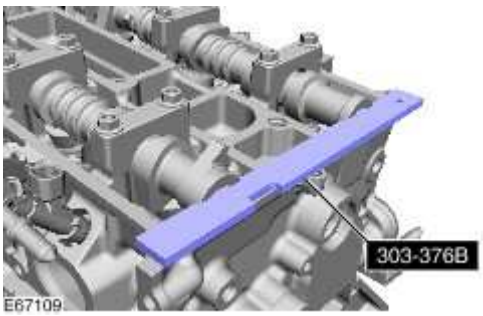
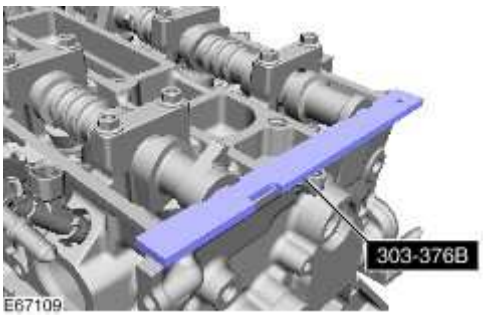




17. NOTE: The special tool may only be installed if the valve timings are correct.
Attach the special tool.

Special Tool(s): 303-376B

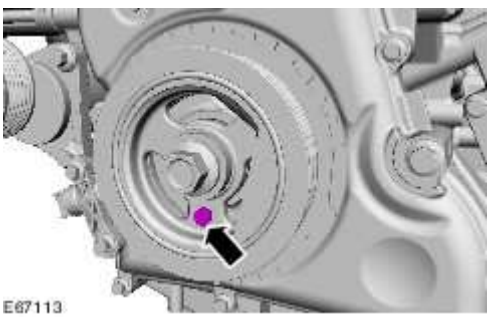


18. Remove the special tool.

Special Tool(s): 303-376B

19. Remove the special tool.

Special Tool(s): 303-748



20.

21. *Torque:* 20 Nm

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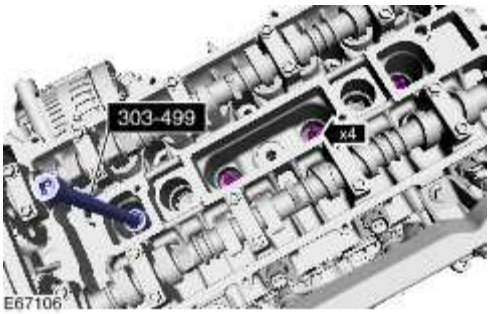
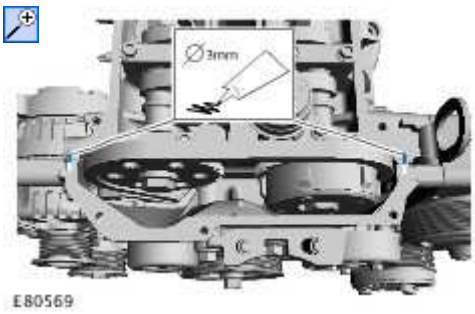
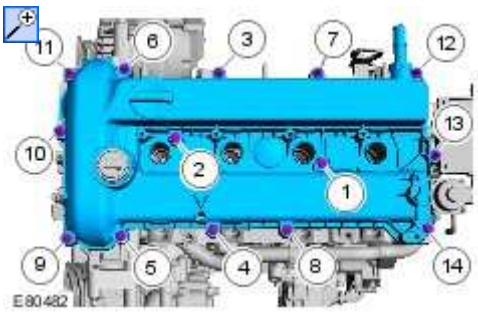


22. *Special Tool(s):* 303-499
Torque: 12 Nm

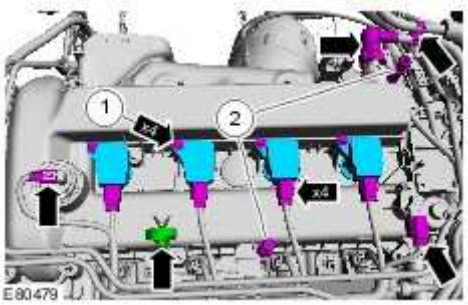


23. Apply sealant (bead diameter 3mm).

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



24. NOTE: The gaskets are to be reused unless damaged.
Torque: 10 Nm



25.
1. *Torque:* 10 Nm
2. *Torque:* 10 Nm

26. *Torque:* 10 Nm

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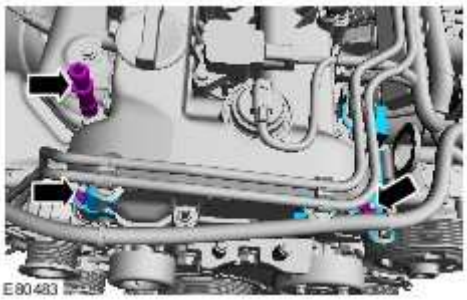

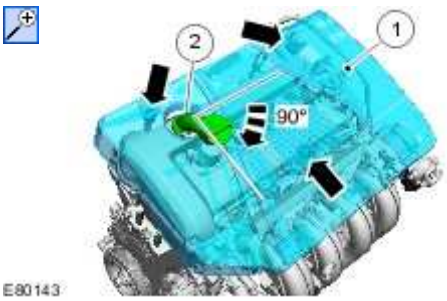

27.

28. Install the accessory drive belt.

    Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

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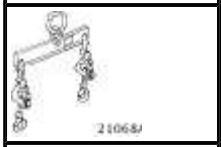
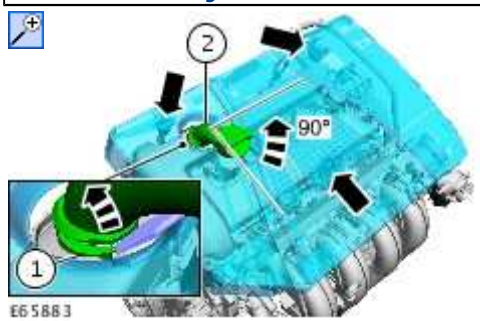
Removal

Special Tool(s)

E42949	204-349 Protector Set, Ball Joint Gaiter
E63772	204-605 Separator, Lower Arm Ball Joint
E63420	204-607 Remover, Ball joint
E75372	204-607-01 Schutz, Kugelgelenk
 21068	303-122 Lifting Bracket, Engine
E51125	310-137 Disconnect Tool, Fuel Line

General Equipment

Cable ties
Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Schlitzschraubendreher
Transmission jack



1. *General Equipment:* Schlitzschraubendreher
2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3.

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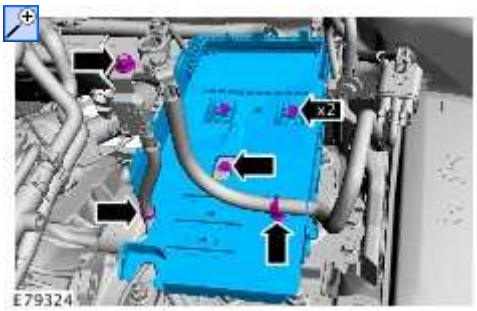
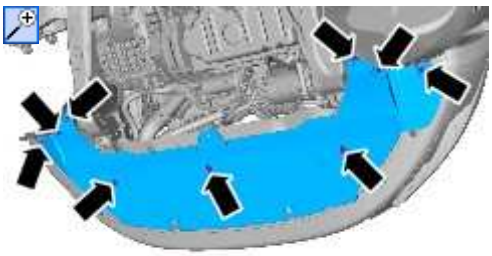


4. Remove the left-hand wheel.

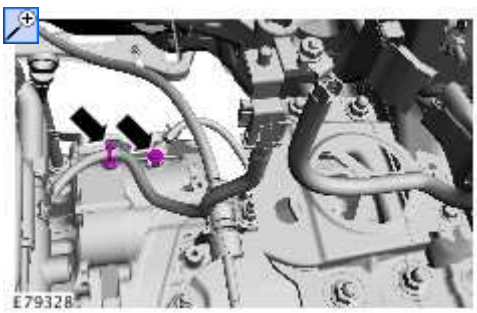
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

5. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



6.

7. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).



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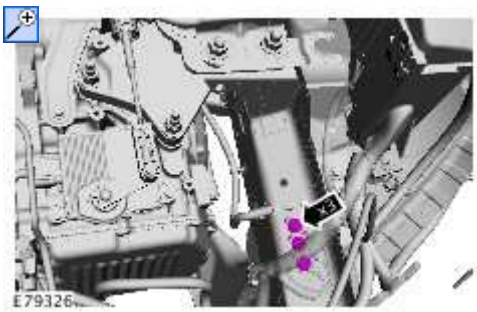

9.

10.

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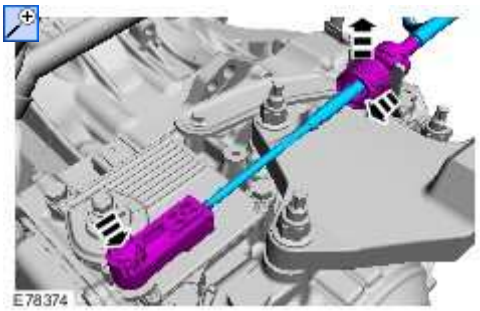
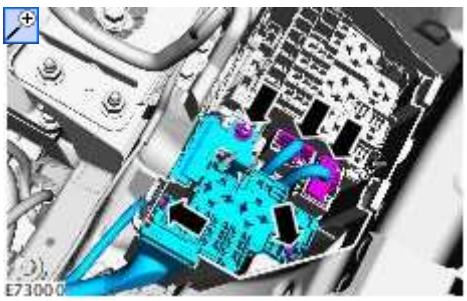
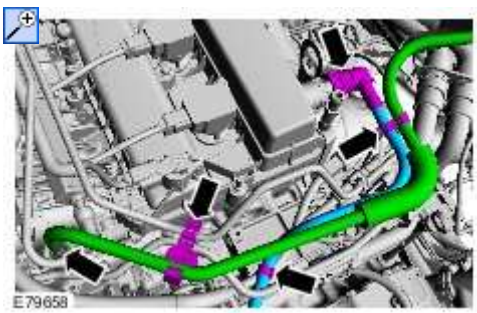


11.

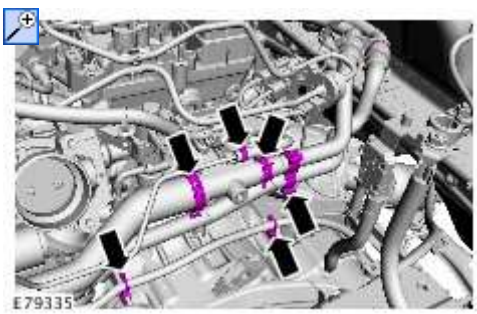
12.



13.



14. *General Equipment:* Hose clamp remover/installer



15.

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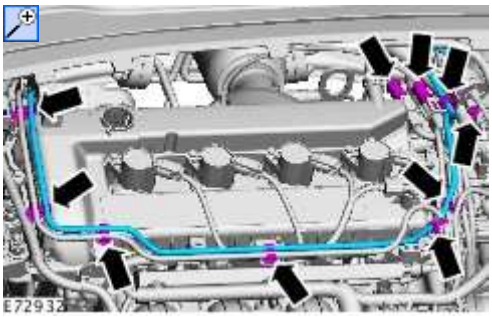
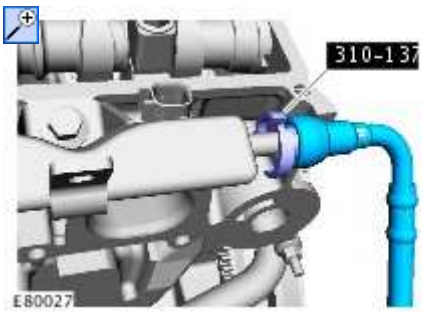


16. *Special Tool(s):* 310-137

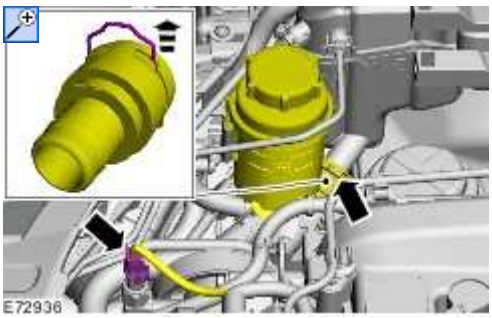


17.

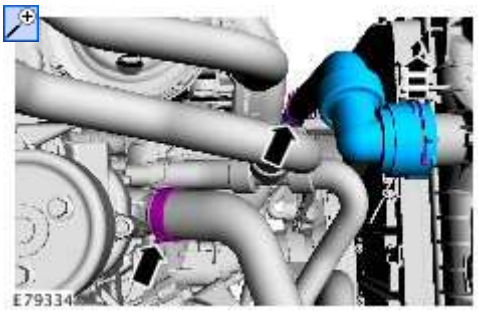
18. Remove the right-hand head lamp unit.

    Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

19.



20.



21. Remove the power steering pump and secure to one side.

    General Equipment: Cable ties

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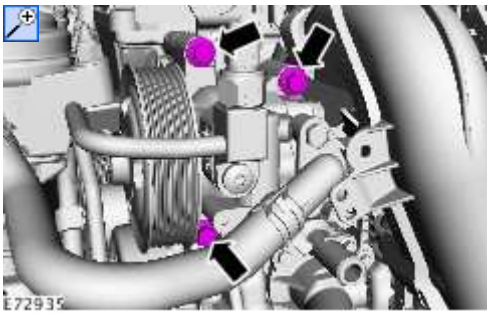
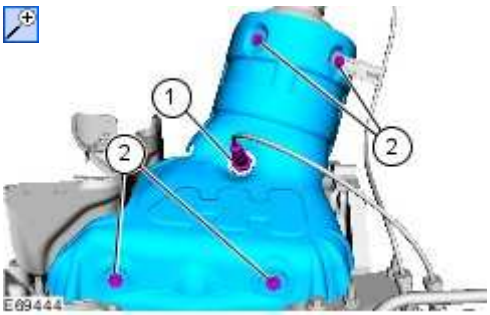
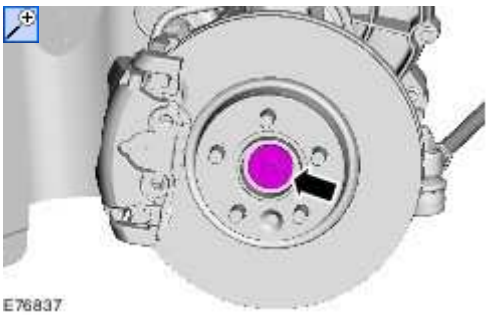
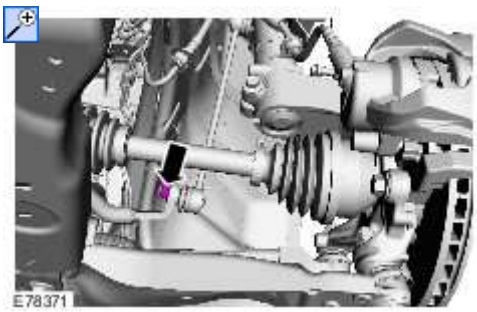




22.

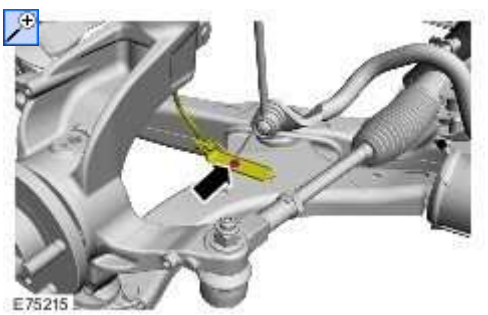


23. On both sides.



24. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

Vehicles with gas discharge headlamps



25.

All Vehicles

26. CAUTION: Make sure that the ball joint ball does not rotate.
Loosen nut on both sides.

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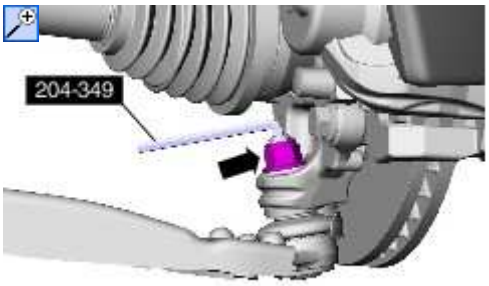
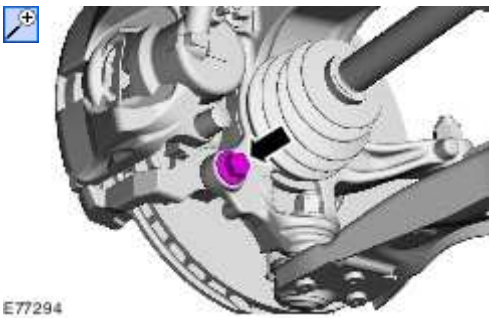
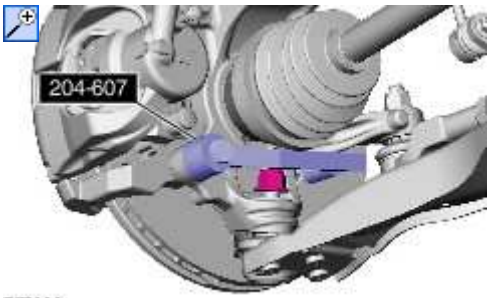


E77293

Special Tool(s): 204-349


E77294

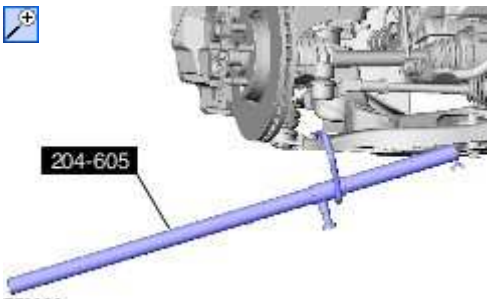
27. On both sides.



E77292

28. On both sides.

Special Tool(s): 204-607



E76839

29. On both sides.

Special Tool(s): 204-605

E76840

30. On both sides.

Special Tool(s): 204-607-01

31. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

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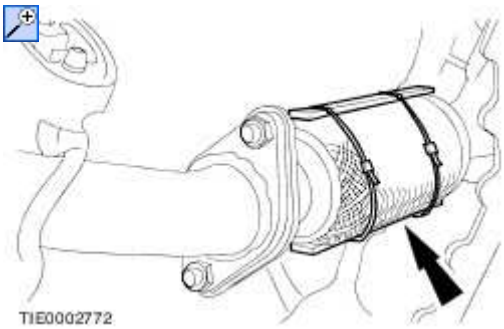

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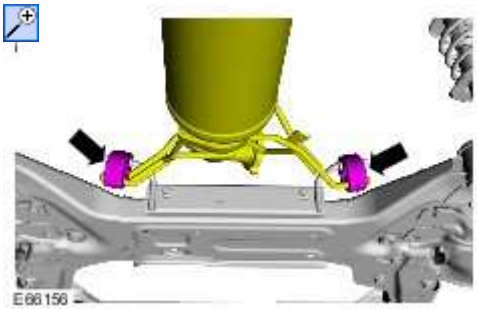

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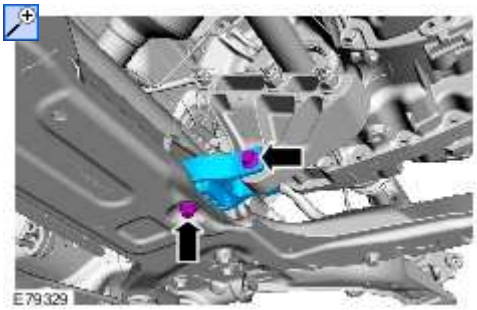

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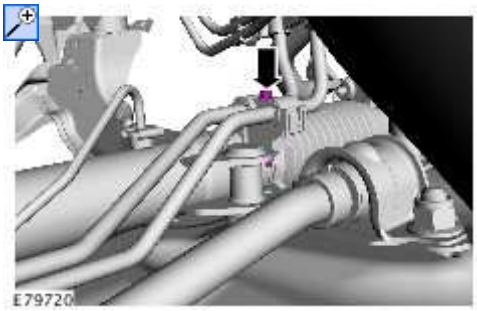
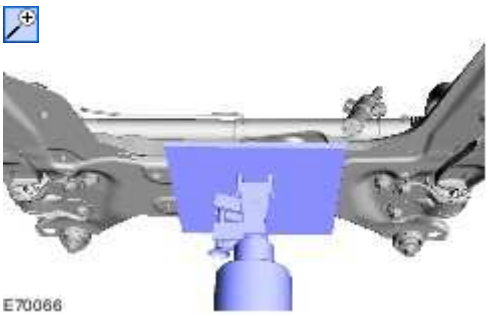


35. *General Equipment:* Transmission jack



36. Secure the steering upwards.

General Equipment: Cable ties

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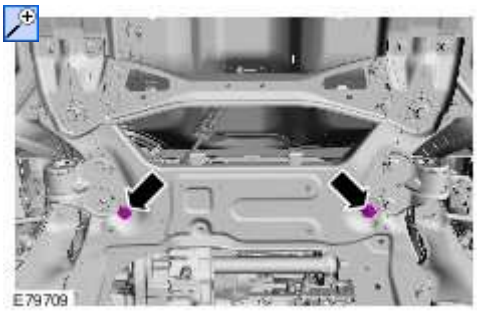
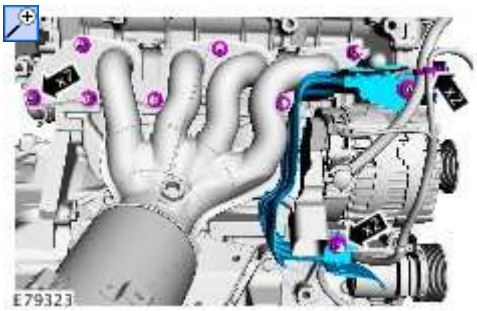
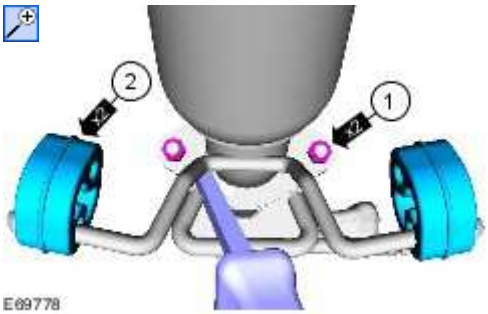


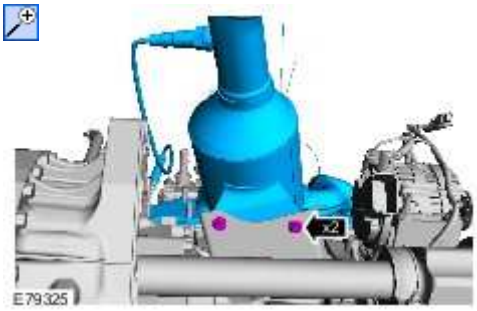
37. WARNING: This step requires the aid of another technician.



38.



39. NOTE: Make sure that the exhaust flexible pipe is not twisted.



40.

41. On both sides.

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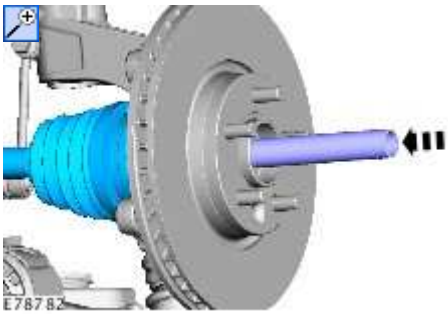

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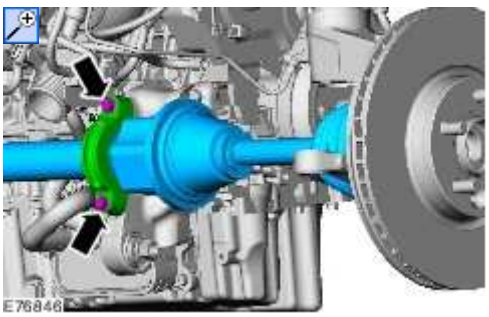

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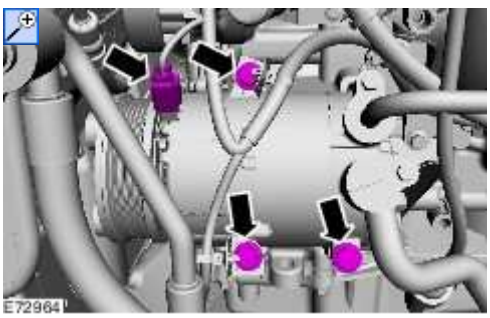

44. Remove the refrigerant compressor and secure to one side.

General Equipment: Cable ties

45.

46.

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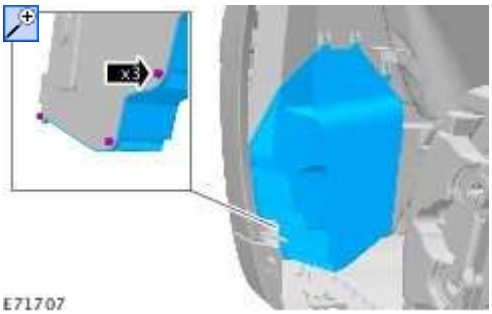

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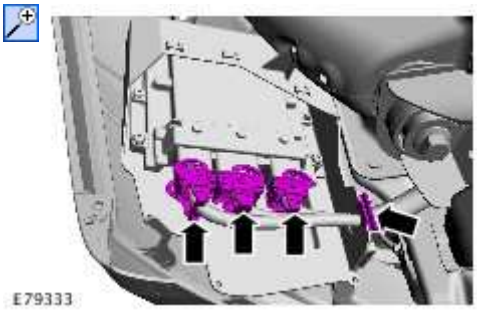

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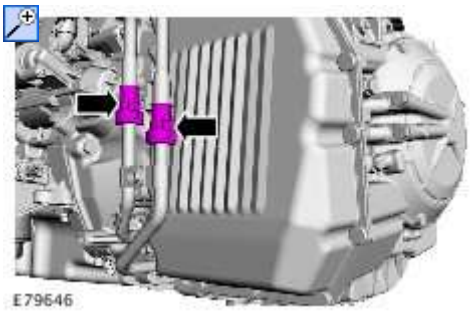

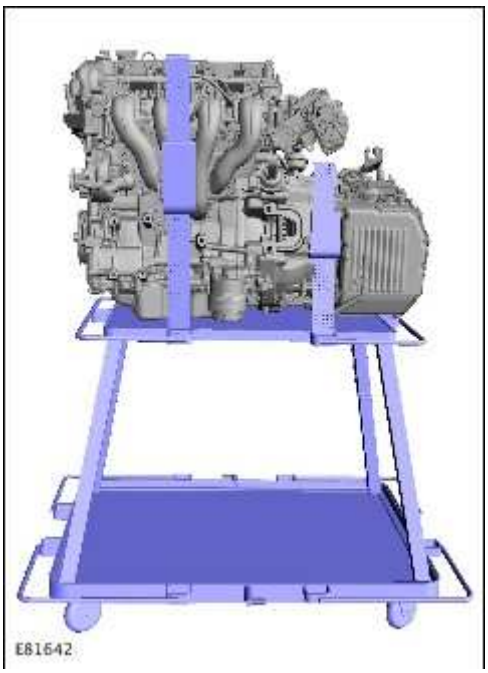

49. WARNING: Support the engine/transmission on wood blocks and secure with suitable straps.
General Equipment: Mounting table set

50.

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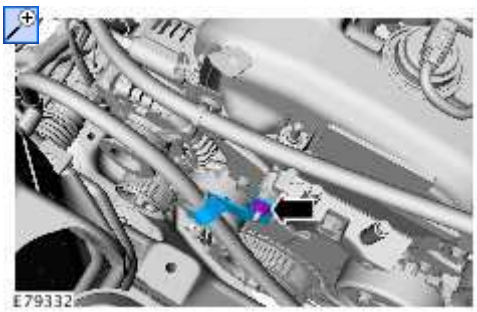

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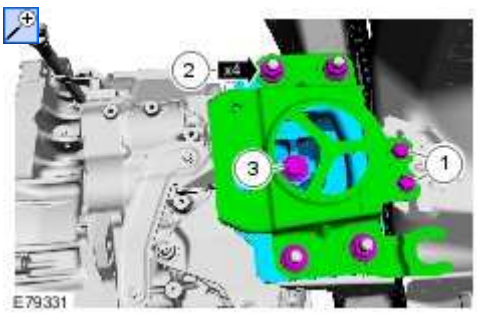
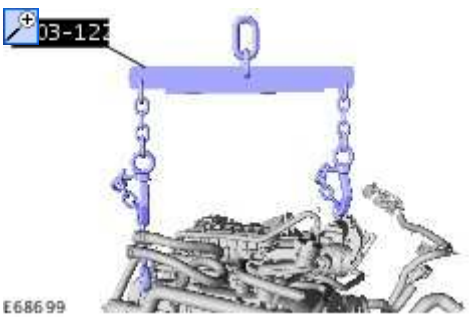


52.

3. Discard the bolt.

53. CAUTION: Make sure that no components catch.
Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



54. Attach the special tool.

Special Tool(s): 303-122
General Equipment: Hydraulic jib crane

55. Refer to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

56.

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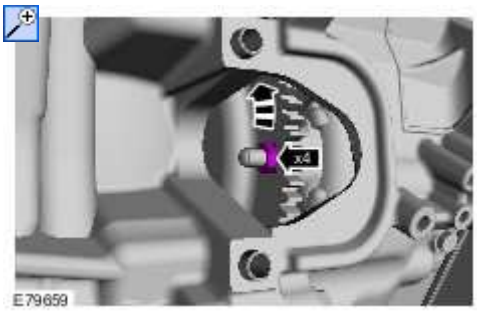

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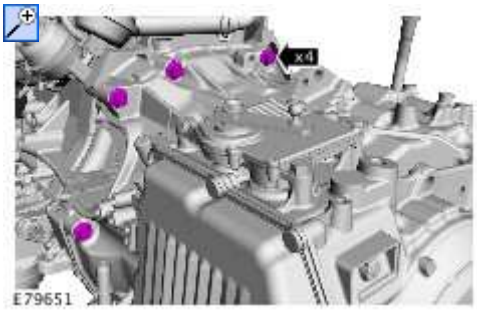

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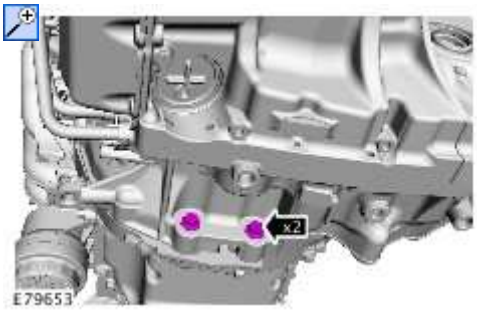

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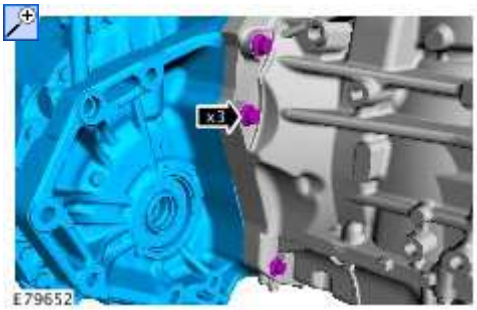

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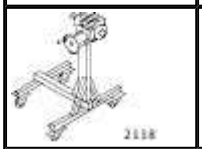
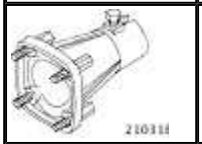
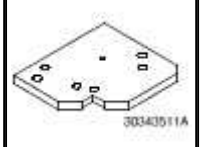
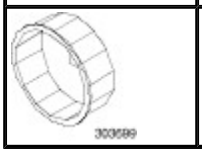
Print

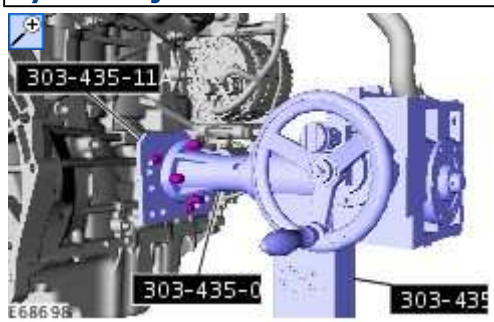
Removal

Special Tool(s)

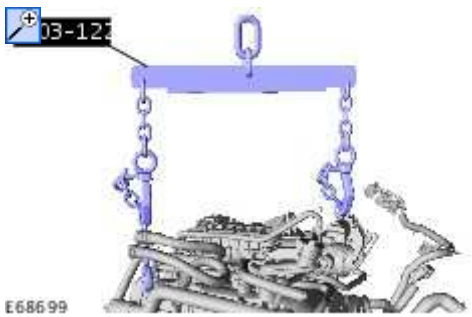
	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06
	303-699 Wrench, Oil Filter

General Equipment

Hose clamp remover/installer
Hydraulic jib crane



1. *Install the Special Tool(s):* 303-435, 303-435-06, 303-435-11A



2. *Remove the Special Tool(s):* 303-122
   General Equipment: Hydraulic jib crane

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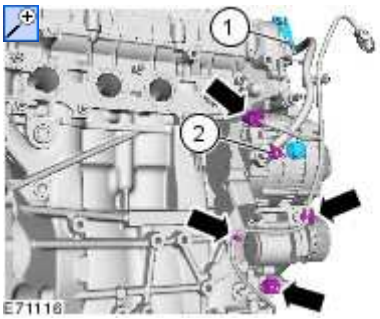
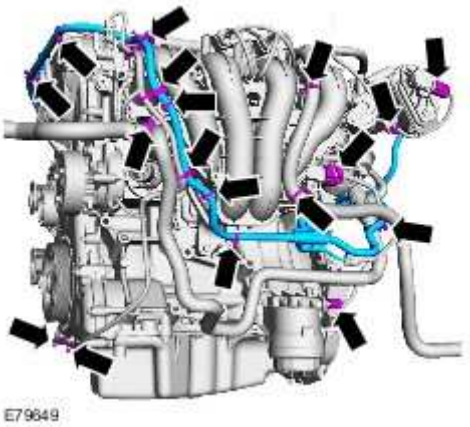


3.



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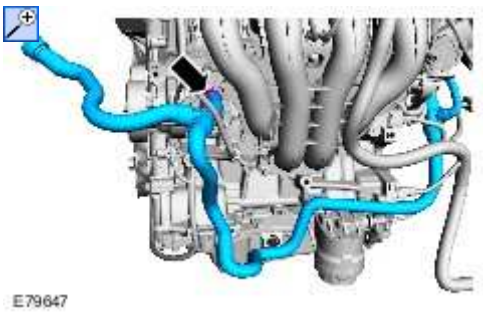
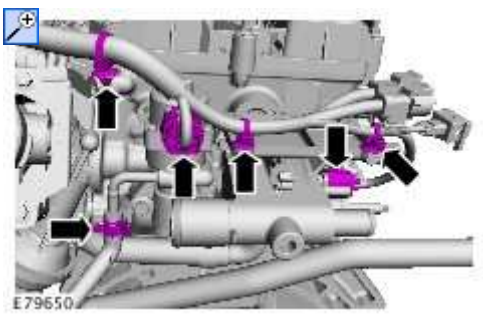
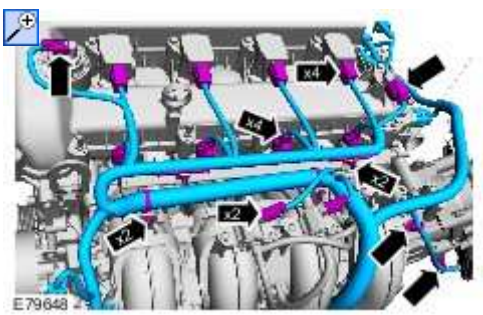


5. *General Equipment:* Hose clamp remover/installer



6. *General Equipment:* Hose clamp remover/installer



7.

8.

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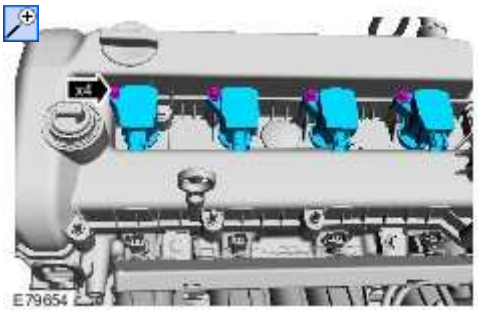
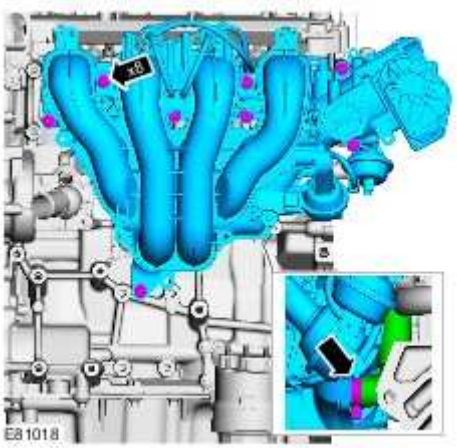
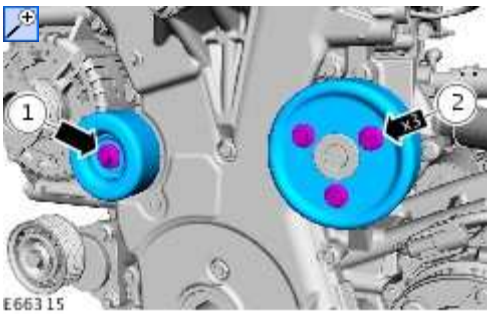




9. *General Equipment:* Hose clamp remover/installer



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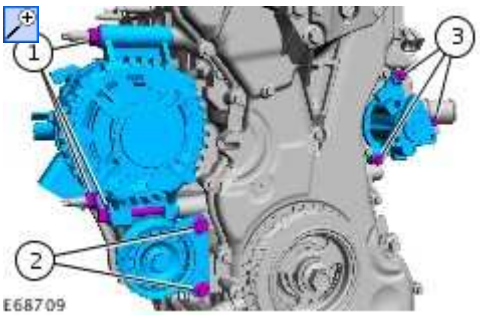

11.

12. *Special Tool(s):* 303-699

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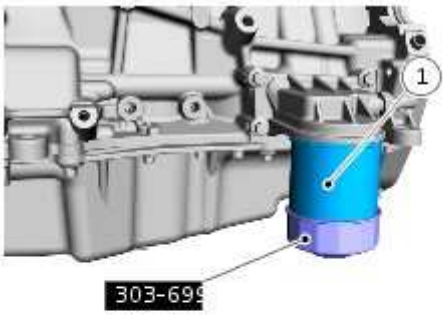
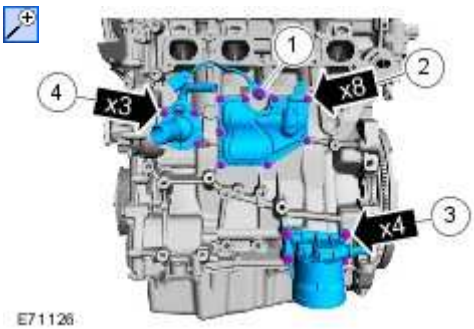
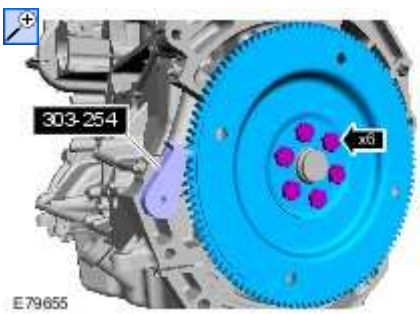


E104703



E71126

13.



E79655

14. Discard the flywheel bolts.

Special Tool(s): 303-254

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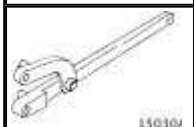
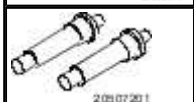
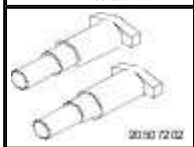
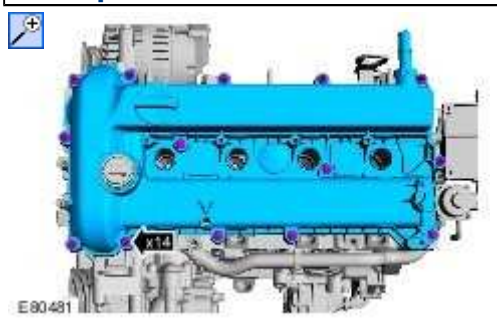
Disassembly

Special Tool(s)

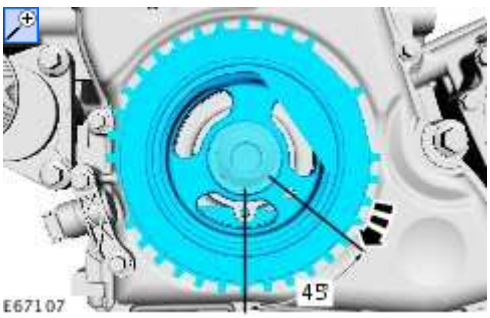
	100-010 Remover, O-Ring Seal
	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	205-072-02 Adapter for 205-072
	303-293 Remover, Crankshaft Seal

General Equipment

2 mm punch



1.



2. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft until piston No. 1 is approximately 45 degrees before top dead center (TDC).

3. *Special Tool(s):* 205-072, 205-072-02

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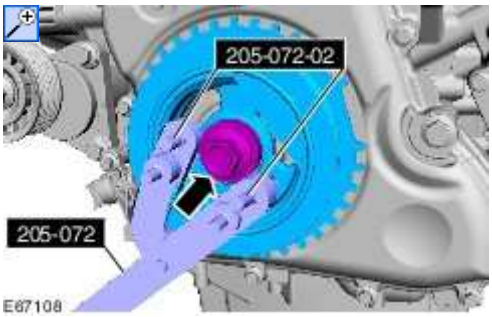
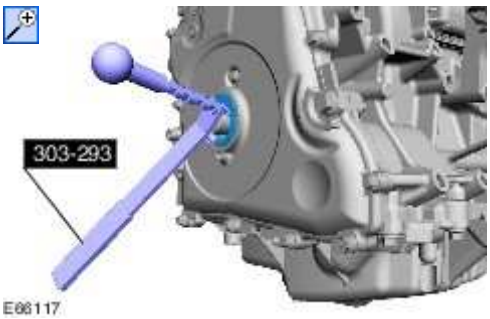
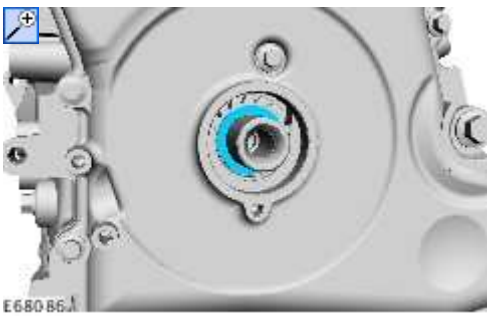
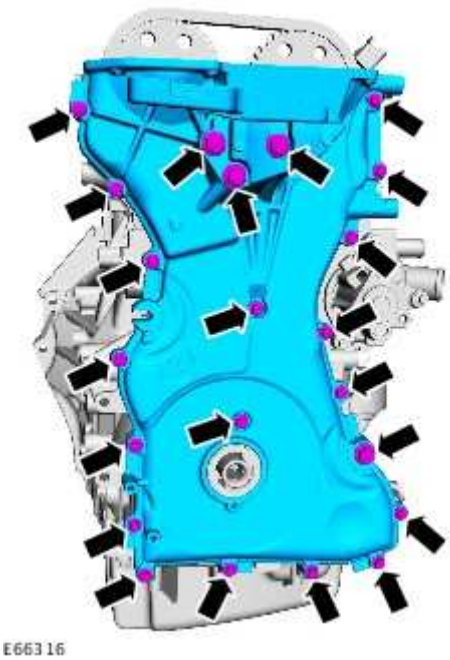




4. *Special Tool(s):* 303-293



5. Discard the friction washer.



6.

7.
   2. *Special Tool(s):* 100-010
   3. *General Equipment:* 2 mm punch

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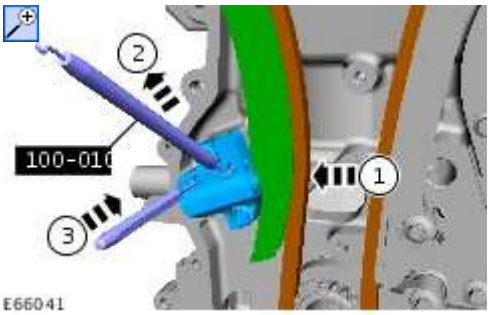
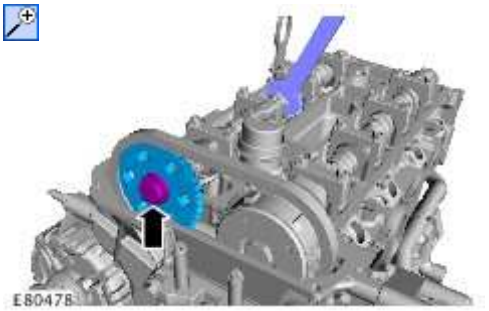
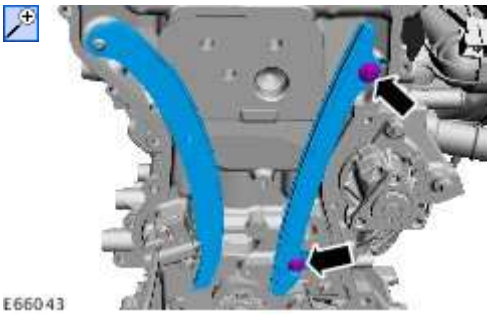
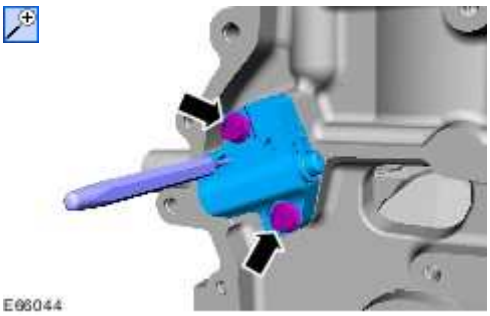




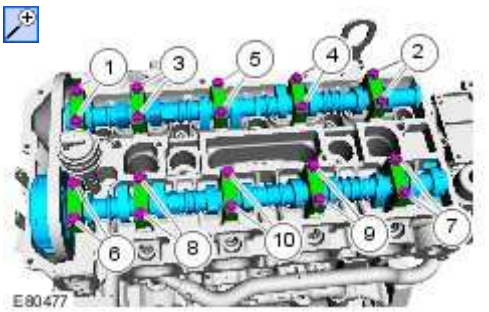
8. CAUTION: Use an open-ended wrench to prevent the component from turning.



9.



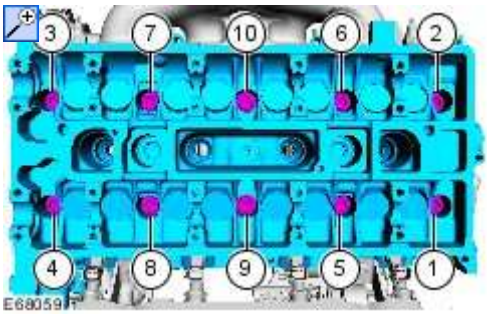
10.

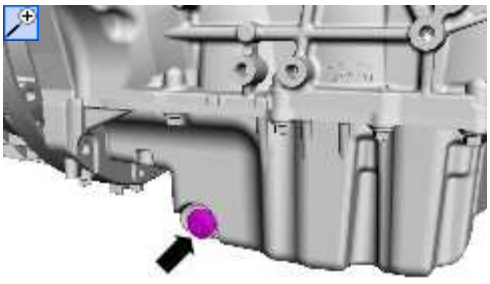


11. CAUTION: Note the position of each component before removal.

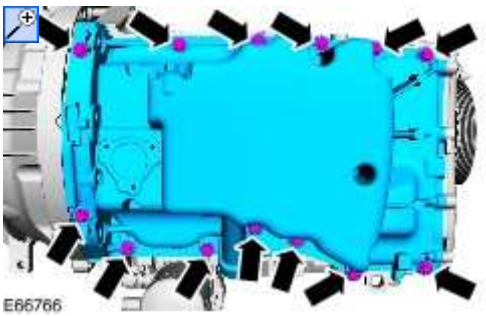
12. Discard the bolts.

http://vnx.su

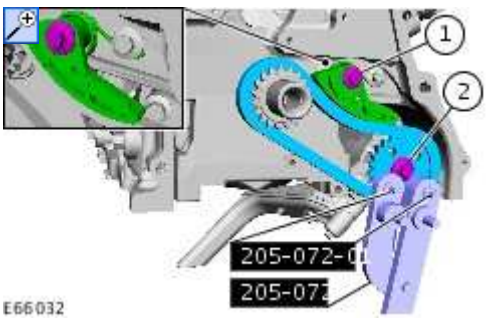




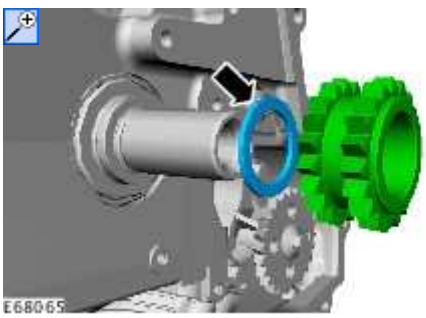
13. NOTE: The gasket is to be reused unless damaged.



14.



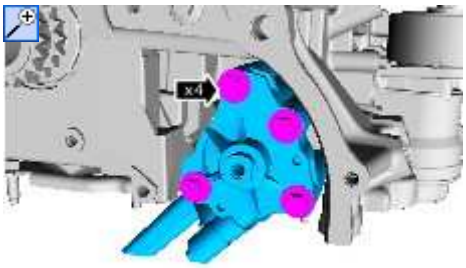
15.
2. *Special Tool(s):* 205-072, 205-072-01



16. Discard the friction washer.

17.

http://vnx.su



E83139

E83140

18.

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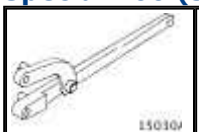
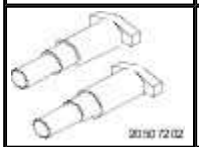
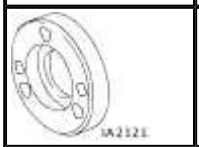
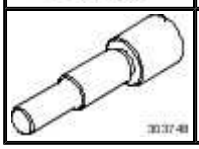
Print

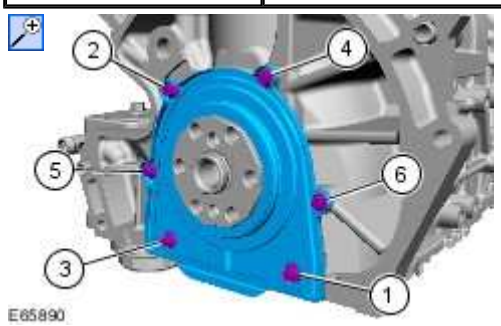
Assembly

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	205-072-02 Adapter for 205-072
	303-376B Alignment Plate, Camshaft
	303-509 Remover, Vibration Damper Hub
	303-748 Locking Tool, Crankshaft

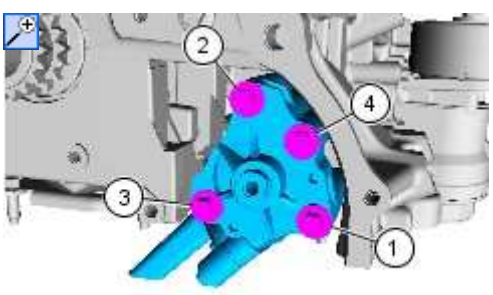
Materials

Name	Specification
Hypoid Oil 85W-90	SQ-M2C9002-AA / A72SX-19K261-CA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA



E65890

1. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Torque: 10 Nm



E68033

2. *Torque:*
   Stage 1: 10 Nm
   Stage 2: 23 Nm

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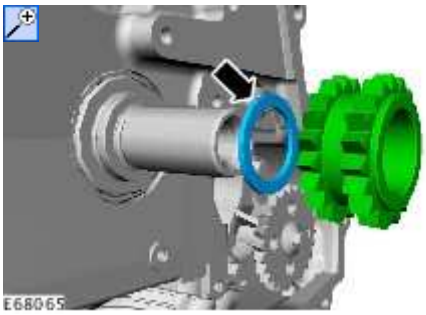
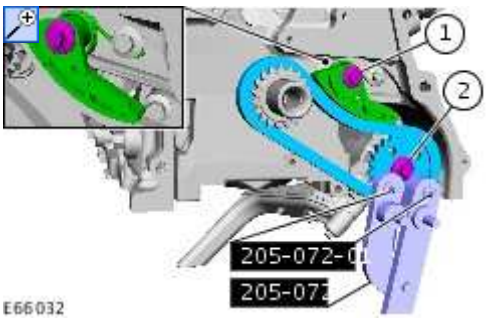
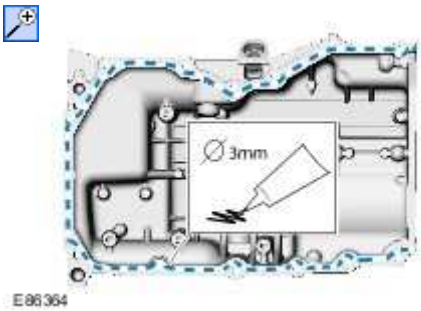


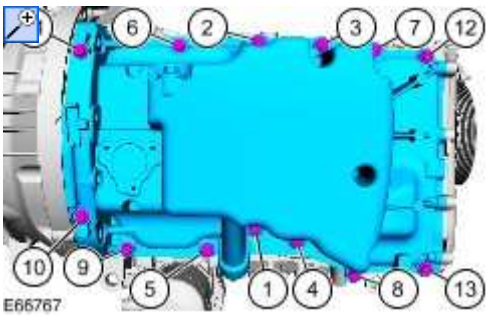
3. CAUTION: Make sure that a new friction washer is installed.



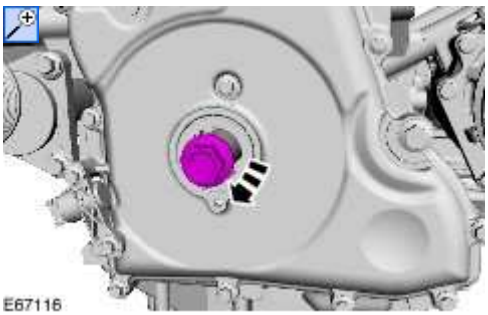
4.
1. *Torque:* 10 Nm
2. *Special Tool(s):* 205-072, 205-072-01
   Torque: 25 Nm



5. NOTE: The component must be installed within 5 minutes of applying the sealant.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



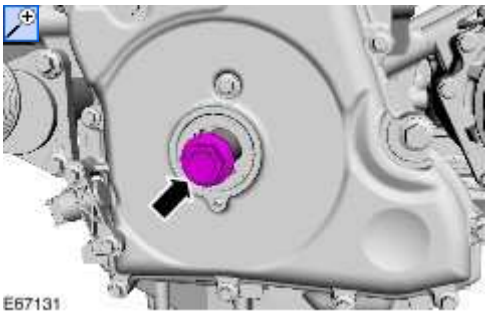
6. *Torque:* 25 Nm

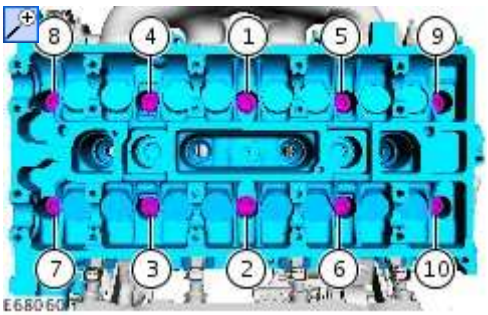


7. CAUTION: Only rotate the crankshaft clockwise.
Turn the crankshaft until no. 1 piston is at about 45° before TDC.

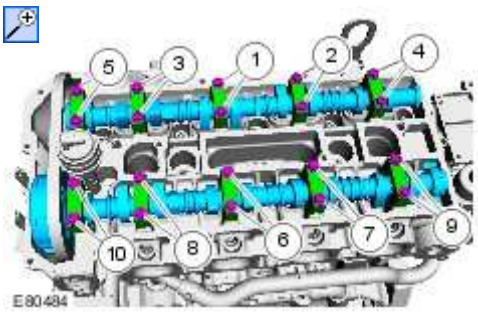
8.

http://vnx.su





9. CAUTION: Make sure that new bolts are installed.
Torque:
Stage 1: 5 Nm
Stage 2: 15 Nm
Stage 3: 45 Nm
Stage 4: 90°
Stage 5: 90°

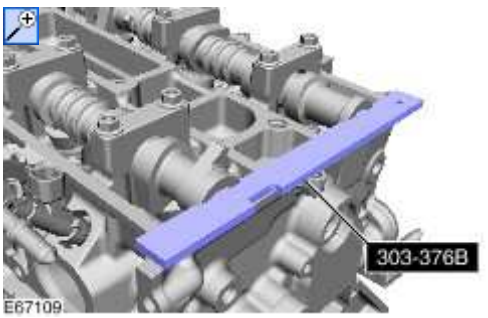


10. CAUTION: Make sure that the camshafts and camshaft bearing caps are installed in their original locations.
Coat the camshaft bearing caps with oil.

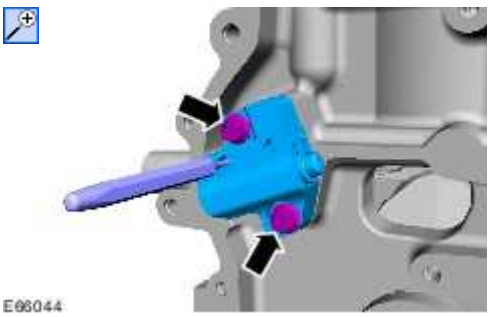
Material: Hypoid Oil 85W-90 (SQ-M2C9002-AA / A72SX-19K261-CA)

11. Install the camshafts approximately at valve overlap position cylinder No. 4.

Torque:
Stage 1: 7 Nm
Stage 2: 16 Nm



12. *Install the Special Tool(s):* 303-376B



13. *Torque:* 10 Nm

14. *Torque:* 10 Nm

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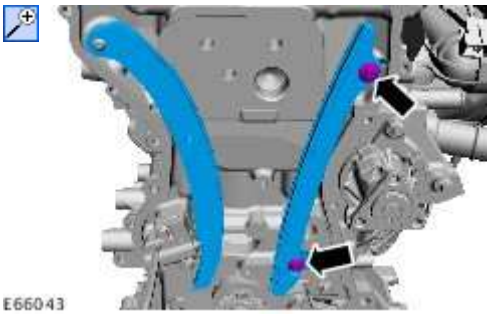
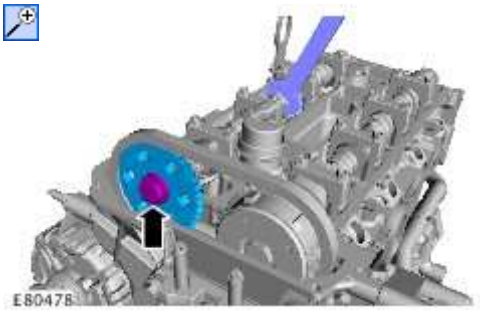
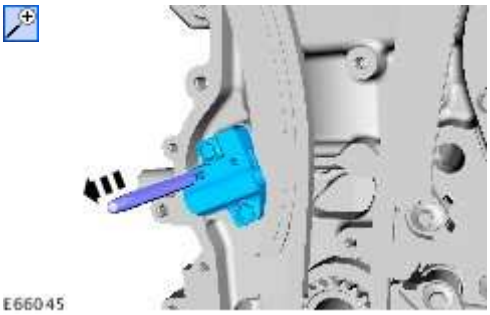
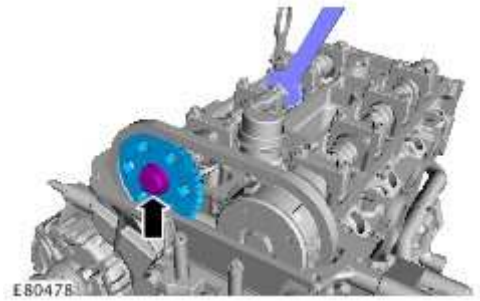




15. NOTE: The camshaft sprocket bolt must not be tightened at this stage.
NOTE: Make sure that the camshaft sprocket can rotate on the camshaft.



16.



17. CAUTION: Use an open-ended wrench to prevent the component from turning.
Torque: 72 Nm

18. NOTE: The component must be installed within 5 minutes of applying the sealant.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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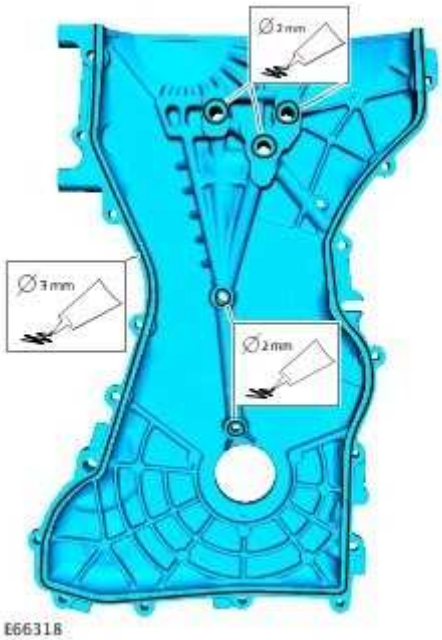

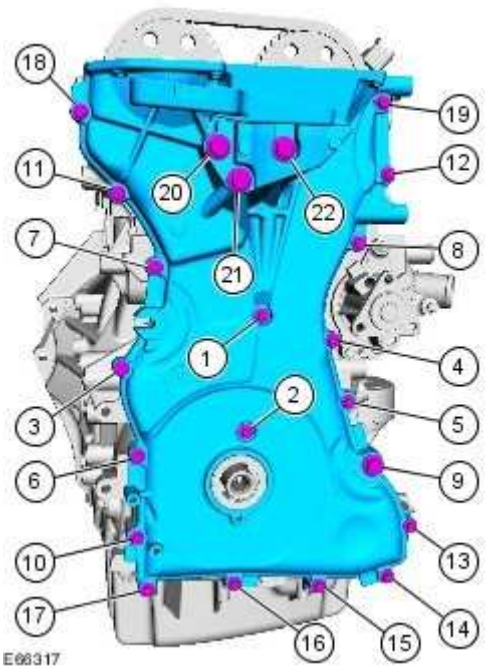

19. *Torque:*
    1-8 10 Nm
    9 48 Nm
    10-19 10 Nm
    20-22 48 Nm

20. CAUTION: Make sure that a new friction washer is installed.

21. *Special Tool(s):* 303-509

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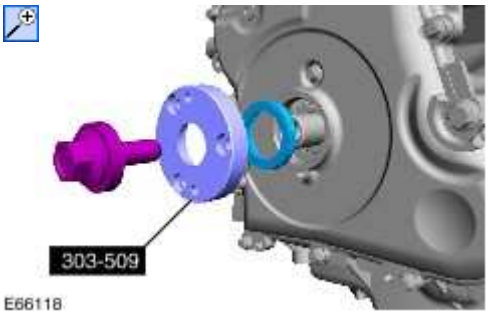


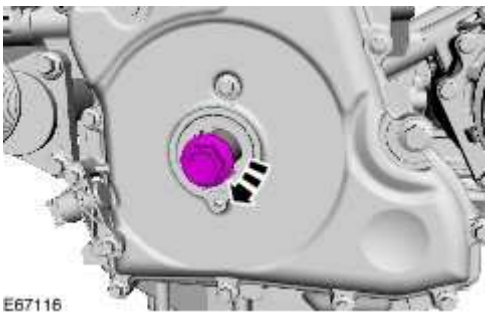
E66118

E67110

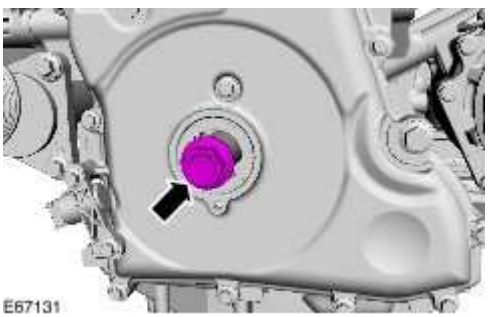
22.

E67111

23. *Install the Special Tool(s):* 303-748


E67116

24. CAUTION: Only rotate the crankshaft clockwise.
Turn the crankshaft until it stops against the special tool.


E67131

25. Discard the bolt.

26. NOTE: Only tighten the bolt finger tight at this stage.
M6 x 18 mm bolt.

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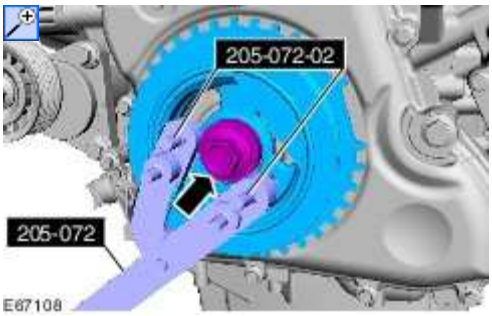
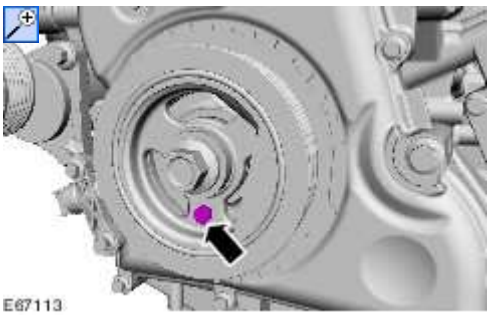


27. CAUTION: Make sure that a new bolt is installed.
Special Tool(s): 205-072, 205-072-02
Torque:
Stage 1: 100 Nm
Stage 2: 90°



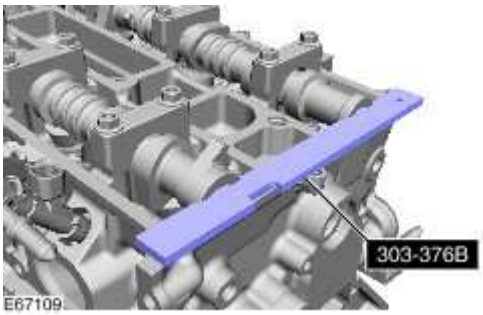
28.

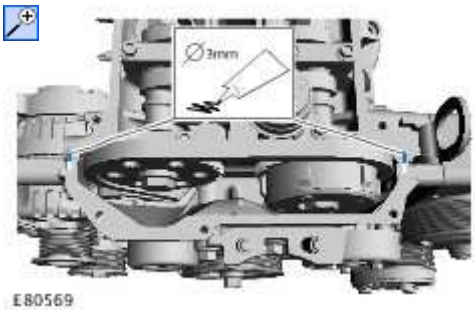
29. *Remove the Special Tool(s):* 303-748

30. *Torque:* 20 Nm

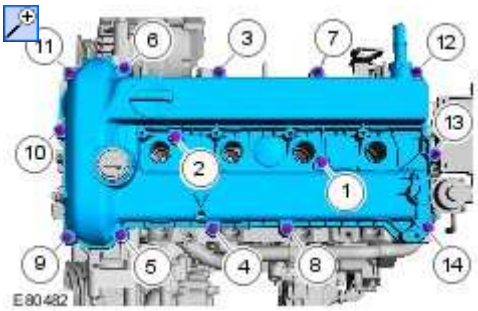
31. *Remove the Special Tool(s):* 303-376B

http://vnx.su





32. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



33. *Torque:* 10 Nm

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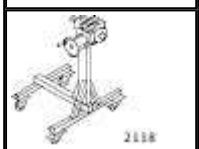
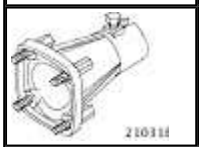
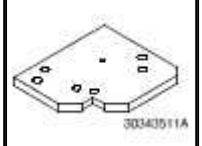
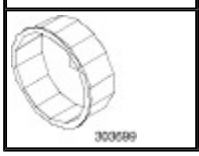
Print

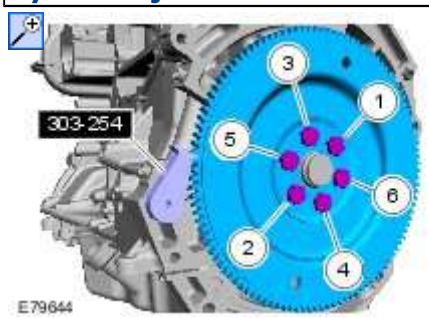
Installation

Special Tool(s)

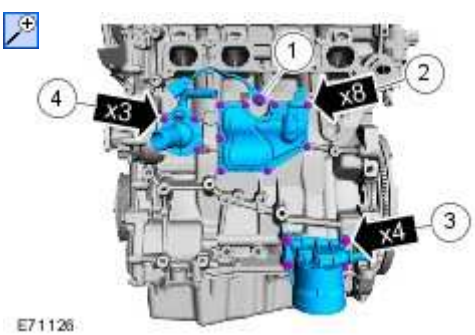
	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11A Mounting Plate for 303-435-06
	303-699 Wrench, Oil Filter

General Equipment

Hose clamp remover/installer
Hydraulic jib crane



1. CAUTION: Make sure that new bolts are installed.
   Special Tool(s): 303-254
   Torque:
   Stage 1: 50 Nm
   Stage 2: 80 Nm
   Stage 3: 112 Nm



2.
   1. *Torque:* 20 Nm
   2. *Torque:* 10 Nm
   3. *Torque:* 25 Nm
   4. *Torque:* 10 Nm

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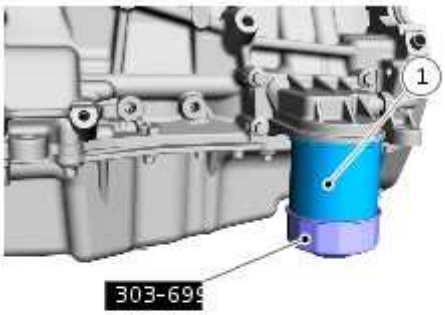
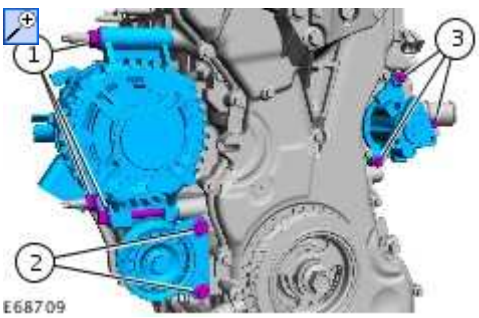
3. *Special Tool(s):* 303-699



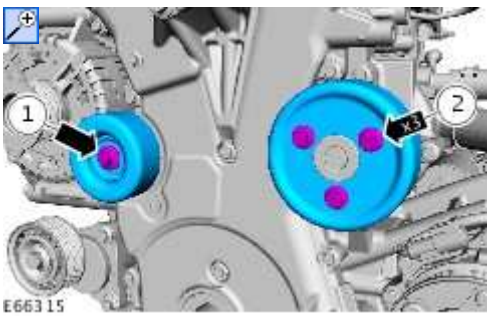
4. NOTE: Make sure that a new component is installed.
   1. If equipped.

      Special Tool(s): 303-699
      Torque: 33 Nm
   2. If equipped.

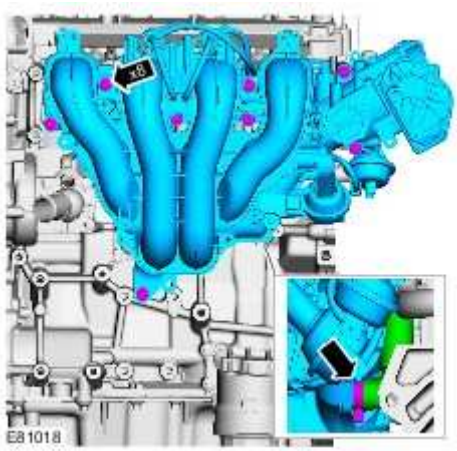
      Special Tool(s): 303-699
      Torque: 18 Nm



5.
   1. *Torque:* 47 Nm
   2. *Torque:* 25 Nm
   3. *Torque:* 10 Nm



6.
   1. *Torque:* 25 Nm
   2. *Torque:* 20 Nm



7. *General Equipment:* Hose clamp remover/installer
   Torque: 18 Nm

8. *Torque:* 10 Nm

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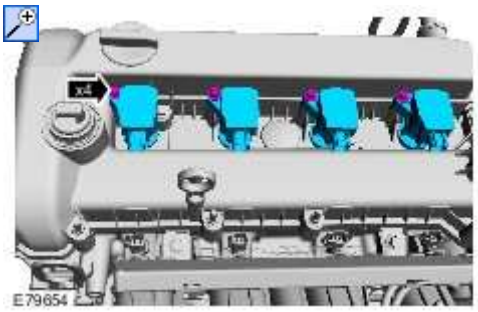
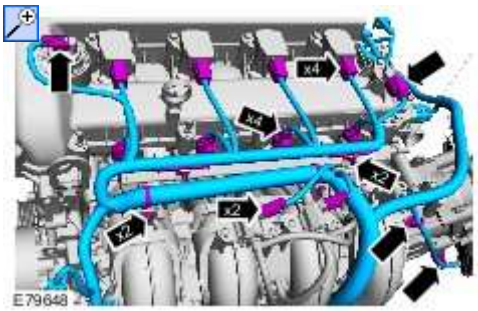
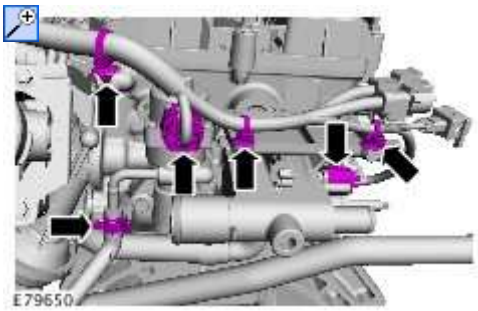


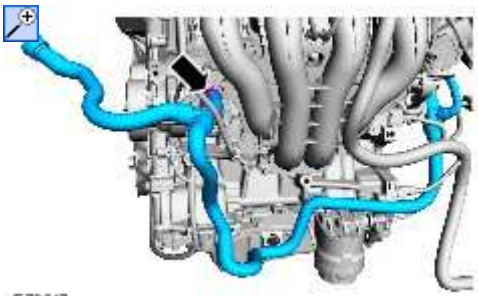
9.



10. *General Equipment:* Hose clamp remover/installer



11. *General Equipment:* Hose clamp remover/installer



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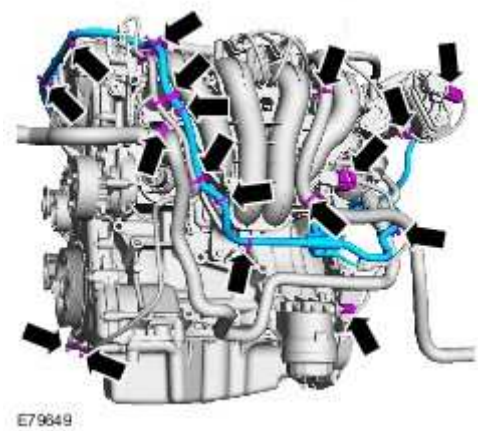

13.

1. *Torque:* 10 Nm
2. *Torque:* 8 Nm

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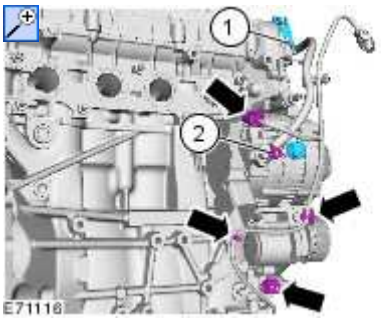
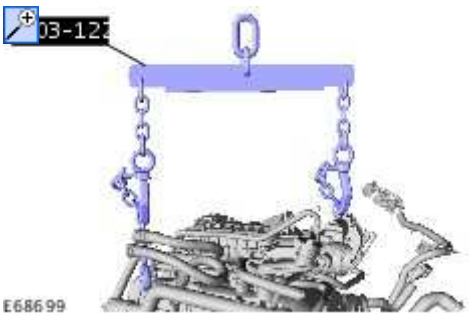
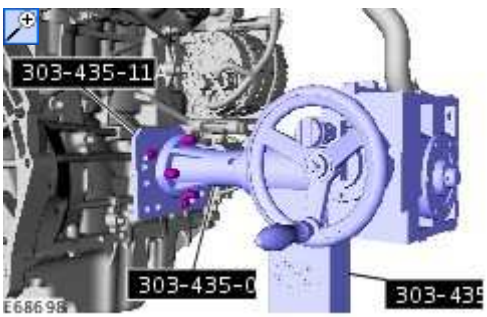




14. *Install the Special Tool(s):* 303-122
General Equipment: Hydraulic jib crane



15. *Remove the Special Tool(s):* 303-435, 303-435-06, 303-435-11A

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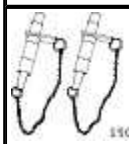
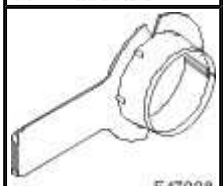
Print

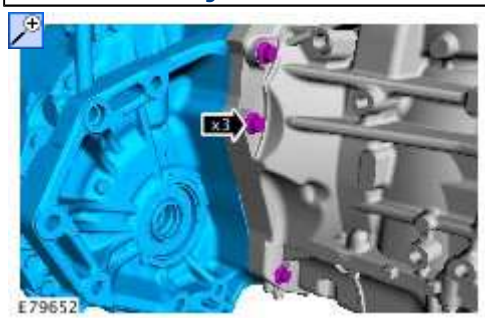
Installation

Special Tool(s)

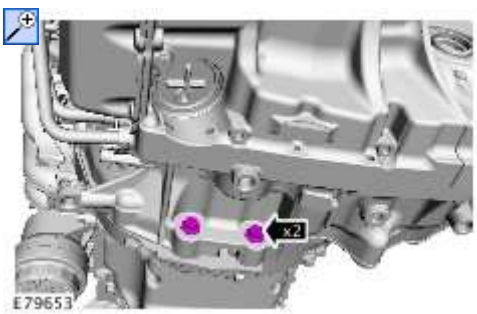
E42949	204-349 Protector Set, Ball Joint Gaiter
 15097	205-316A Alignment Pins, Subframe
 E47098	205-775 Protector Halfshaft Seal
21068	303-122 Lifting Bracket, Engine

General Equipment

Hose clamp remover/installer
Hydraulic jib crane
Mounting table set
Transmission jack



1. *Torque:* 48 Nm



2. *Torque:* 48 Nm

3. *Torque:* 48 Nm

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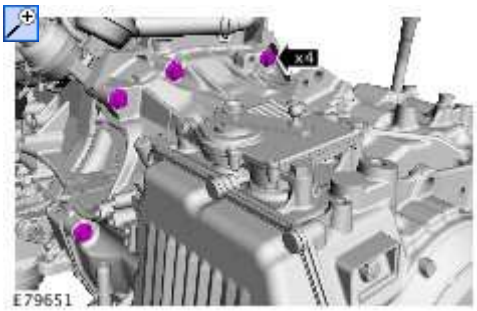
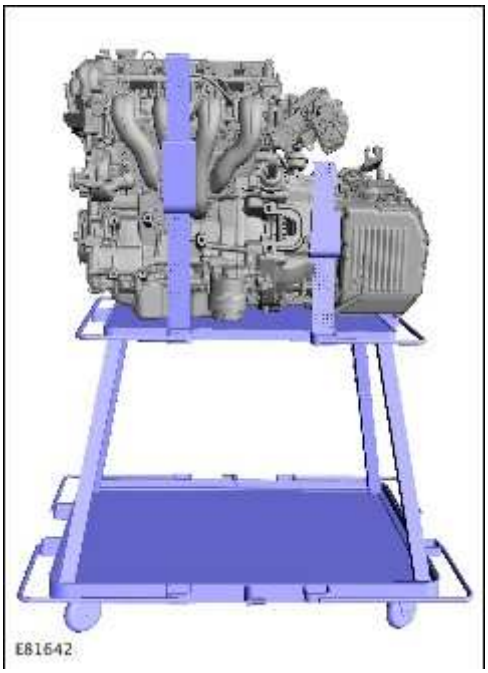
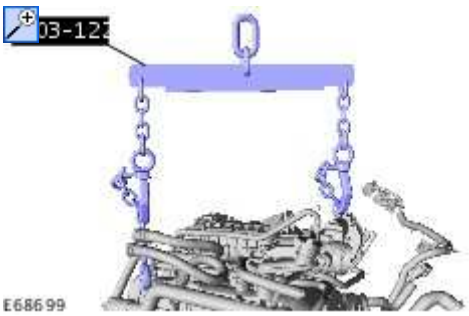




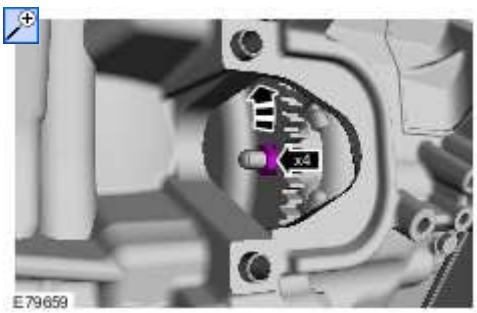
4. Secure the engine to the assembly table with retaining straps.

   General Equipment: Mounting table set



5. Remove the special tool.

   Special Tool(s): 303-122
   General Equipment: Hydraulic jib crane



6. *Torque:* 36 Nm

7. Refer to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

8. CAUTION: Make sure that no

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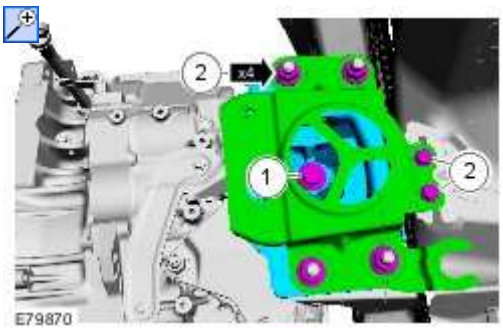
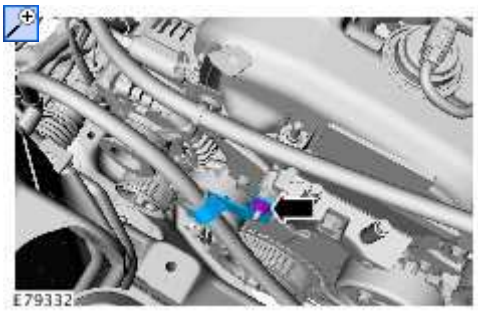
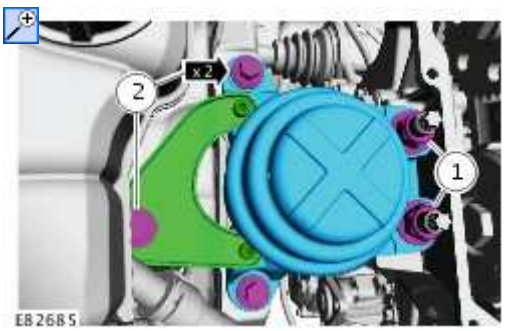
components catch.
Lower the vehicle to take the load off the engine mountings.



9.
1. *Torque:* 133 Nm
2. NOTE: Only tighten the bolts finger tight at this stage.

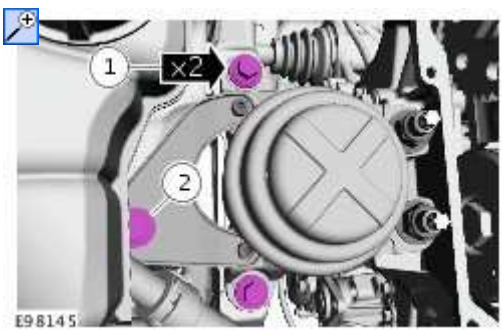


10. *Torque:* 15 Nm

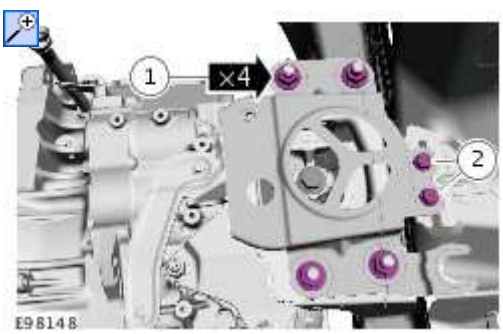


11.
1. *Torque:* 80 Nm
2. NOTE: Only tighten the bolts finger tight at this stage.

12. Remove the assembly stand.



13. *Torque:* 90 Nm



14. *Torque:*
1 80 Nm
2 25 Nm

15.

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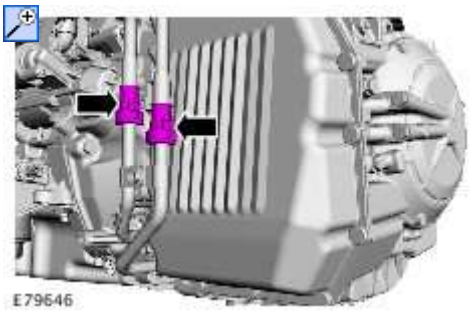

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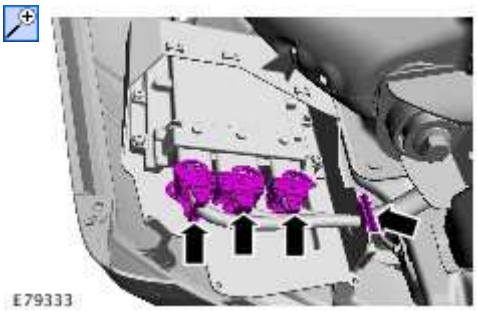
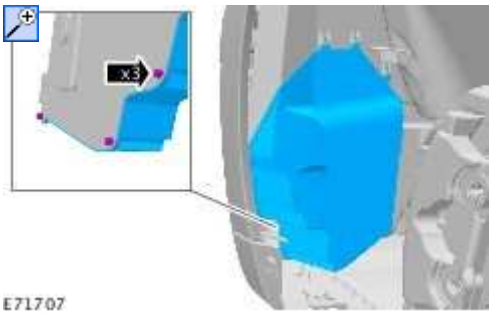
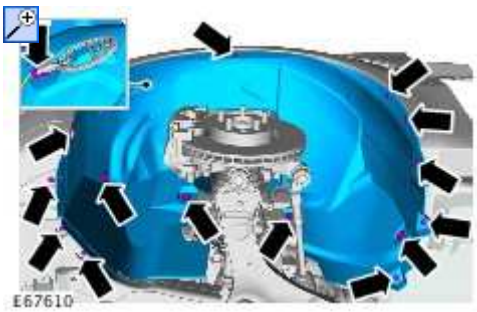


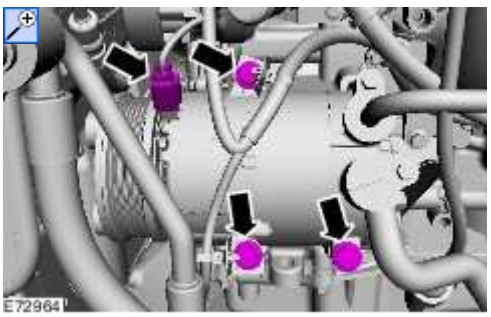
17.



18.



19. *Torque:* 25 Nm



20. NOTE: Make sure that a new component is installed.

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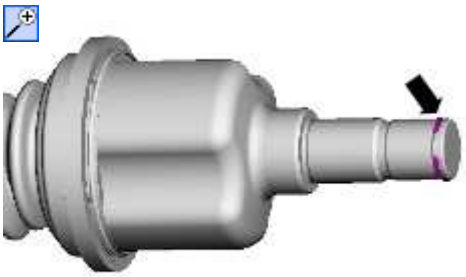
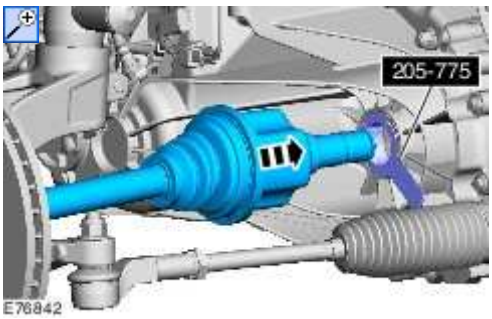
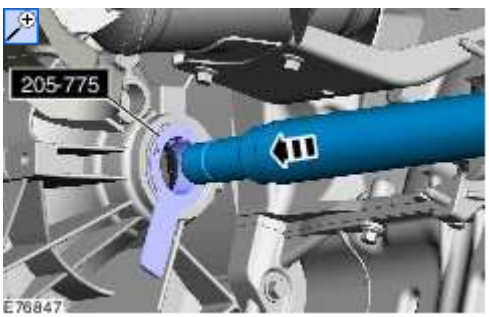

E78783



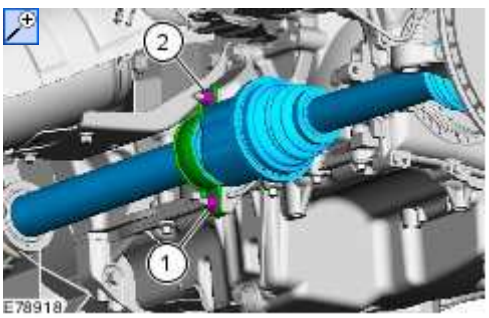
E76842

21. *Special Tool(s):* 205-775



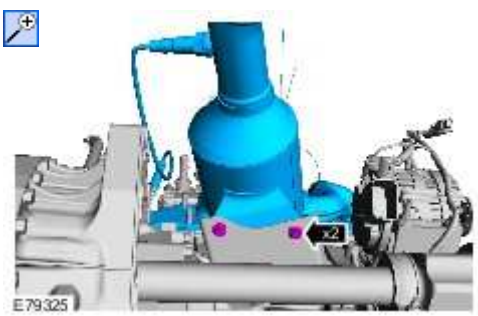
E76847

22. *Special Tool(s):* 205-775



E78918

23. *Torque:* 25 Nm



E79325

24. NOTE: Make sure that the exhaust flexible pipe is not twisted.
Torque: 48 Nm

25.

1. CAUTION: Jointing compound must not be used forward of the catalytic converter.
Torque: 55 Nm
2. *Torque:* 48 Nm

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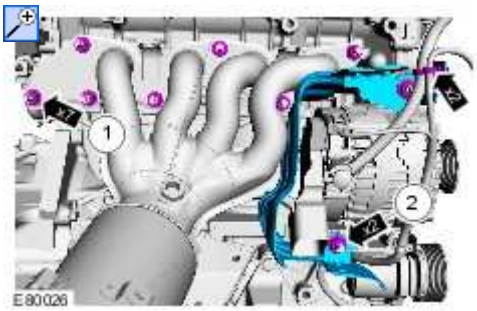
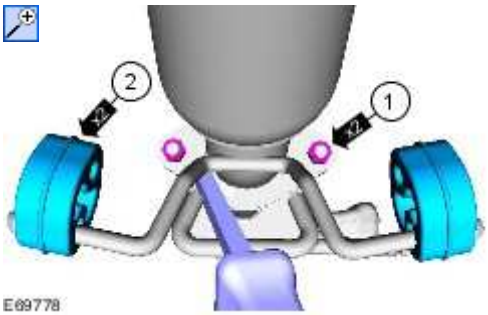
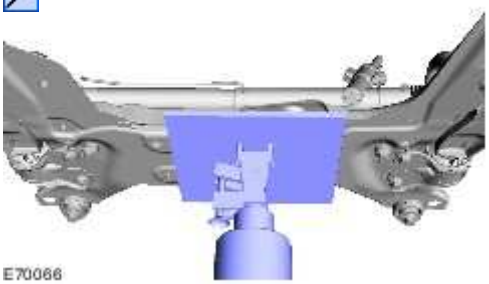


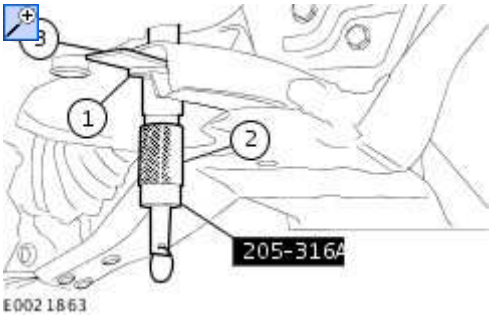


26. *Torque:* 48 Nm



27. *General Equipment:* Transmission jack

28. NOTE: Only tighten the bolts finger tight at this stage.



29.
1. Insert the washer, with inside diameter 22 mm, outside diameter 44 mm and height 5 mm, into the front subframe above the alignment hole.
2. Insert the alignment pin through the front subframe alignment holes and the washer.

   Special Tool(s): 205-316A
3. Slide the locking plates on top of the washer and into the groove of the special tool and tighten the alignment pin sleeve.

30. WARNING: This step requires the aid of another technician.
1. *Torque:*
   Stage 1: 180 Nm
   Stage 2: 90°

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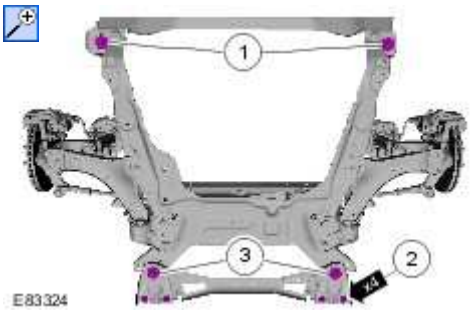
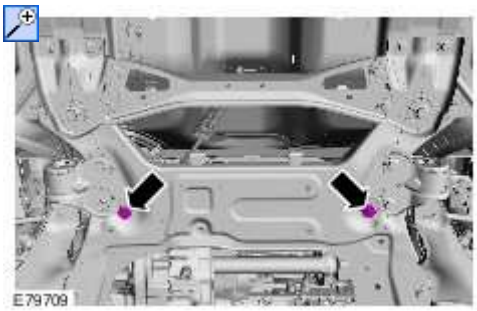
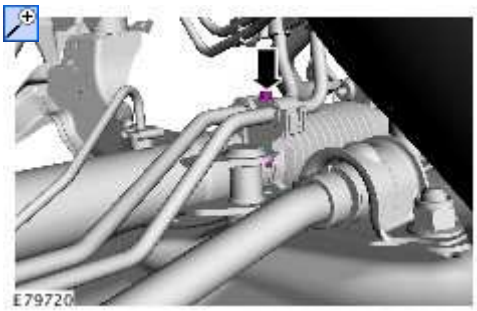


2. *Torque:* 30 Nm
3. *Torque:*
   Stage 1: 180 Nm
   Stage 2: 90°
4. Remove the special tool.

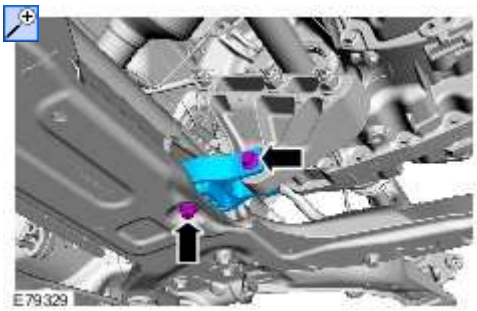


31. Tighten the power steering bolts.

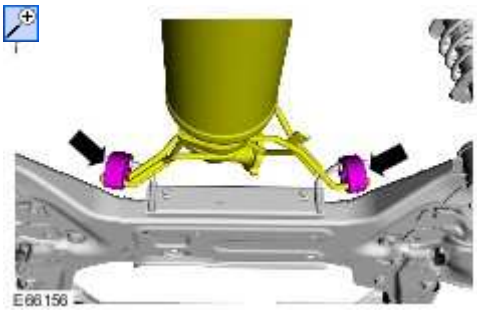
    Torque: 120 Nm



32.



33. *Torque:* 85 Nm



34.

35. On both sides.

    Torque: 220 Nm

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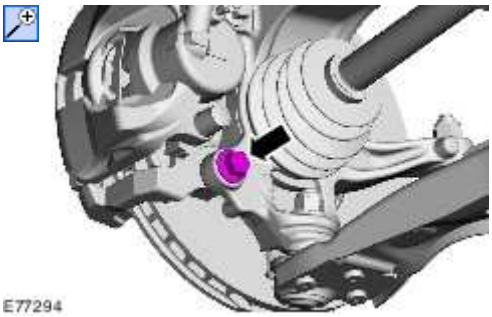
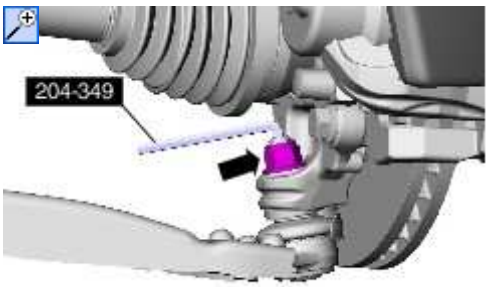

E77294

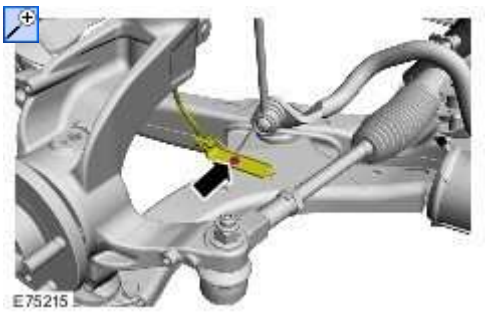


E77293

36. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

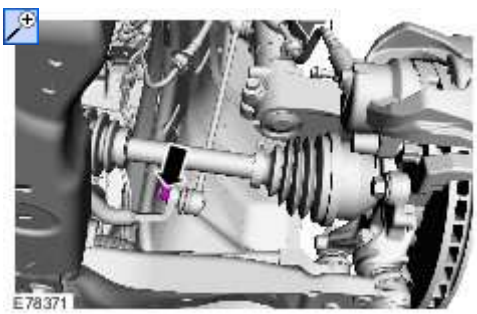
Special Tool(s): 204-349
Torque: 100 Nm

Vehicles with gas discharge headlamps


E75215

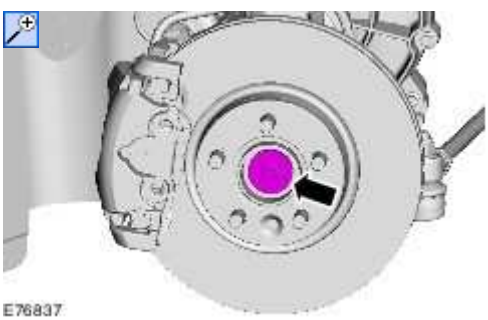
37.

All Vehicles


E78371

38. CAUTION: Make sure that the ball joint ball does not rotate.
On both sides.

Torque: 60 Nm


E76837

39. NOTE: Make sure that a new component is installed.
On both sides.

Torque:
Stage 1: 45 Nm
Stage 2: 80°

40.
1. *Torque:* 48 Nm
2. *Torque:* 10 Nm

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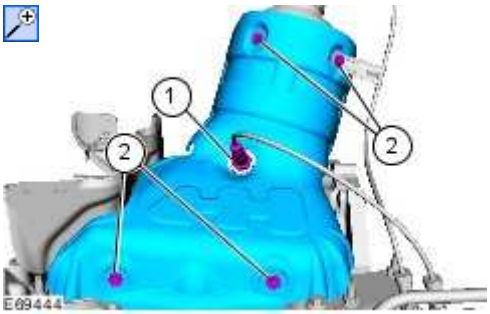
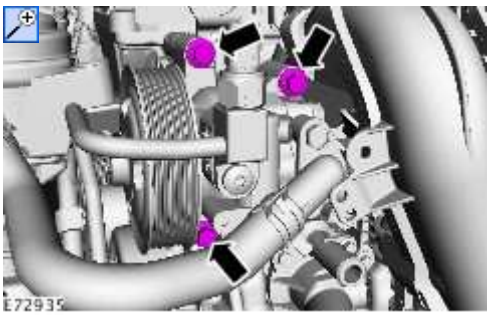
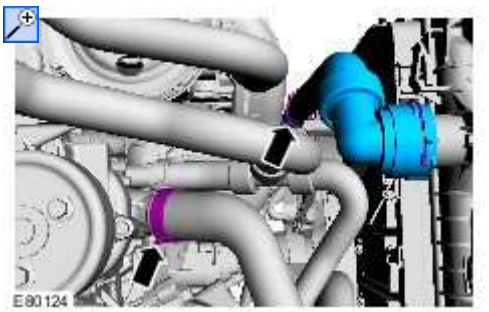
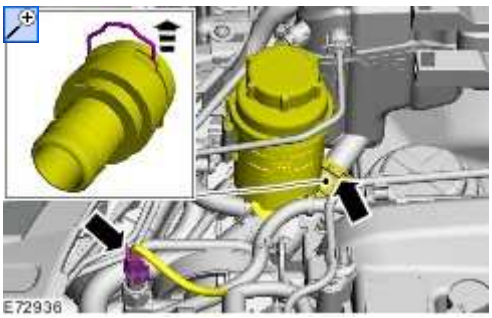




41. *Torque:* 25 Nm

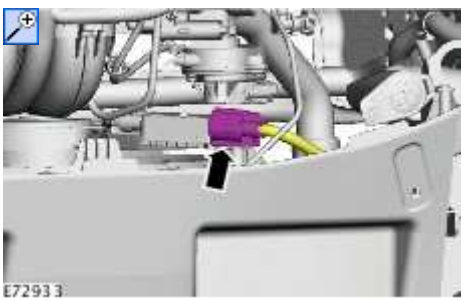


42. *General Equipment:* Hose clamp remover/installer



43.

44. Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



45.

46.

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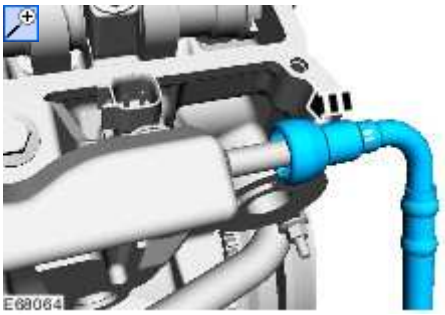

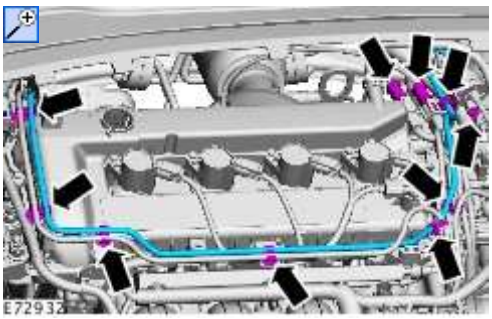

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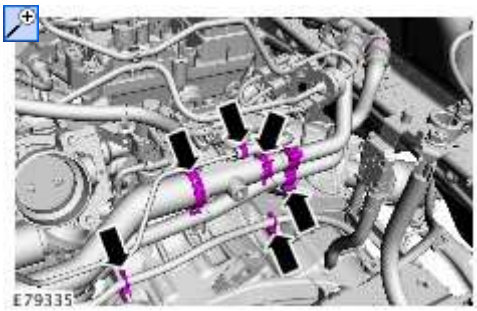
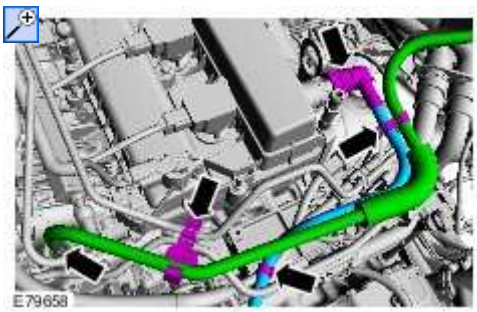


48. *General Equipment:* Hose clamp remover/installer



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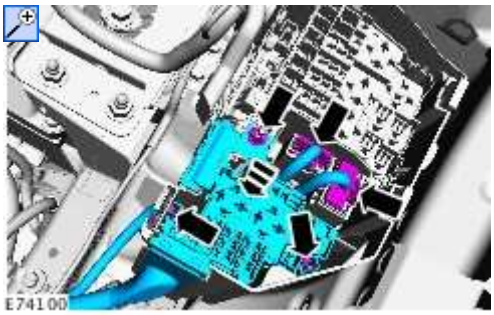

50. *Torque:* 12 Nm

51.

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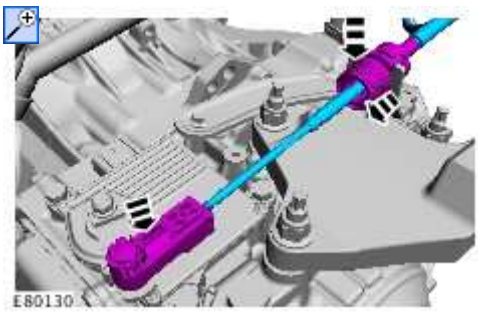
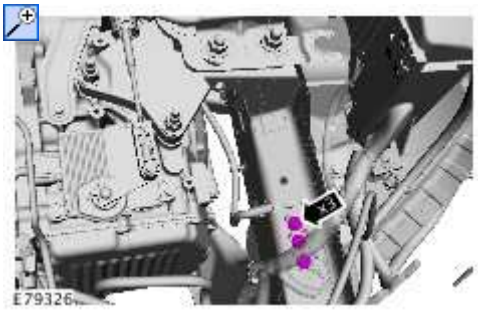
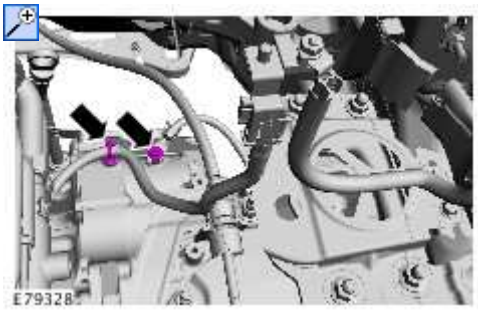
52.



53. *Torque:* 15 Nm



54. *Torque:* 15 Nm



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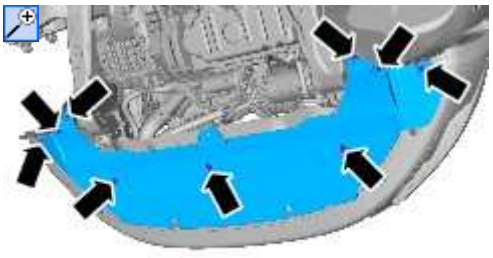

56. Refer to: Antriebsriemen - Zusatzaggregate (303-05 Antrieb - Zusatzaggregate - 2.5L Duratec (VI5), Removal and Installation).

57. Refer to: Kühlsystem entleeren, mit Kühlmittel auffüllen und entlüften (303-03 Kühlsystem - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), General Procedures).

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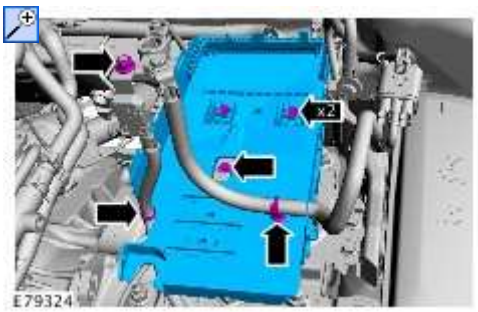
58. Refer to: Rad und Reifen (204-04 Räder und Reifen, Removal and Installation).

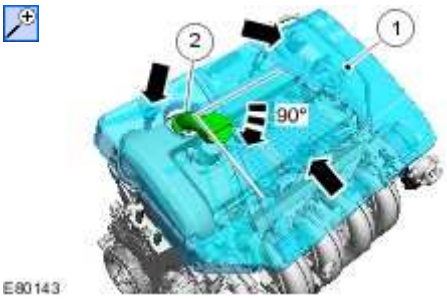


59. *Torque:* 12 Nm

60. Refer to: Batterie (414-01 Batterie, Befestigung und Batteriekabel, Removal and Installation).

61. Refer to: Fensterhebermotor initialisieren (501-11 Fenster, Rahmen und Betätigungsmechanismen, General Procedures).

62.



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Engine Data

Description	
Engine code	HUWA
Firing order	1-2-4-5-3
Emission level	Stage IV
Bore	83 mm
Stroke	93.2 mm
Cubic capacity	2522 cm³
Compression ratio	9 : 1
Power output at 5000 rpm	162 kW (220 PS)
Max. torque at 1500 rpm	320 Nm
Maximum engine speed (intermittent)	6800 rpm
Maximum engine speed (continous)	6500 rpm
Idle speed	800 rpm
Number of main bearings	6
Camshaft drive	Timing Belt
Maximum oil consumption	0.5 l/1000 Km

Engine Oil

Viscosity / ambient temperature	Type	Specification
Recommended engine oil		
SAE 5W-30 / below -20°C to over +40°C	Ford Formula E	WSS-M2C913-C
Alternative engine oils (for top-up only)		
SAE 10W-40 / -20°C to over +40°C	Ford Formula XR+	ACEA A3/B3
SAE 5W-40 / below -20°C to over +40°C	Ford Formula S	ACEA A3/B3

Engine Oil Capacity

Description	Liters
Service fill including filter	5.8
Service fill excluding filter	5.5

Engine Oil Pressure

Description	Bar
Minimum oil pressure at 800 - 850 rpm (normal operating temperature)	1.0
Minimum oil pressure at 4000 rpm (normal operating temperature)	3.5
Oil pressure relief valve opening pressure	4.8

Valve Clearance

Description	mm
Valve clearance (engine cold), intake	0.17 - 0.23
Valve clearance (engine cold), exhaust	0.37 - 0.43

Valves

Description	mm
Intake valve lenght	101.93 - 102.07
Intake valve shaft diameter	5.87 - 6.01
Intake valve guide clearance	0.05 - 0.07
Exhaust valve lenght	101.43 - 101.57
Exhaust valve shaft diameter	5.87 - 6.01
Exhaust valve guide clearance	0.05 - 0.07

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Valve Seats

Description	degree
Intake valve seat angle	45.33 - 45.67
Exhaust valve seat angle	45.33 - 45.67

Cylinder Head

Description	mm
Cylinder head height	149.25 - 149.55
Maximum mating face distortion (lengthwise)	0.05
Maximum mating face distortion (crosswise)	0.02
Maximum face milling	0.30

Camshafts

Description	mm
Intake camshaft lobe lift	8.68
Exhaust camshaft lobe lift	9.05

Crankshaft

Description	mm
Crankshaft axial clearance	0.08 - 0.19

Crankshaft Main Bearing Selection

	Code - Cylinder block					
	A		B		C	
Crankshaft main bearing for:	Cylinder block	Crankshaft main bearing carrier	Cylinder block	Crankshaft main bearing carrier	Cylinder block	Crankshaft main bearing carrier
Code - Crankshaft						
A	yellow medium	yellow medium	yellow medium	blue thick	blue thick	blue thick
B	red thin	yellow medium	yellow medium	yellow medium	yellow medium	blue thick
C	red thin	red thin	red thin	yellow medium	yellow medium	yellow medium

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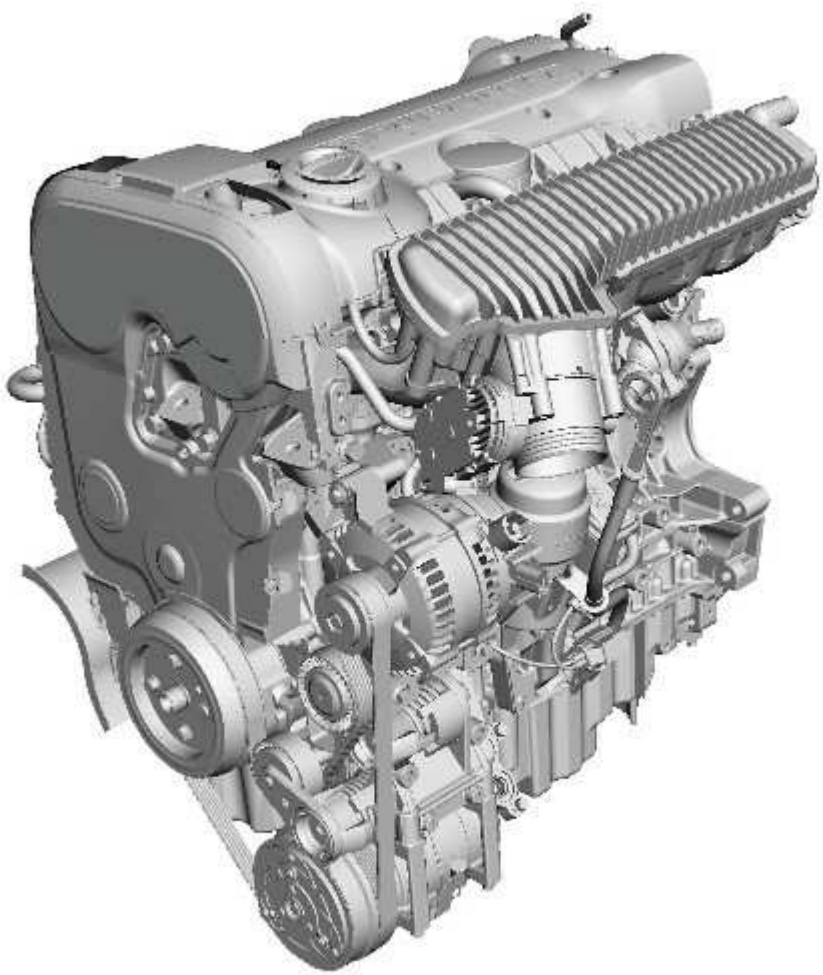
Description and Operation

2.5L Duratec-ST (VI5) engine



E62439

General

The 2.5L Duratec-ST (VI5) engine is a transversely mounted 5-cylinder, 20-valve, 2522 cm³, turbo engine.

The cylinder bore is 83 mm.

The stroke is 93.2 mm.

It has a compression ratio of 9:1.

The valve train is driven by a timing belt.

The valve timing of the intake and exhaust camshafts is adjusted by variable camshaft timing (VCT) control units.

The accessories are driven by two elastic multigroove belts.

The tension of the two multigroove belts is maintained automatically by two separate mechanical belt tensioners.

Engine management

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- Bosch ME 9.0 engine management system
- Knock control with two knock sensors
- Electronic throttle plate
- Electronic accelerator pedal
- Variable camshaft timing for intake and exhaust camshafts
- Fuel rail with combined fuel pressure and temperature sensor
- Sequential multi-port fuel injection
- Camshaft position (CMP) sensors for intake and exhaust camshafts.
- Crankshaft position (CKP) sensor

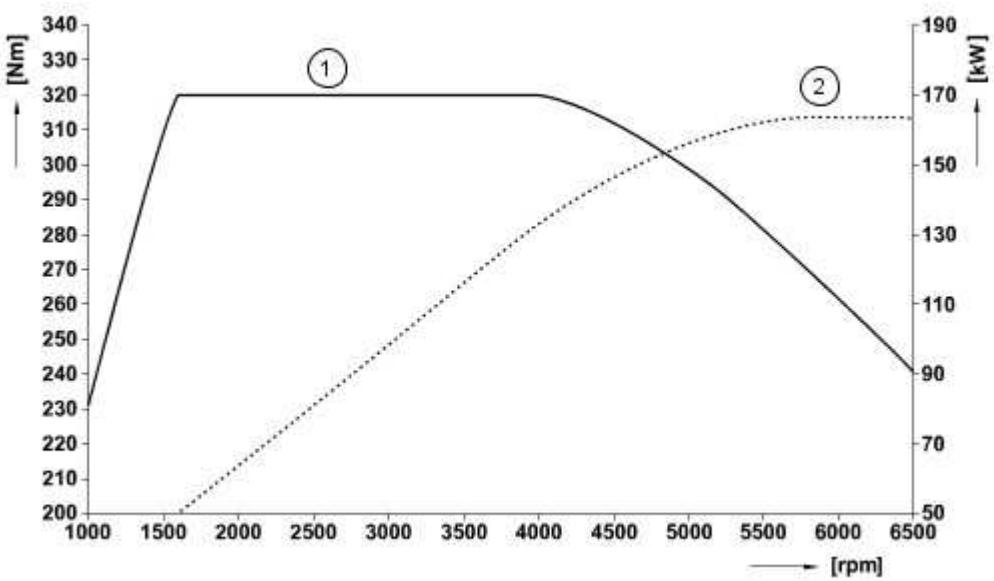
Engine emission control

- Complies with European emissions standard IV
- EOBD (European On-board Diagnostic) for the monitoring of emissions-related components.
- HO2S (Heated Oxygen Sensor), pre- and post-catalytic converter

Diagnosis

Diagnosis is performed using WDS (Worldwide Diagnostic System) via the DLC (Data Link Connector).

Engine power output and torque



E62614

Item	Part Number	Description
1	-	Torque curve
2	-	Power output curve

By the use of VCT for the intake and exhaust camshafts it is possible to attain maximum torque across a wide engine speed range.

The maximum torque of 320 Nm is available between 1600 and 4000 rpm.

Maximum power output of the engine is 166 kW (225 PS) at 6000 rpm.

2.5L Duratec-ST (VI5) engine

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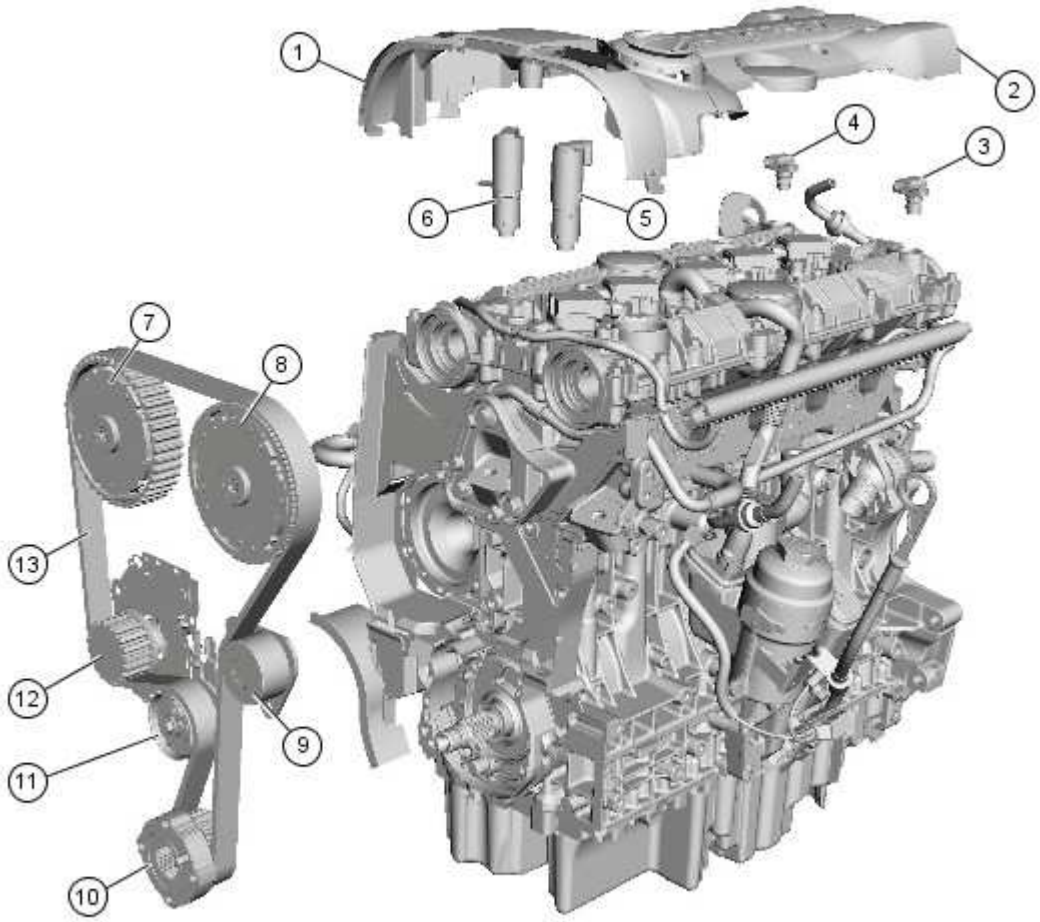

E62441

Item	Part Number	Description
1	-	Engine front cover
2	-	Engine rear cover
3	-	CMP sensor, intake camshaft
4	-	CMP sensor, exhaust camshaft
5	-	VCT oil control solenoid, intake camshaft
6	-	VCT oil control solenoid, exhaust camshaft
7	-	Exhaust VCT control unit
8	-	Intake VCT control unit
9	-	Timing belt idler pulley
10	-	Crankshaft timing belt pulley
11	-	Timing belt tensioner
12	-	Coolant pump pulley
13	-	Timing belt

Design

The 2.5L Duratec-ST (VI5) engine is a turbo charged engine with 5 cylinders and 20 valves with electronically-controlled dual VCT.

The entire engine is made of aluminum.

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The cylinder head consists of two parts.

The cylinder block consists of three parts.

A conventional cylinder head gasket is installed between the cylinder head and the cylinder block.

The gaskets between the other mating faces are fluid gaskets.

The two camshafts are supported by six bearing caps in the two halves of the cylinder head. The top half of the cylinder head consists of a valve cover with integral camshaft bearing caps.

Maintenance-free mechanical valve tappets are installed in the cylinder head.

The spark plug wells are additionally sealed by O-rings.

A cover has been fitted over the spark plug recesses as a protection against dirt and water.

The valve train is controlled via a timing belt which drives the intake VCT control unit and the exhaust VCT control unit. These control units then drive the respective camshafts.

The timing belt is tensioned via a mechanical timing belt tensioner.

The coolant pump is also driven via the timing belt.

The compact pent-roof combustion chamber design, the V-shaped arrangement of the valves and the centrally-positioned spark plugs ensure optimum combustion, low knock-susceptibility and low exhaust emissions.

The crankshaft has six bearings.

The shims are located at the 5th crankshaft main bearing.

The pistons are made of a homogeneous aluminum alloy with a graphite coating on the sides. This coating serves to reduce friction and dampen noise. The pistons are cooled from below via oil-spray nozzles screwed into the cylinder block.

Design of the variable camshaft timing system

This system is an electronically-controlled, dual, independent VCT control system that allows for independent, variable valve timing for the intake and exhaust camshafts.

A reference mark for the CMP sensor is machined into each camshaft.

The CMP sensors are located in the valve cover.

Function

The variable camshaft timing system is driven hydro-mechanically by means of the engine oil circuit.

Provided for this purpose on the drive side of each of the camshafts is a electronically-controlled flow valve with an integral spring mechanism (VCT oil control solenoid), which is supplied with the current engine-speed and load values by the powertrain control module (PCM). Based on these input signals, a larger or smaller camshaft rotation angle is achieved relative to the crankshaft. The CMP sensors register the position of the camshafts and transmit this information to the PCM.

Camshafts

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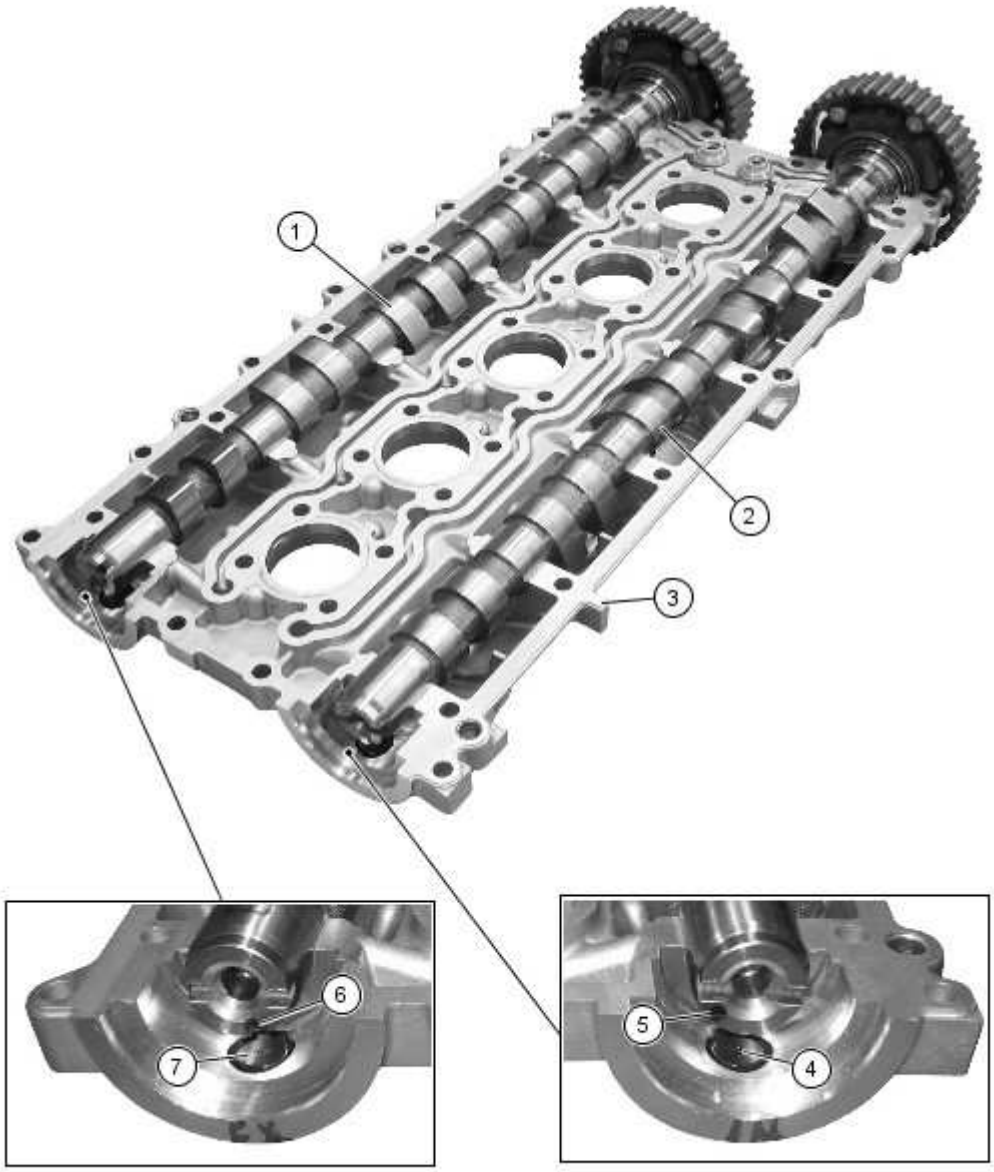

E62570

Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Intake camshaft
3	-	Valve cover / upper camshaft bearings
4	-	CMP sensor for intake camshaft
5	-	Intake camshaft reference mark
6	-	Exhaust camshaft reference mark
7	-	CMP sensor for exhaust camshaft

Recesses are provided on the ends of the camshafts; these are for attaching the new special tool (Locking Tool, Camshaft 303-1183) for locking the camshafts.

Threads have been cut into the camshafts for attaching the special tool (303-1178).

NOTE: The new special tool (303-1178) can only be attached when the camshafts are precisely set to the timing marks.

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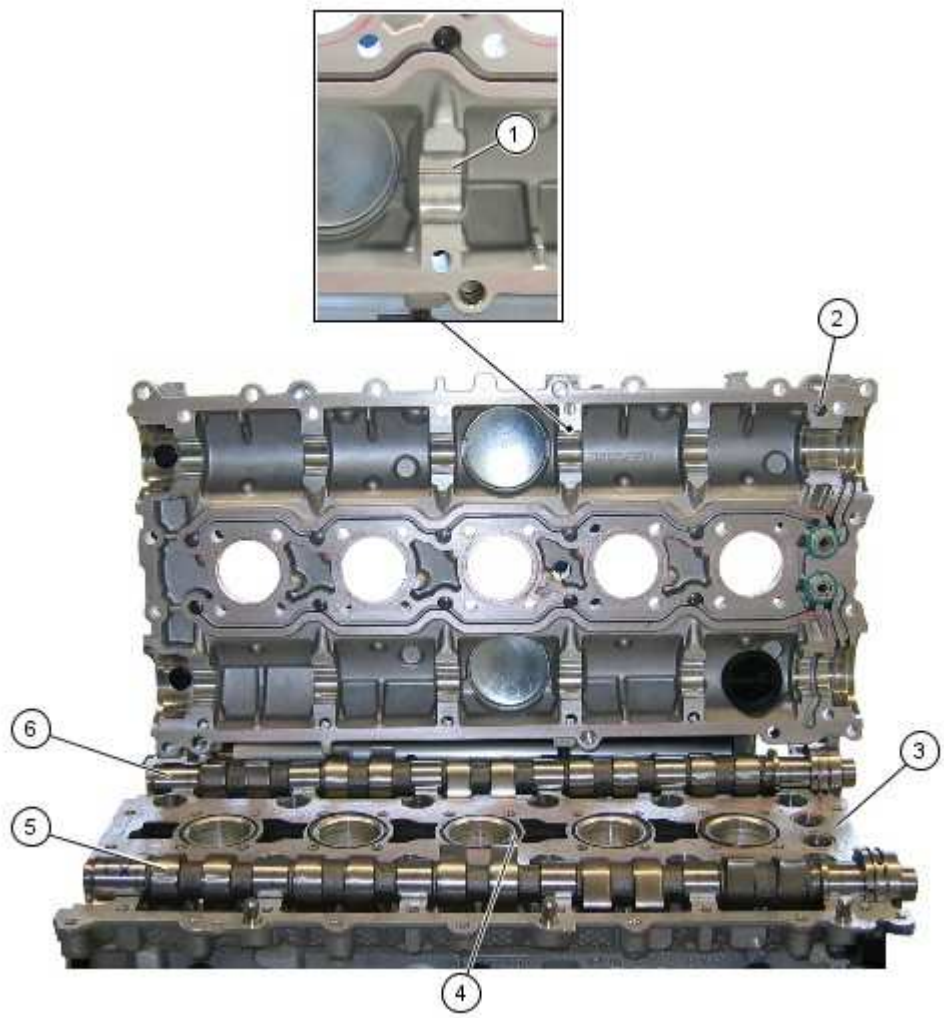
Refer to the workshop literature for the exact procedure for attaching and using the new special tool (303-1178).

For detection of the CMP sensor signals, reference marks in the form of grooves have been machined into the ends of the camshafts. When the camshafts are set precisely to the timing marks, the machined mark on the exhaust camshaft is located roughly at the 5 o'clock position and the machined mark on the intake camshaft is located at 8 o'clock.

No marks have been provided on the camshafts in production; we therefore recommend marking the camshafts before removing them.

Camshaft bearings

Valve cover and cylinder head



E62857

Item	Part Number	Description
1	-	Camshaft bearings
2	-	Valve cover
3	-	Cylinder head
4	-	Spark plug well sealing ring
5	-	Exhaust camshaft
6	-	Intake camshaft

The camshafts are supported in the cylinder head (lower camshaft bearings) and in the valve cover (upper camshaft bearings) by six bearings.

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VCT (Variable Camshaft Timing)

VCT control units

The engine oil is pumped from the oil pan via the VCT oil control solenoids to the control units of the intake and exhaust camshaft as needed. Here, the camshaft timing is advanced or retarded, based on the input signals from the PCM.

The VCT control units for the intake and exhaust camshafts are moved into the locked base position when the engine is stopped through the engagement of a spring-loaded locking pin.

The movement to the locked base position is assisted by the tensile force of the timing belt for the intake VCT control unit.

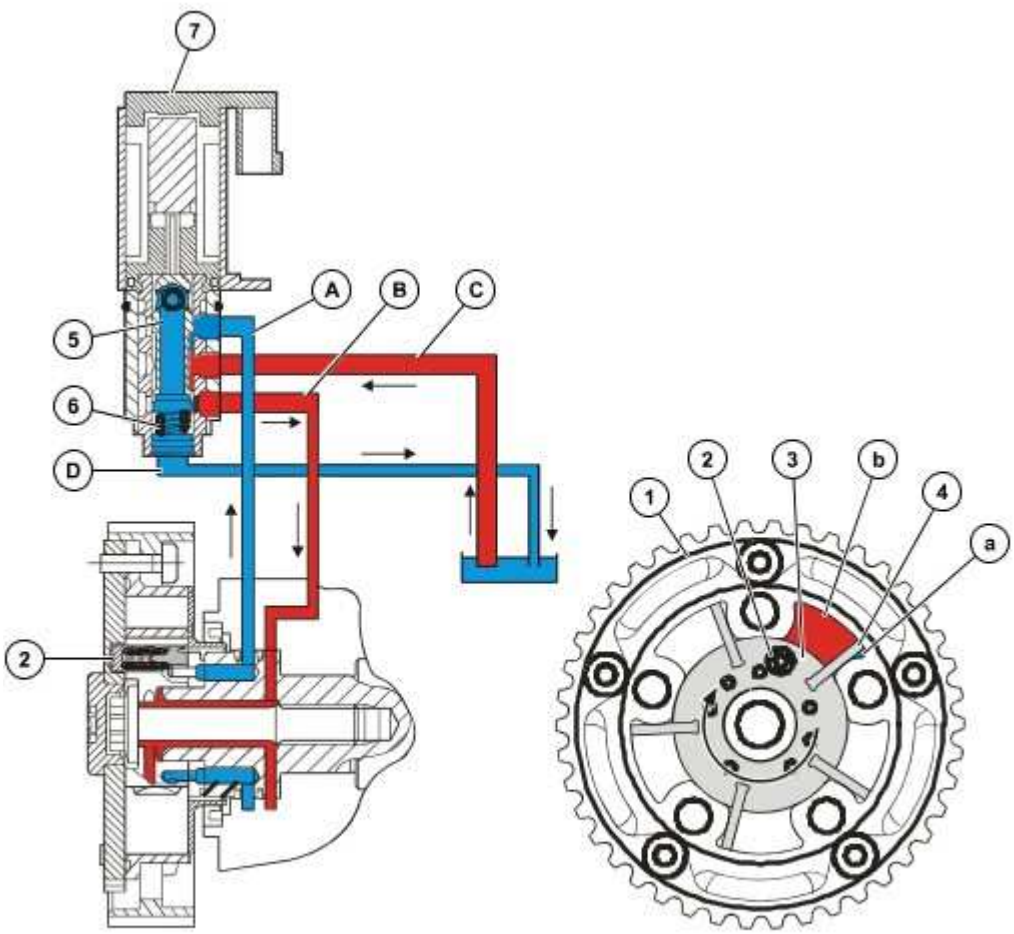
With the exhaust VCT control unit, a spring inside the control unit additionally assists in reaching the locked base position.

The intake VCT control unit is in the "retarded timing" position and the exhaust VCT control unit is in the "advanced timing" position when in the locked base position. When the engine is started, the lock is hydraulically released when a certain EOP (Engine Oil Pressure) is reached.

The procedures must therefore be strictly adhered to when performing adjustment work.

The intake and exhaust VCT control units can only be replaced as complete units during servicing.

Timing retard



E62711

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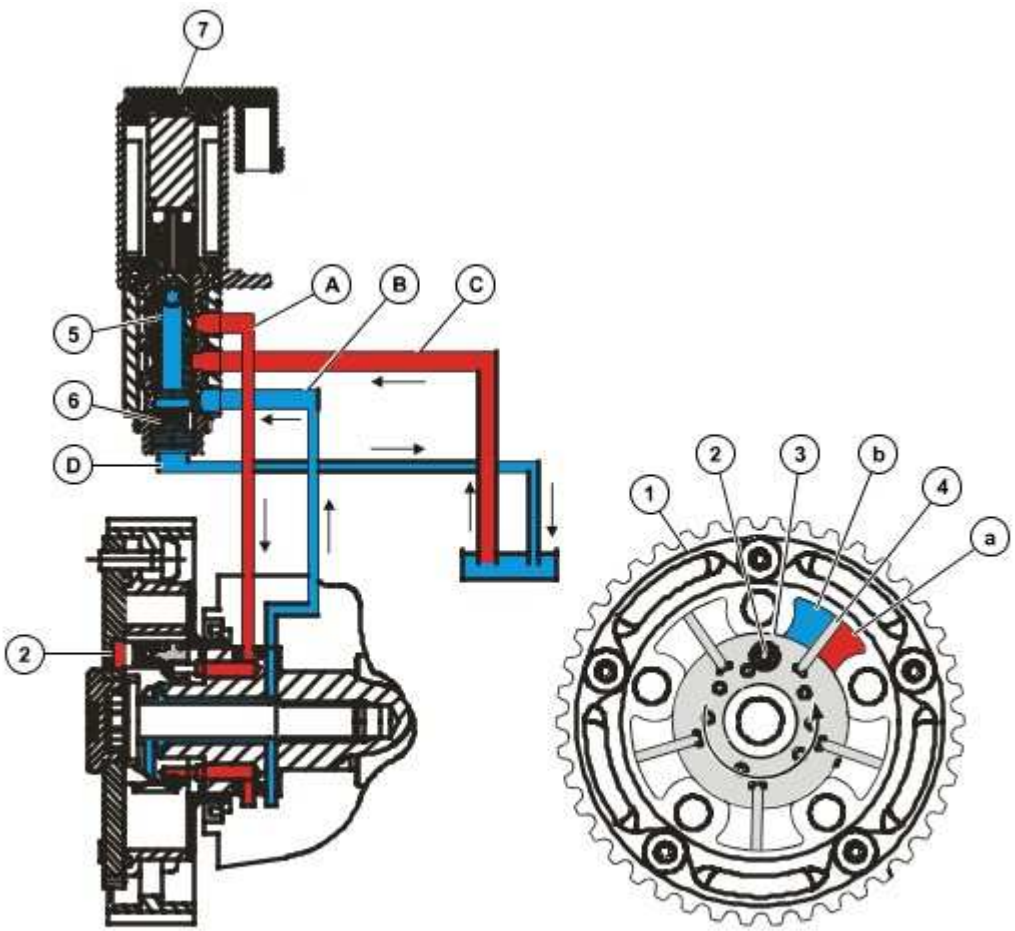
Item	Part Number	Description
1	-	Camshaft pulley
2	-	Spring-loaded locking pin
3	-	Rotor
4	-	Rotor vane
5	-	Plunger
6	-	Return spring
7	-	VCT oil control solenoid
A	-	Duct connected to chamber (a)
B	-	Duct connected to chamber (b)
C	-	Oil feed duct
D	-	Oil return duct

The engine oil is drawn from the oil pan and routed to the camshaft oil ducts via the engine oil circuit before being routed from there to the VCT oil control solenoid (7) and to the locking pin (2). This releases the locking pin (2) and separates the positive engagement between the camshaft pulley (1) and the rotor (3). When the control unit is being retarded, the chamber (b) fills with engine oil. The rotor (3) starts to turn clockwise as a result of the EOP prevailing in the chamber (b). The engine oil returning from the chamber (a) flows via the oil return duct (D) to the VCT oil control solenoid and from there back into the oil pan.

Timing advance



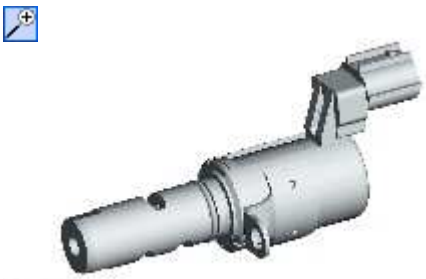
E62710

http://vnx.su

Item	Part Number	Description
1	-	Camshaft pulley
2	-	Spring-loaded locking pin
3	-	Rotor
4	-	Rotor vane
5	-	Plunger
6	-	Return spring
7	-	VCT oil control solenoid
A	-	Duct connected to chamber (a)
B	-	Duct connected to chamber (b)
C	-	Oil feed duct
D	-	Oil return duct

When the VCT control unit is being advanced, the chamber (a) fills with engine oil. The rotor (3) starts to turn counter-clockwise as a result of the EOP prevailing in the chamber (a). This completes the advance adjustment. The engine oil returning from the chamber (b) flows via the oil return duct (D) to the VCT oil control solenoid and from there back into the oil pan.

VCT oil control solenoid



E53049

The VCT oil control solenoids are located in the front area in the centre on the valve cover. The purpose of the VCT oil control solenoids is to supply engine oil to the VCT control units in accordance with the actuation by the PCM. This causes the camshaft/valve timing to be either advanced or retarded.

Cylinder block

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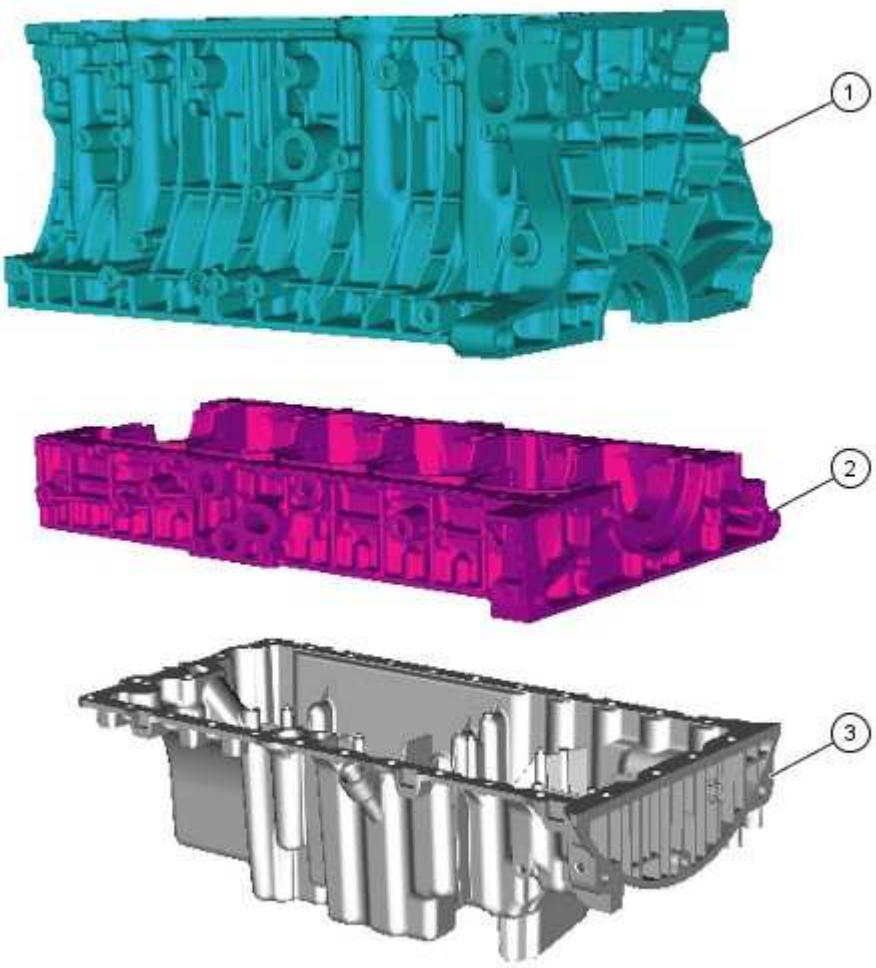

E64016

Item	Part Number	Description
1	-	Cylinder block
2	-	Ladder frame
3	-	Oil pan

The cylinder block consists of three parts. These are the cylinder block, ladder frame and oil pan.

The cylinder block has five cylinder liners made of cast iron, which cannot be replaced.

The ladder frame serves as a reinforcement and also forms the lower crankshaft bearings.

The oil pan supports the sturdy construction and serves as an additional reinforcement.

Crankshaft

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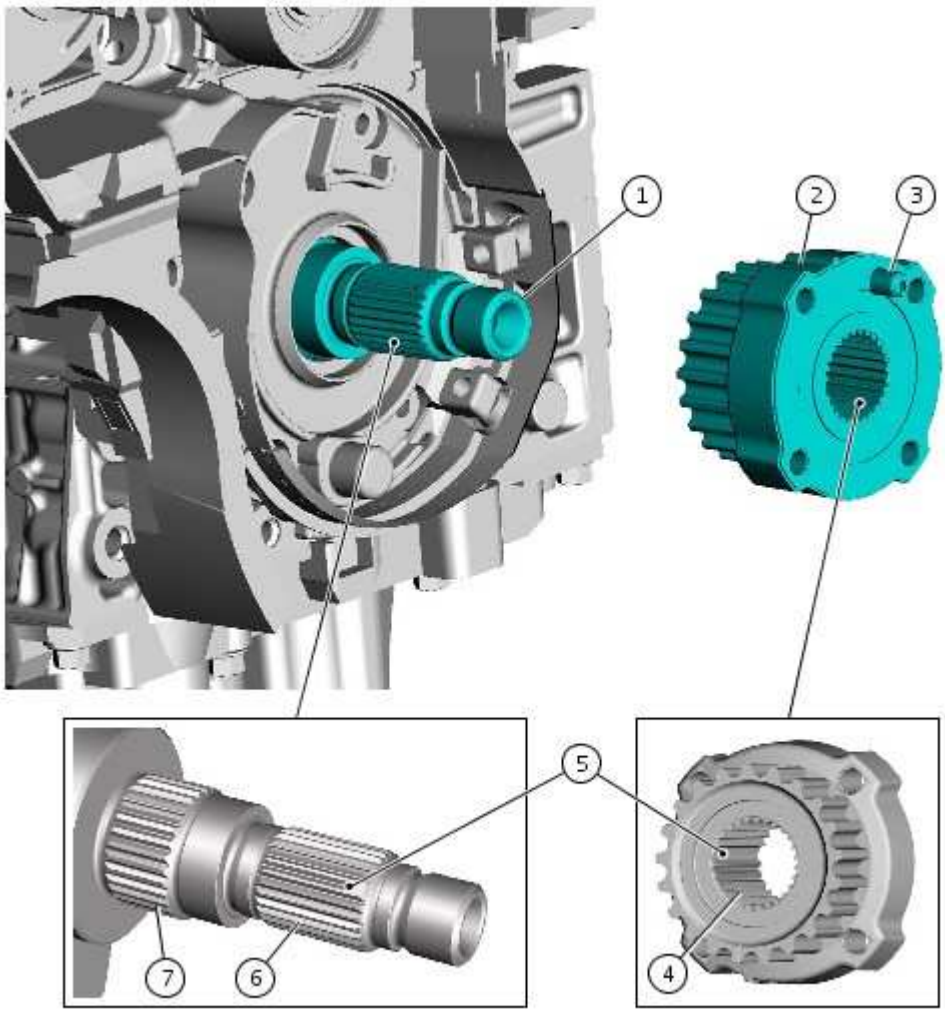

E62853

Item	Part Number	Description
1	-	Crankshaft
2	-	Timing belt pulley
3	-	Cylindrical pin
4	-	Timing belt pulley splines
5	-	Wide spline
6	-	Crankshaft outer splines
7	-	Crankshaft inner splines

The forged crankshaft in the 2.5L Duratec-ST (VI5) engine is supported in the cylinder block (upper crankshaft bearings) and in the ladder frame (lower crankshaft bearings) by six bearings.

The shims are located at the 5th crankshaft main bearing.

Located on the drive side of the crankshaft are two sets of splines. The inner splines drive the oil pump. The outer splines engage in the timing belt pulley.

The timing belt pulley can only be pushed onto the outer shaft splines in one specific position. For this purpose, one spline on the timing belt pulley and one on the crankshaft have been made wider.

The cylindrical pin secures the mass damper.

Valve timing

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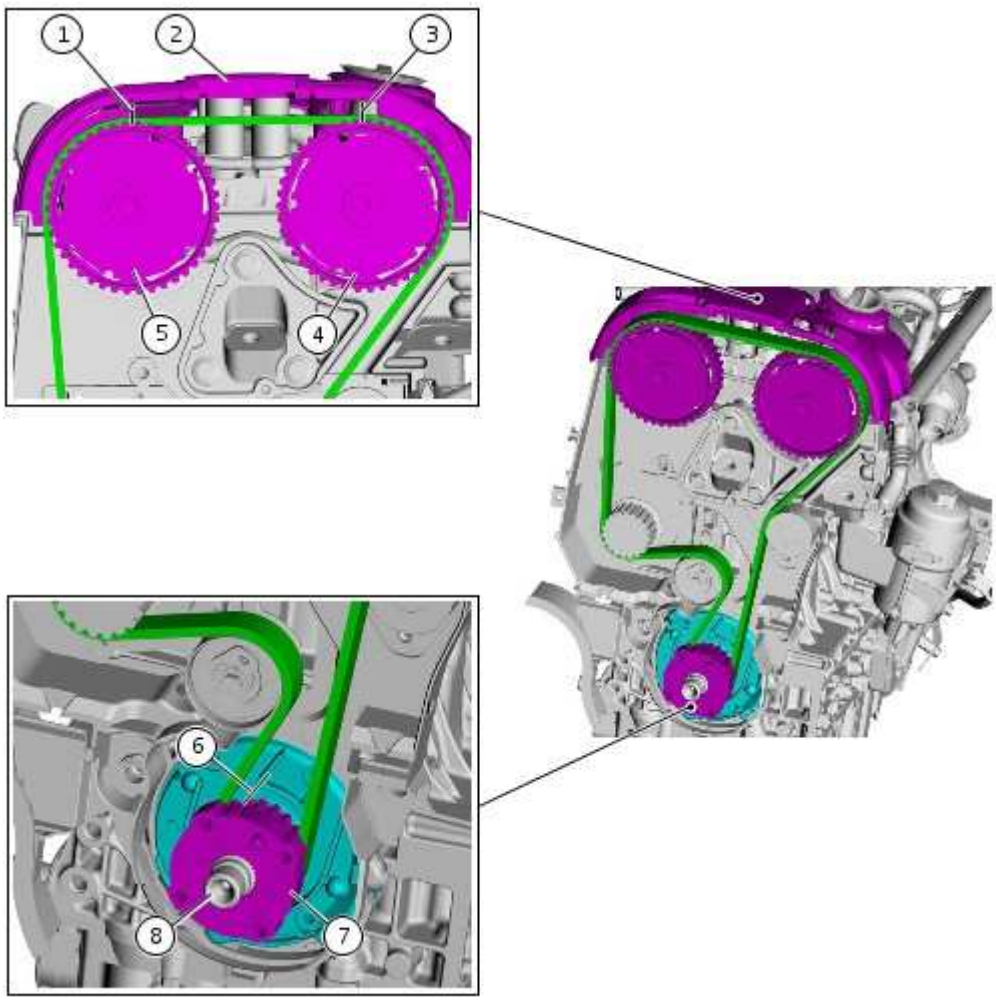
Timing marks



E62440

Item	Part Number	Description
1	-	Exhaust camshaft pulley timing mark
2	-	Engine front cover with timing marks
3	-	Intake camshaft pulley timing mark
4	-	Intake camshaft pulley
5	-	Exhaust camshaft pulley
6	-	Crankshaft timing belt pulley timing mark
7	-	Crankshaft timing belt pulley
8	-	Crankshaft

When checking the valve timing, ensure that the timing marks are aligned exactly.

The front engine cover must always be installed when checking and adjusting the valve timing, i.e. timing belt tension, as the timing marks for both camshaft pulleys are provided on its front end.

The mark on the crankshaft timing belt pulley must be in exact alignment with the mark on the oil pump housing.

Timing belt tension

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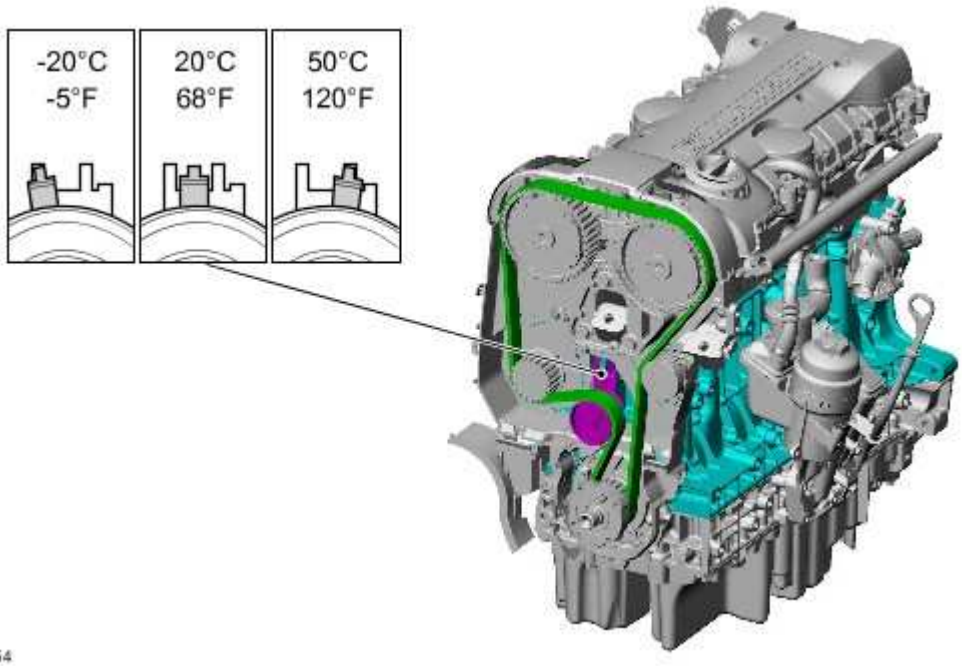

E62854

The interior mechanism of the timing belt tensioner comprises a spring and a friction element. The friction element serves to absorb small vibrations and fluctuations in engine speed. The spring ensures the correct timing belt tension, regardless of wear and temperature.

The tension of the timing belt should be set when the engine is cold.

NOTE: If the engine temperature is higher or lower, remember that a different position is specified for the timing belt tensioner (see illustration).
The timing belt should be fitted starting from the crankshaft over the idler pulley, the intake and exhaust camshaft pulleys, the coolant pump and finally on the timing belt tensioner.

Once the timing belt has been correctly tensioned, the engine must be rotated by hand two turns clockwise at the crankshaft in order to allow a subsequent check of the timing belt tension and adjustment.

No direction of movement is specified when using a new timing belt. If, however, the old timing belt is reused, the direction of movement must be marked prior to removal.

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Diagnosis and Testing

General Equipment

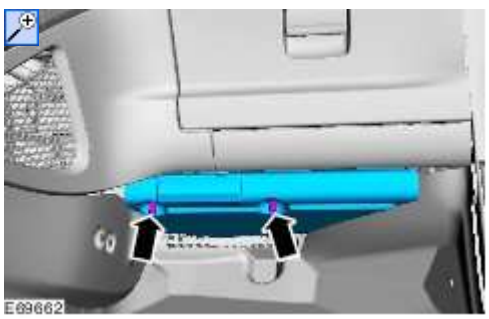
Worldwide Diagnostic System (WDS).

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

Measure the compression pressure

NOTE: The powertrain control module (PCM) receives an error message when the fuel pump relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory using worldwide diagnostic system (WDS) after completing the compression test.
NOTE: Valve clearance must be set correctly before performing a compression test. Run the engine to normal operating temperature.
NOTE: The varying design of compression checking devices and fluctuating starter motor speeds normally only allows for a comparison to be made of the compression pressures in all cylinders.



1. **1.** Remove the central junction box (CJB) cover.

2. **2.** Open the CJB and remove fuse 22.

3. NOTE: The engine will start, run for a few seconds and then stop.
   3. Start the engine.

4. **4.** Disconnect the ignition coil-on-plug.
   REFER to: Zündspule - Direktzündung (303-07C, Removal and Installation).

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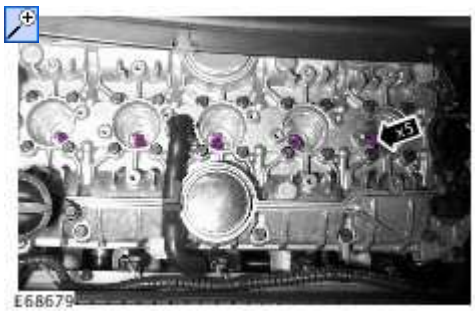
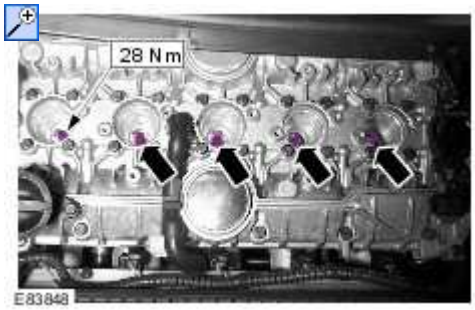


5. **5.** Remove the spark plugs.

NOTE: Operate the starter motor with wide open throttle until the reading on the compression tester stops rising.

6. **6.** Perform the measurement on each cylinder according to the instructions provided by the manufacturer of the measuring device. Use a compression pressure recorder with a suitable adapter.



7. **7.** Install the spark plugs.

8. **8.** Install the ignition coil-on-plug.
   REFER to: Zündspule - Direktzündung (303-07C, Removal and Installation).

9. **9.** Install fuse 22 and close the CJB.

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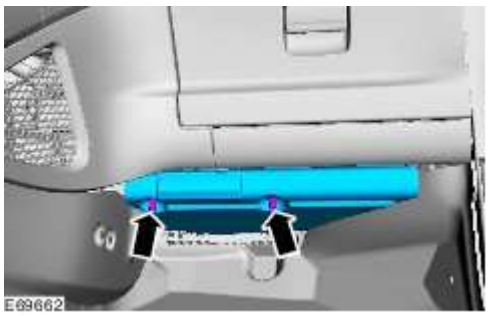


10. **10.** Install the CJB cover.

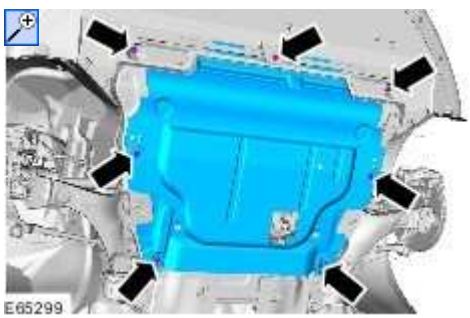
11. **11.** Using worldwide diagnostic system (WDS), clear the fault codes from the powertrain control module (PCM).

Measuring the oil pressure

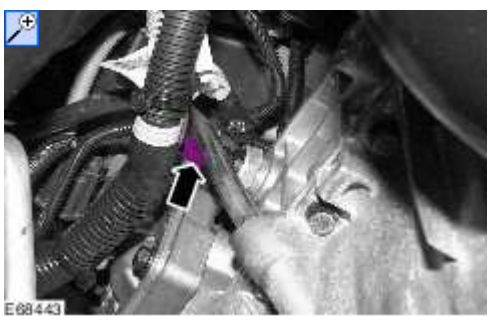
NOTE: The oil pressure is defined by several factors. Among others, this includes the engine speed, oil temperature, oil viscosity and the degree of filter contamination.
NOTE: Measure the oil pressure at the specified engine speed.

1. **1.** Raise vehicle. REFER to: (100-02 Fahrzeug anheben)

   Anheben mit Wagenheber (Description and Operation),
   Anheben mit Hebebühne (Description and Operation).



2. **2.** Remove the engine under shield.



3. **3.** Disconnect the oil pressure switch electrical connector from the oil pressure switch.

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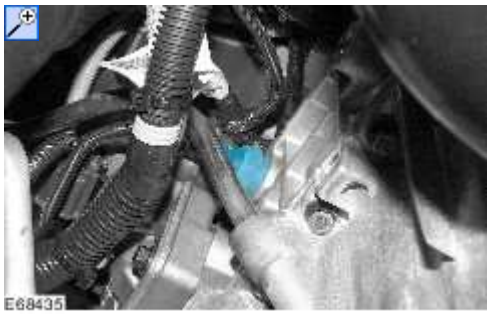

4. **4.** Remove the oil pressure switch.

5. **5.** Attach the oil pressure gauge with the oil pressure gauge connector to the oil pressure switch bore, and position it to allow reading from above.

6. **6.** Lower the vehicle.

7. NOTE: Measure the oil pressure at an oil temperature of 100° C.
   NOTE: Measure the oil pressure at idle speed and at 4000 rpm.
   NOTE: Minimum oil pressure at idle speed: 1.0 bar.
   NOTE: Minimum oil pressure at 4000 rpm: 3.5 bar.
   NOTE: Maximum oil pressure: 4.8 bar.
   7. Check the oil pressure

8. **8.** Raise vehicle. REFER to: (100-02 Fahrzeug anheben)

   Anheben mit Wagenheber (Description and Operation),
   Anheben mit Hebebühne (Description and Operation).

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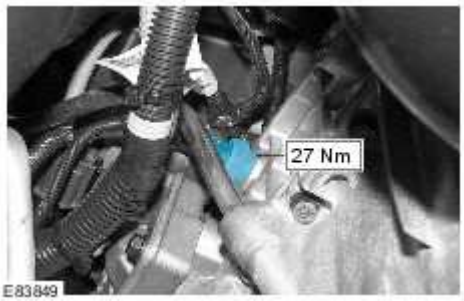
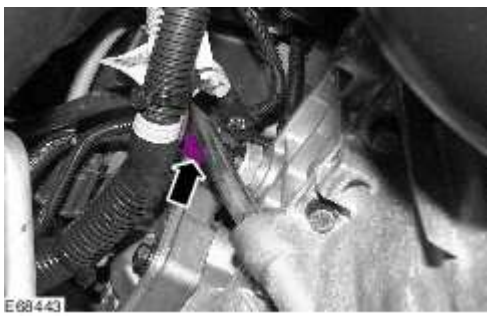
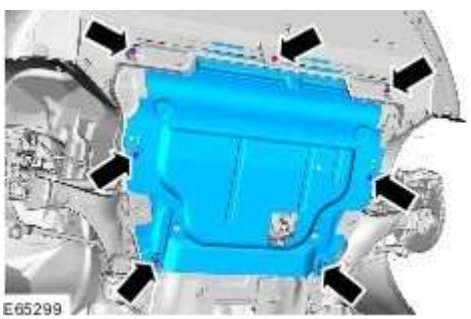
9. **9.** Detach the oil pressure gauge and connector from the oil pressure switch bore.
10. **10.** Coat the oil pressure switch with adhesive.



11. **11.** Install the oil pressure switch.



12. **12.** Push on the oil pressure switch connector.



13. **13.** Install the engine under shield.
14. **14.** Lower the vehicle.

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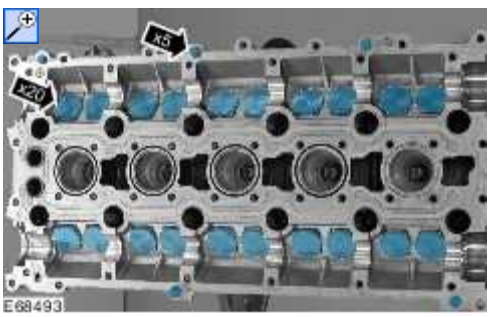
General Procedures

Special Tool(s)

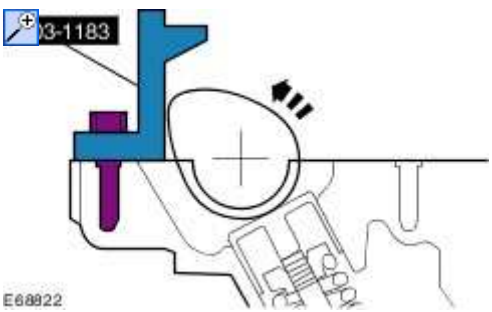
	303-1183 Holder, Camshaft

1. Remove the camshafts.

   Refer to: Camshafts (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

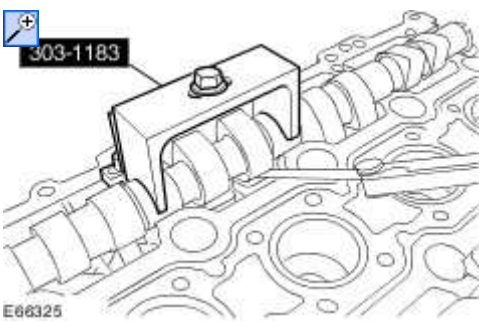


2. CAUTION: Make sure that the valve tappets are installed in their original locations.



3. Install only one pair of tappets and the camshaft for the first measurement.

   Special Tool(s): 303-1183
   Torque: 17 Nm



4. Measure the valve clearance and if neccessary, adjust by installing new tappets.

   Special Tool(s): 303-1183
   Torque: 12 Nm

5. Repeat the measuring procedures for all cylinders on the intake and on the exhaust side.

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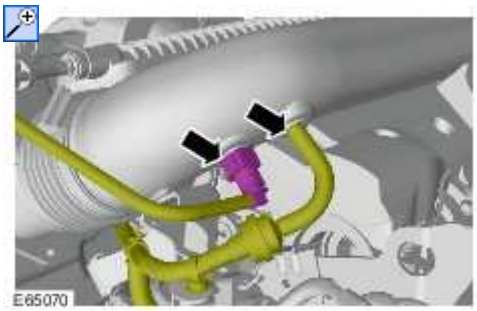
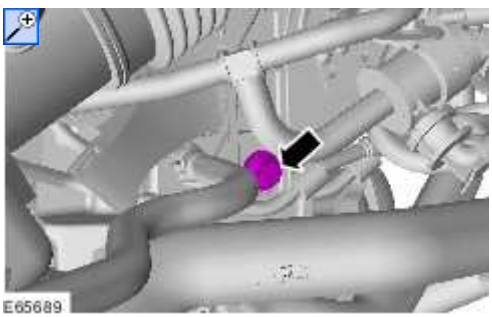
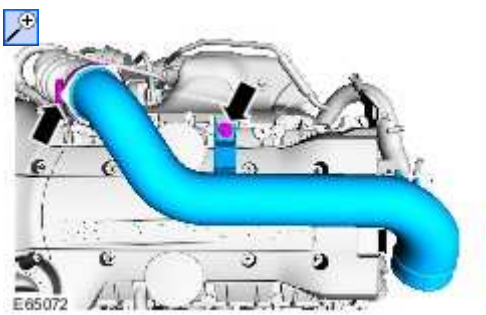
Removal and Installation

Removal

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
5. 

6. *Torque:* 10 Nm


7. *Torque:* 10 Nm


8.

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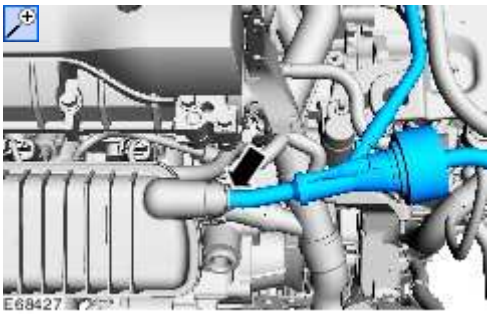

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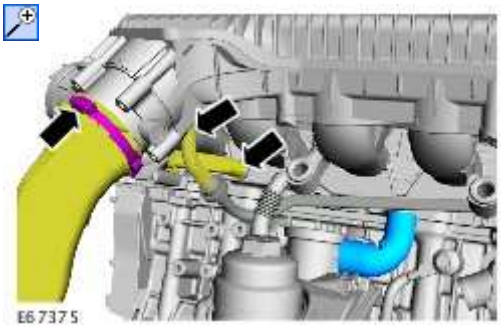

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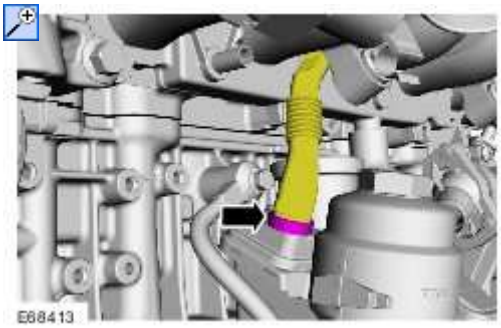
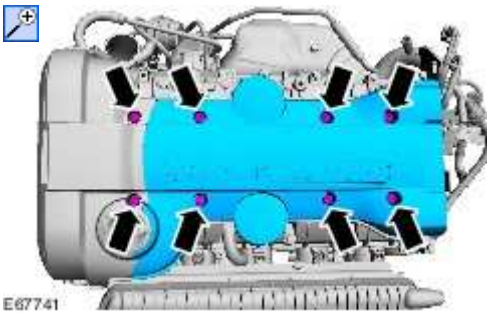
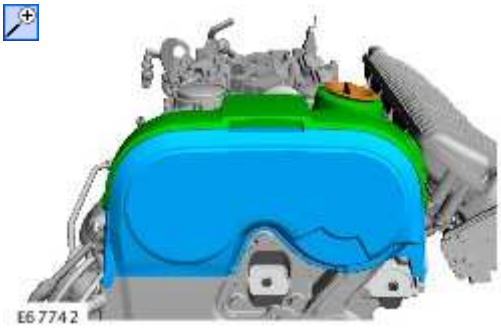


11. *Torque:* 10 Nm



12.



13.

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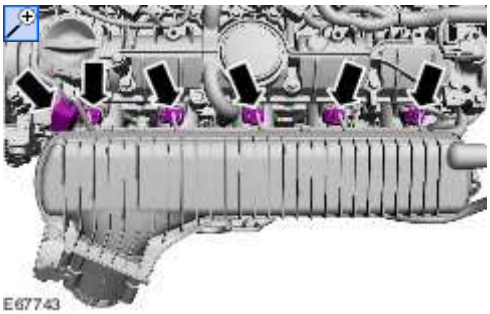

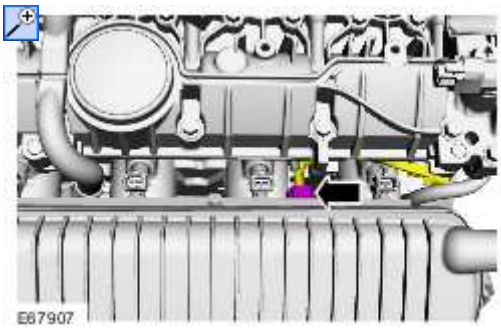

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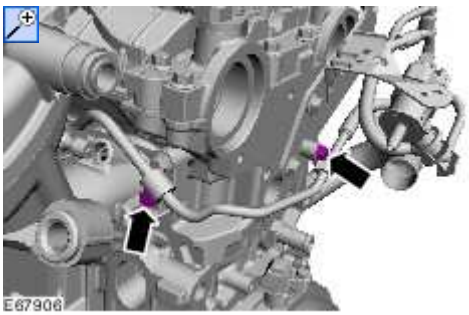
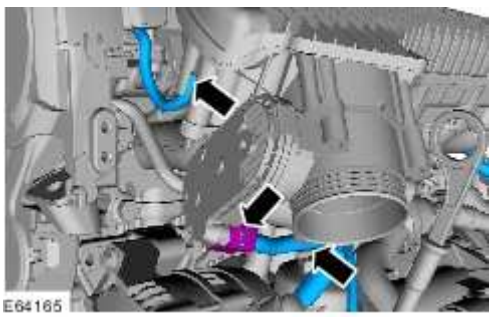


15. *Torque:* 10 Nm



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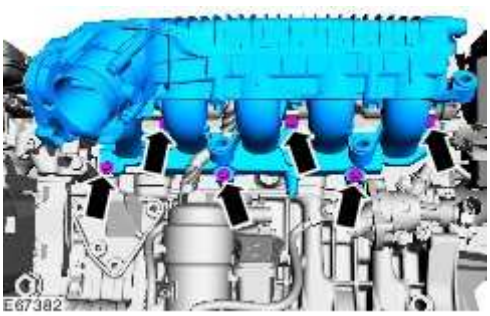

17. *Torque:* 19 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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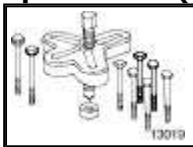
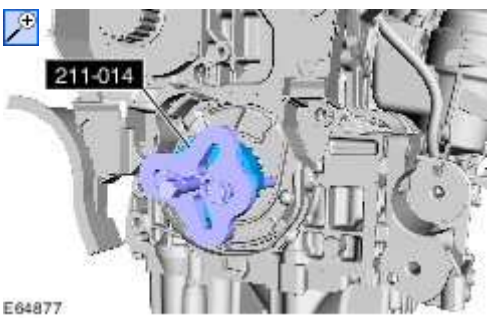
Removal and Installation

Special Tool(s)

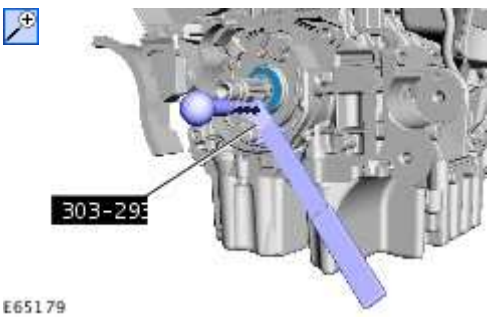
	211-014 Remover, Steering Wheel
	303-1180 Installer, Crankshaft Front Seal
	303-293 Remover, Crankshaft Seal

Removal

1. Refer to: Timing Belt (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
2. *Special Tool(s):* 211-014



3. *Special Tool(s):* 303-293



Installation

1. *Special Tool(s):* 303-1180

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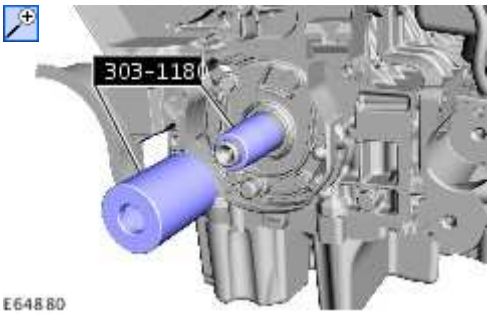

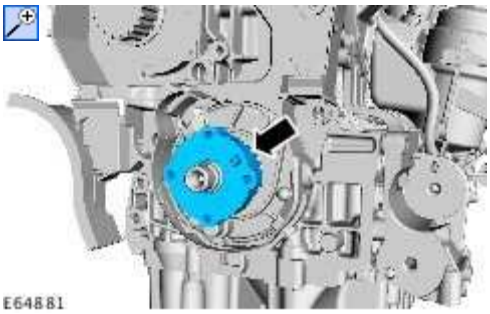

2. NOTE: The crankshaft timing pulley can only be installed in 1 position on the crankshaft splines.

3. Refer to: Timing Belt (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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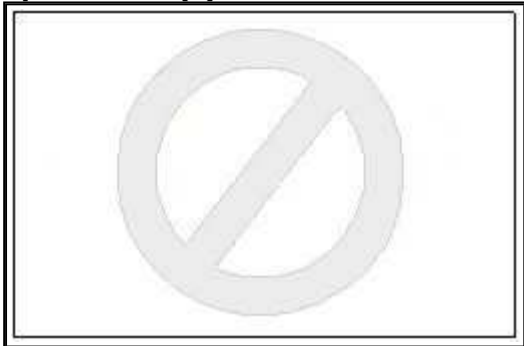
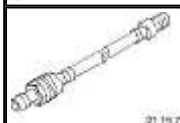
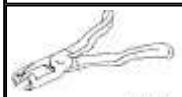
Removal and Installation

Special Tool(s)

	303-361B Compressor, Valve Spring
	303-361B-06 Adapter for 303-361B
	303-363 Adapter, Air Supply (Cylinder Head)
	303-508 Pliers, Valve Stem Seal

Removal

1. Remove the camshafts.

   Refer to: Camshafts (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

2.

3. Using the special tool, apply 7 to 10 bar of compressed air into the cylinder.

   Special Tool(s): 303-363

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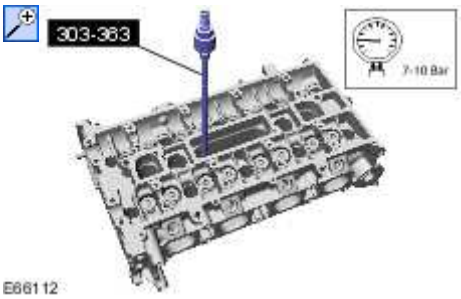
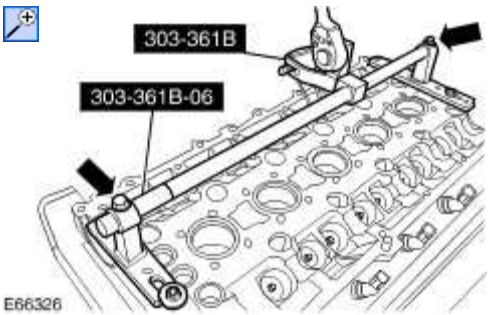
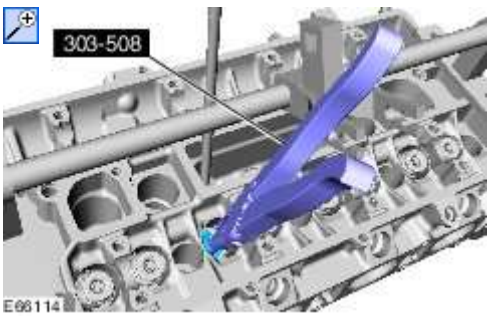




4. *Special Tool(s):* 303-361B, 303-361B-06



5. *Special Tool(s):* 303-508

Installation

1. To install reverse the removal procedure.

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Pr

Removal and Installation

Special Tool(s)

	303-1178 Timing Tool Camshaft

Materials

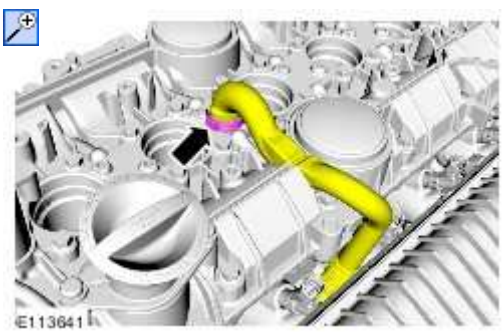
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA

General Equipment

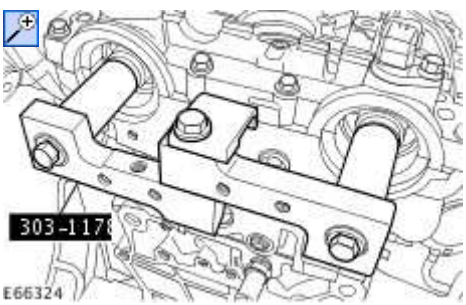
Punch

Removal

1. Refer to: Camshaft Seal (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



2.



3. *Remove the Special Tool(s):* 303-1178

4. *General Equipment:* Punch

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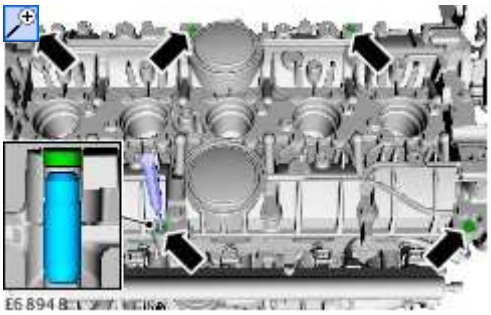
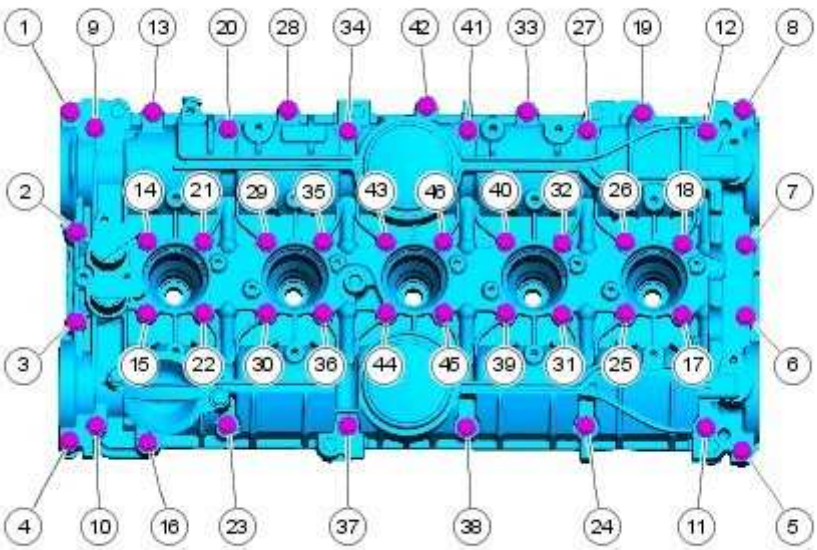


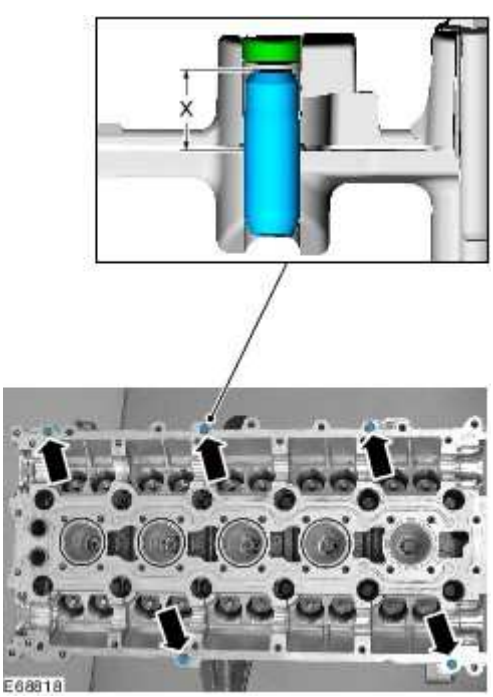
5. Loosen each bolt turns at a time until all bolts a removed.



E68743

Installation

1. Refer to: Valve Clearance Adjustment (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Genera Procedures).
2.
   - X = 15 mm.



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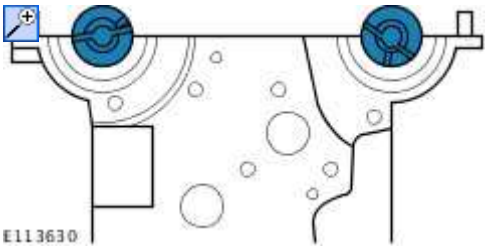
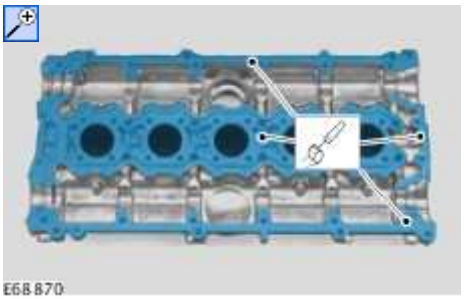


3. Apply a thin coating.

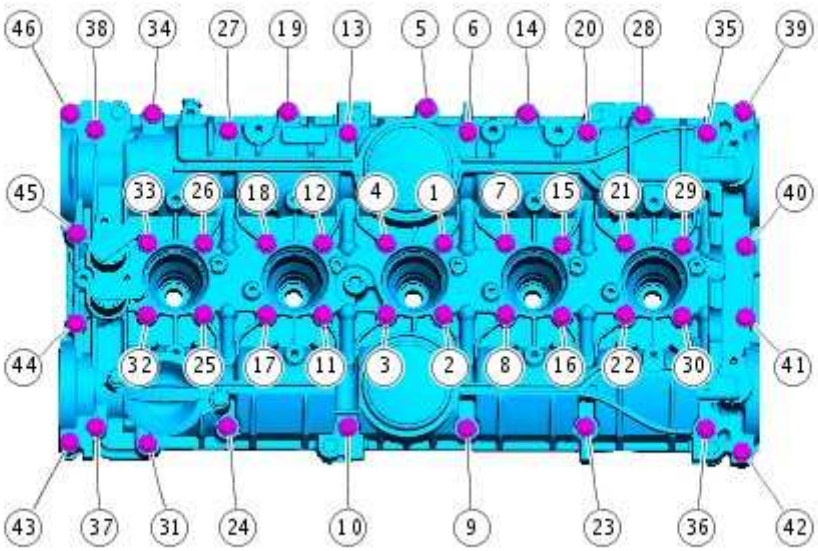
   Material: Engine Oil - 5W-30 (WSS-M2C913-C)



4. *Material:* Flange Sealant - Anaerobic LP (WSK-M2G348-A7 / 5U7J-M2G348-BA)

5. Tighte
   each
   bolt 2
   turns
   a time

   Torqu
   17 Nn



6. *Install the Special Tool(s):* 303-1178
   Torque: 10 Nm

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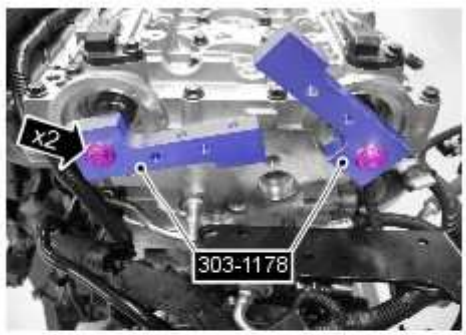

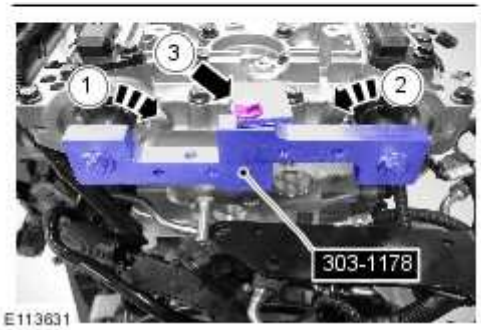

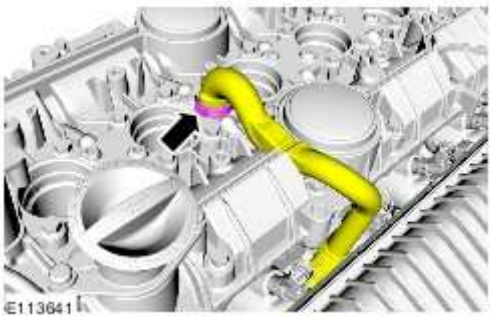

7.

8. Refer to: Camshaft Seal (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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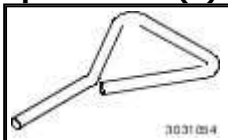
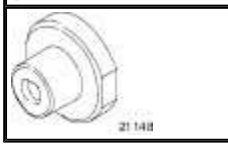
Print

Removal and Installation

Special Tool(s)

	303-1054 Locking Tool, Timing Belt Tensioner
	303-1178 Timing Tool Camshaft
	303-1179 Holding Wrench, Crankshaft
	303-1182 Timing Tool, Crankshaft
	303-318 Aligner/Installer, Crankshaft Front Seal

General Equipment

Hose clamp remover/installer
Trolley jack

Removal

1. Remove the following items:
    1. Refer to: Ignition Coil-On-Plug (303-07B Engine Ignition - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
    2. Refer to: Starter Motor (303-06C Starting

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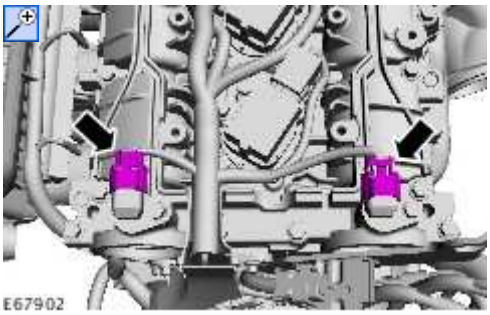
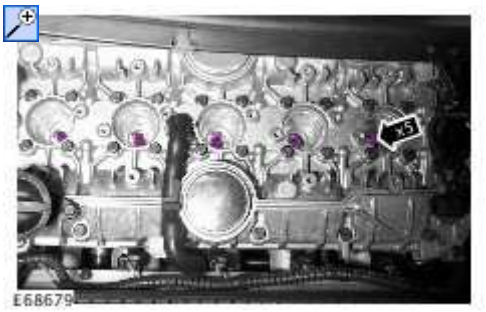
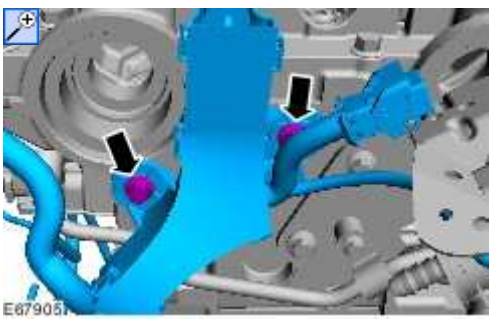
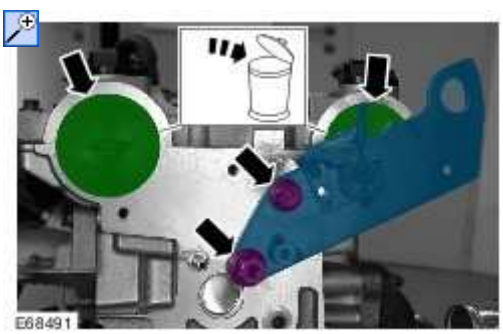
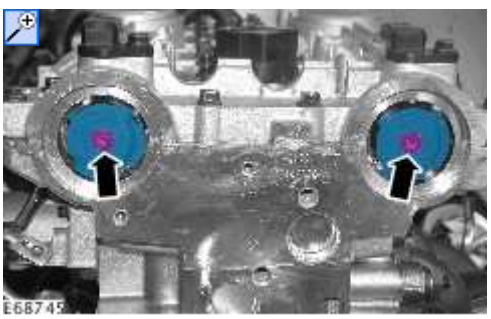
System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

2. 

3. 

4. 

5. 

6. 

7. Refer to: Timing Belt (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
8. *Install the Special Tool(s):* 303-1178
   Torque: 10 Nm

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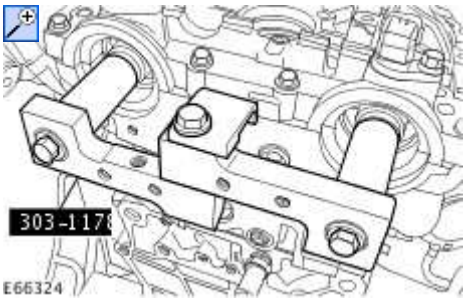
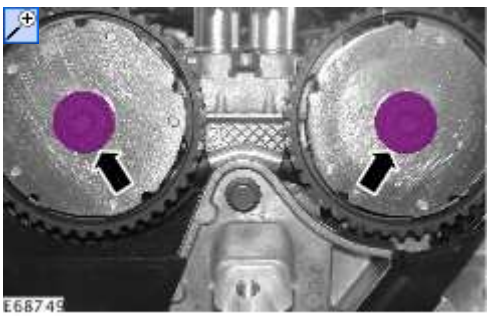
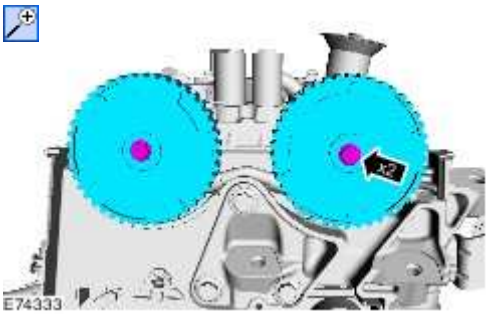


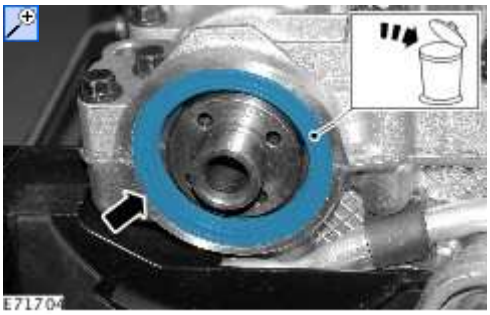
9.



10.



11.



Installation

1. *Special Tool(s):* 303-318

2. NOTE: Only tighten the bolts finger tight at this stage.

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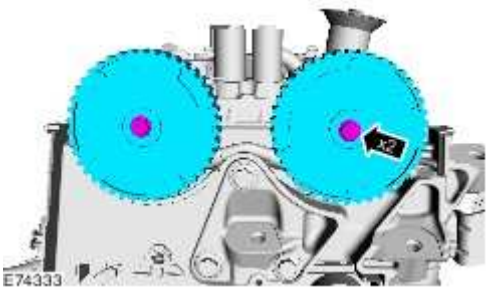
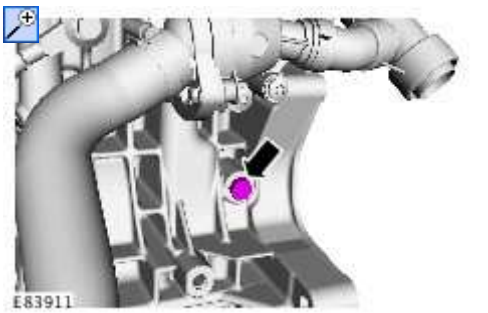
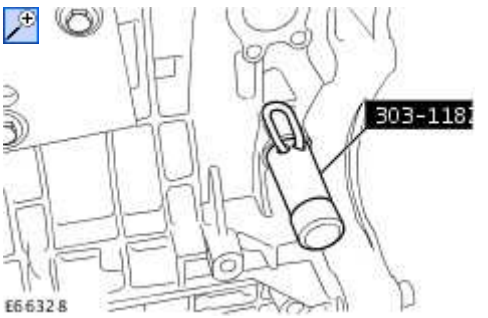


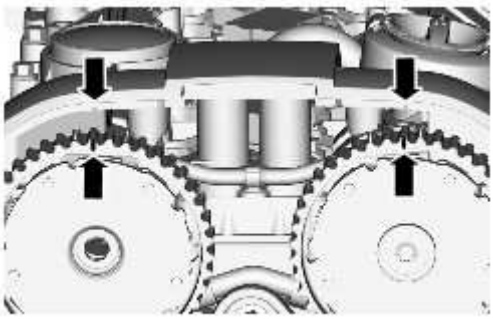


3.

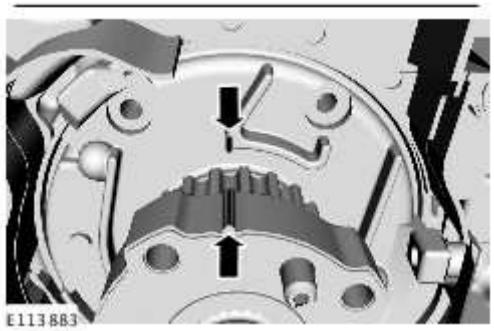


4. Using the special tool, align the crankshaft.

   Install the Special Tool(s): 303-1182



5. CAUTION: Make sure that the installation marks are aligned.



Vehicles with mechanical timing belt tensioner

6. NOTE: Make sure that new components are installed.
   1. *Torque:* 25 Nm
   3. NOTE: The timing belt tensioner setting

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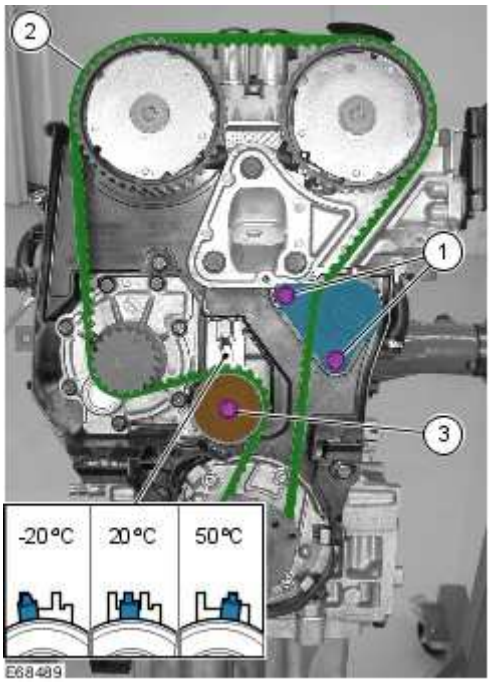
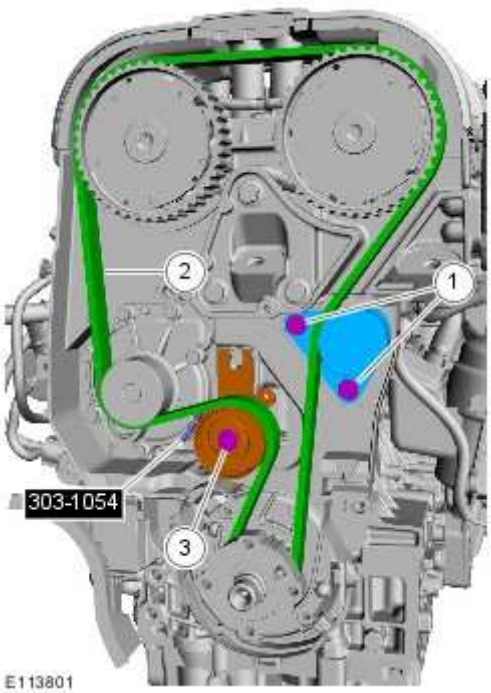
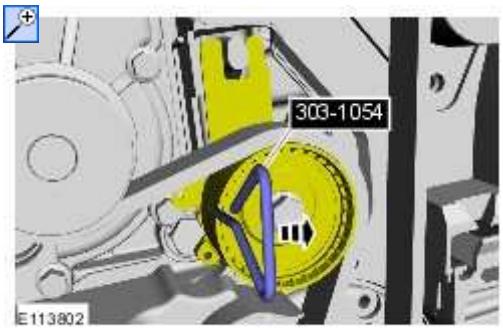


is dependant on the engine temperature.
Torque: 25 Nm

Vehicles with automatic timing belt tensioner



7. NOTE: Make sure that new components are installed.
   1. *Torque:* 25 Nm
   3. *Special Tool(s):* 303-1054
      Torque: 25 Nm



8. WARNING: Take extra care when handling the compressed spring.
   Remove the Special Tool(s): 303-1054

All vehicles

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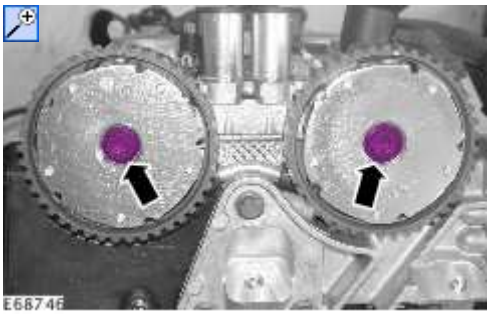
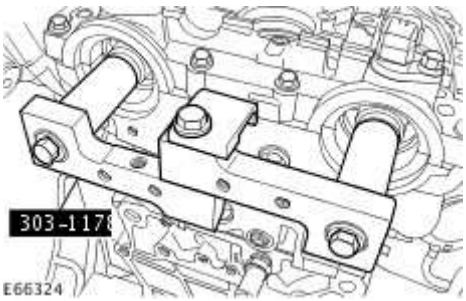
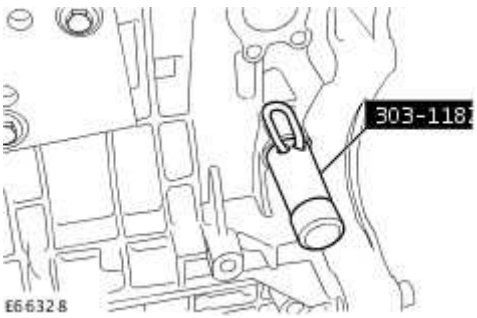


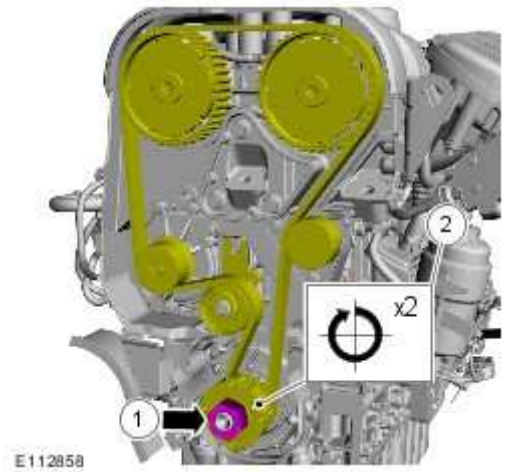
9. *Torque:* 120 Nm



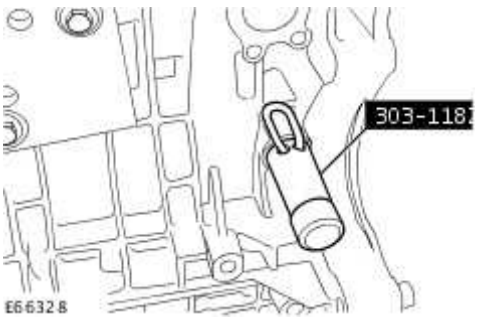
10. *Remove the Special Tool(s):* 303-1178



11. *Remove the Special Tool(s):* 303-1182



12.



13. Using the special tool, align the crankshaft.

    Install the Special Tool(s): 303-1182

14. *Install the Special Tool(s):* 303-1178
    Torque: 10 Nm

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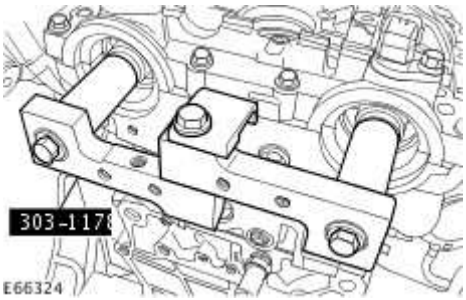
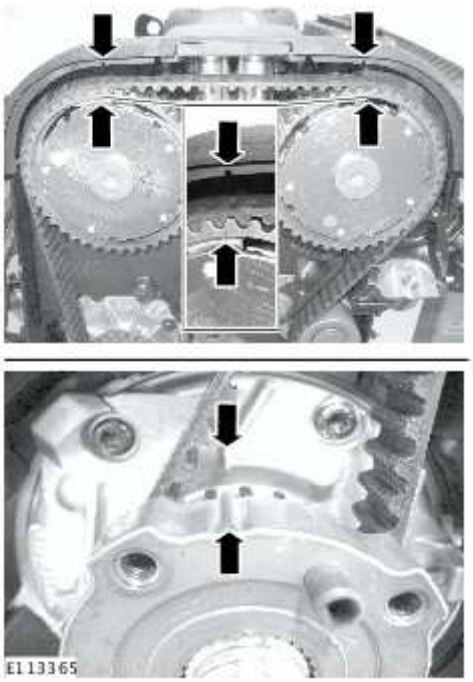
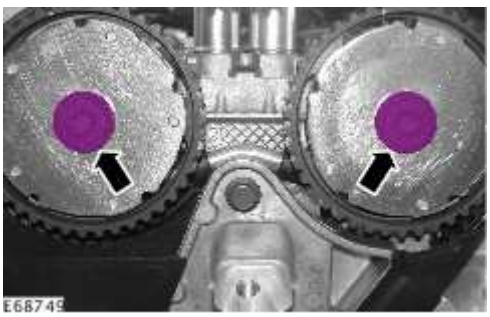
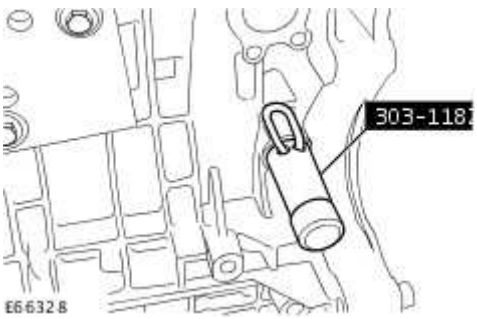




15. CAUTION: Make sure that the installation marks are aligned.



16. *Torque:* 35 Nm



17. *Remove the Special Tool(s):* 303-1182

18. *Remove the Special Tool(s):* 303-1178

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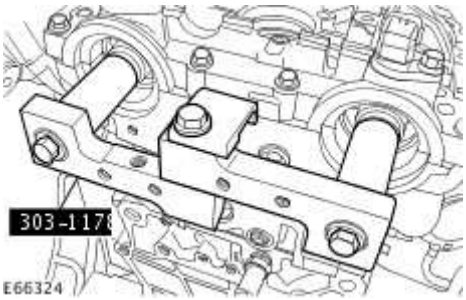
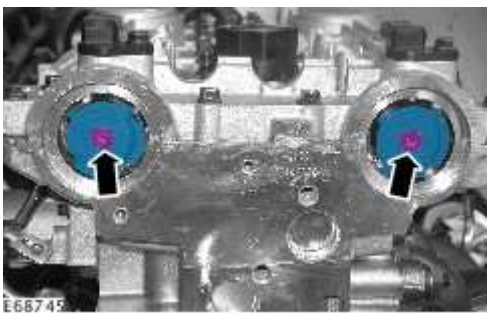
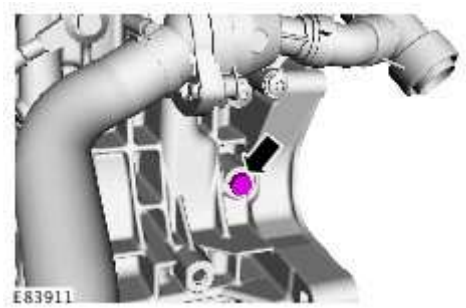
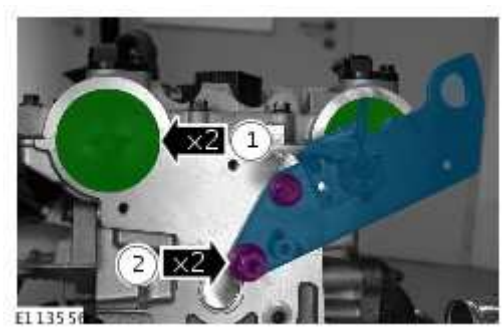




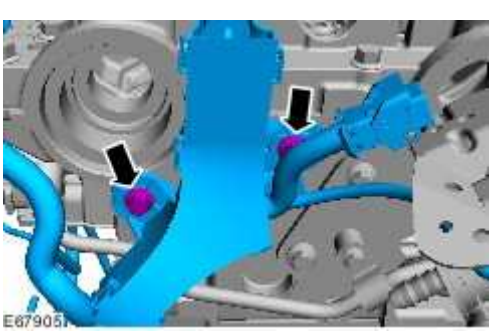
19. *Torque:* 17 Nm



20. *Torque:* 40 Nm



21.
   1. NOTE: Make sure that new components are installed.
   2. *Torque:* 40 Nm



22. *Torque:* 10 Nm

23. *Torque:* 28 Nm

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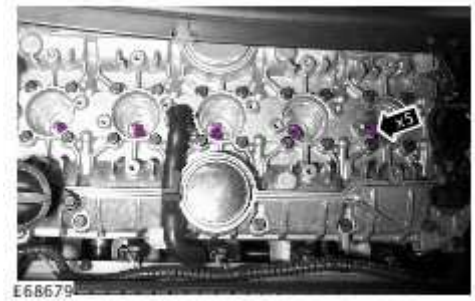
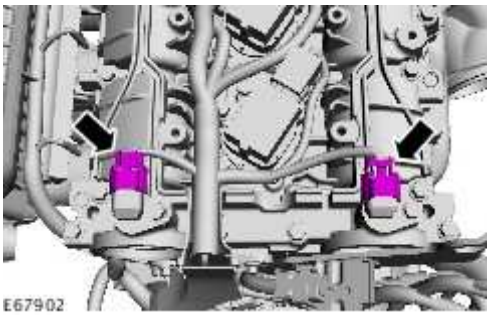
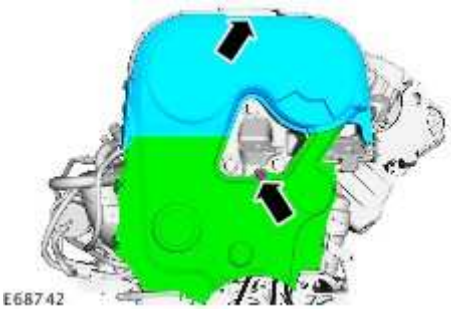




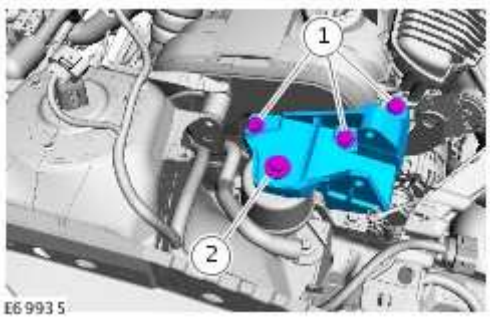
24.

25. Refer to: Ignition Coil-On-Plug (303-07B Engine Ignition - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

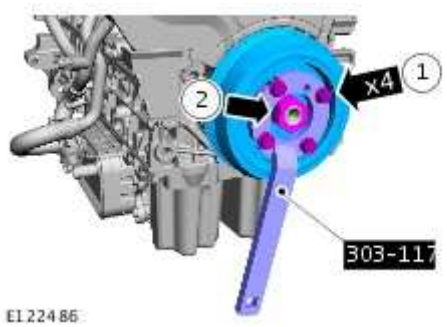
26. *Torque:* 10 Nm



27.
1. *Torque:* 80 Nm
2. NOTE: Only tighten the bolt finger tight at this stage.



28.
1. NOTE: Only tighten the bolts finger tight at this stage.
   Install the Special Tool(s): 303-1179
2. *Torque:* 180 Nm



29. *Remove the Special Tool(s):* 303-1179

30. *Torque:*
Stage 1: 25 Nm
Stage 2: 60°

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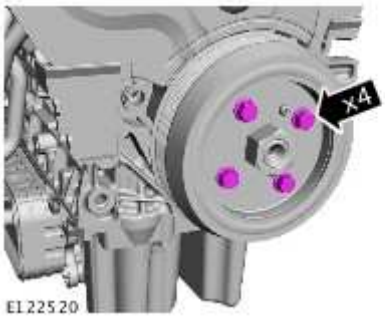
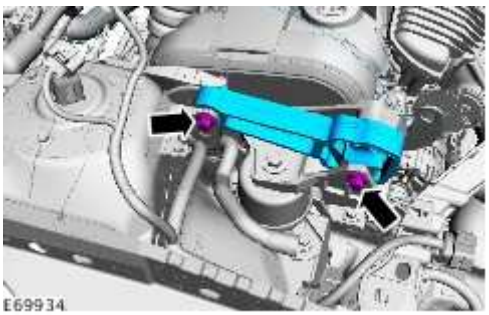
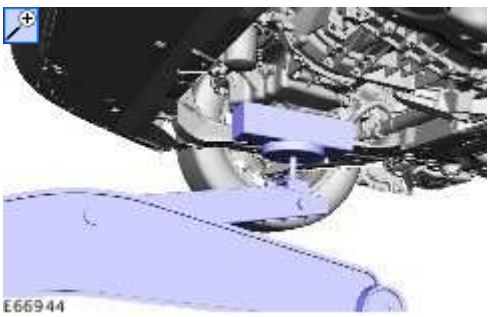


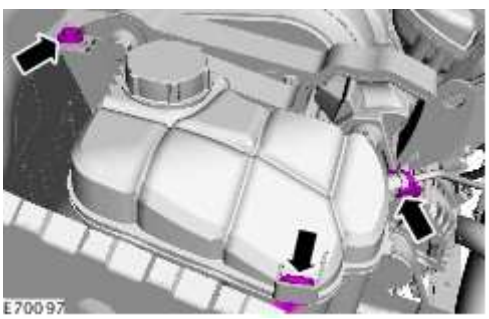
31. *Torque:* 80 Nm



32. *Torque:* 110 Nm



33. Remove the following items:
    1. *General Equipment:* Trolley jack



34.

35. *General Equipment:* Hose clamp remover/installer

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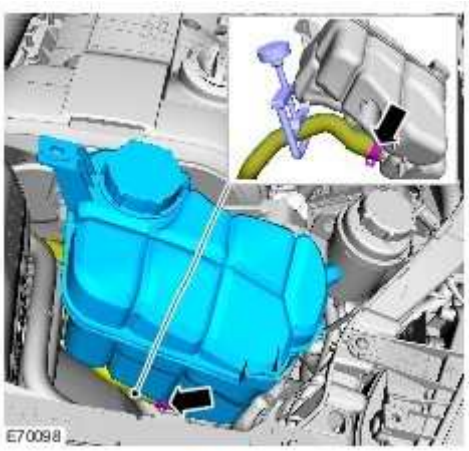

36. Install the following items:
    1. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
    2. Refer to: Starter Motor (303-06C Starting System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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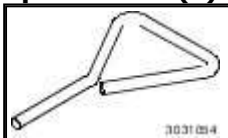
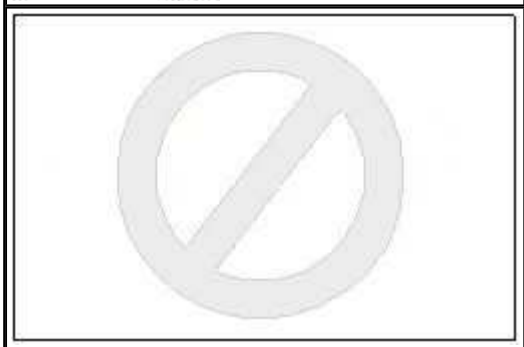
Removal and Installation

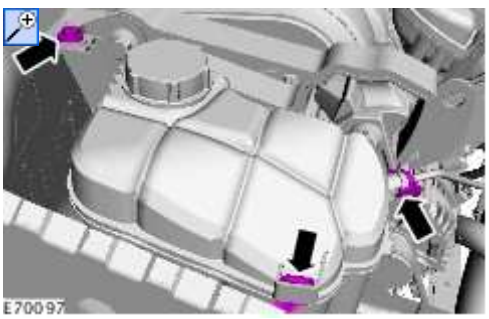
Special Tool(s)

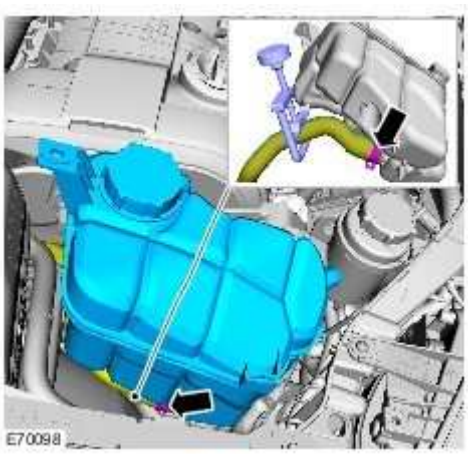
	303-1054 Locking Tool, Timing Belt Tensioner
	303-1179 Holding Wrench, Crankshaft

General Equipment

Hose clamp remover/installer
Trolley jack
Two leg puller

Removal

1. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
2. 

3. *General Equipment:* Hose clamp remover/installer


4. *General Equipment:* Trolley jack

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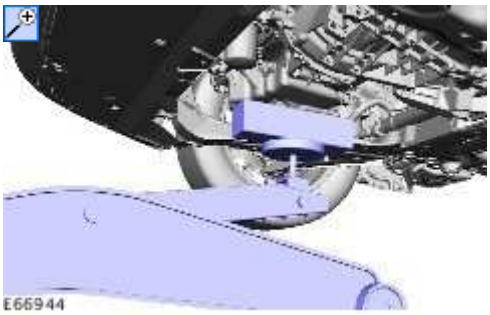
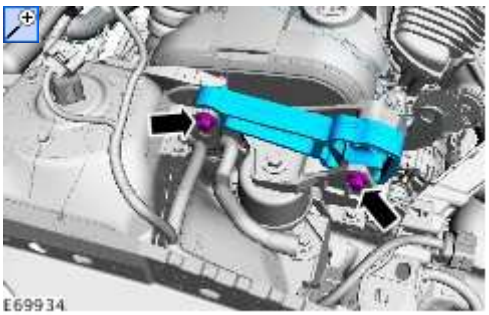


5.



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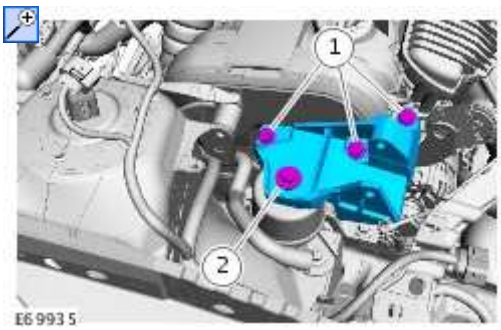

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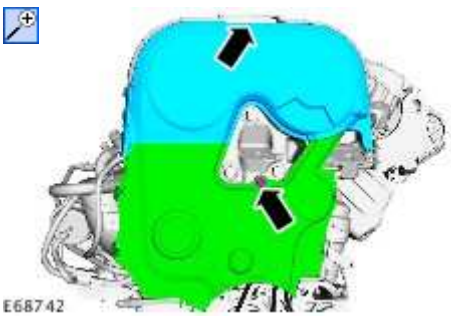
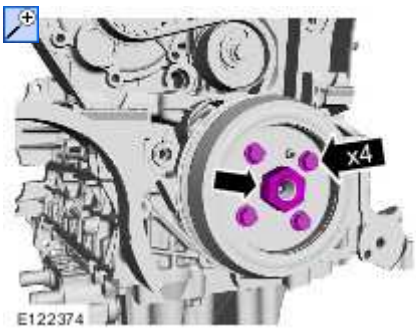


8.



9. *General Equipment:* Two leg puller

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10. CAUTION: Make sure that the installation marks are aligned.

Vehicles with mechanical timing belt tensioner

11.

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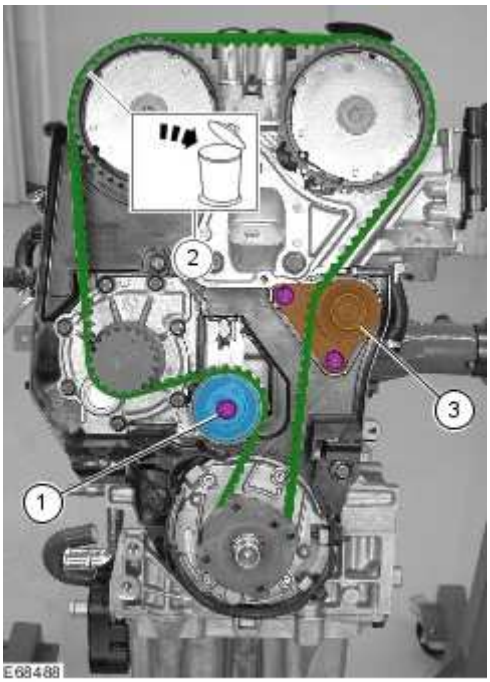
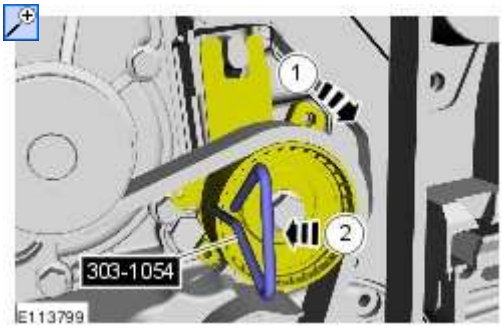
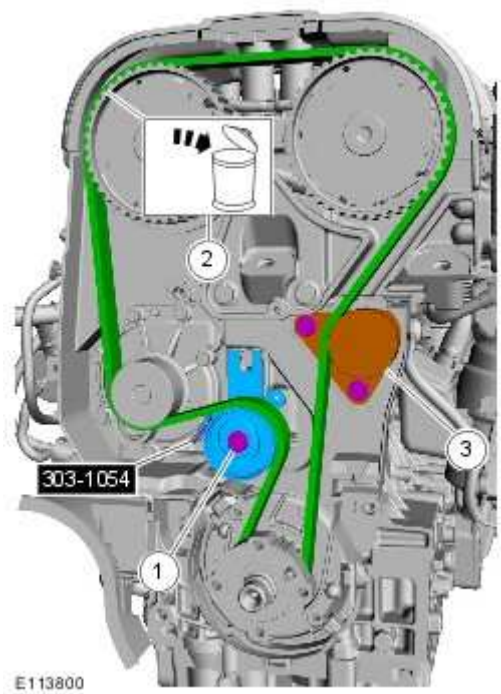


Vehicles with automatic timing belt tensioner



12. WARNING: Take extra care when handling the compressed spring.
Install the Special Tool(s): 303-1054



13. WARNING: Take extra care when handling the compressed spring.

Installation

Vehicles with mechanical timing belt tensioner

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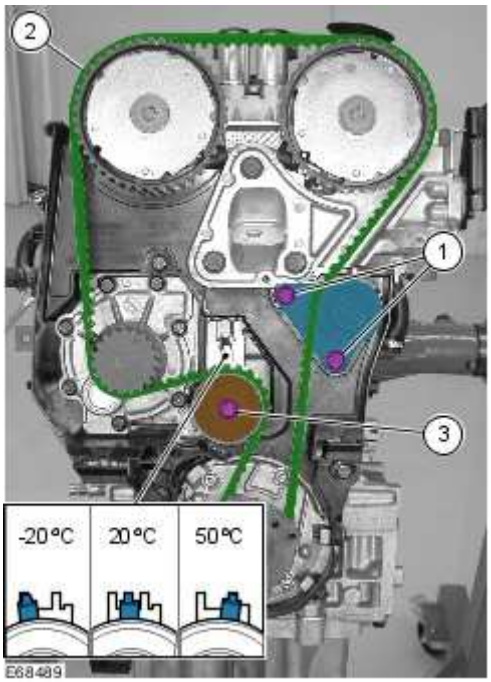
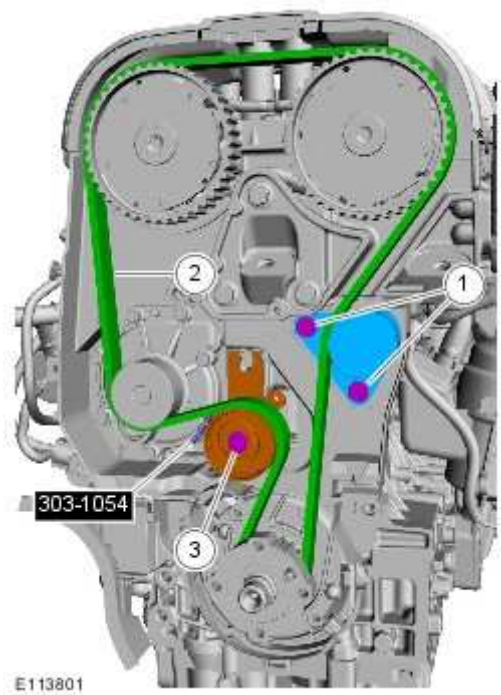
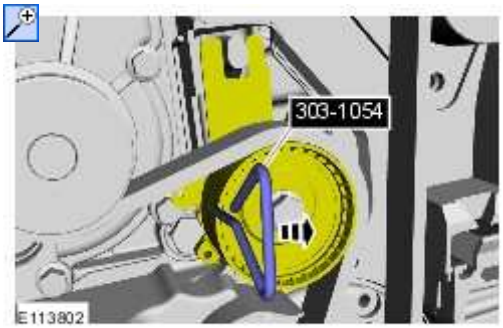


1. NOTE: Make sure that new components are installed.
   - *Torque:* 25 Nm

Vehicles with automatic timing belt tensioner



2. NOTE: Make sure that new components are installed.
   1. *Torque:* 25 Nm
   3. *Special Tool(s):* 303-1054
      Torque: 25 Nm



3. WARNING: Take extra care when handling the compressed spring.
   Install the Special Tool(s): 303-1054

All vehicles

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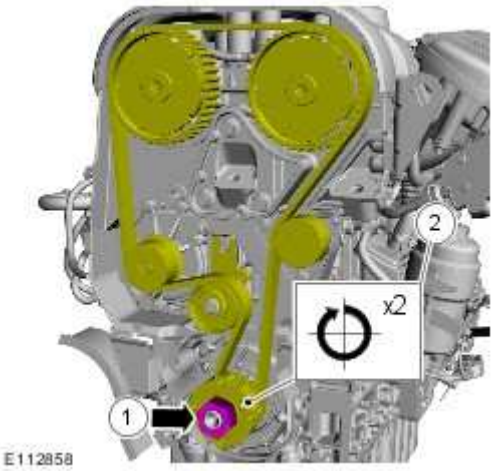
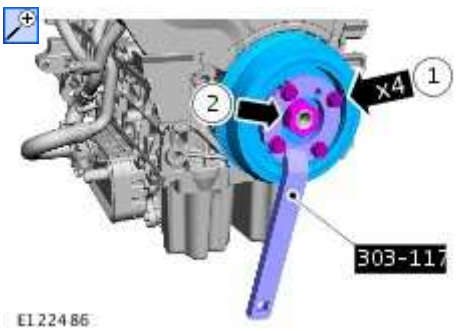


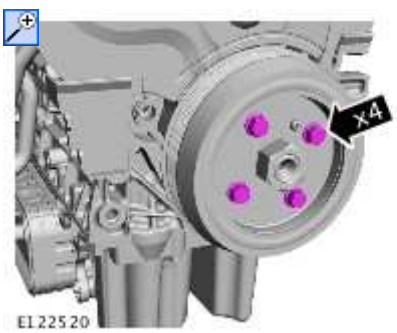
4.

5. CAUTION: Make sure that the installation marks are aligned.



6.
1. NOTE: Only tighten the bolts finger tight at this stage.
   Install the Special Tool(s): 303-1179
2. *Torque:* 180 Nm

7. *Remove the Special Tool(s):* 303-1179



8. *Torque:*
   Stage 1: 25 Nm
   Stage 2: 60°

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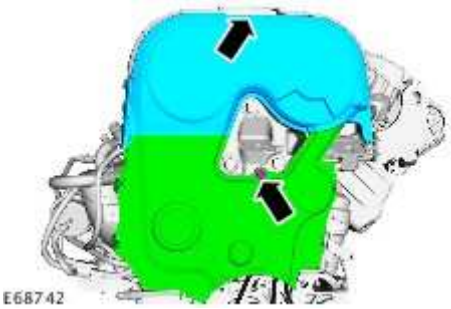
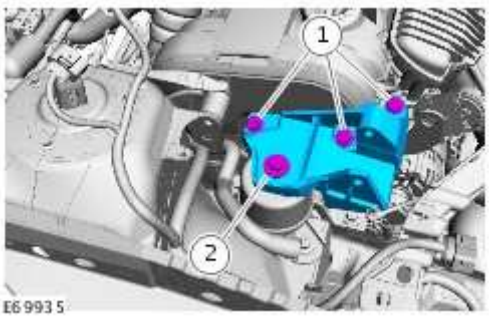
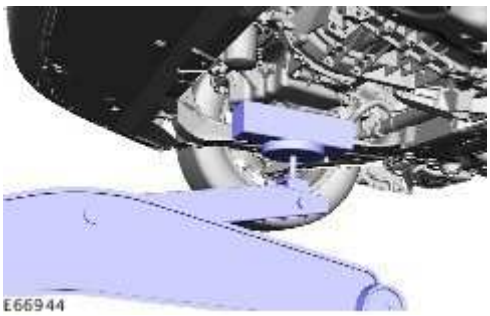


9. *Torque:* 10 Nm

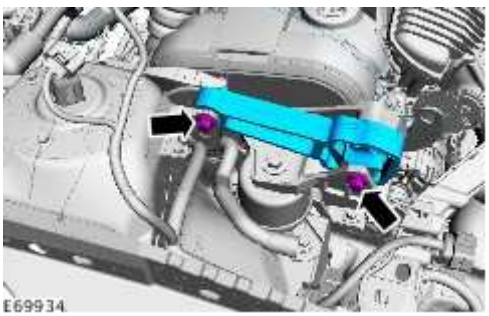


10.
    1. *Torque:* 80 Nm
    2. NOTE: Only tighten the bolt finger tight at this stage.



11. Remove the following items:
    1. *General Equipment:* Trolley jack

12. *Torque:* 80 Nm



13. *Torque:* 110 Nm

14. *General Equipment:* Hose clamp remover/installer

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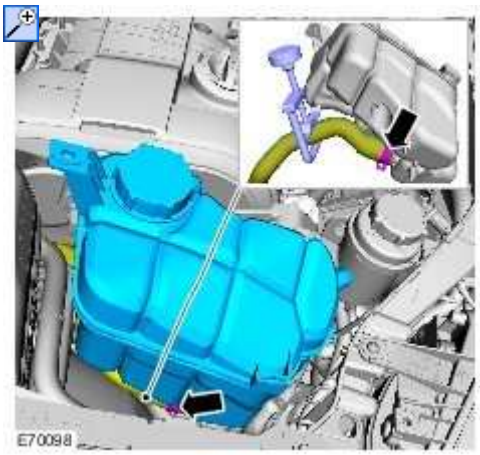

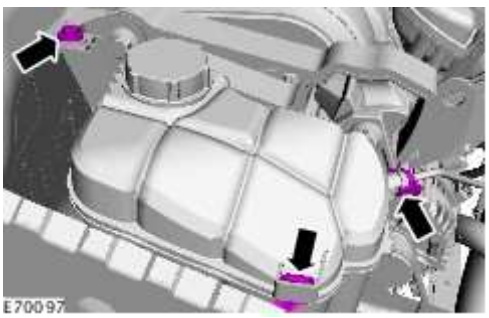

15.

16. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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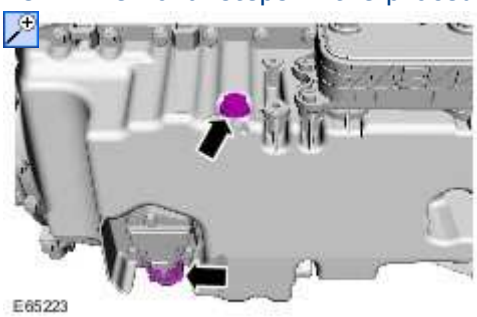
Removal and Installation

Materials

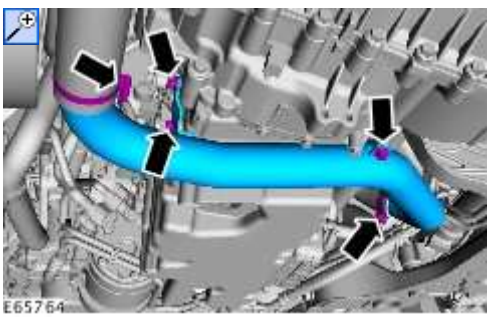
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA

Removal

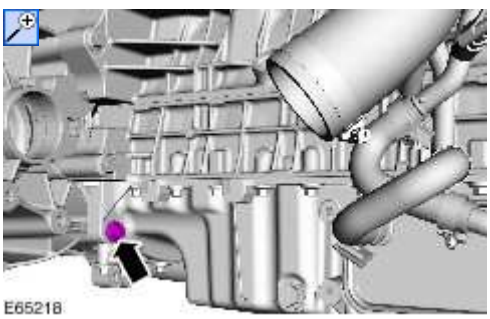
NOTE: Removal steps in the procedure may contain installation details.



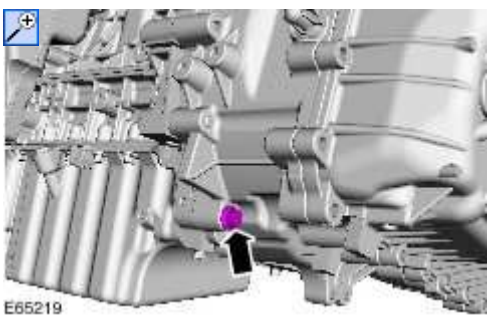
1.
WARNING: Be prepared to collect escaping fluid.
Torque: 38 Nm



2. *Torque:* 17 Nm



3. *Torque:* 48 Nm



4. *Torque:* 48 Nm

5. *Torque:* 10 Nm

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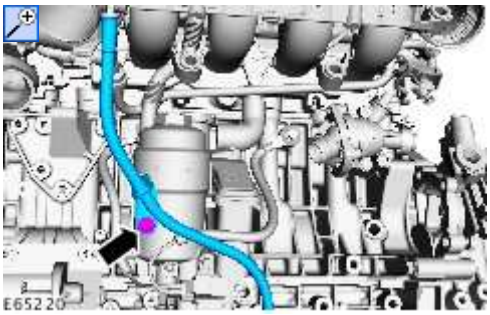
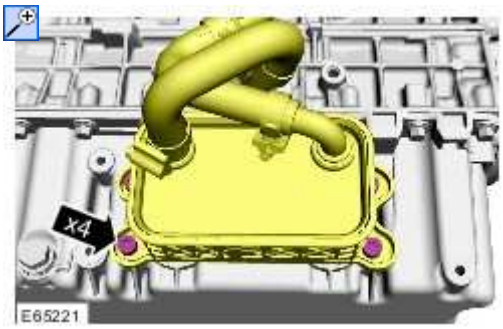
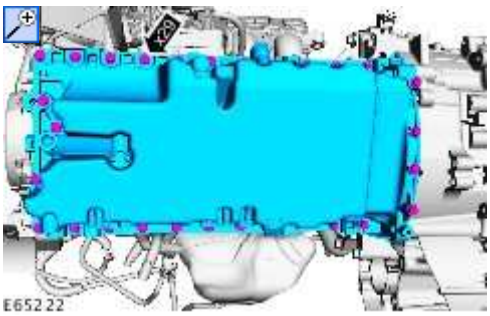


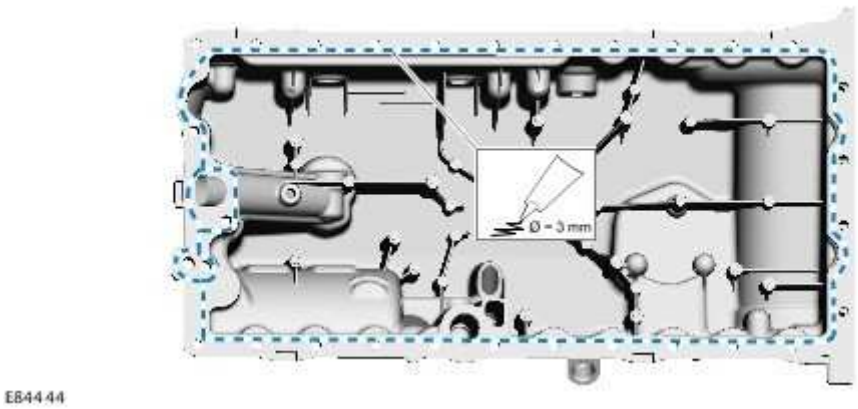


6. *Torque:* 17 Nm



7. *Torque:* 17 Nm

Installation



1. NOTE: The component must be installed within 5 minutes of applying the sealant. *Material:* Flange Sealant - Anaerobic LP (WSK-M2G348-A7 / 5U7J-M2G348-BA)
2. To install, reverse the removal procedure.
3. CAUTION: The fluid level must remain between the MAX and MIN marks. *Material:* Engine Oil - 5W-30 (WSS-M2C913-C)

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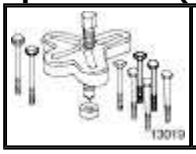
Removal and Installation

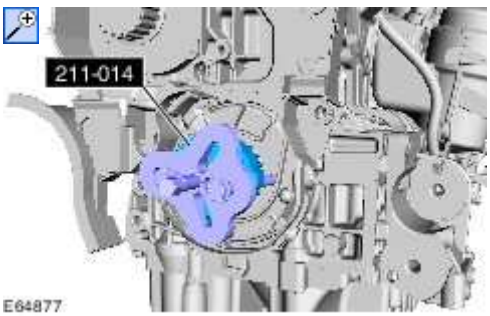
Special Tool(s)

	211-014 Remover, Steering Wheel

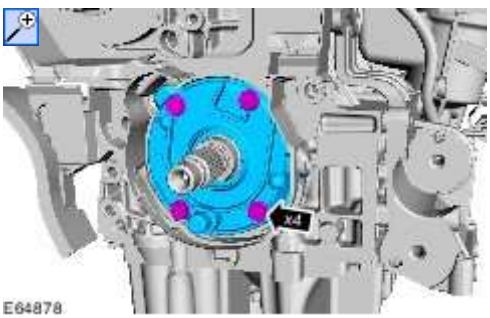
Removal

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

1. Refer to: Timing Belt (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



2. *Special Tool(s):* 211-014



3. *Torque:* 6 Nm

4. Refer to: Crankshaft Front Seal (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

1. Remove the turbocharger.

   Refer to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Installation

1. Install the turbocharger.

   Refer to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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Removal and Installation

Materials

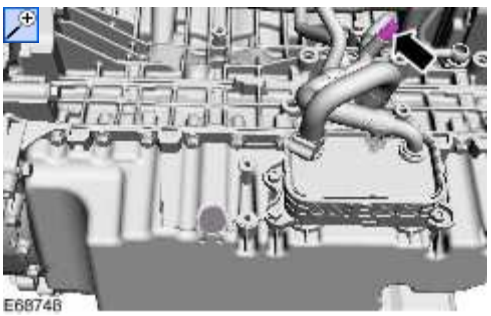
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

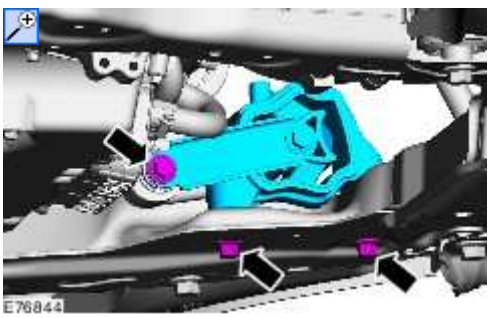
General Equipment

Fluid container

Removal

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
5. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
6. 

7. 

Torque: 110 Nm
8. CAUTIONS:

   Make sure that the exhaust flexible pipe is not twisted.

   Jointing compound must not be used

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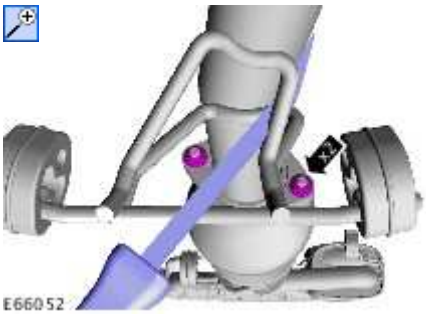
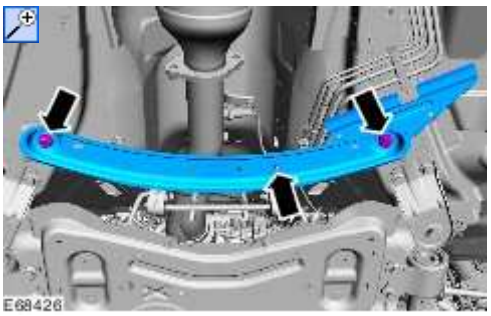


forward of the catalytic converter.

- Coat the catalytic converter to flexible pipe studs with grease.

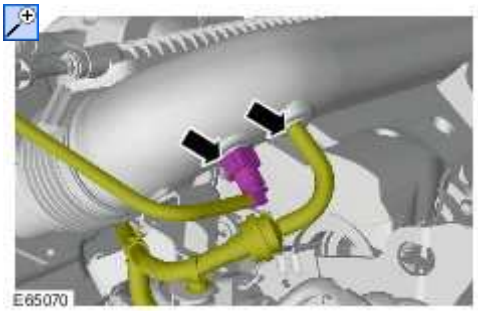
  Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
  Torque: 50 Nm



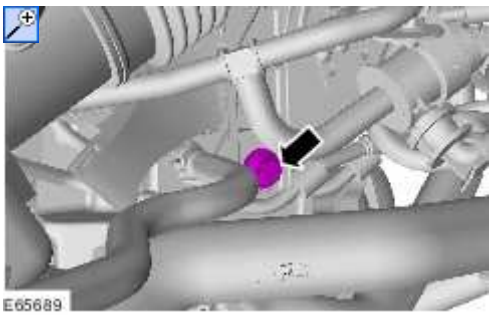
9. *Torque:* 24 Nm

10. Detach the turbocharger from the cylinder head.

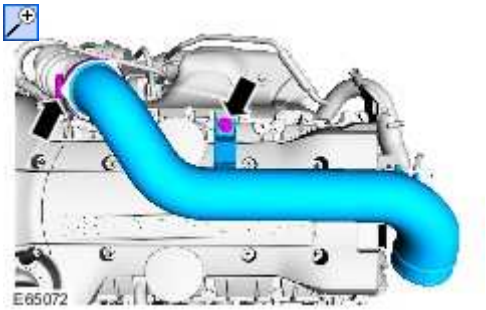
    Refer to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



11.



12. *Torque:* 10 Nm



13. *Torque:* 10 Nm

14.

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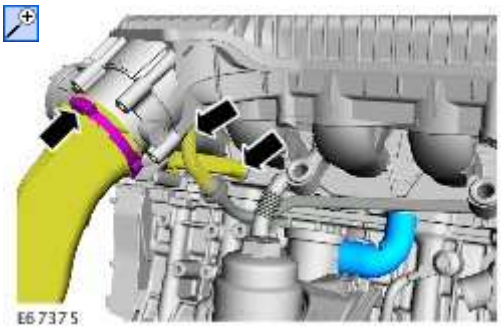

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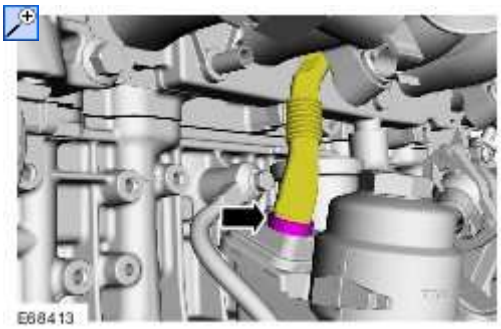
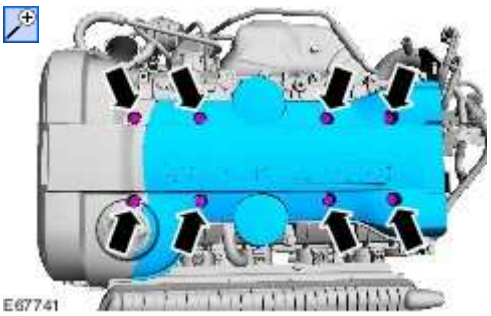


16. *Torque:* 10 Nm



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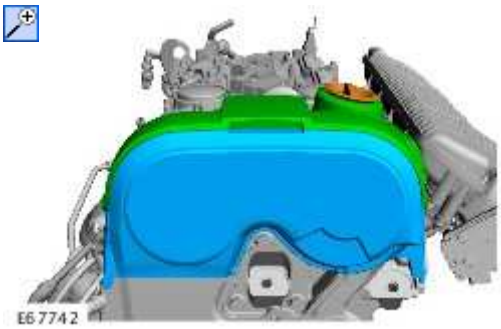

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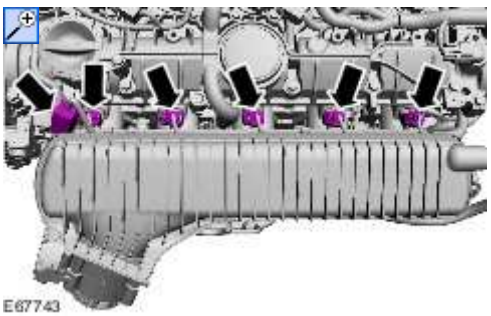

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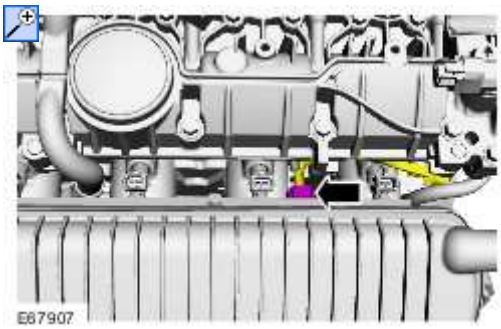
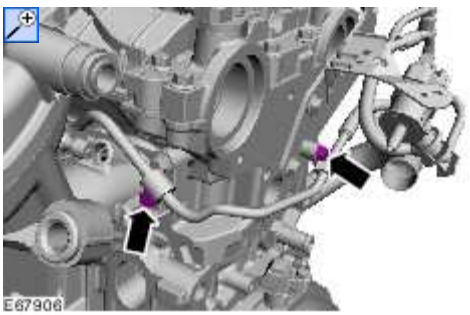
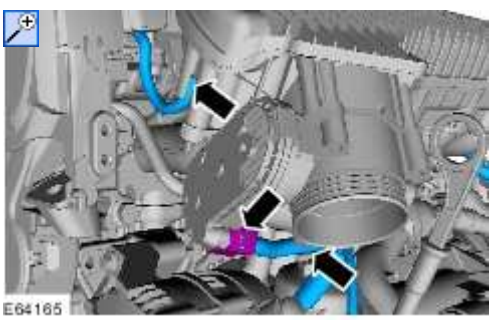




20. *Torque:* 10 Nm



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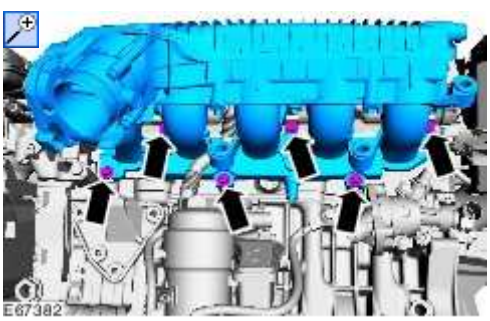
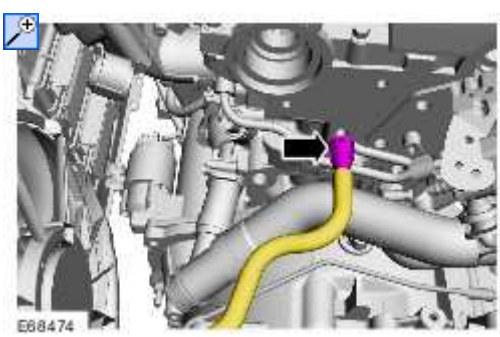


22. *Torque:* 19 Nm



23.

24. Refer to: Camshafts (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
25. *Torque:* 25 Nm

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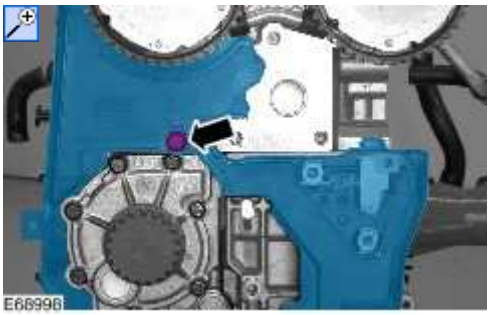
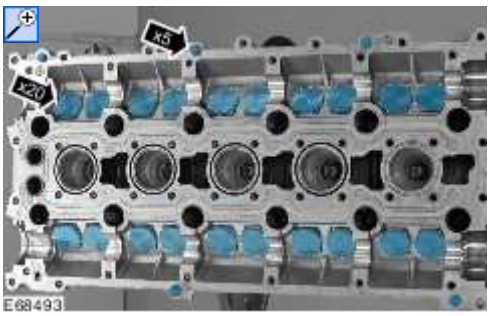
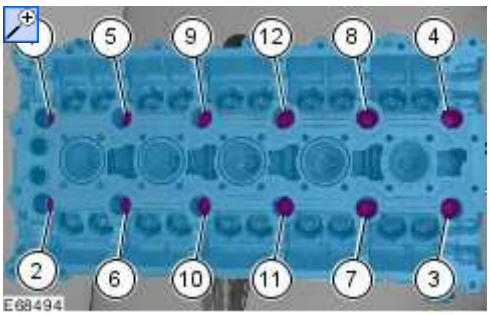




26. CAUTION: Make sure that the components are installed to the position noted before removal.



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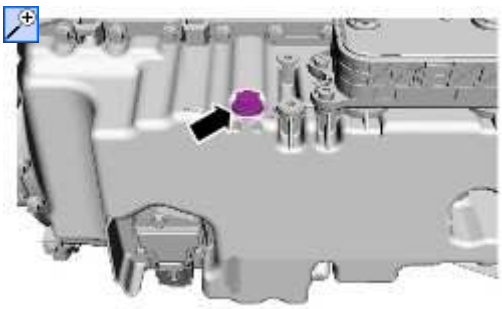

28. WARNING: Be prepared to collect escaping fluid.
General Equipment: Fluid container
Torque: 38 Nm

29. *Torque:* 25 Nm

30.

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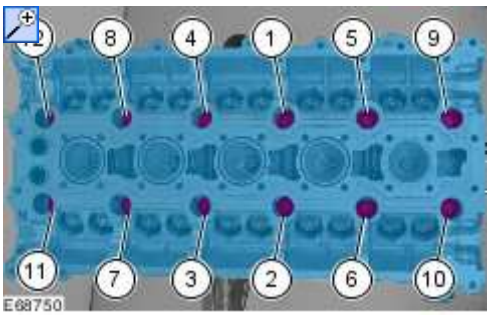
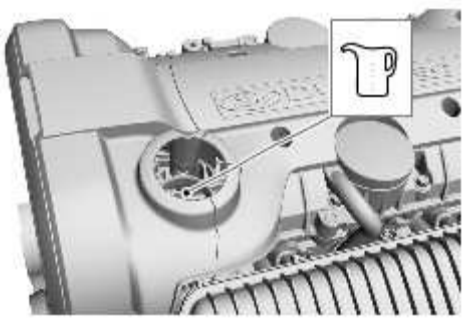
Installation



1. To install, reverse the removal procedure.
2. *Torque:*
   Stage 1: 20 Nm
   Stage 2: 60 Nm
   Stage 3: 130°



3. Refer to: Specifications (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Specifications).
   Material: Engine Oil - 5W-30 (WSS-M2C913-C)

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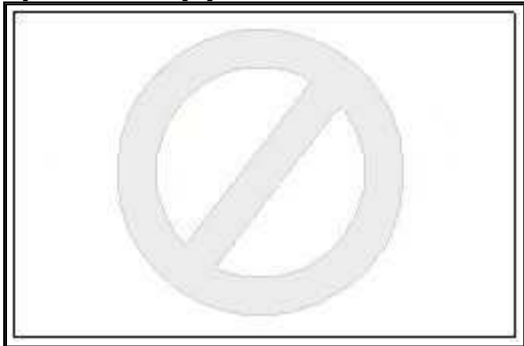
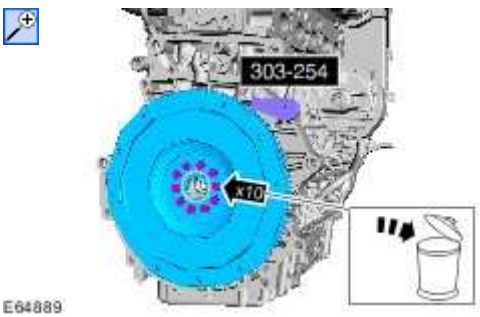
Removal and Installation

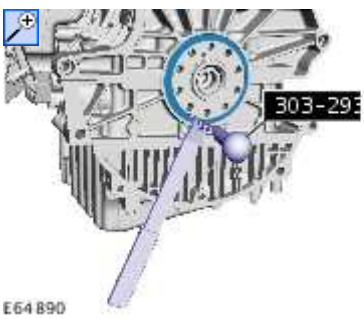
Special Tool(s)

	303-1181 Installer, Crankshaft Rear Seal
	303-254 Locking Tool, Flywheel
	303-293 Remover, Crankshaft Seal

Removal



1. Refer to: Clutch Disc and Pressure Plate (308-01D, Removal and Installation).
2. CAUTION: Discard the flywheel bolts.
   Special Tool(s): 303-254



3. *Special Tool(s):* 303-293

Installation

1. *Special Tool(s):* 303-1181

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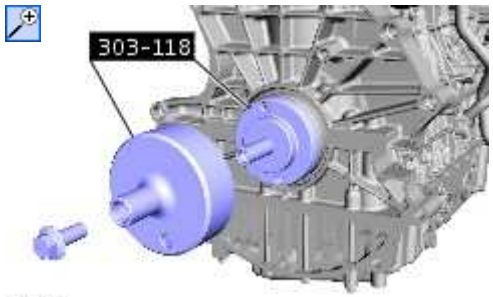
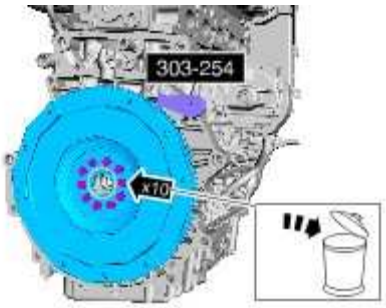


E64891



E64889

2. CAUTION: Make sure that no excess sealant residue is evident.
   NOTE: Make sure that the locating pin on the crankshaft is aligned with the guide hole in the flywheel.
   Special Tool(s): 303-254
   Torque:
   Stage 1: 45 Nm
   Stage 2: 65°
3. Refer to: Clutch Disc and Pressure Plate (308-01D, Removal and Installation).

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Removal and Installation

Materials

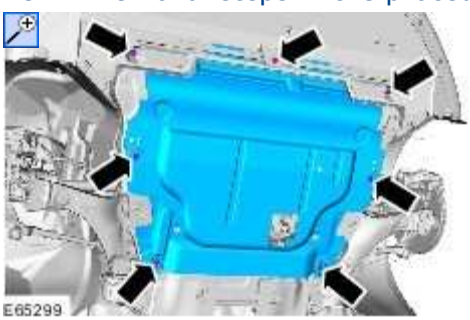
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

General Equipment

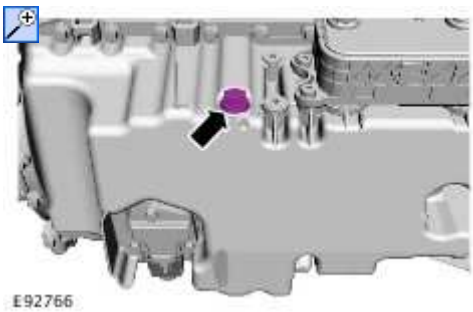
Fluid container
Hose clamp(s)

Removal

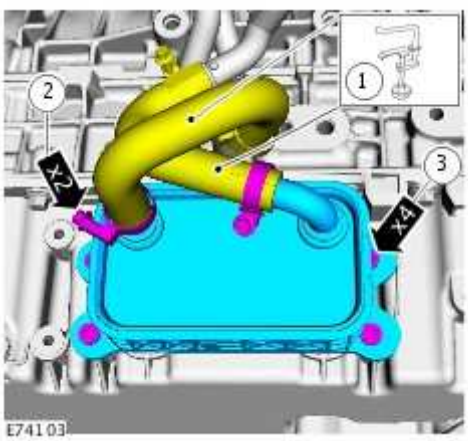
NOTE: Removal steps in the procedure may contain installation details.



1.



2. WARNING: Be prepared to collect escaping fluid.
General Equipment: Fluid container
Torque: 38 Nm



3. WARNING: Be prepared to collect escaping fluids.
   1. *General Equipment:* Fluid container
      General Equipment: Hose clamp(s)
   2. *Torque:* 3 Nm
   3. *Torque:* 17 Nm

Installation

1. To install, reverse the removal procedure.
2. CAUTION: Make sure that fluid level is to the MAX mark.
   Refer to: Specifications (303-01D Engine - 2.5L

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Duratec (162kW/220PS) - VI5, Specifications).
Material: Engine Oil - 5W-30 (WSS-M2C913-C)

3. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).

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Removal

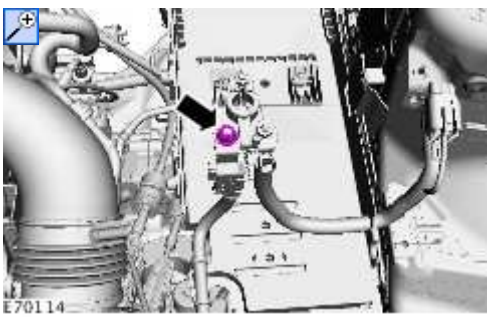
Special Tool(s)

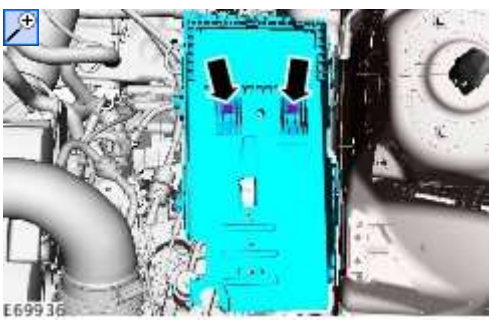
	303-122 Lifting Bracket, Engine

General Equipment

Mounting table set

1. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
2. Remove the following items:
   1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
   2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. Drain the coolant.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
4. 

5. 

6. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

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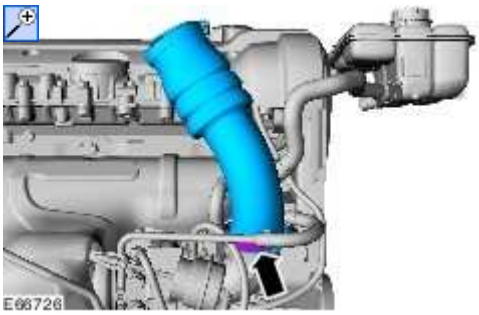

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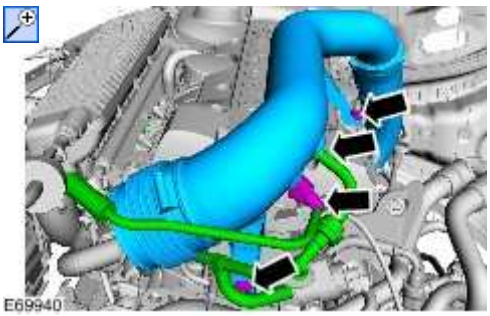

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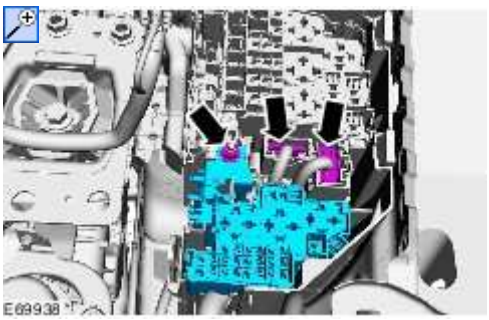

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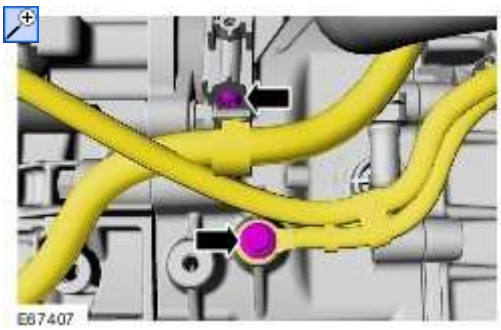

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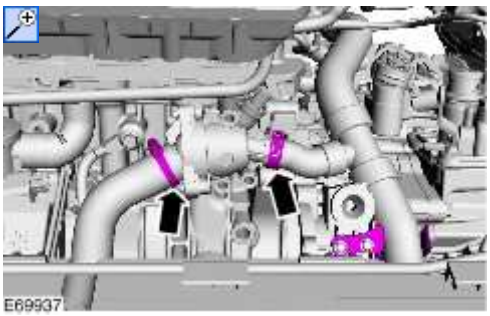

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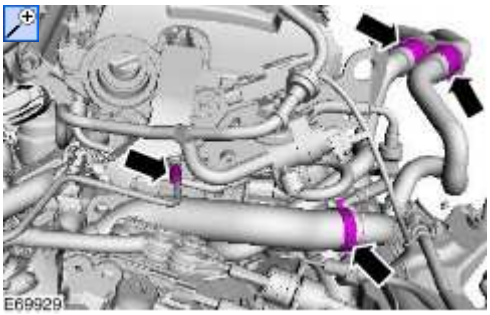
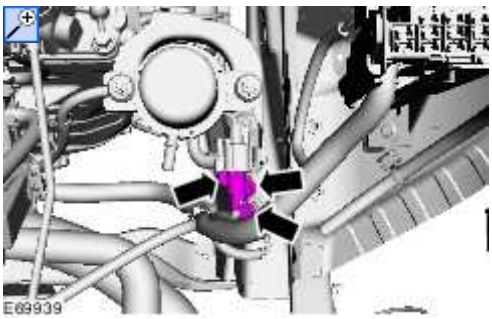
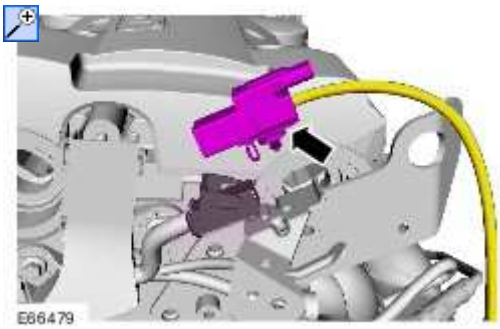


12. 

13. 

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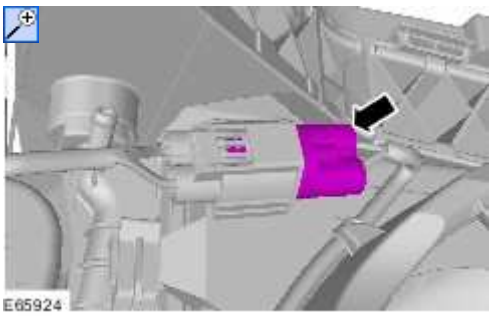
15. 

16. CAUTION: Gearshift cables must not be kinked or bent.

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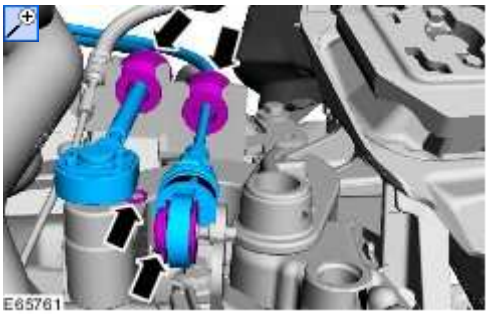

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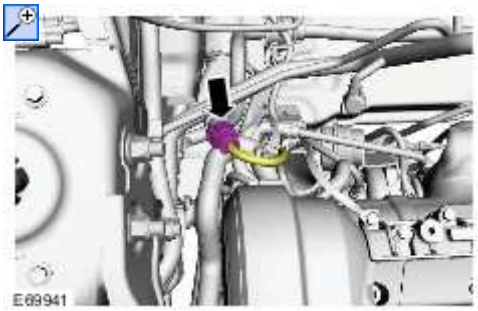

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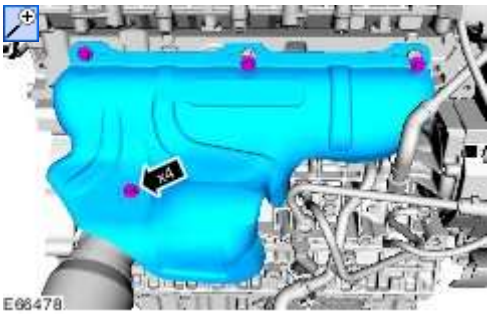
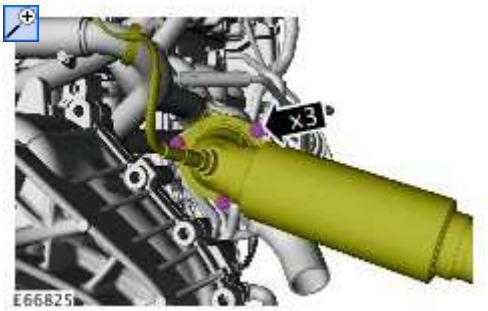


19. Remove the following items:
    1. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
    2. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    4. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



20.

21. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

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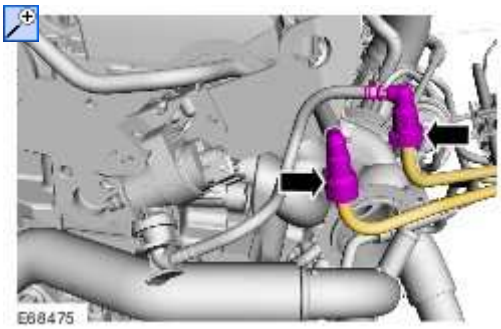

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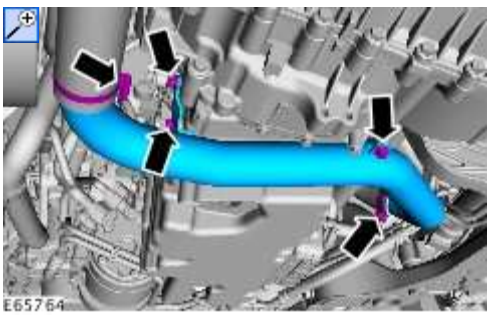

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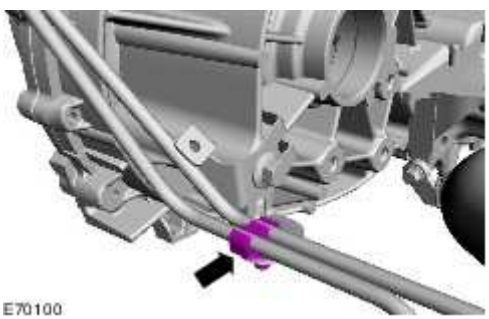

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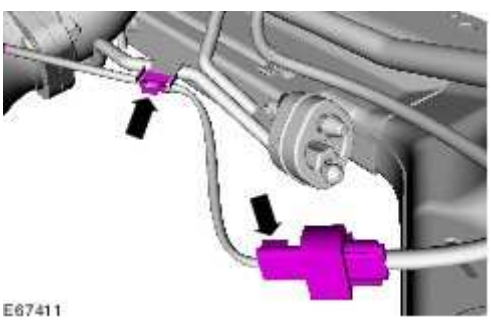

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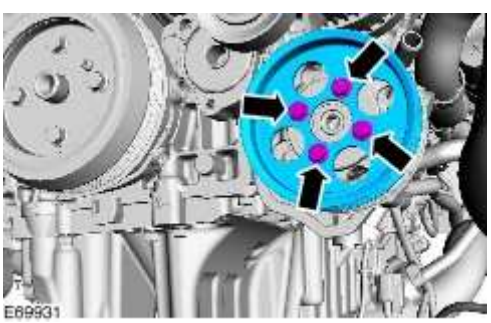

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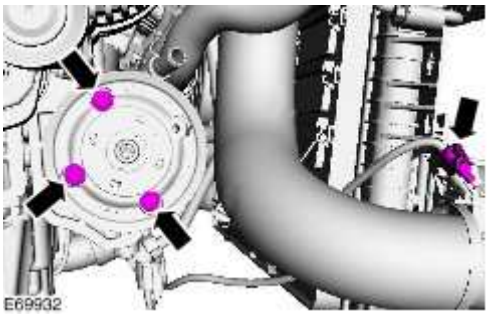
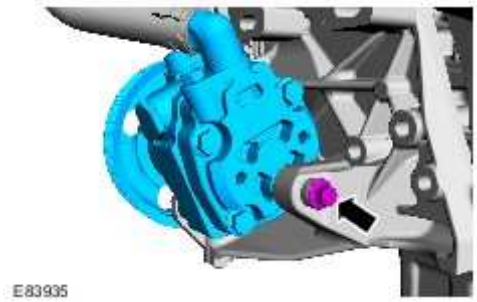
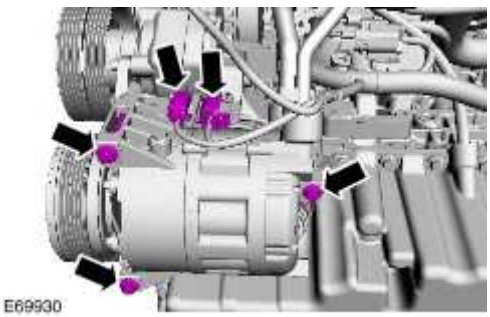


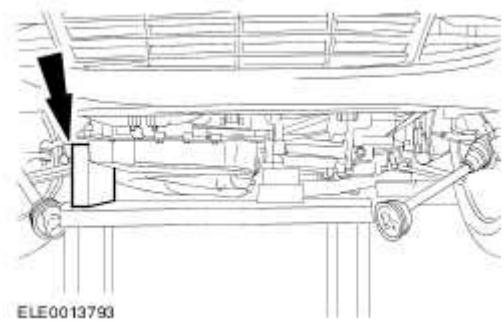
27. Position the PAS pump to one side.



28. Position the A/C compressor to one side.



29. WARNING: Make sure that the engine and transmission assembly is on wooden blocks and secured with suitable retaining straps.
General Equipment: Mounting table set



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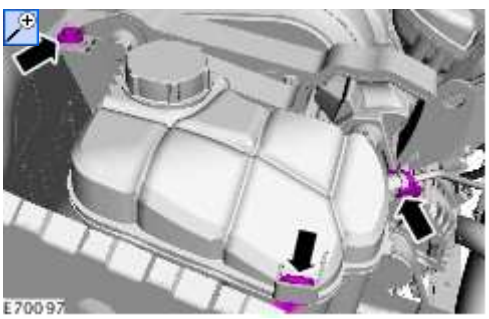

31.

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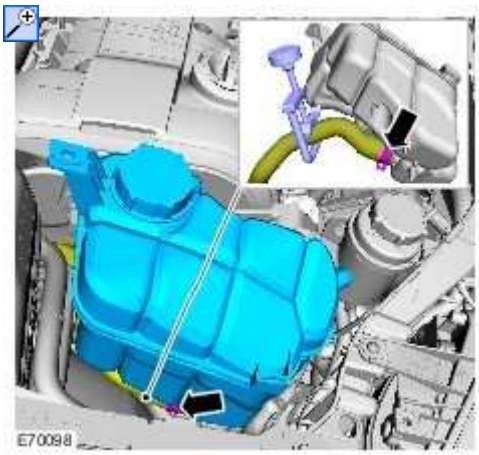

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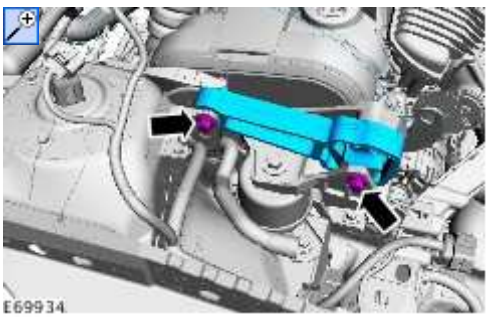

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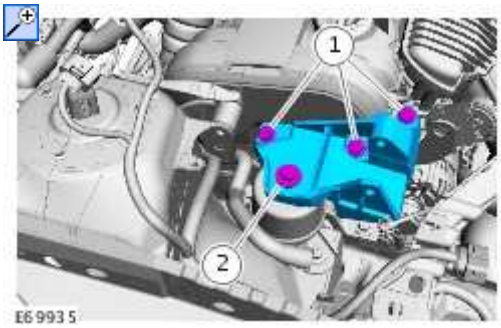

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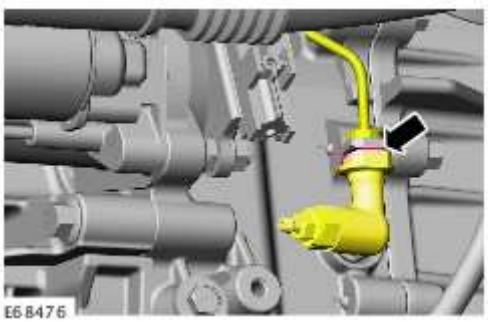

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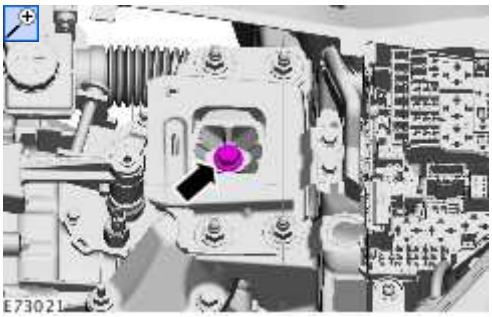
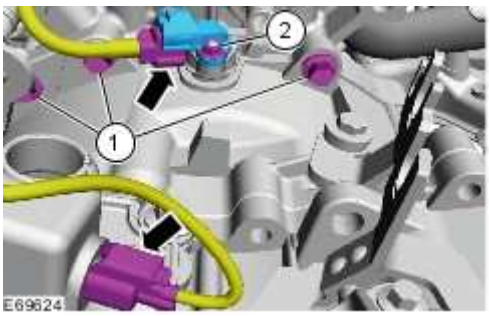
http://vnx.su



37. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
38. Refer to: Starter Motor (303-06C Starting System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



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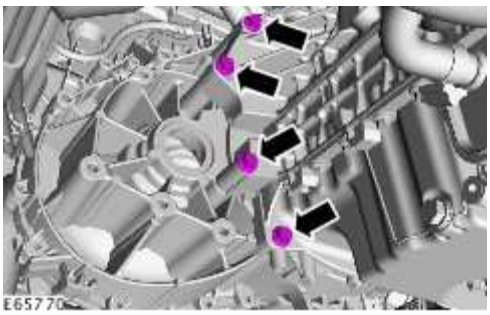

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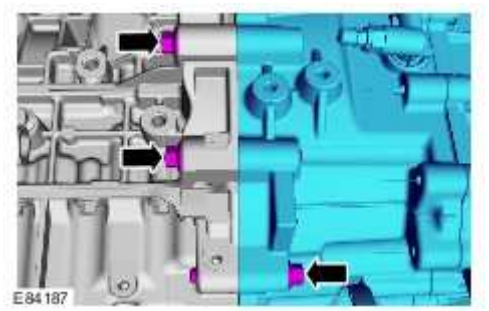

41.

42. *Install the Special Tool(s):* 303-122

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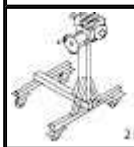
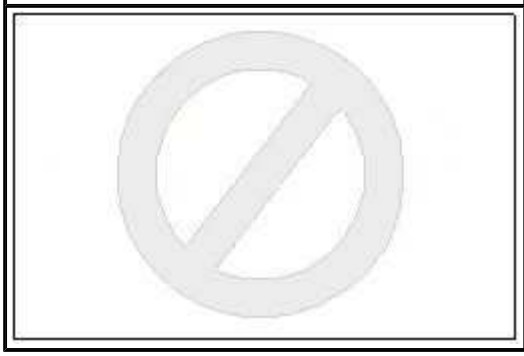
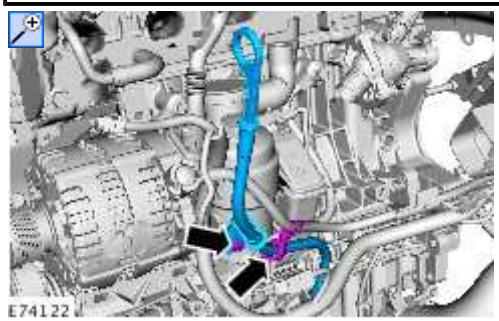
Print

Removal

Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-14B Mounting Plate for 303-435-06



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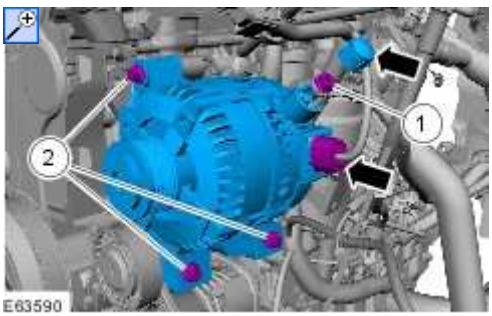

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3.

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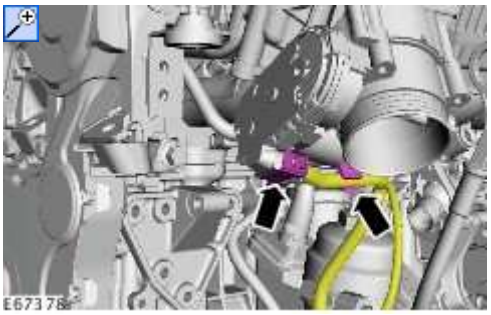

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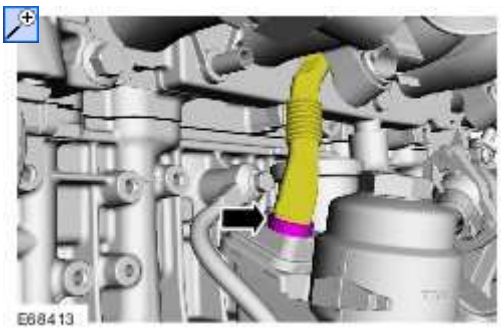

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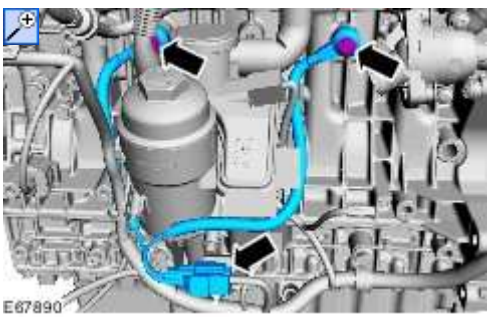

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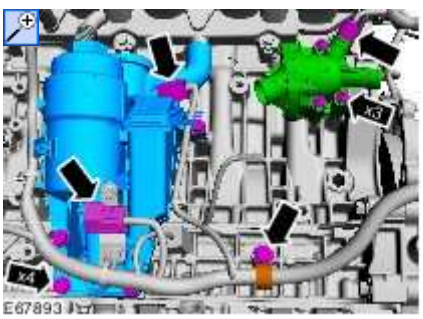

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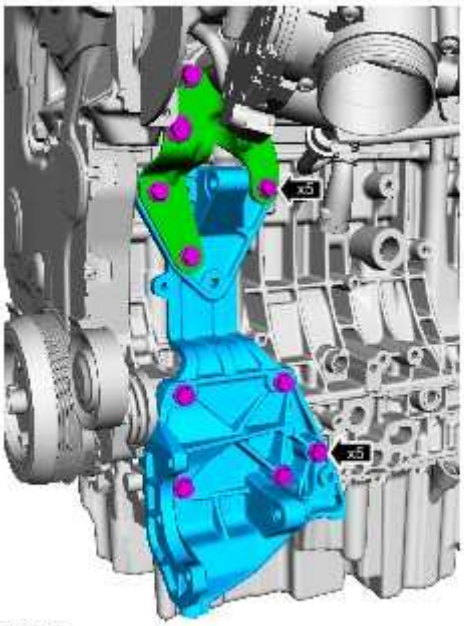
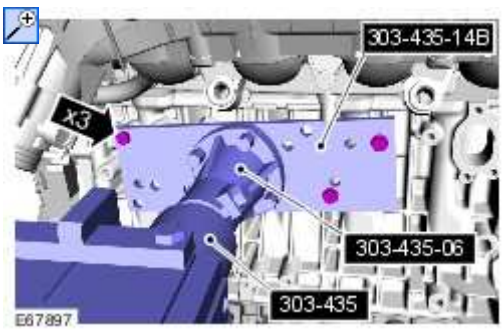
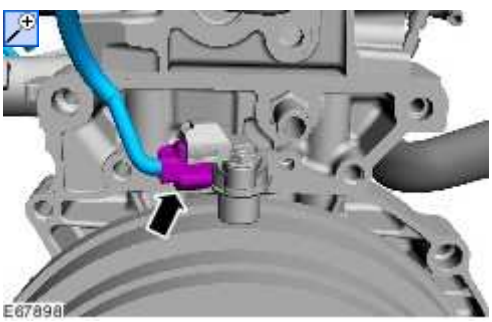




8. *Install the Special Tool(s):* 303-435, 303-435-06, 303-435-14B

9. *Remove the Special Tool(s):* 303-122



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11.

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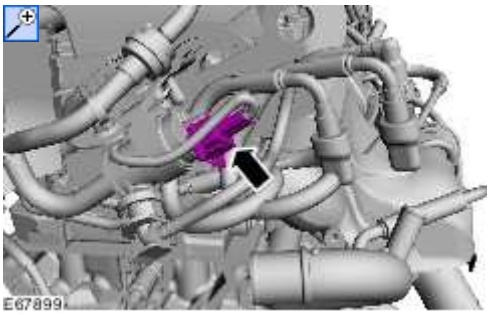
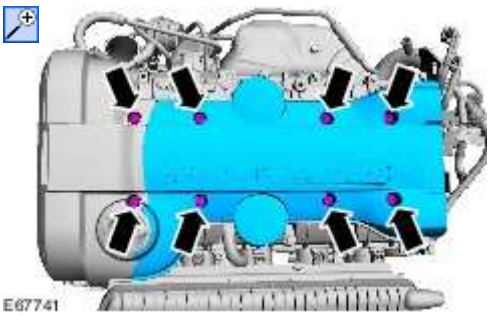
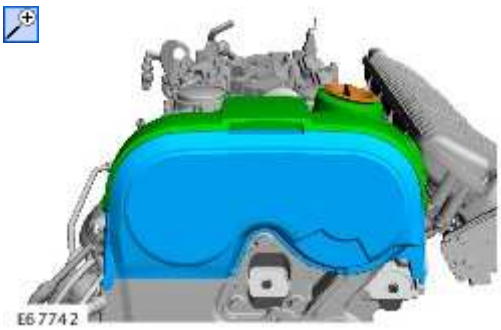
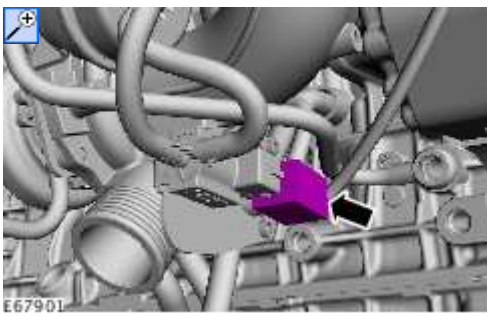
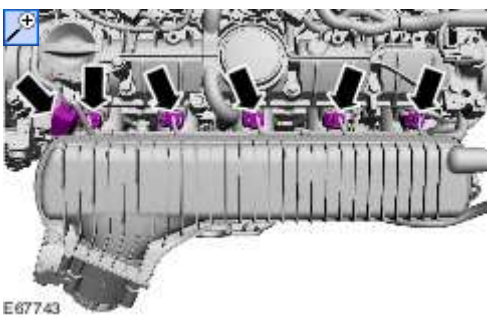


12. 

13. 

14. 

15. 

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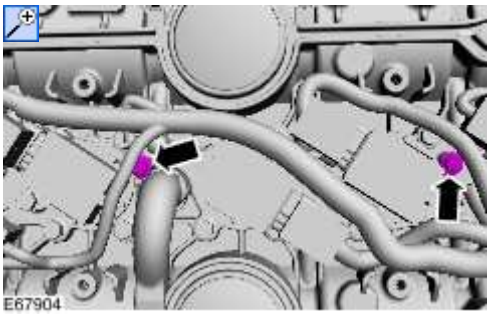

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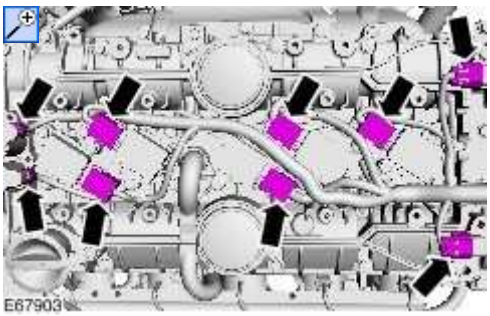

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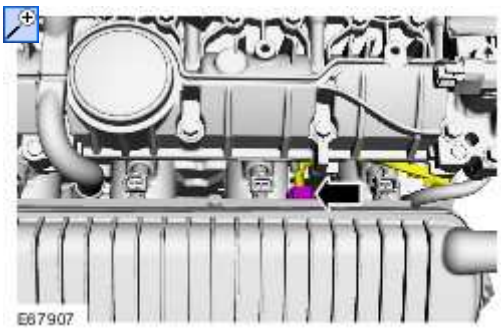

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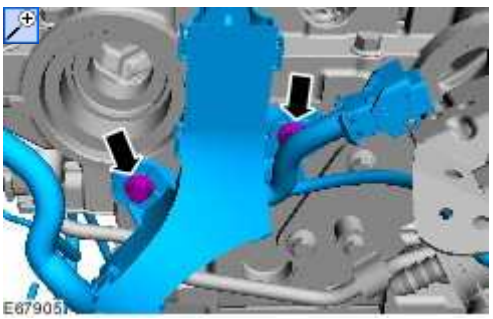

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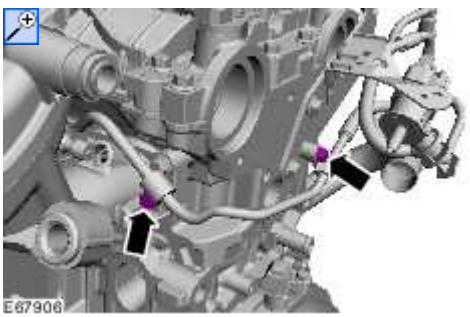

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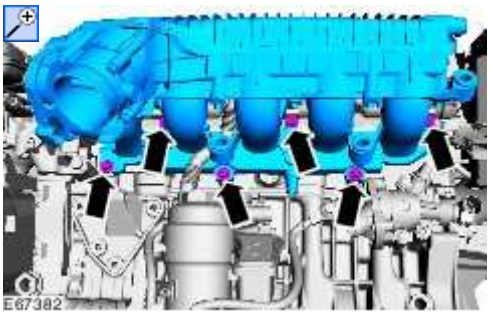
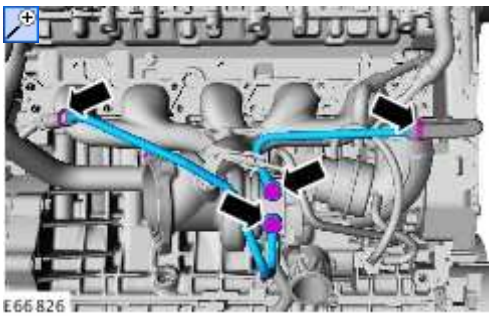
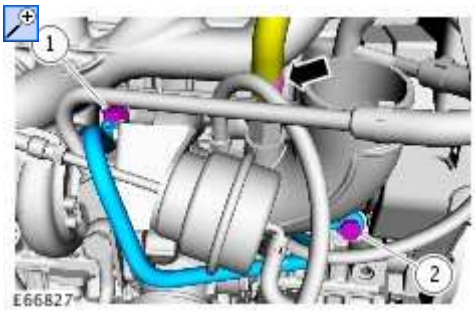
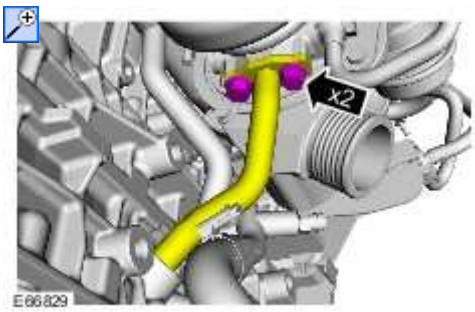
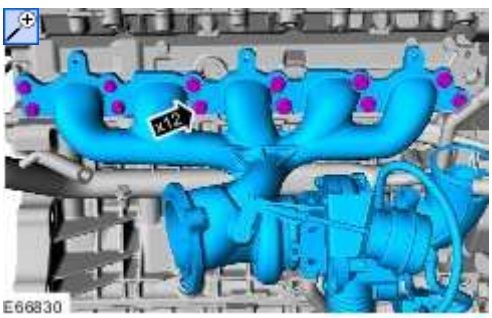


22. 

23. 

24. 

25. 

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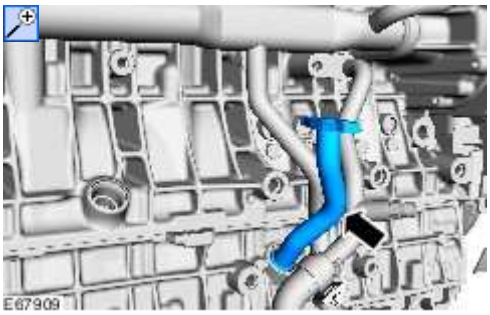

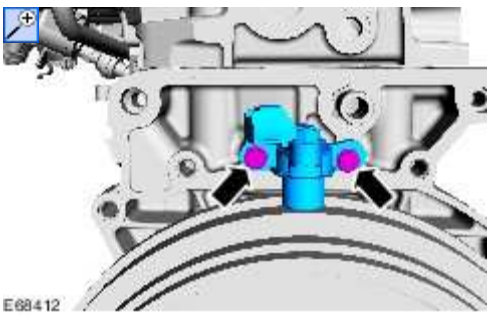

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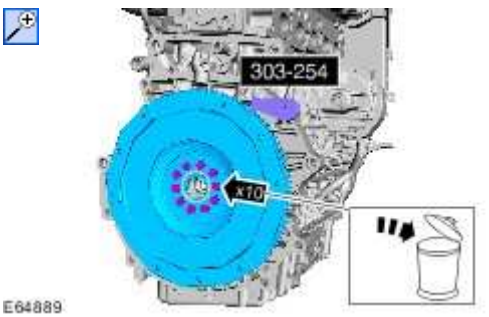
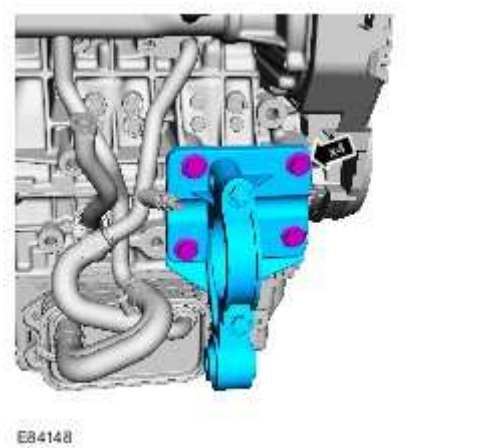


28. *Special Tool(s):* 303-254



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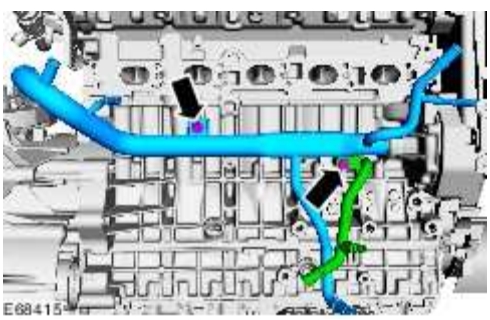

30.

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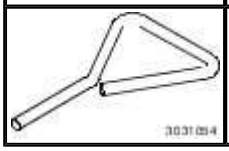
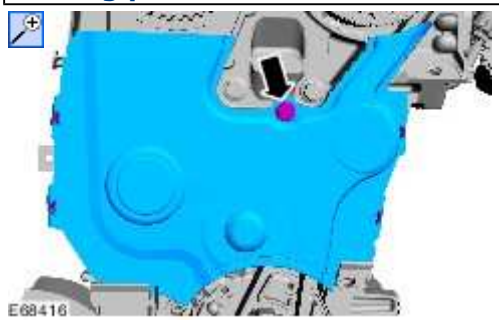
Disassembly

Special Tool(s)

	211-014 Remover, Steering Wheel
	303-1054 Locking Tool, Timing Belt Tensioner

General Equipment

Punch
Two leg puller



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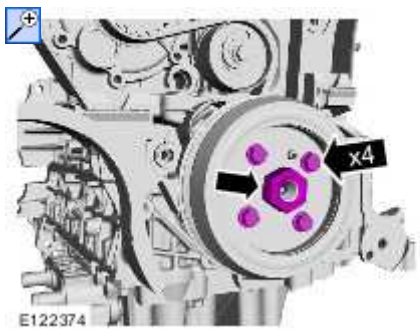

2.

3. *General Equipment:* Two leg puller

Vehicles with mechanical timing belt tensioner

4.

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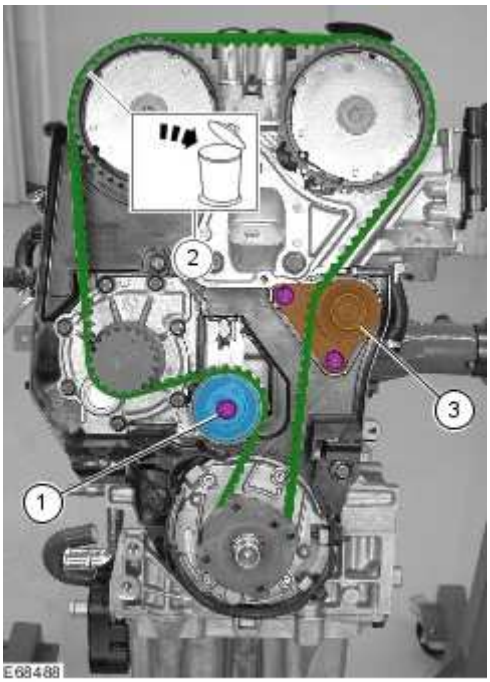
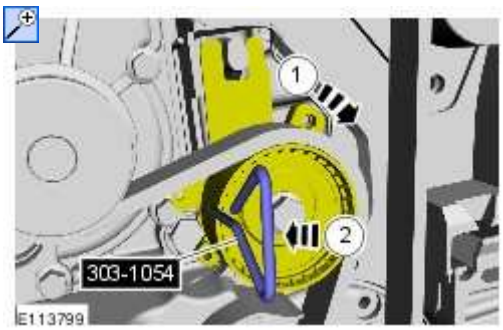
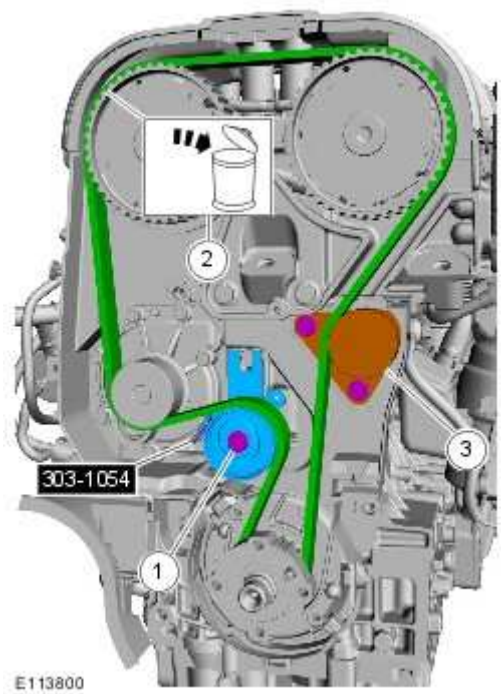


Vehicles with automatic timing belt tensioner



5. WARNING: Take extra care when handling th compressed spring.
Install the Special Tool(s): 303-1054



6. WARNING: Take extra care when handling th compressed spring.
Special Tool(s): 303-1054

All vehicles

7.

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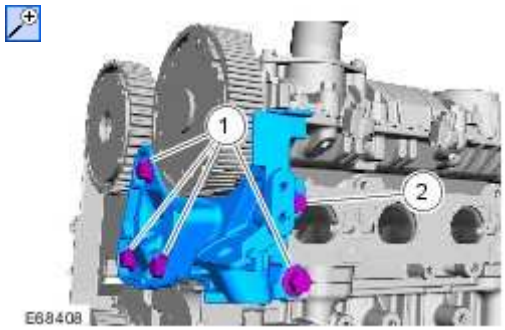

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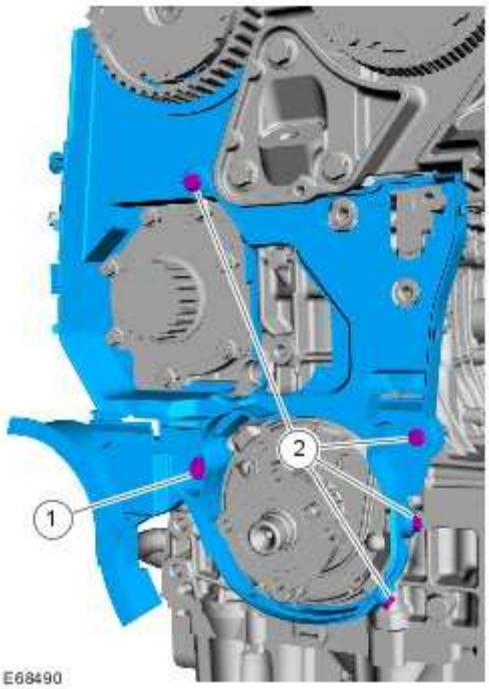

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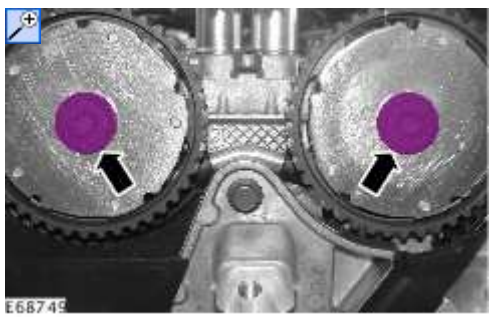

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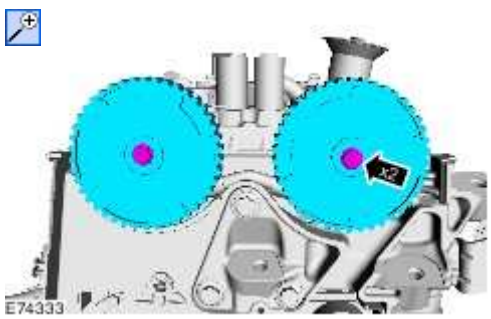

11. *Special Tool(s):* 211-014

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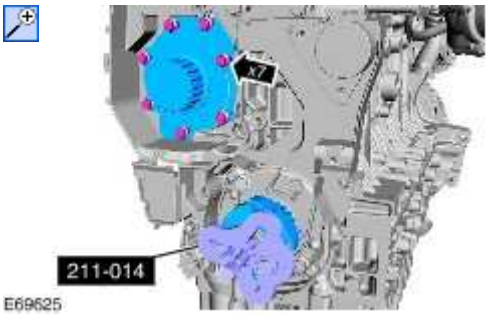
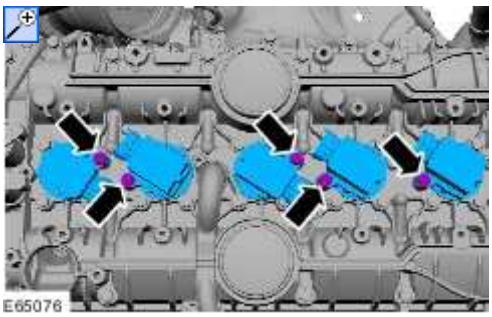
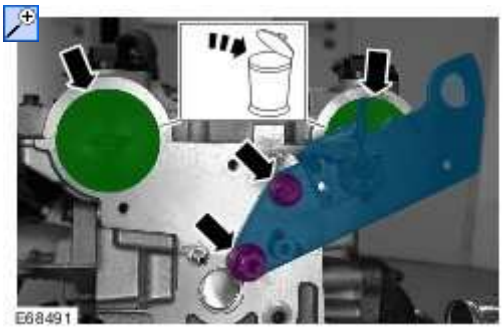




12.



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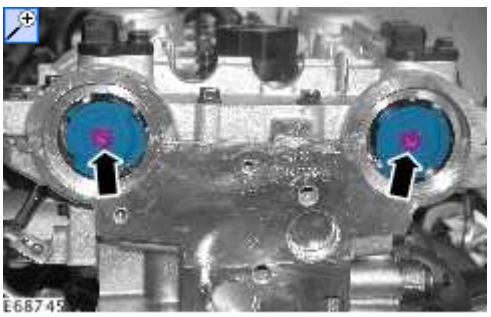

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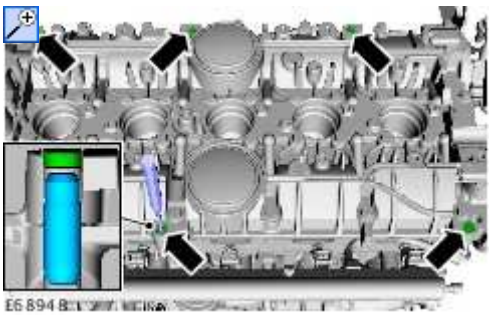
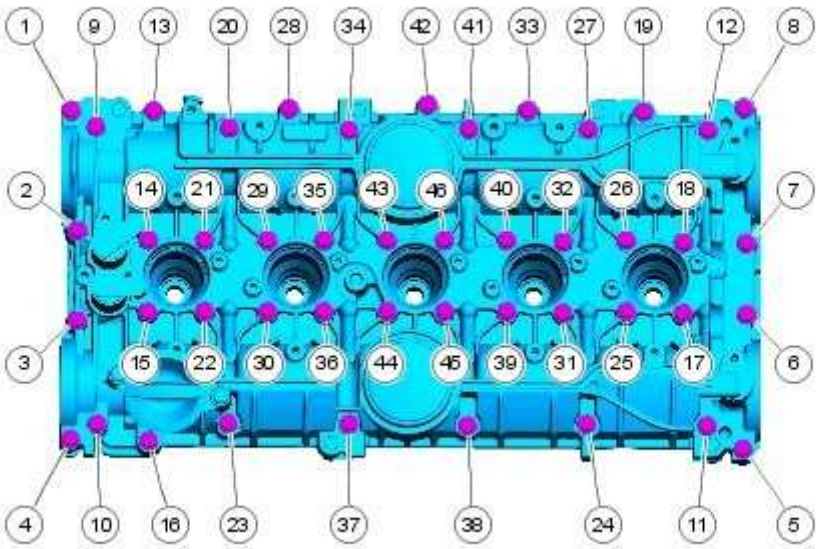


15. *General Equipment:* Punch

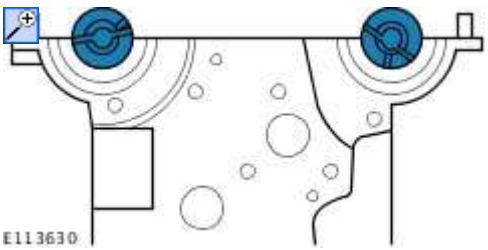
16.

http://vnx.su



E68743

17.



E113630

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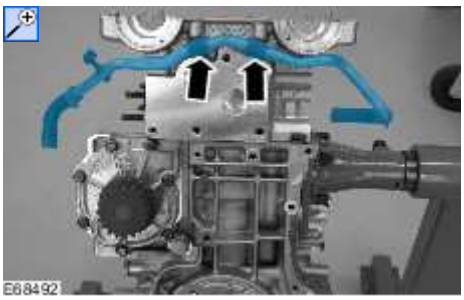
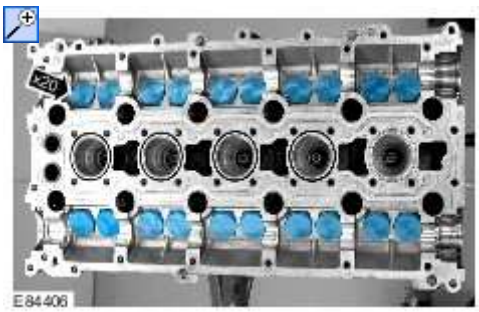


E68492

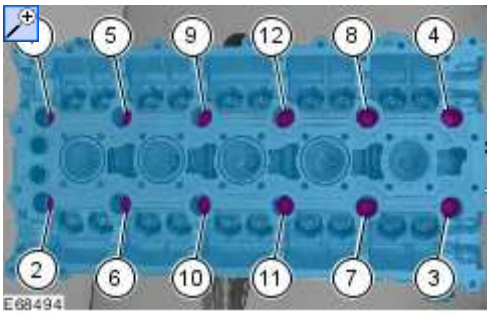
19.



E84406

20.

http://vnx.su



E68494

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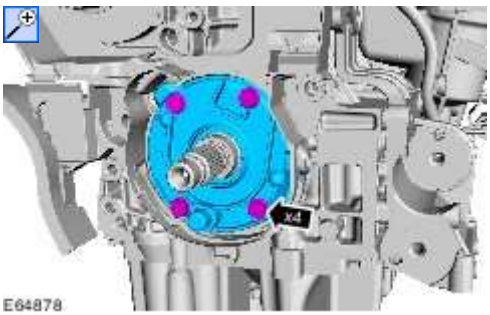
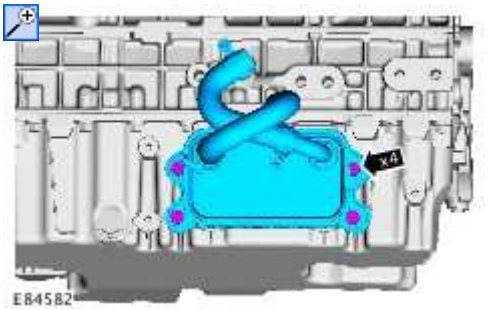


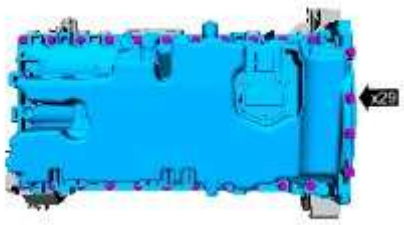
E64878

22.



E84582

23.



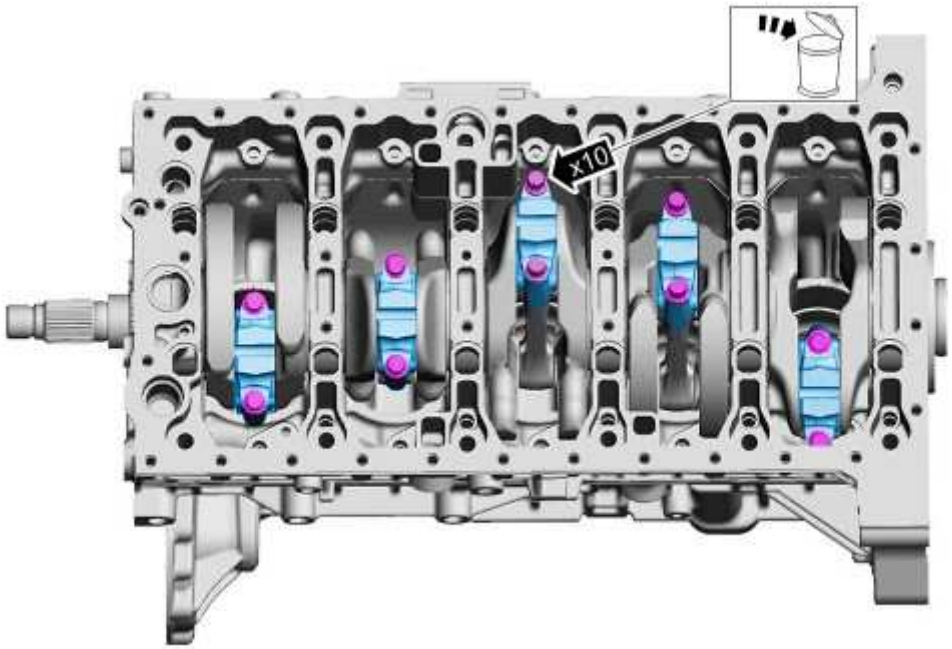
E84206

24.

E68495

25. CAU
Note the
position
compone
before
removal

http://vnx.su



E122192

E77266

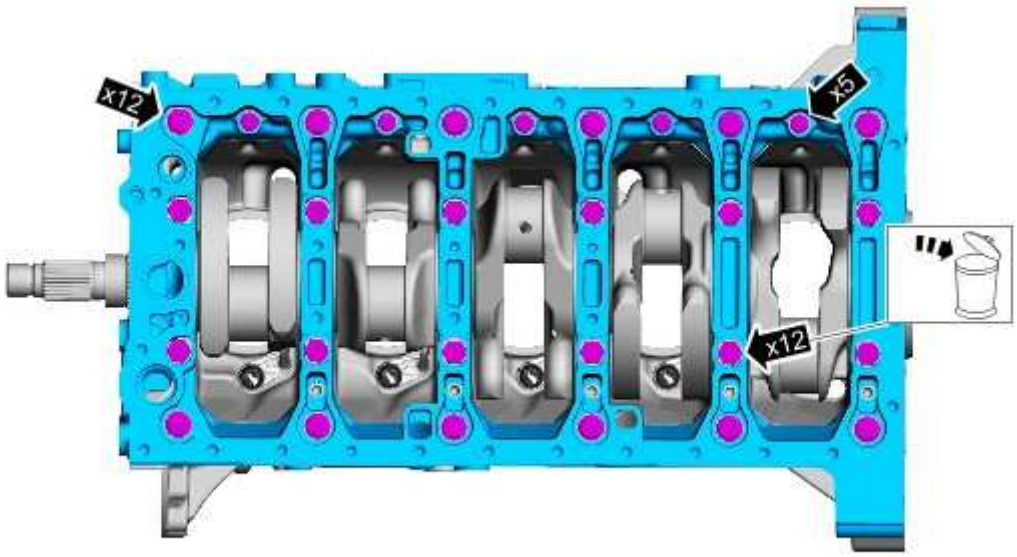
26. CAUTION: Note the position of the component before removal.

E122197

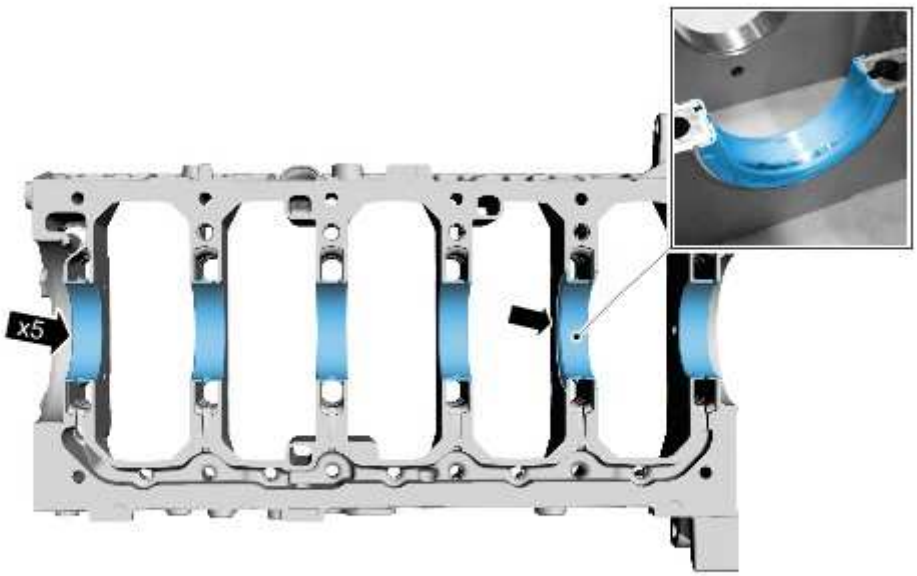
27. CAUTION: Note the position of the componen before removal.

28.

http://vnx.su



E122198



E122294

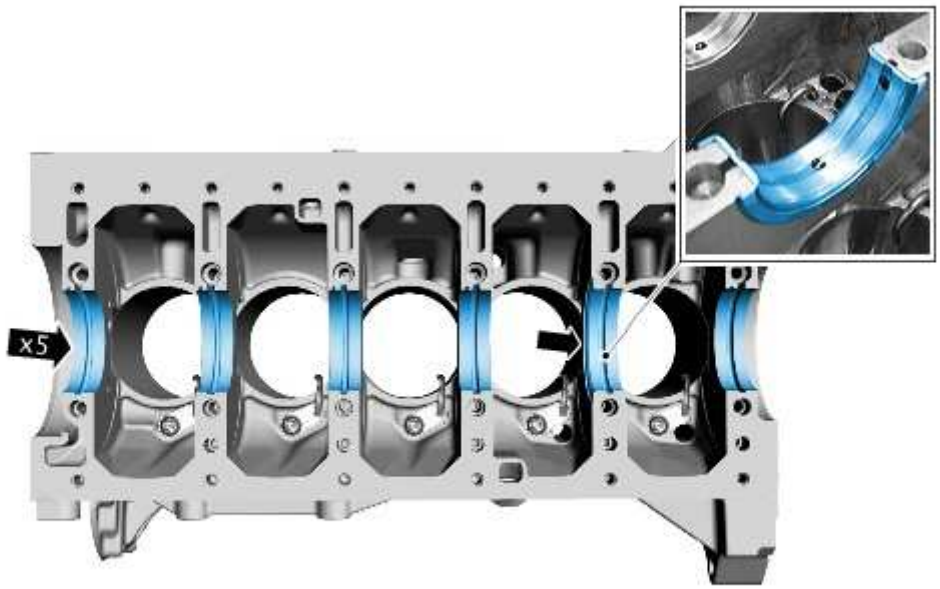
29. CAU
Note the
position
compone
before
removal

30.

E122227

31. CAU
Note the
position

http://vnx.su



E122293

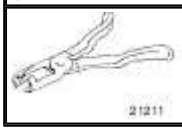
compone
before
removal

http://vnx.su

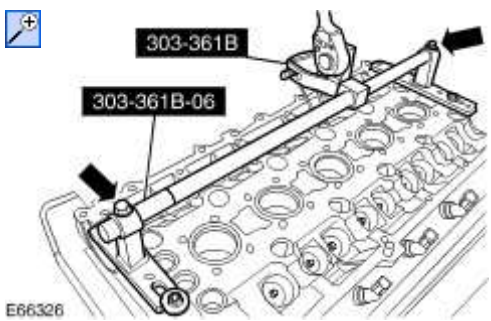
Print

Disassembly and Assembly of Subassemblies

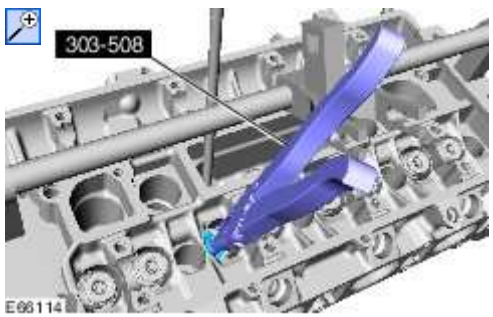
Special Tool(s)

	303-361B Compressor, Valve Spring
	303-361B-06 Adapter for 303-361B
 21211	303-508 Pliers, Valve Stem Seal

Disassembly



1. *Special Tool(s):* 303-361B, 303-361B-06



2. *Special Tool(s):* 303-508

Assembly

3. To install, reverse the assembly procedure.

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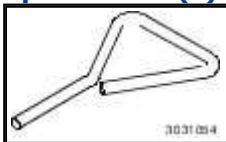
Assembly

Special Tool(s)

	303-1054 Locking Tool, Timing Belt Tensioner
	303-1178 Timing Tool Camshaft
	303-1179 Holding Wrench, Crankshaft
	303-1180 Installer, Crankshaft Front Seal
	303-1181 Installer, Crankshaft Rear Seal
	303-1182 Timing Tool, Crankshaft

http://vnx.su

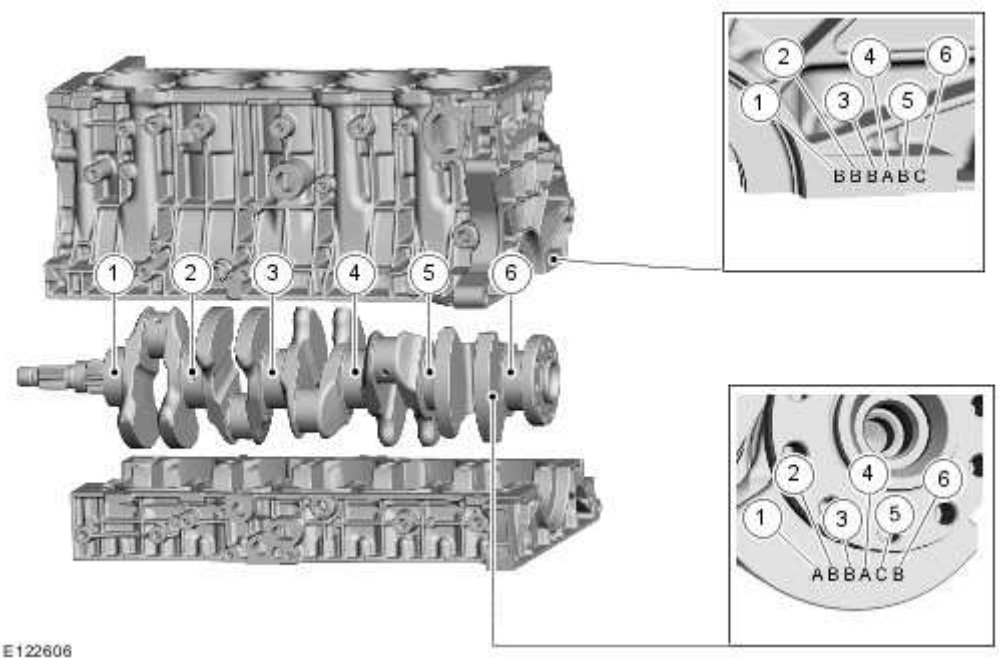
	303-318 Aligner/Installer, Crankshaft Front Seal

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA

General Equipment

Piston ring compressor
Round-ended steel rule



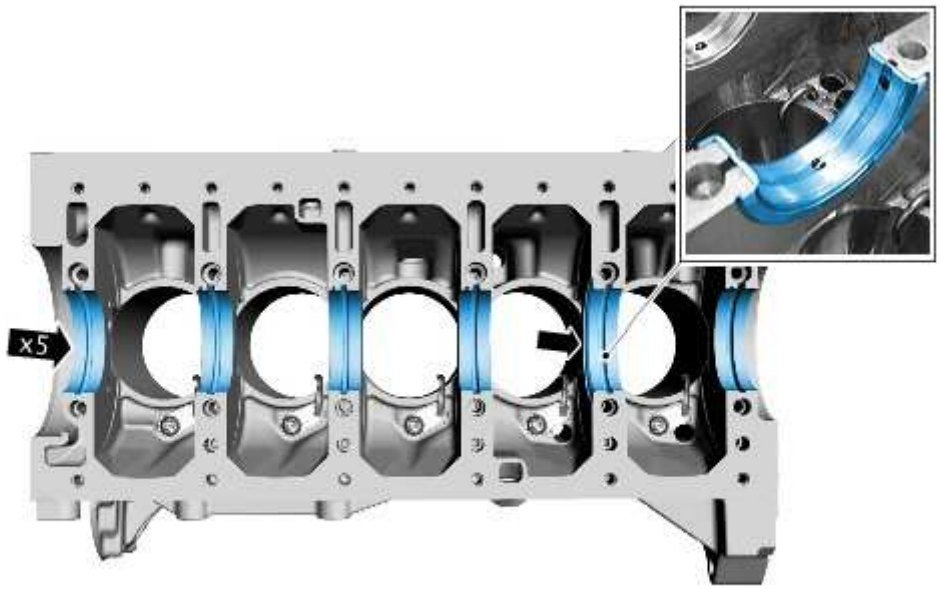
E122606

1. NOTE: T
only nec
when ins
new com
Refer to:
Specifica
01D Eng
Duratec
(162kW/
Specifica

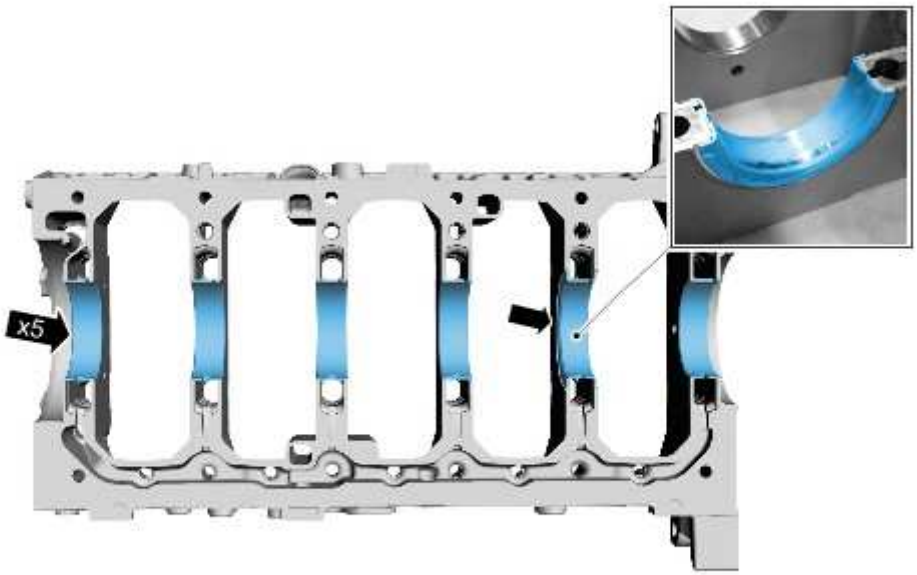
2. CAU
Make su
compone
installed
position
before re
Apply a t

Material:
5W-30 (
M2C913-

http://vnx.su



E122293

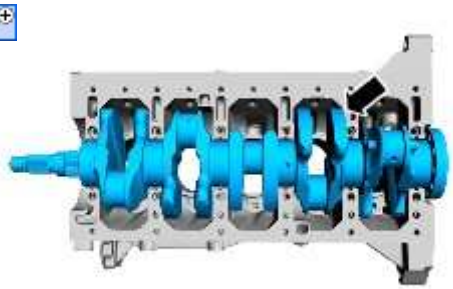


E122294

3. CAU
Make su
compone
installed
position
before re
Apply a t

Material:
5W-30 (
M2C913-

4.



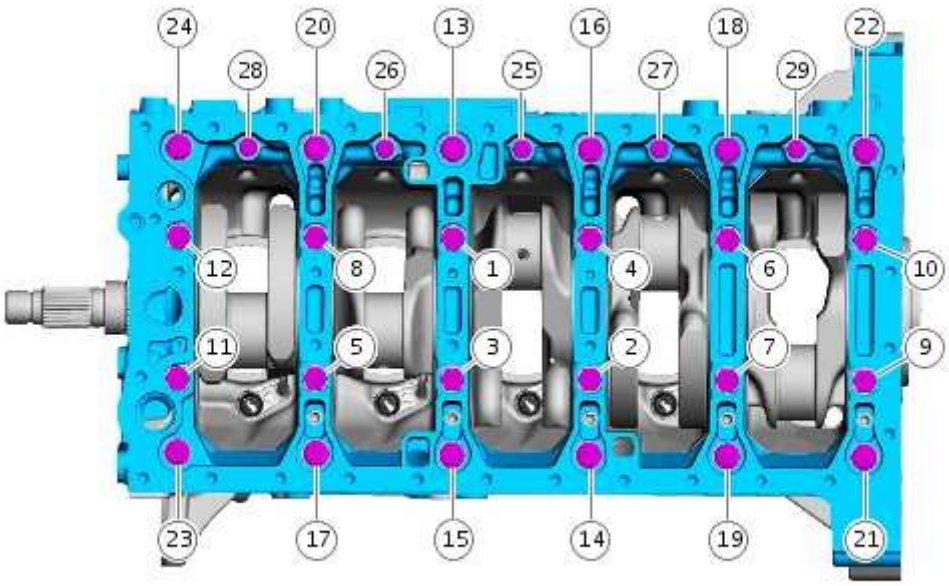
E122227

5. NOTE: T
compone
be instal
5 minute

http://vnx.su

applying
sealant.
Material:
Sealant
LP (WSK
A7 / 5U7
BA)

E122323



E122331

6. CAU
Make su
bolts are
Torque:
S

S

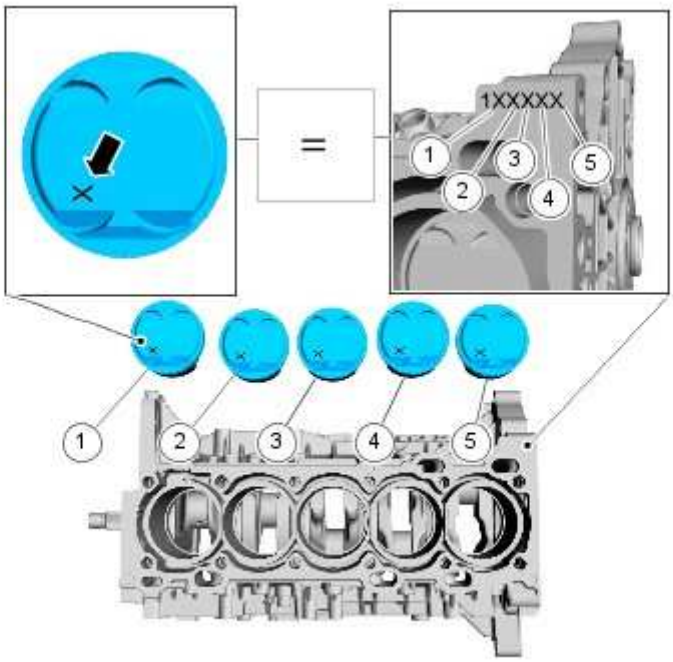
7. *Torque:*
M8:

8. *Torque:*
M7:

9. *Torque:*
M10

10. NOTE: T
only nec
when ins
new com

http://vnx.su



E122634

E122334

11. CAUTION: Make sure that the components ar
to the position noted before removal.
General Equipment: Piston ring compressor

E77266

12. CAUTION: Make sure that the components are
to the position noted before removal.
Apply a thin coating.

Material: Engine Oil - 5W-30 (WSS-M2C913-C)

13. CAUTIOI

Mak
the com
are insta
position
before r

Mak
new bolt
installed
Apply a t

Material:

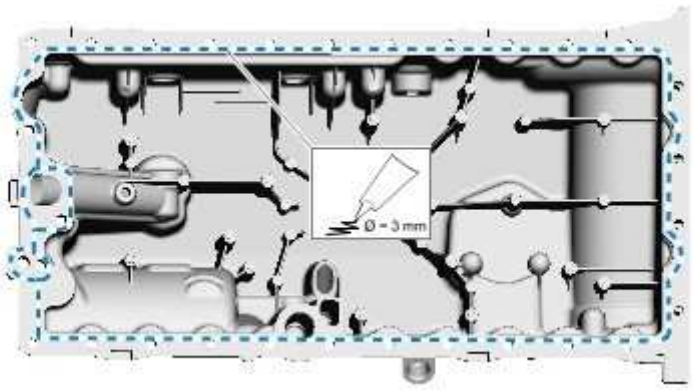
http://vnx.su

5W-30 (
M2C913-
Torque:
Nm

E122335

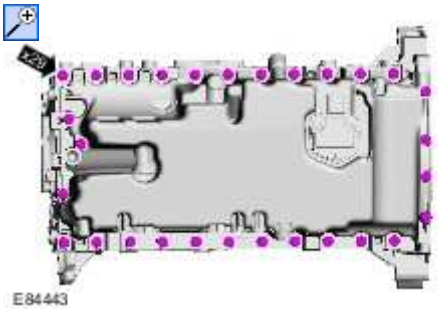
E68495

14. *Torque:* 10 Nm



E84444

15. NOTE: The cor
must be instal
minutes of app
sealant.
Material: Flang
Anaerobic LP (
M2G348-A7 / 5
M2G348-BA)

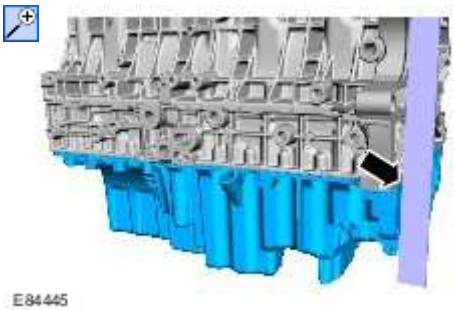


E84443

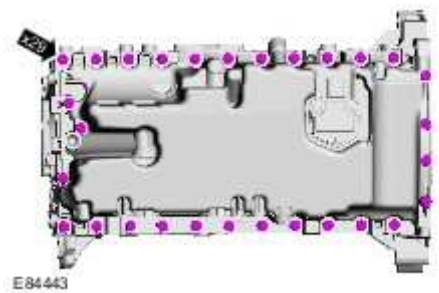
16. NOTE: Only tighten the bolts finger tight at this st

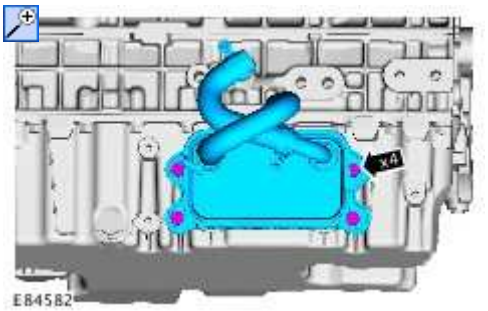
17. *General Equipment:* Round-ended steel rule

http://vnx.su

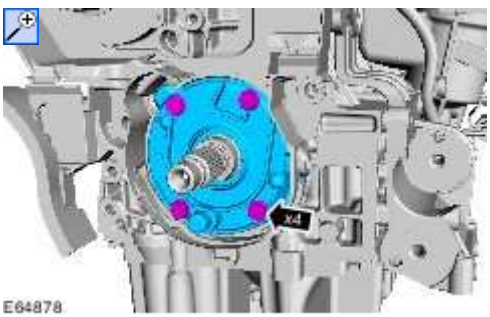


18. *Torque:* 17 Nm

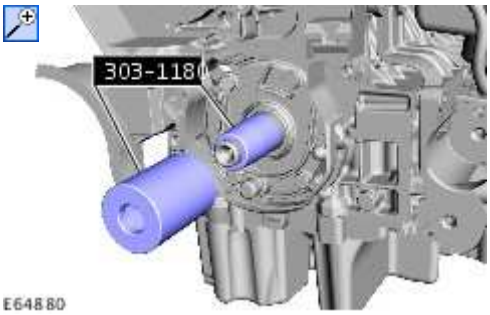




19. *Torque:* 17 Nm



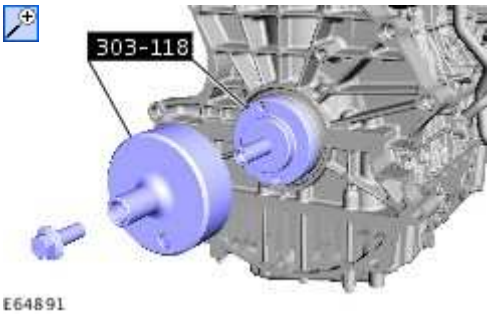
20. *Torque:* 6 Nm



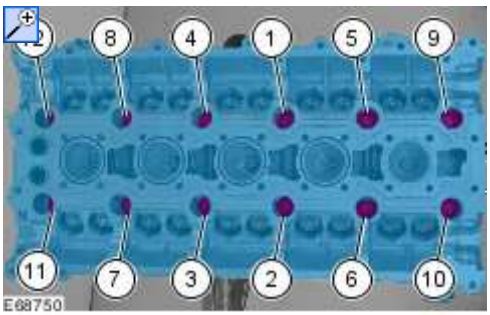
21. *Special Tool(s):* 303-1180

22. *Special Tool(s):* 303-1181

http://vnx.su

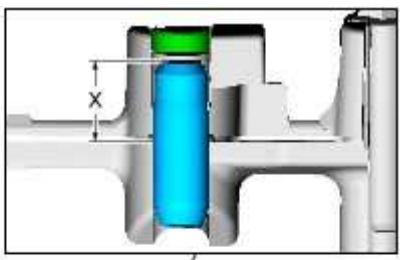


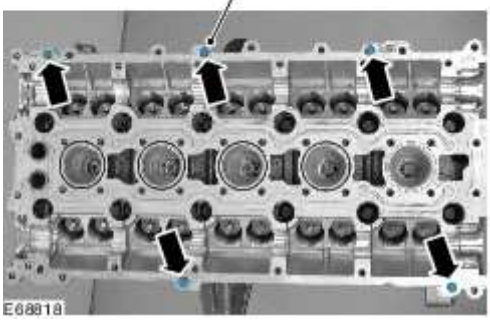
E64891



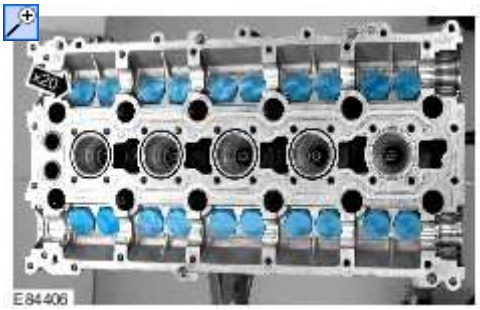
E68750

23. *Torque:*
Stage 1: 20 Nm
Stage 2: 60 Nm
Stage 3: 130°




E68818

24.
- X = 15 mm.

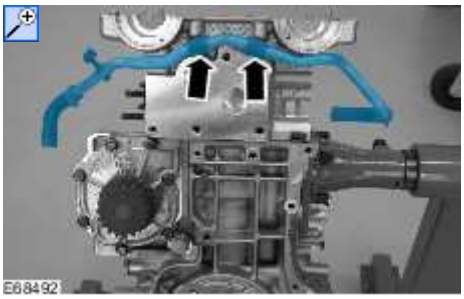


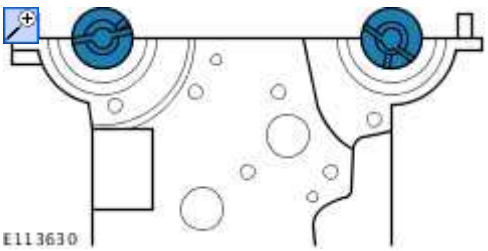
E84406

25.

26.

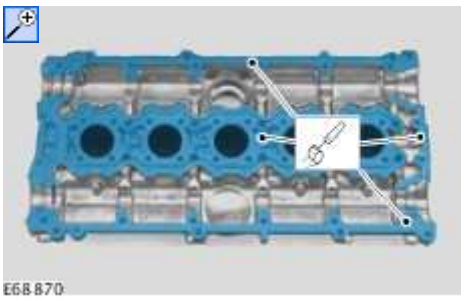
http://vnx.su





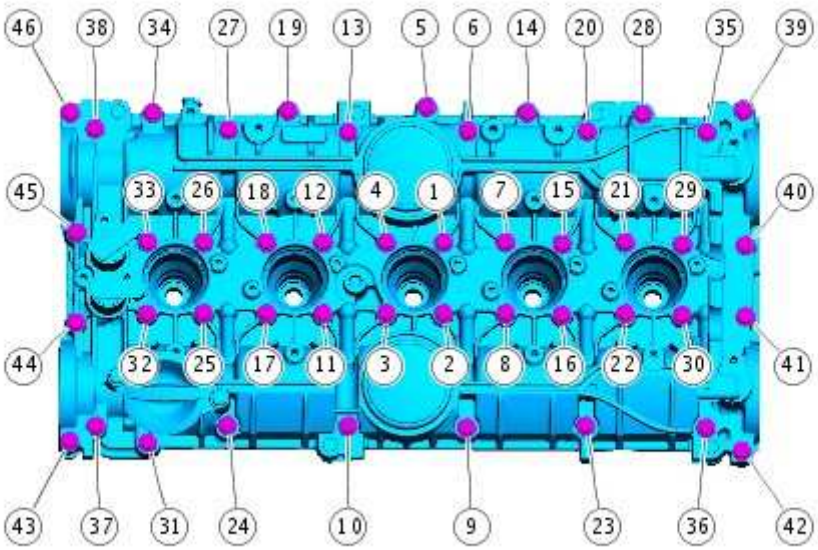
27. Apply a thin coating.

    Material: Engine Oil - 5W-30 (WSS-M2C913-C)



28. *Material:* Flange Sealant - Anaerobic LP (WSK-M2G3 5U7J-M2G348-BA)

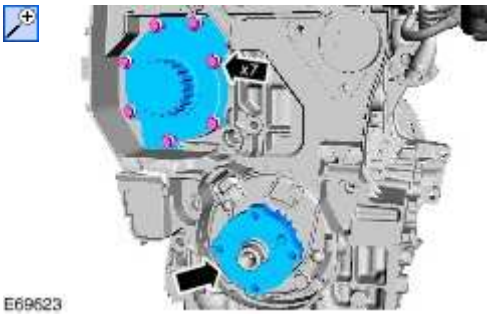
29. *Torqu*



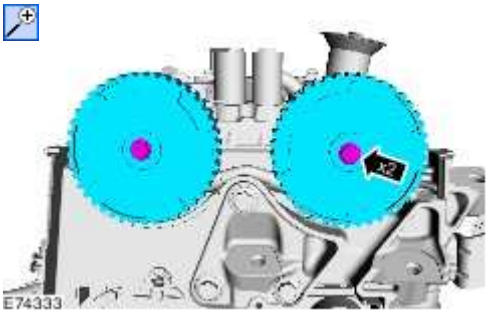
E87508

30. *Special Tool(s):* 303-318

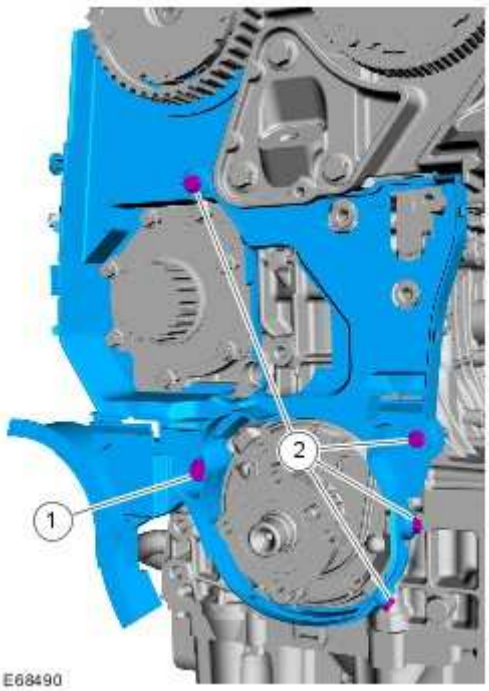
http://vnx.su



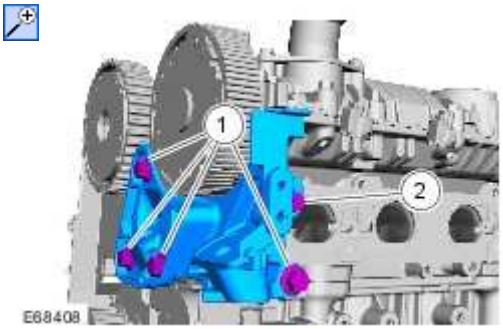
31. NOTE: The crankshaft timing pulley can only be in position on the crankshaft splines.
Torque: 17 Nm



32. NOTE: Only tighten the bolts finger tight at this st



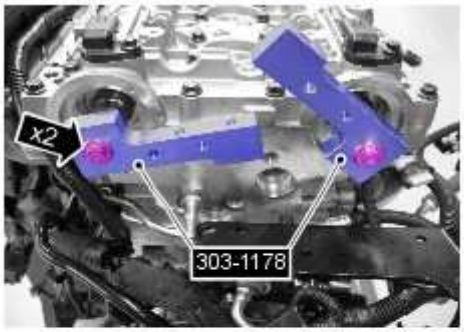
33.
1. *Torque:* 25 Nm
2. *Torque:* 12 Nm

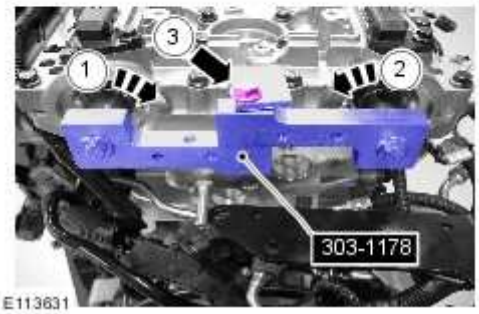


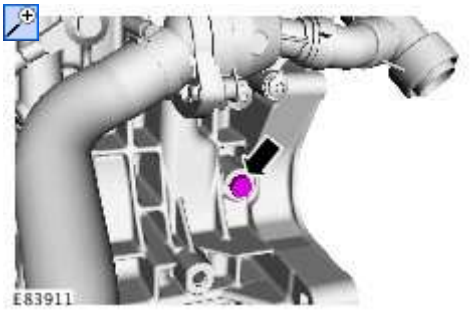
34. NOTE: Install all the bolts finger tight before final
1. *Torque:*
Stage 1: 35 Nm
Stage 2: 75°
2. *Torque:*
Stage 1: 15 Nm
Stage 2: 90°

35. *Install the Special Tool(s):* 303-1178
Torque: 10 Nm

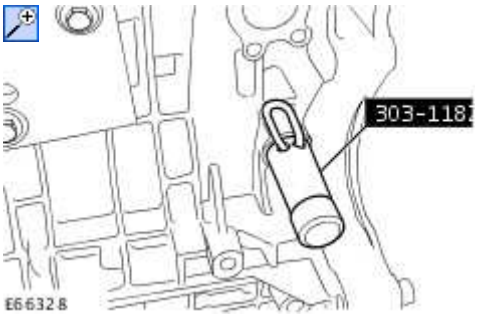
http://vnx.su







36.



37. CAUTION: Only rotate the crankshaft clockwis
Rotate the crankshaft slowly until the crankshaft sto

Install the Special Tool(s): 303-1182

38. CAUTION: Make sure that the installation ma
aligned.

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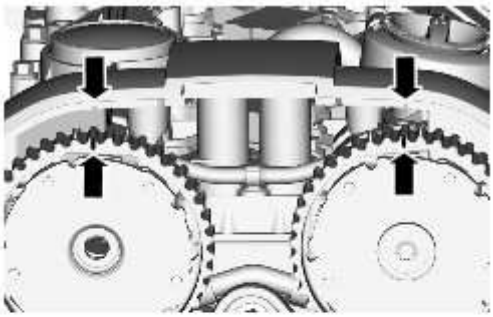
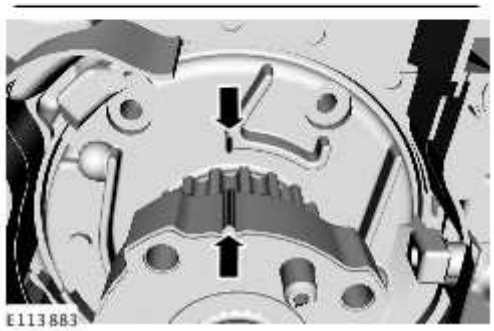
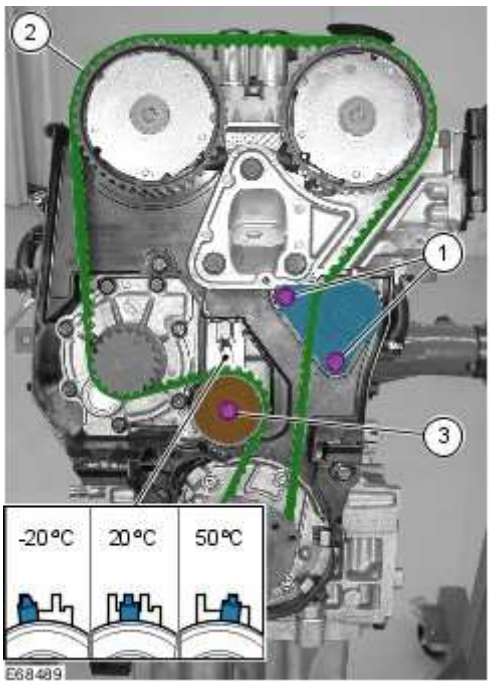




Vehicles with mechanical timing belt tensioner



39. NOTE: Make sure that new components are install
    1. *Torque:* 25 Nm
    3. *Torque:* 25 Nm

Vehicles with automatic timing belt tensioner

40. NOTE: Make sure that new components are instal
    1. *Torque:* 25 Nm
    3. *Special Tool(s):* 303-1054
       Torque: 25 Nm

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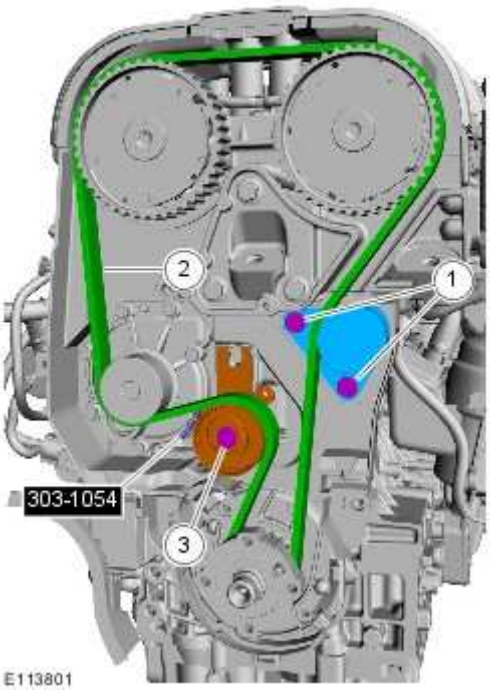
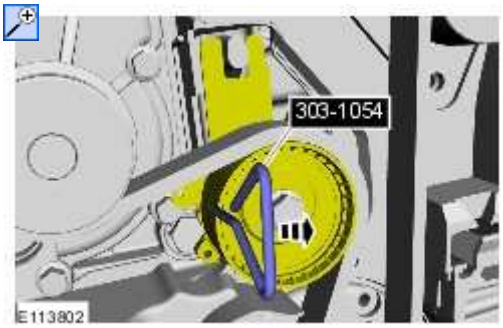
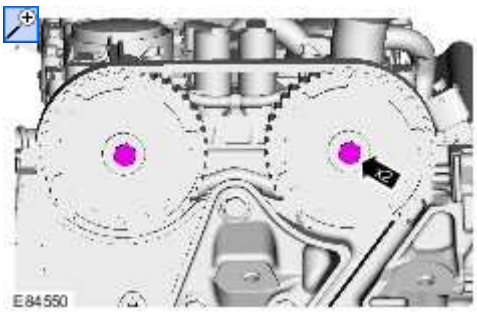


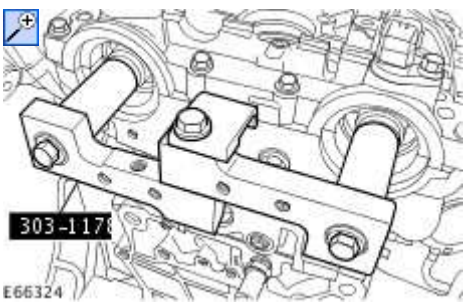


41. WARNING: Take extra care when handling th compressed spring.
Remove the Special Tool(s): 303-1054

All vehicles



42. *Torque:* 120 Nm



43. *Remove the Special Tool(s):* 303-1178

44. CAUTION: Only rotate the crankshaft clockwis
Rotate the crankshaft slowly until the crankshaft sto

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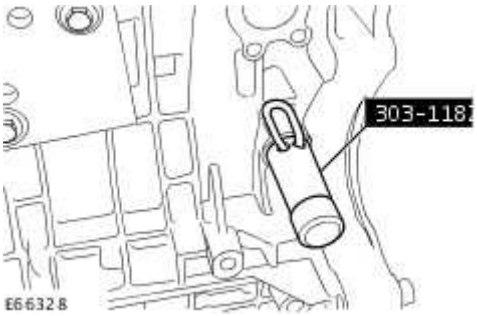
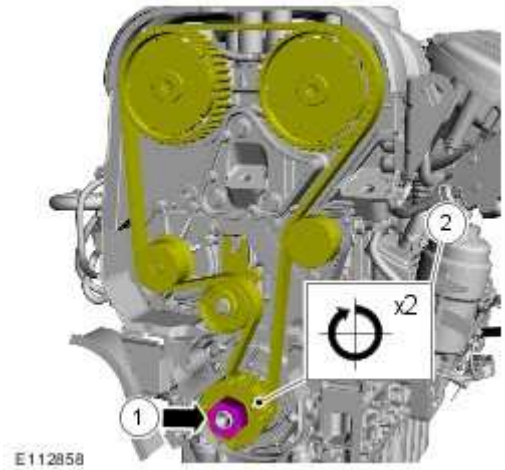
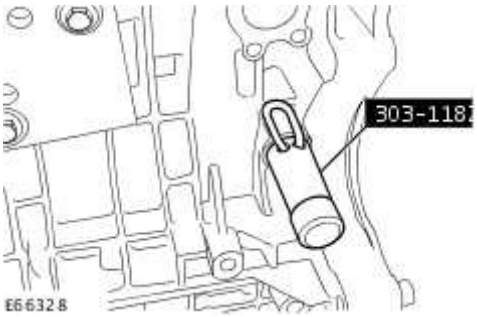


Remove the Special Tool(s): 303-1182

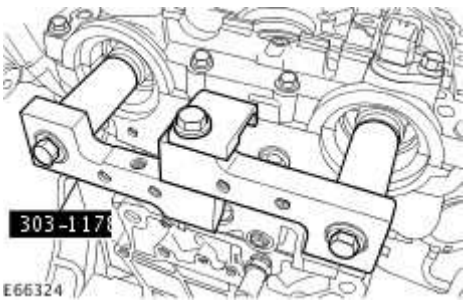


45.



46. CAUTION: Only rotate the crankshaft clockwis
Rotate the crankshaft slowly until the crankshaft sto

Install the Special Tool(s): 303-1182



47. *Install the Special Tool(s):* 303-1178
Torque: 10 Nm

48. CAUTION: Make sure that the installation ma
aligned.

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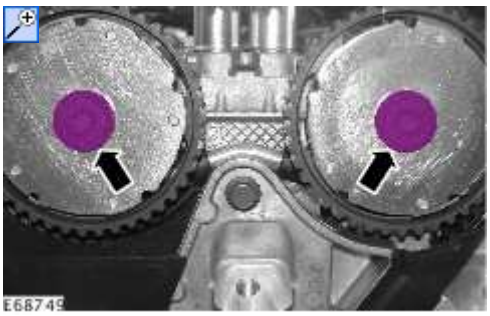
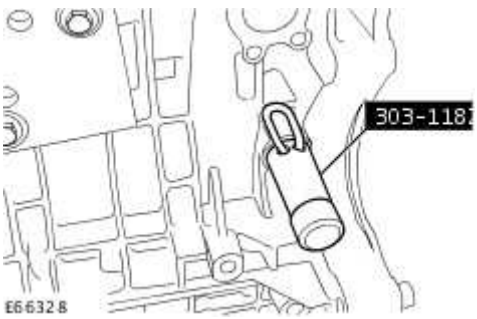
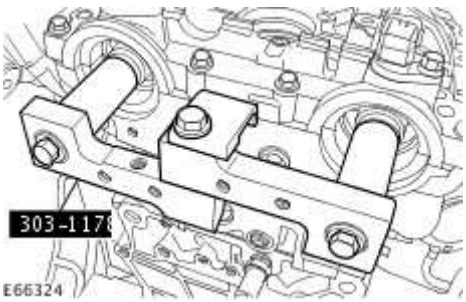


49. *Torque:* 35 Nm



50. *Remove the Special Tool(s):* 303-1182



51. *Remove the Special Tool(s):* 303-1178

52. *Torque:* 17 Nm

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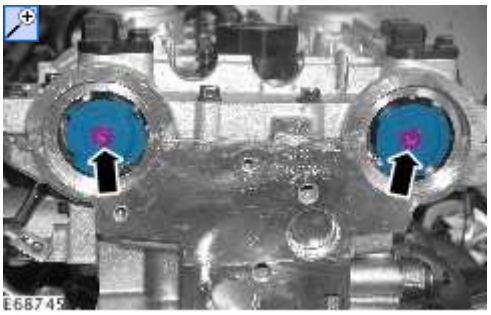
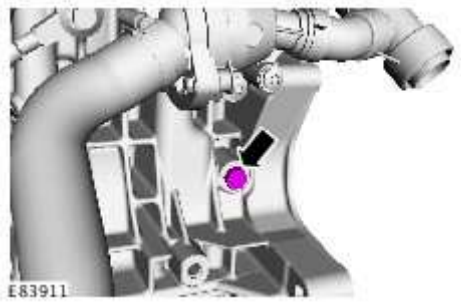
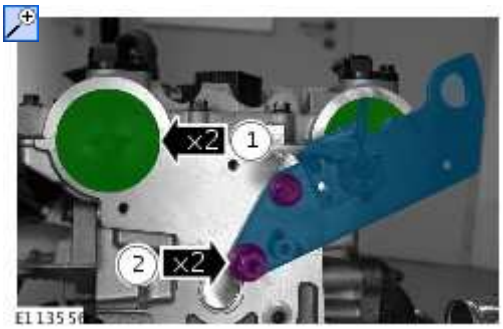
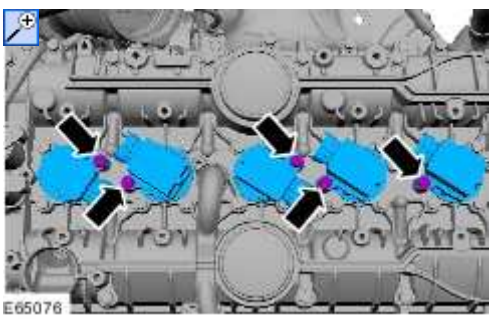




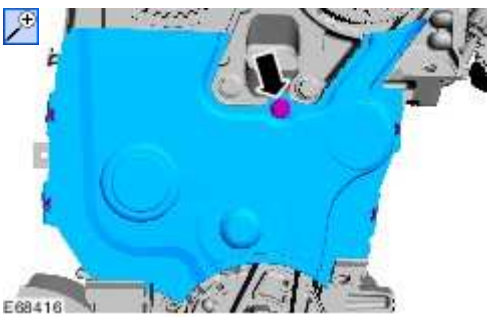
53. *Torque:* 40 Nm



54.
1. NOTE: Make sure that new components are
2. *Torque:* 40 Nm



55. *Torque:* 10 Nm



56. *Torque:* 10 Nm

57.
1. NOTE: Only tighten the bolts finger tight at
   Install the Special Tool(s): 303-1179
2. *Torque:* 180 Nm

58. *Remove the Special Tool(s):* 303-1179

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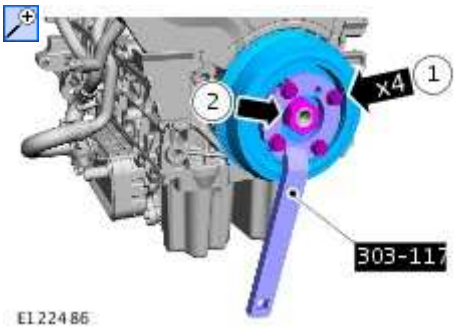

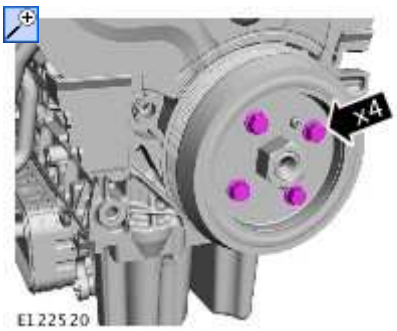

59. *Torque:*
    Stage 1: 25 Nm
    Stage 2: 60°

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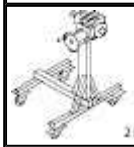
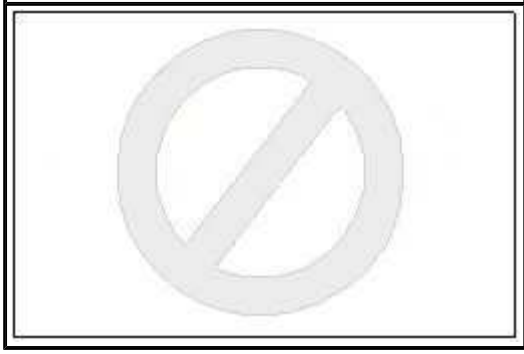
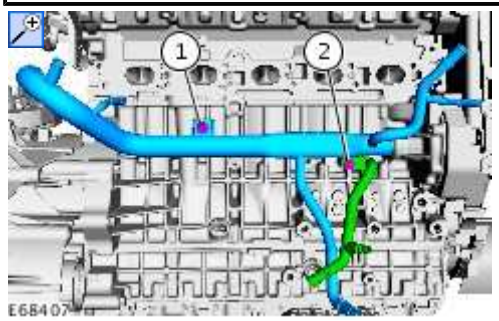
Print

Installation

Special Tool(s)

	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-14B Mounting Plate for 303-435-06



1. *Torque:* 17 Nm

2. *Torque:* 48 Nm

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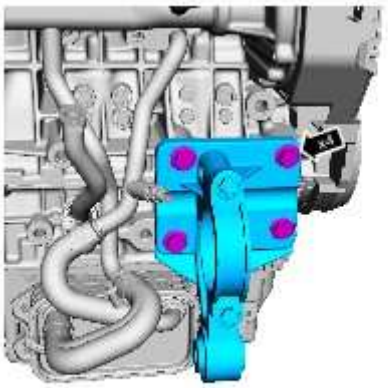
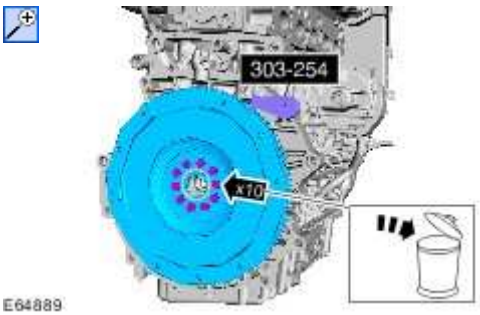
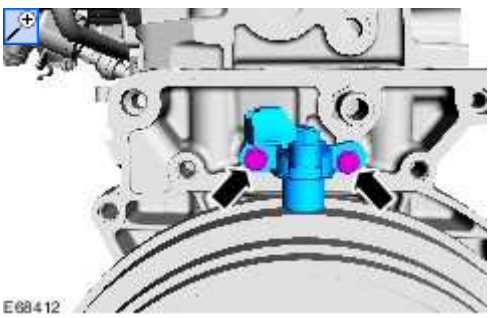


E84148

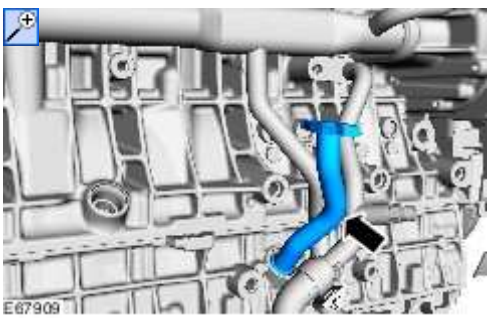


E64889

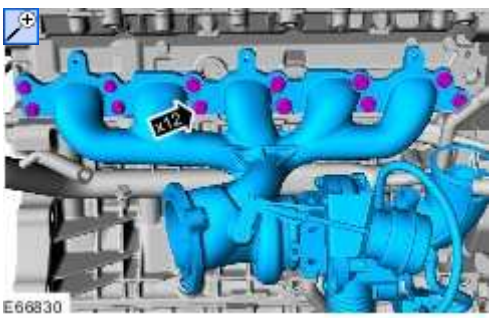
3. CAUTION: Make sure that no excess sealant residue is evident.
NOTE: Make sure that the locating pin on the crankshaft is aligned with the guide hole in the flywheel or flexplate.
Special Tool(s): 303-254
Torque:
Stage 1: 45 Nm
Stage 2: 65°


E68412

4. *Torque:* 17 Nm


E67909

5.



E66830

6. *Torque:* 24 Nm

7. *Torque:* 12 Nm

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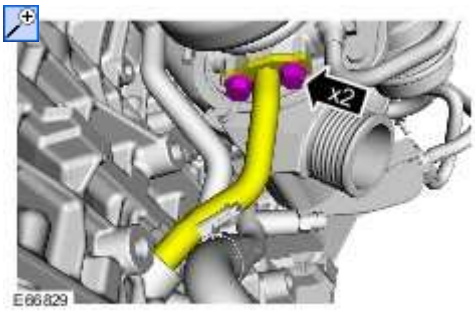
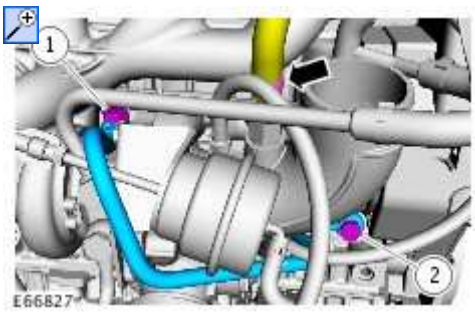
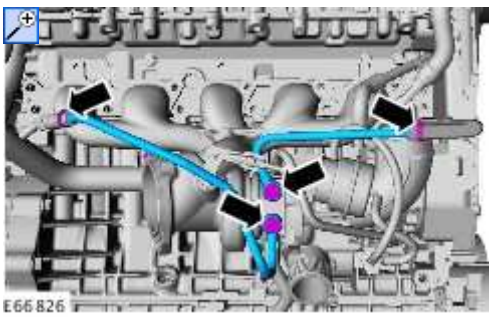
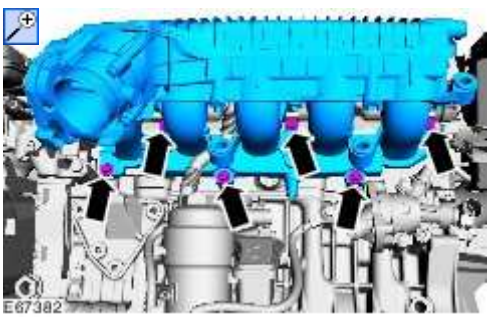




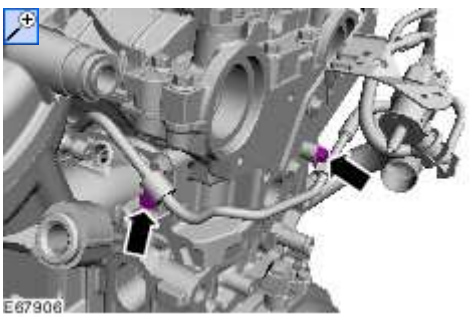
8.
1. *Torque:* 26 Nm
2. *Torque:* 38 Nm



9. *Torque:* 38 Nm



10. *Torque:* 19 Nm



11. *Torque:* 10 Nm

12. *Torque:* 10 Nm

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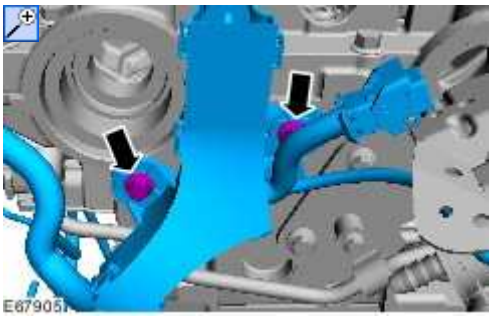
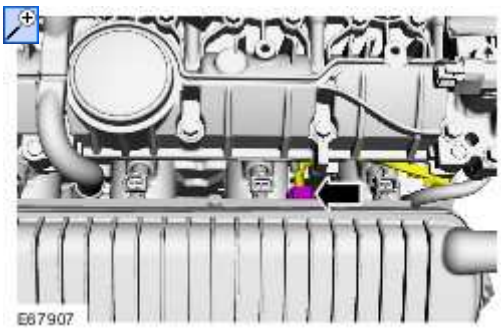
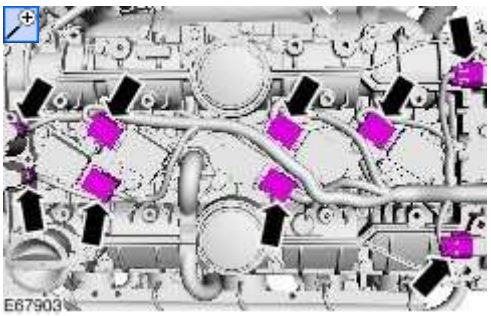


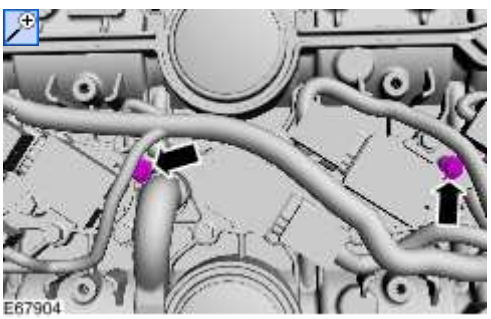
13.



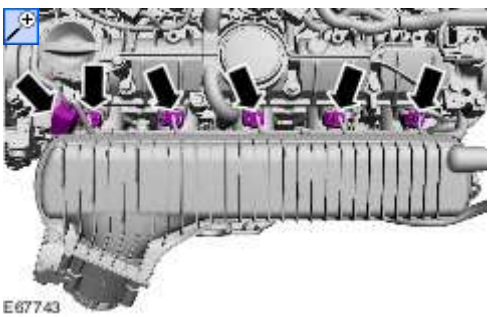
14.



15. *Torque:* 10 Nm



16.



17.

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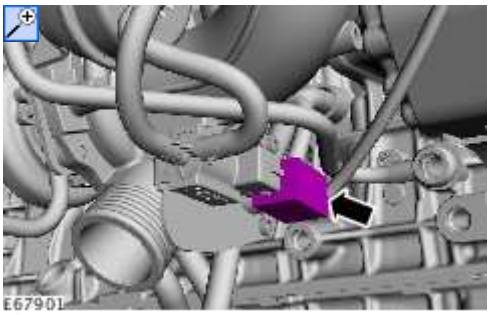
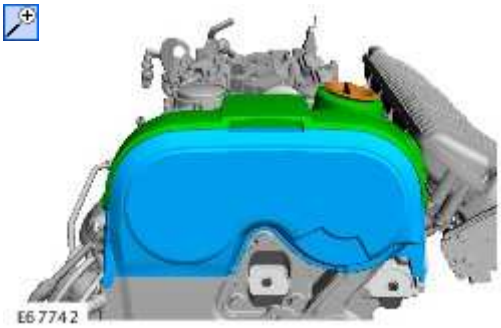
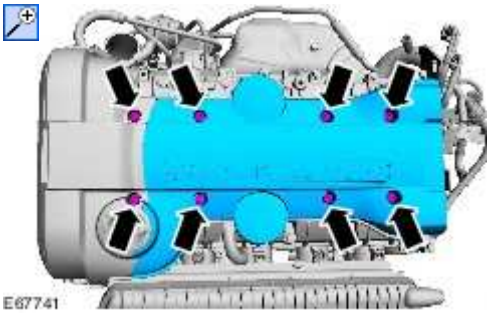


18.



19. *Torque:* 10 Nm



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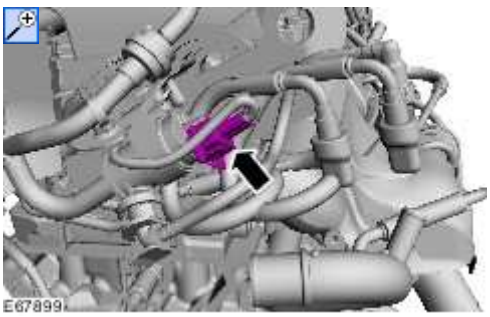

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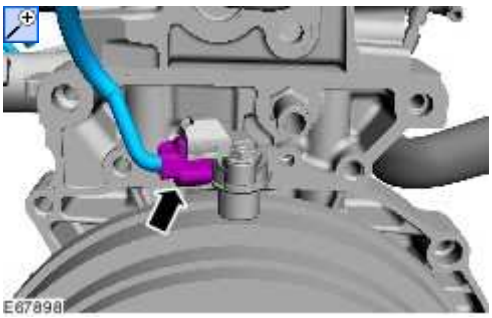

22. *Install the Special Tool(s):* 303-122

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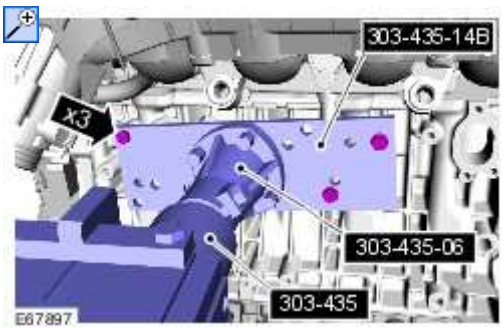
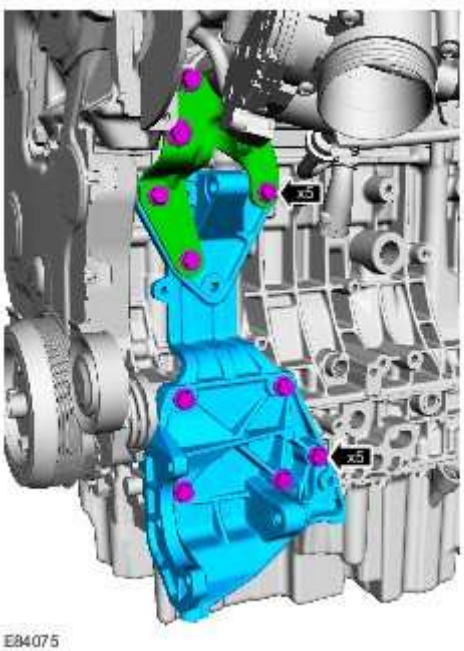
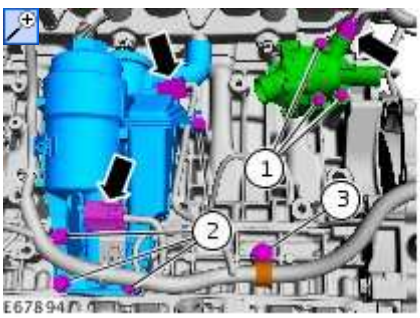


23. *Remove the Special Tool(s):* 303-435, 303-435-06, 303-435-14B



24. *Torque:* 24 Nm



25.
1. *Torque:* 17 Nm
2. *Torque:* 16 Nm
3. *Torque:* 24 Nm

26. *Torque:* 20 Nm

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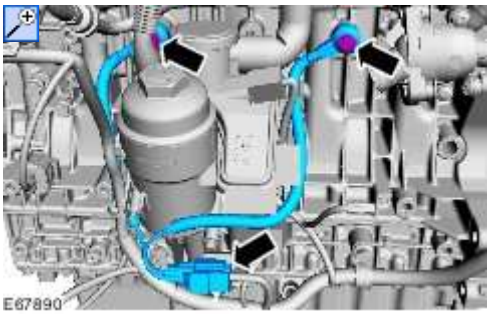

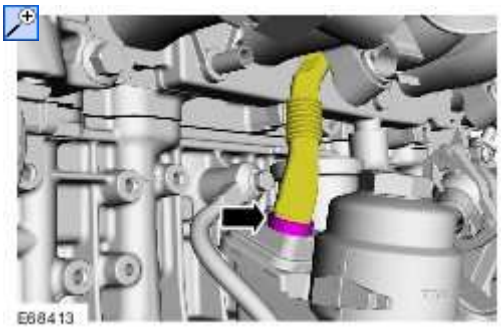

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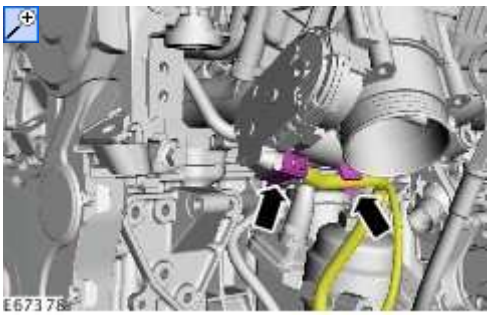

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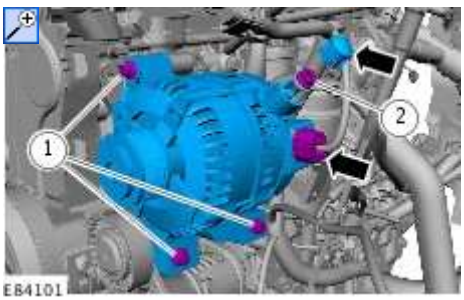
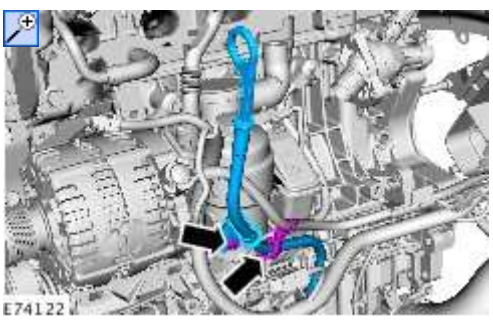


29.

1. *Torque:* 24 Nm
2. *Torque:* 15 Nm



30. *Torque:* 10 Nm

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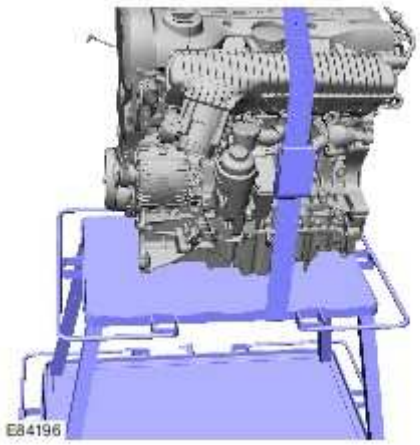
Installation

Special Tool(s)

	303-122 Lifting Bracket, Engine

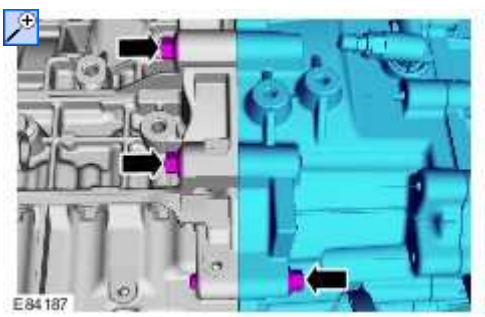
General Equipment

Hose clamp remover/installer
Mounting table set
Retaining Strap



1. WARNING: Make sure that the engine and transmission assembly is on wooden blocks and secured with suitable retaining straps.
   General Equipment: Mounting table set
   General Equipment: Retaining Strap

2. *Remove the Special Tool(s):* 303-122



3. *Torque:* 48 Nm

4. *Torque:* 48 Nm

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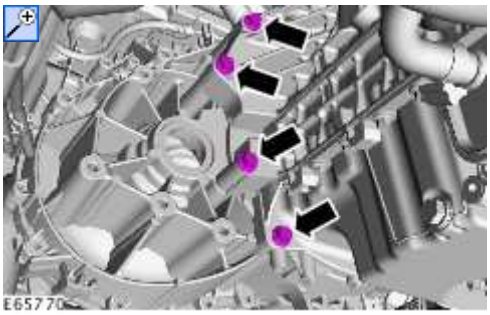
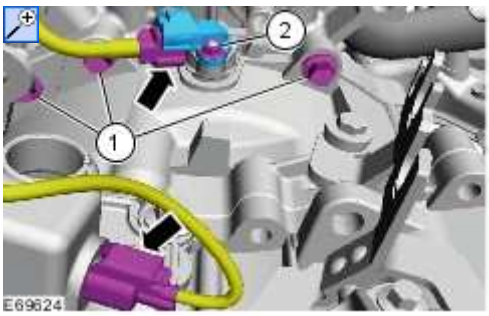
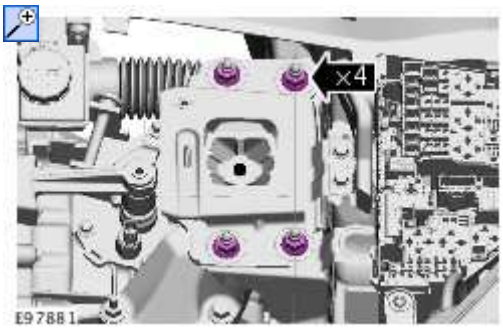


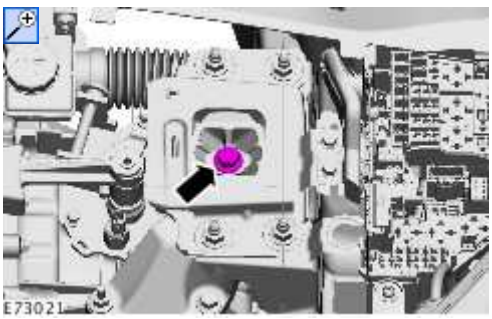


5.
1. *Torque:* 48 Nm
2. *Torque:* 6 Nm

6. CAUTION: Make sure that no components catch.
Lower the vehicle until the engine mounts are free from load.



7. *Loosen:* 2 turn(s)



8. NOTE: Make sure that a new component is installed.
Torque: 133 Nm

9. *Torque:* 12 Nm

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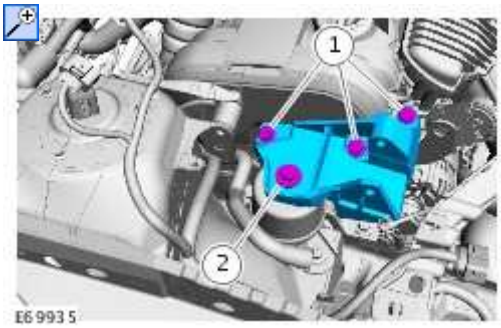
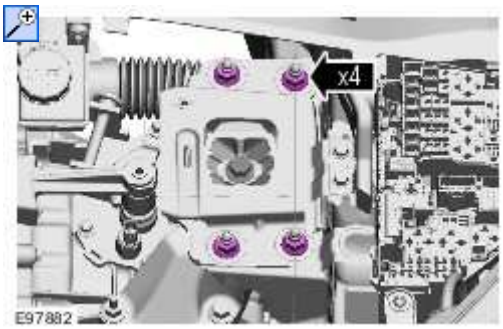


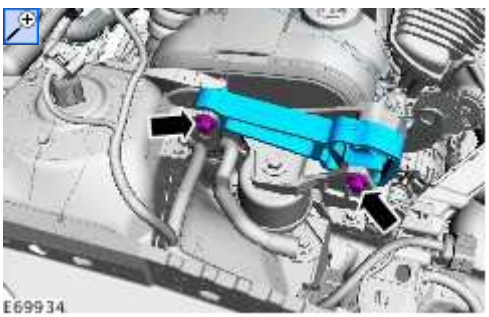
10.
1. *Torque:* 80 Nm
2. NOTE: Only tighten the bolt finger tight at this stage.

11. Remove the following items:
- *General Equipment:* Mounting table set
  General Equipment: Retaining Strap



12. *Torque:* 80 Nm

13. *Torque:* 80 Nm



14. *Torque:* 110 Nm

15. Refer to: Starter Motor (303-06C Starting System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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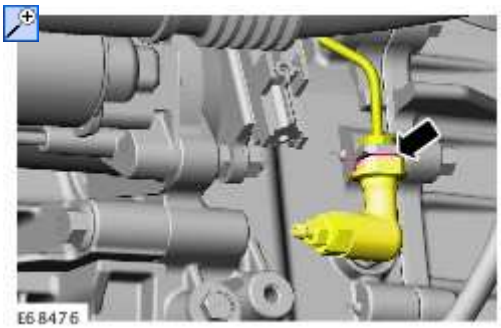

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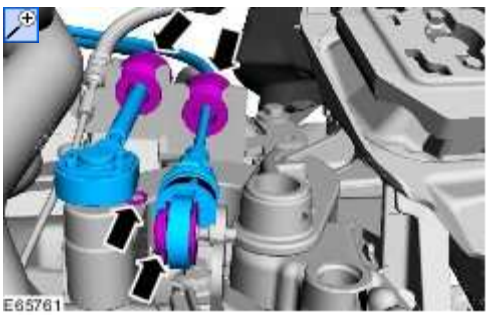
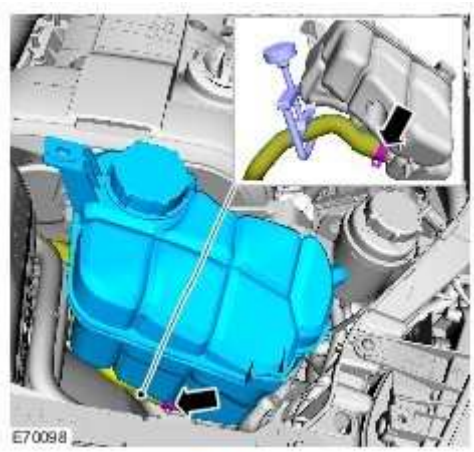
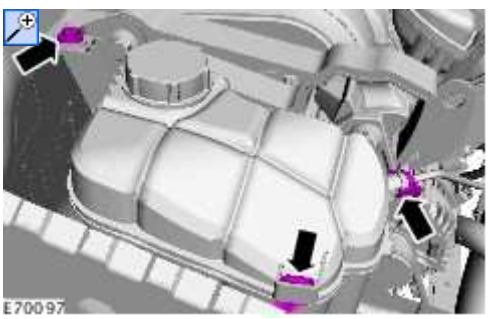


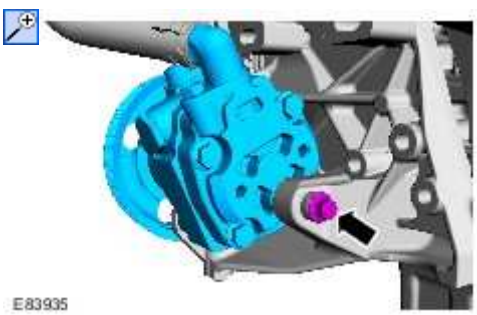
17. CAUTION: Gearshift cables must not be kinked or bent.



18. *General Equipment:* Hose clamp remover/installer



19. *Torque:* 10 Nm



20. *Torque:* 25 Nm

21. *Torque:* 25 Nm

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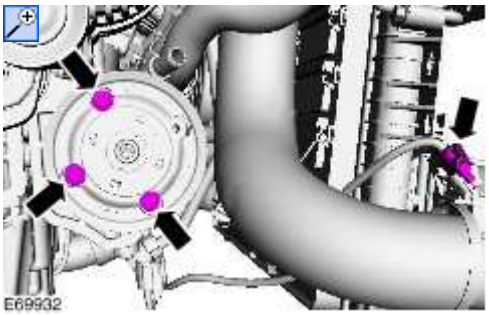
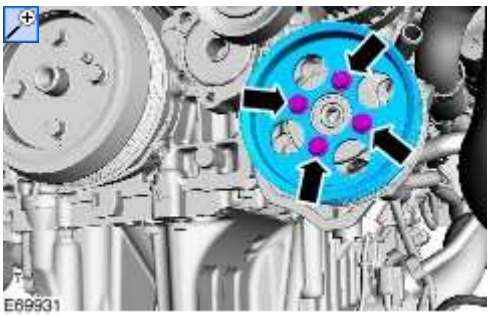
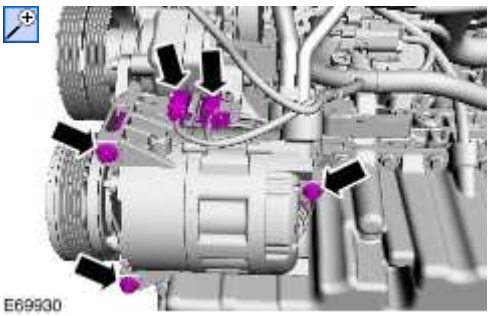
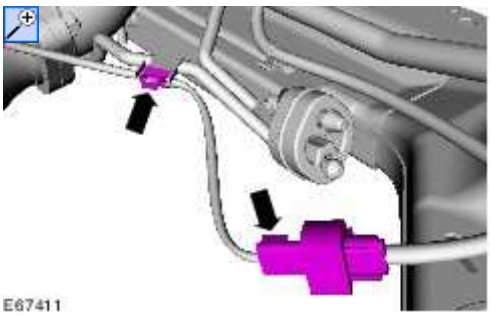




22. *Torque:* 25 Nm



23. *Torque:* 25 Nm



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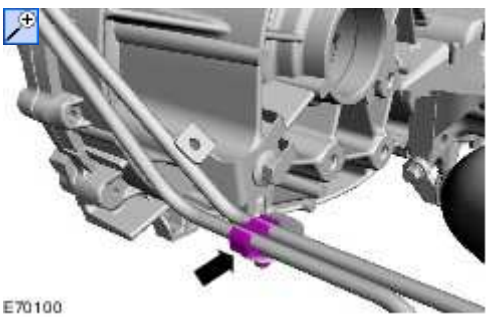

25.

26. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

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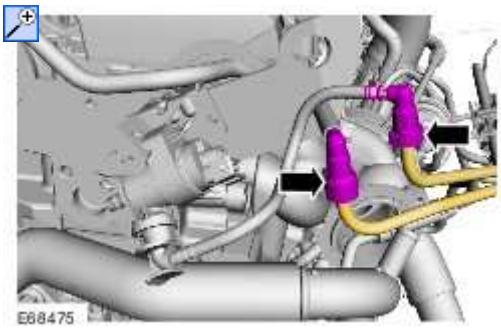
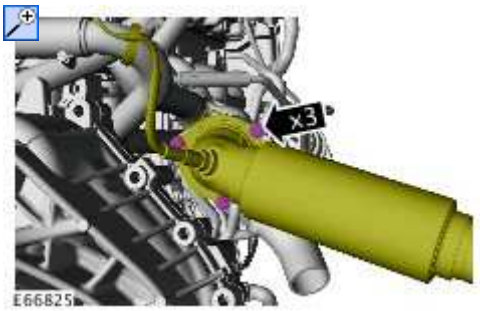
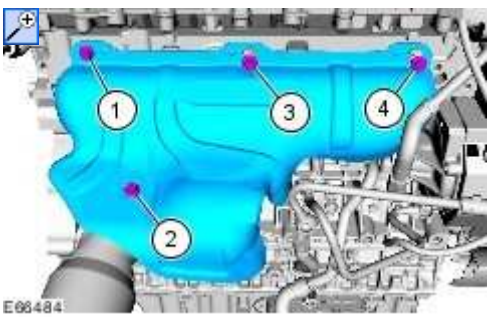


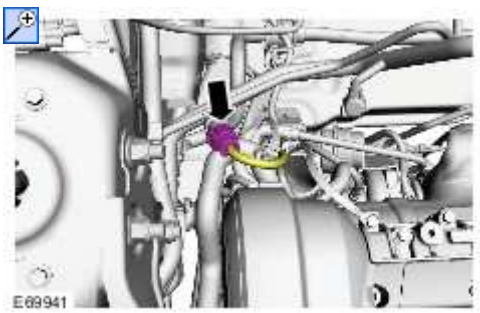


27. *Torque:* 28 Nm

28. Install the following items:
    1. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
    2. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    4. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



29. *Torque:* 20 Nm



30.

31.

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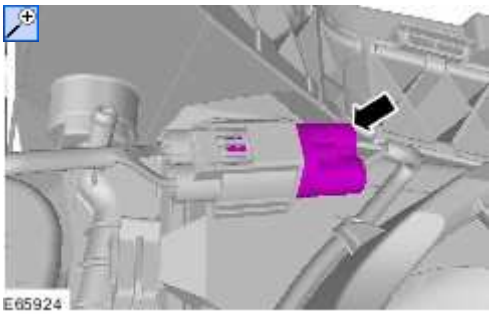

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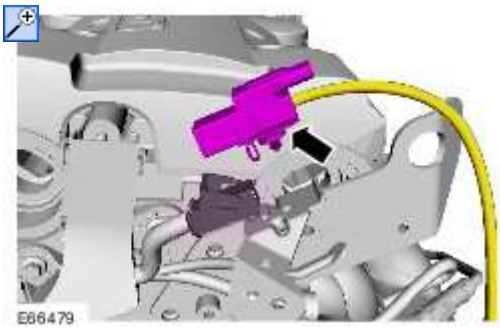

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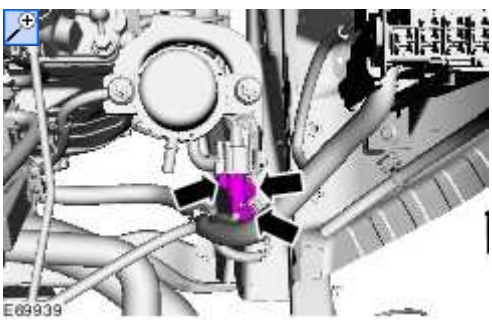
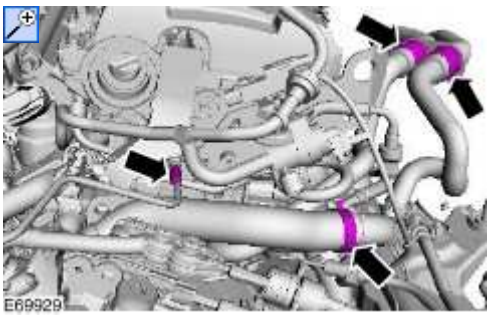


34. *Torque:* 10 Nm



35.

36.

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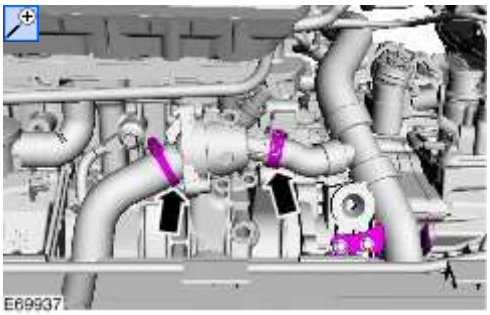
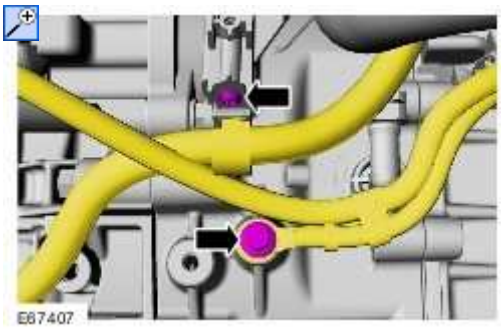
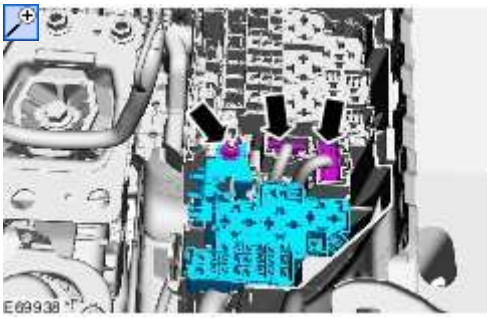




37. *Torque:* 24 Nm



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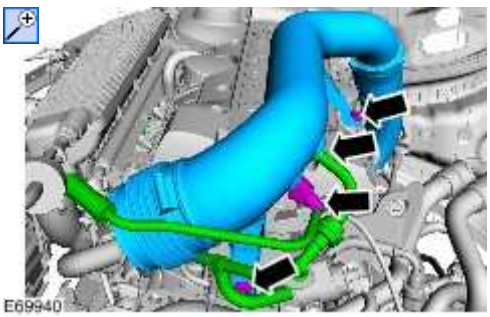
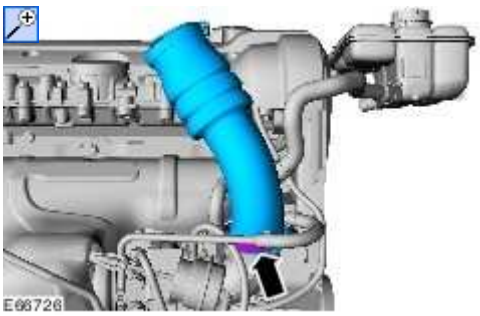


39. *Torque:* 10 Nm



40. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

41.

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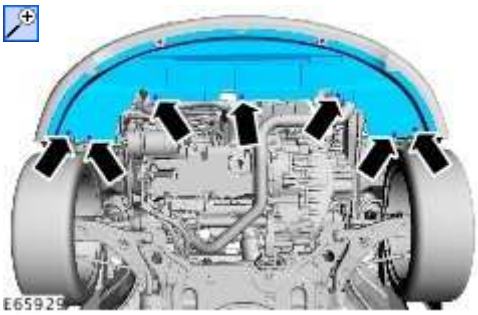

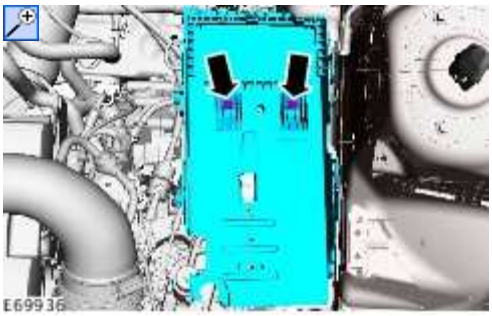

42. *Torque:* 12 Nm

43. *Torque:* 12 Nm

44. Install the following items:
    1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
45. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
46. Refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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Engine Data - 100 PS

Description
Code
Emission level
Firing order
Bore diameter
Stroke
Displacement
Compression ratio
Maximum power output at 3
Maximum torque at 180(
Idle speed
Maximum oil consumpt

Engine Data - 125 PS

Description
Code
Emission level
Firing order
Bore diameter
Stroke
Displacement
Compression ratio
Maximum power output at 3
Maximum torque at 180(
Idle speed
Maximum oil consumpt

Lubricants, Fluids, Sealers and Adhesives

Item
Ford Formula E SAE 5W-30 engine oil
Coolant
Sealant - oil pan to ladder frame
Sealant - ladder frame to cylinder block
Sealant - camshaft bearing cap no. 1
Sealant - fuel pump pulley

Engine Oil Capacity

Initial fill including oil filter
Service fill including oil filter
Service fill without oil filter

Cylinder Block Dimensions

Description
Cylinder bore diameter - Class 1
Cylinder bore diameter - Class 2
Main bearing parent bore diameter

Piston Dimensions

Description

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Piston diameter - Class 1
Piston diameter - Class 2
Piston ring end gaps
- upper compression ring
- lower compression ring
- oil control ring

Piston ring gap position: The piston ring gaps must be distributed evenly around the

Crankshaft Dimensions

	Description
Crankshaft end play	
Main bearing journal diameter	
Connecting rod bearing journal diameter	

Connecting Rod Dimensions

	Description
Big end bore diameter	
Small end bore diameter	
Connecting rod bearing radial clearance	

Piston Pin Dimensions

	Description
Piston pin diameter	

Camshaft Dimensions

	Description
Camshaft end float	
Camshaft bearing journal diameter	

Cylinder Head Dimensions

	Descript
Valve guide inner diameter	
Intake valve clearance	
Exhaust valve clearance	
Camshaft bearing parent bore diameter	
Maximum distortion - measured longitudinally and diagonally	
Thickness of cylinder head gasket with piston protrusion of 0.550 mm - 0.600 mm	
Thickness of cylinder head gasket with piston protrusion of 0.601 mm - 0.650 mm	
Thickness of cylinder head gasket with piston protrusion of 0.651 mm - 0.700 mm	
Thickness of cylinder head gasket with piston protrusion of 0.701 mm - 0.750 mm	
Thickness of cylinder head gasket with piston protrusion of 0.751 mm - 0.800 mm	
Thickness of cylinder head gasket with piston protrusion of 0.801 mm - 0.850 mm	

Oil Pressure Specifications

Minimum oil pressure at idle speed
Minimum oil pressure at 2000 rpm

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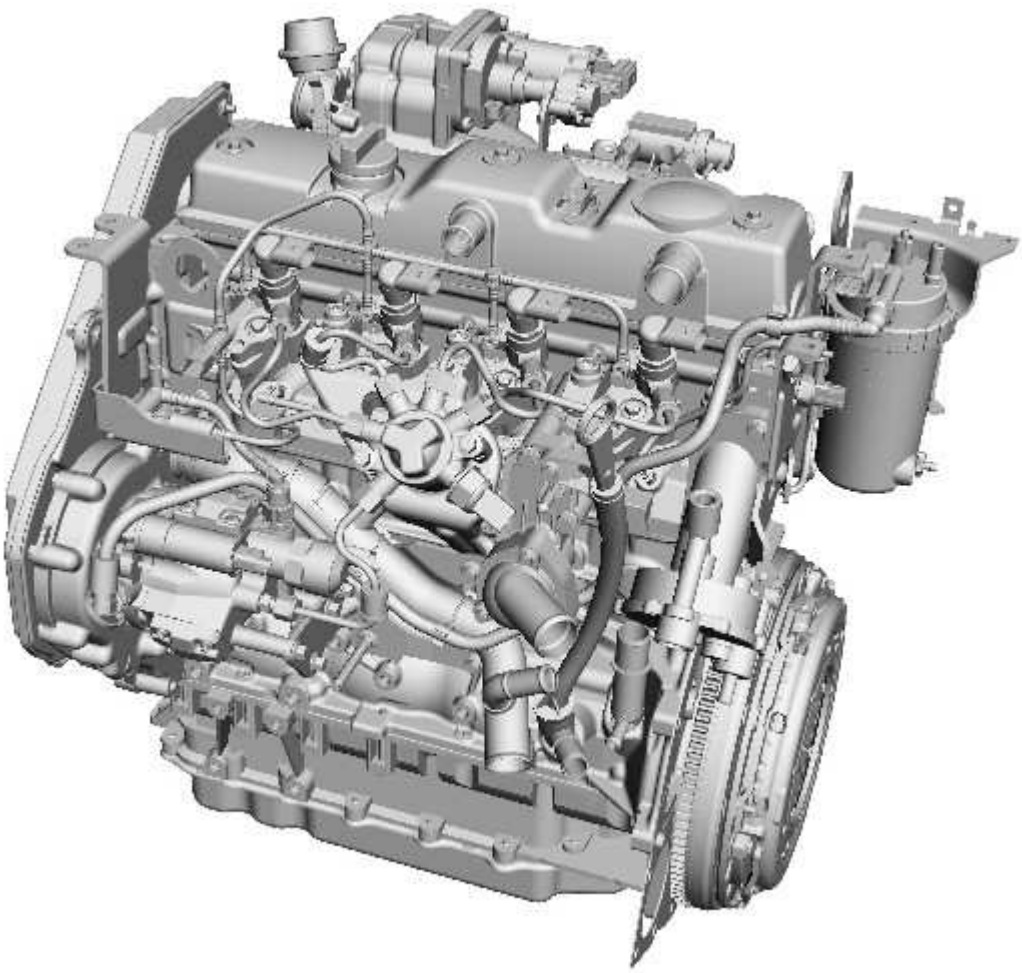
Description and Operation



E75533

Engine

- Transversely-mounted 4-cylinder in-line turbo diesel engine with direct fuel injection, based on the 1.8L Duratorq DI
- 1.8L cubic capacity with 74kw (100 PS) and 92kW (125 PS)
- Turbocharger with variable turbine geometry and intercooler
- Common rail fuel injection system
- Dual mass flywheel for the reduction of drive noise

Common rail fuel injection system

- High-pressure pump for the generation of pressure in the fuel rail with integral transfer pump for fuel supply
- Fuel rail for constant fuel pressure
- Piezo fuel injectors for optimal metering of the fuel quantity
- Variable pilot and main injection for optimization of noise emissions

Engine management

- A Siemens Powertrain Control Module (PCM) (one box design) with 128 pins for fuel-quantity regulation, control of the fuel injectors, exhaust gas recirculation and integrated

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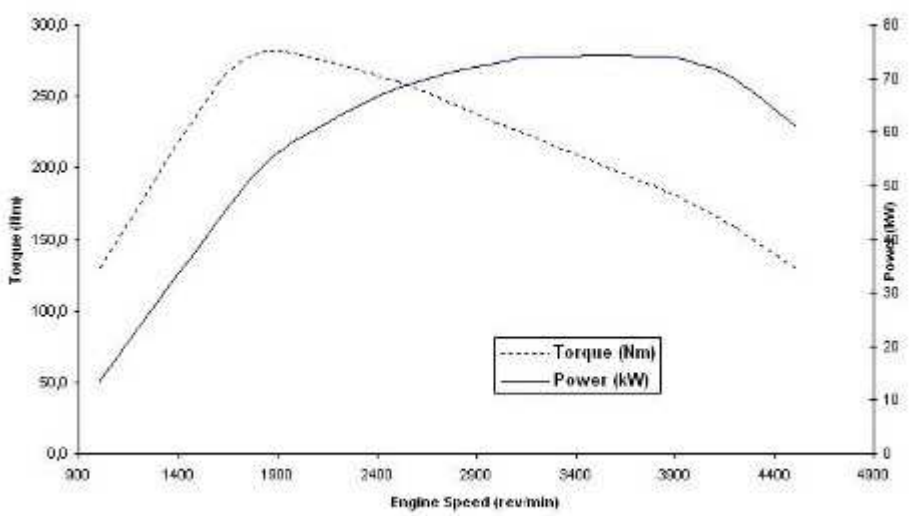
immobilizer

- Camshaft Position (CMP) sensor for determining the injection sequence
- Knock Sensor (KS) for reduction of combustion noise
- Electrical actuator for turbocharger guide vane adjustment for optimisation of boost pressure control

Engine emission control

- Fulfils European emissions standard level IV
- Oxidation catalytic converter
- Actuator motor-controlled Exhaust Gas Recirculation (EGR) valve with integral position sensor
- EGR cooler for the reduction of nitrogen oxides (NOx)
- Vacuum-controlled intake manifold flap with position sensor for optimization of exhaust gas recirculation rate

Engine power output torque 74kw (100 PS)



E75535

Engine power output torque 92kw (125 PS)

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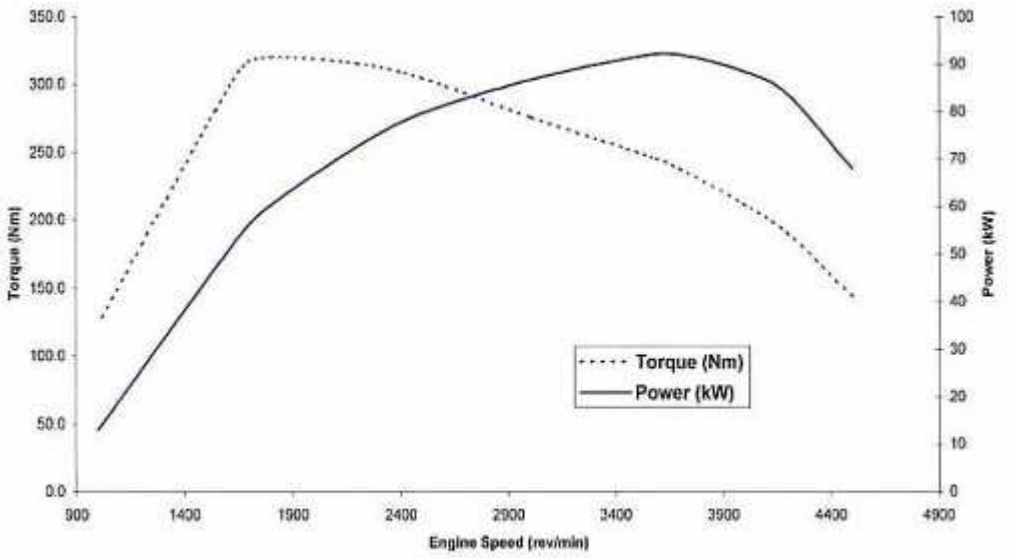

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Diagnosis and Testing

Special Tool(s)

E62013	Compression Test Adapter 303-1049A

General Equipment

Worldwide Diagnostic System (WDS)

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Oil leaks • Fuel system leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts	• Fuse(s) • Loose or corroded connector(s) • Control module • Damaged or worn switch(es)

Symptom Chart

Symptom	Possible Sources	Action
Loss of oil	* Oil leaks on components that are either coated in oil themselves or on components local to them.	* CHECK for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if an oil leak is not evident. INSTALL new gaskets or components as required.
	* Internal or external leak at the oil cooler.	* CHECK the coolant expansion tank for a film of oil on the coolant surface. INSTALL a new oil cooler or oil cooler gasket.
	* Leak at the crankshaft seal.	* INSTALL a new crankshaft seal.
	* Leaks from oil carrying components or basic engine.	* CHECK for cracks in oil-carrying components of the basic engine by means of a UV leak test. INSTALL new components or seals as necessary.
Oil consumption	* Use of the wrong type of engine oil.	* DETERMINE the last type of engine oil used and compare with the specification. Change the engine oil to the

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		specification.
	* Faulty positive crankcase ventilation (PCV) system. - Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes more oil to enter the combustion chamber. - PCV oil separator is faulty and engine oil can enter the combustion chamber through the intake manifold.	* CHECK if the PCV system is operating correctly and repair as necessary. REFER to: Engine Emission Control (303-08C Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
	* Turbocharger seals.	* INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Damaged gaskets or mating surfaces. - Cylinder head gasket is damaged or mating face are warped. - Valve stem seals are worn and engine oil can enter the combustion chamber between the valve stem and the valve stem guide.	* CHECK the gaskets and mating surfaces for damage. - Remove the cylinder head. CHECK the mating faces, cylinder head gasket and the evenness of the cylinder head and engine block mating faces. - INSTALL new valve seals. REFER to: Valve Stem Seals (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Piston ring or cylinder liner wear.	* INSTALL new components as necessary.
	* Damaged cylinder liners or excessive clearance of engine components. - Pistons. - Piston rings (clearance in groove and end gap). - Cylinder liners.	* CHECK the running surfaces and clearances of the individual engine components. INSTALL new components as necessary. INSTALL a new cylinder block if necessary. * Check the pistons and piston rings.
Coolant consumption	* Cooling system components.	* Check the cooling system components. REFER to: Engine Cooling (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
	* Oil cooler.	* INSTALL a new oil cooler.
	* Damaged gaskets or warped mating faces.	* CHECK the cylinder head gasket for damage. CHECK the cylinder head for distortion.
	* Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	* DETERMINE the damaged engine component(s) and install new component (s) as necessary.

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Engine will not crank	* Battery or cables.	* CHECK the battery, bracket and cables. REFER to: Battery (414-01, Diagnosis and Testing).
	* Starter motor or cables.	* CHECK the starting system. REFER to: Starting System (303-06, Diagnosis and Testing).
Engine cranks but will not start	* Fuel tank is empty.	* CHECK the fuel level.
	* Water in fuel (only diesel engine).	* Drain the water from the fuel system.
	* Fuel filter blocked.	* INSTALL a new fuel filter.
	* Engine intake air system.	* CHECK the intake air system. REFER to: Intake Air Distribution and Filtering (303-12, Diagnosis and Testing).
	* Glow plug faulty (only diesel engine).	* CHECK the glow plugs. INSTALL new glow plugs as necessary. REFER to: Glow Plug System (303-07, Diagnosis and Testing).
	* Engine management system.	* CHECK the engine management system. REFER to: Electronic Engine Controls - 1.8L Duratorq-TDCi (Lynx) Diesel (303-14, Diagnosis and Testing).
	* Incorrect valve timing.	* CHECK and adjust the valve timing. REFER to: Valve Clearance Adjustment (303-01, General Procedures).
	* Broken or damaged timing belt/timing chain or pulley/sprocket.	* CHECK the timing belt/timing chain and sprockets/pulleys. INSTALL new components as necessary. REFER to: Timing Belt (303-01, Removal and Installation).
Very poor power output or fuel consumption too high or engine running rough.	* Fuel system.	* CHECK the fuel system. REFER to: Turbocharger (303-04, Diagnosis and Testing).
	* Engine intake air system.	* CHECK the intake air system. REFER to: Intake Air Distribution and Filtering (303-12, Diagnosis and Testing).
	* Exhaust system blocked.	* CHECK the exhaust system. REFER to: Exhaust System (309-00, Description and Operation).
	* Engine management system.	* CHECK the engine management system. REFER to: Electronic Engine Controls - 1.8L Duratorq-TDCi (Lynx) Diesel (303-14, Diagnosis and Testing).
	* Turbocharger.	* CHECK the turbocharger. REFER to: Turbocharger (303-04, Diagnosis and Testing).
	* Incorrect valve timing. Timing belt/timing sprocket or pulley/sprocket damaged.	* CHECK and adjust valve timing. REFER to: Timing Belt (303-01, Removal and Installation).
	* Ignition timing incorrect (only petrol engines).	* CHECK the electronic engine controls. REFER to: Electronic Engine Controls - 1.8L Duratorq-TDCi (Lynx) Diesel (303-14, Diagnosis and Testing).
Noisy running	* Engine auxiliary components loose or damaged.	* CHECK engine auxiliary components for damage or looseness. CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01, Removal and Installation).
Noisy running,	* Incorrect fuel	* DETERMINE which type of fuel was last

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misfiring, backfiring or knocking		put in the tank (note the country specific fuel specifications).
	* Water in fuel or fuel contaminated.	* CHECK the fuel system for water or other contamination.
	* Valve timing incorrect, timing belt/chain or pulley/sprocket damaged.	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01, Removal and Installation).
Noisy running or valve train noise	* Valve clearance too large due to faulty valve tappets or worn valve train components.	* INSTALL new hydraulic lash adjusters or adjust the valve clearance. REFER to: Valve Clearance Adjustment (303-01, General Procedures).
	* Timing belt or timing chain damaged.	* INSTALL a new timing belt or timing chain. REFER to: Timing Belt (303-01, Removal and Installation).
	* Timing belt or timing chain incorrectly tensioned.	* CHECK the timing belt tension. INSTALL a new timing belt or timing chain as necessary. REFER to: Timing Belt (303-01, Removal and Installation).
Noisy running or engine noise	* Engine components - Pistons. - Piston rings. - Connecting rod big end, main bearing or thrust bearing journals. - Connecting rods bent or damaged.	* CHECK the engine components for wear or damage. Make sure all components are within specification. INSTALL new components as necessary. REFER to: Specifications (211-00, Specifications).

Engine - Oil Leaks

NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.
If the oil leak cannot be identified clearly by a visual inspection, carry out an ultraviolet (UV) test:

Ultraviolet (UV) Testing

1. **1.** Clean the engine and transmission with a suitable cleaning fluid.
2. **2.** Pour the UV-test fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.

WARNING: Vehicles with manual transaxle, shift the transaxle into Neutral. Failure to follow this instruction may result in personal injury.

3. **3.** Start the engine and let it run for about five minutes.
4. **4.** Switch off the engine.

NOTE: If no leak can be found, road test the vehicle under various loads and check the engine for leaks again.

5. **5.** Check the engine for oil leaks using a suitable UV lamp.
6. **6.** Rectify any leaks found and check the engine for oil leaks.

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Measure the compression pressure

NOTE: The powertrain control module (PCM) receives an error message when the fuel pump relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory using worldwide diagnostic system (WDS) after completing the compression test.
NOTE: Valve clearance must be set correctly before performing a compression test. Make sure the engine is at the normal operating temperature.
NOTE: The varying design of compression checking devices and fluctuating starter motor speeds normally only allows for a comparison to be made of the compression pressures in all cylinders.

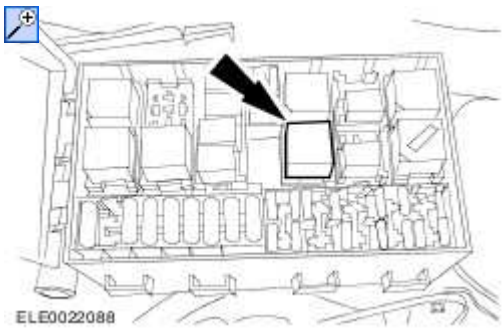
Measure the compression pressure (Engine - 1.8L Duratorq-TDCI (Kent) Diesel)

WARNINGS:

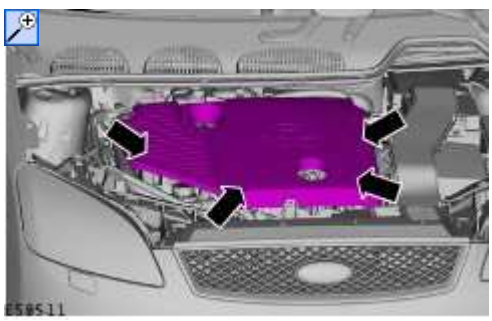
Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and can ignite. Failure to follow these instructions may result in personal injury.

Do not carry out any repairs to the fuel injection system without checking that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater. Failure to follow these instructions may result in personal injury.

1. **1.** Using datalogger in worldwide diagnostic system (WDS), check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater.



2. **2.** Open the central junction box (CJB) and remove the glow plug relay.



3. NOTE: The engine upper cover is held in place by 4 ball clips. The ball clips are not vertical, but are angled backwards by approximately 20 degrees.
   3. Location of the engine upper cover retaining clips.

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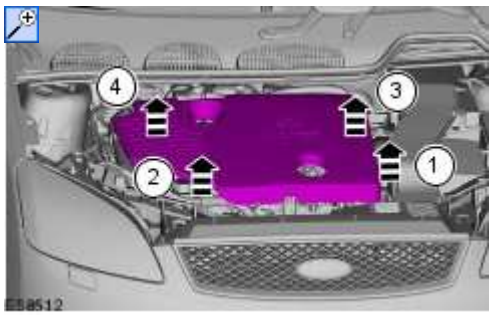
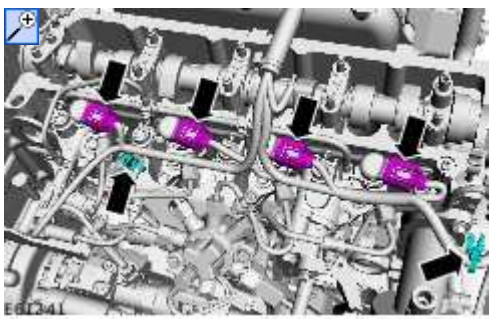


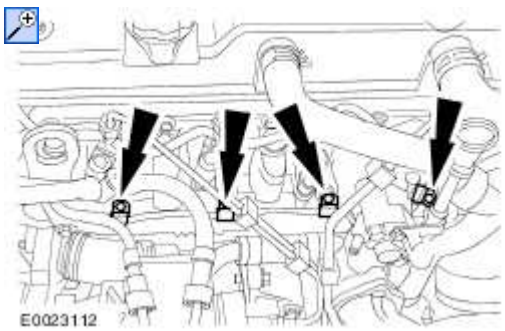
4. CAUTIONS:

   Care must be taken when releasing the 4th retaining clip and manoeuvering the engine upper cover past the manifold absolute pressure (MAP) sensor. Failure to follow this instruction may result in damage to the MAP sensor.

   Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. If the ambient temperature is below 0°C, detach the engine upper cover with extreme caution. Failure to follow this instruction may cause the engine upper cover to be damaged.
   NOTE: Only remove and install the engine upper cover in the sequence shown.
   4. Remove the engine upper cover.



5. **5.** Disconnect the fuel injector electrical connectors.
   - Detach the wiring harness clips from the cylinder head.



6. **6.** Remove the glow plug power supply.

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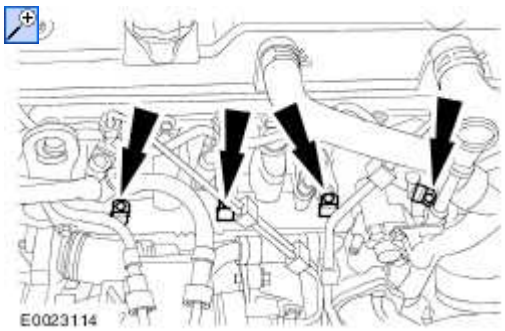
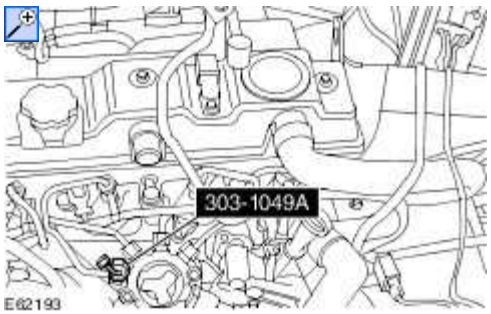


7. **7.** Remove the glow plugs.

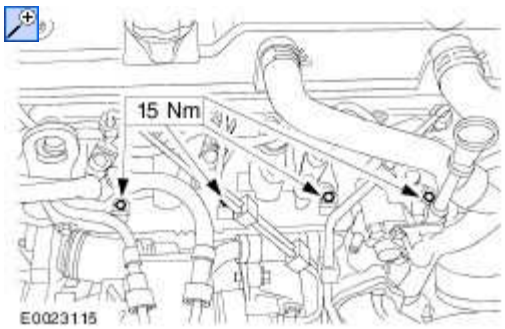


8. **8.** Install the special tool and a suitable compression tester into the glow plug bore.

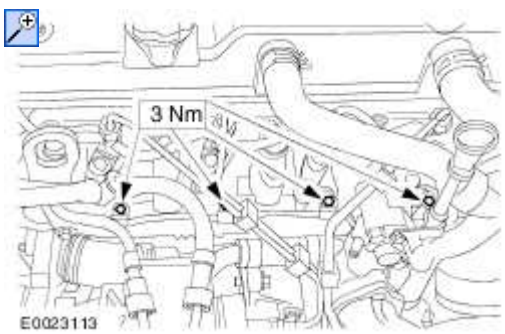
NOTE: Crank the engine with the starter motor until the pointer on the compression tester stops rising.

9. **9.** Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions.

10. **10.** Detach the compression tester and the special tool.



11. **11.** Install the glow plugs.



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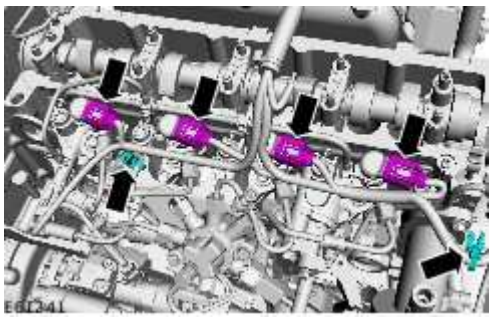
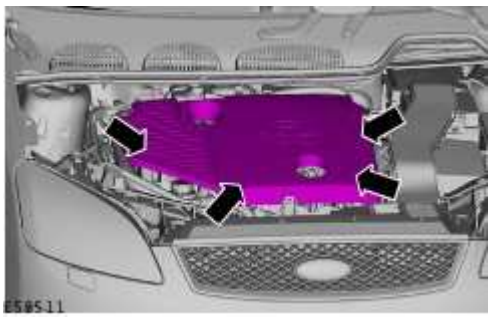
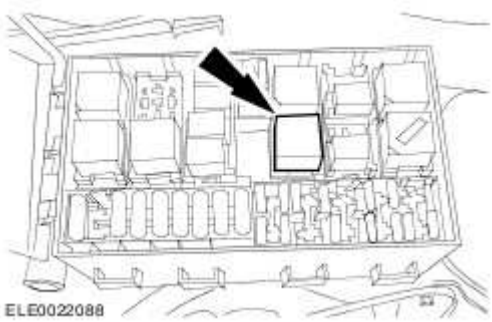
12. **12.** Install the glow power supply.



13. **13.** Connect the fuel injector electrical connectors.
    - Attach the wiring harness clips to the cylinder head.
14. **14.** Apply soap solution to the ball clip mountings in the engine upper cover.
    - Soap solution (maximum concentration of soap in water 1:200).



15. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. Failure to follow this instruction may cause the engine upper cover to be damaged.
    15. Put the engine cover into installation position and clip it in place by pressing at the places shown.
    - Make sure that the engine upper cover is fully engaged in the area of the fuel filter, if necessary apply more pressure in the areas shown.



16. **16.** Install the glow plug relay and close the CJB.
17. **17.** Reset the PCM fault memory.

Measure the oil pressure (21 113 0)

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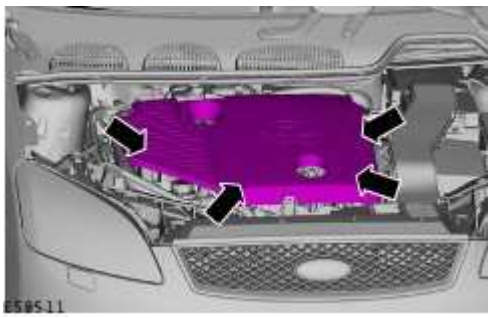
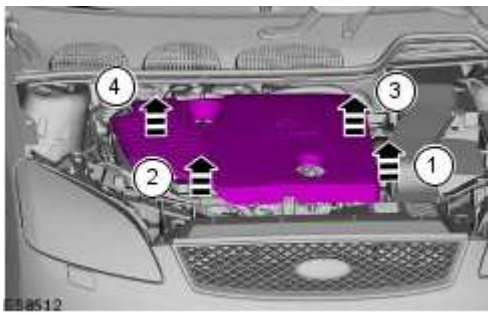
The oil pressure depends on various factors (engine speed, oil temperature, oil viscosity, amount of oil filter contamination etc.).

Measure the oil pressure (Engine - 1.8L Duratorq-TDCI (Kent) Diesel)

NOTE: Measure the oil pressure at the specified engine speed.



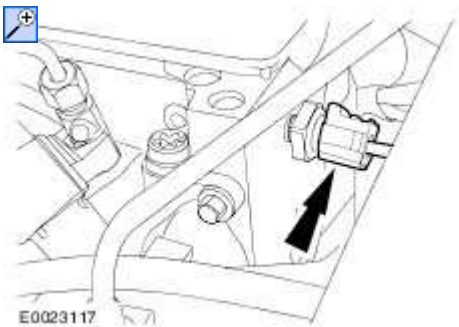
1. NOTE: The engine upper cover is held in place by 4 ball clips. The ball clips are not vertical, but are angled backwards by approximately 20 degrees.
   1. Location of the engine upper cover retaining clips.



2. CAUTIONS:

   Care must be taken when releasing the 4th retaining clip and manoeuvering the engine upper cover past the manifold absolute pressure (MAP) sensor. Failure to follow this instruction may result in damage to the MAP sensor.

   Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. If the ambient temperature is below 0°C, detach the engine upper cover with extreme caution. Failure to follow this instruction may cause the engine upper cover to be damaged.
   NOTE: Only remove and install the engine upper cover in the sequence shown.
   2. Remove the engine upper cover.



3. **3.** Disconnect the oil pressure switch electrical connector (components shown removed for clarity).

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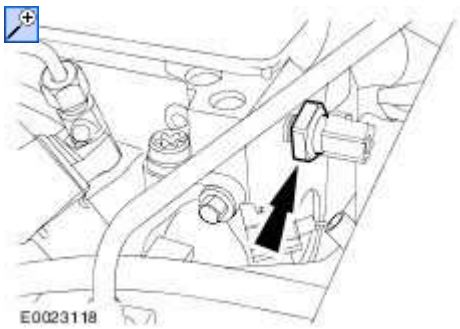


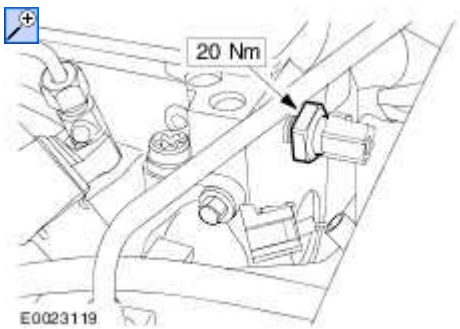
4. **4.** Remove the oil pressure switch (components shown removed for clarity).

5. NOTE: Measure the oil pressure at the specified engine speed. Measure the oil pressure at an oil temperature of 80° C.
   NOTE: Measure the oil pressure at idle speed and at 2000 rpm.
   NOTE: Oil pressure at idle speed: 0.75 bar.
   NOTE: Oil pressure at 2000 rpm: 1.5 bar.
   5. Attach the oil pressure gauge with the oil pressure gauge connector.

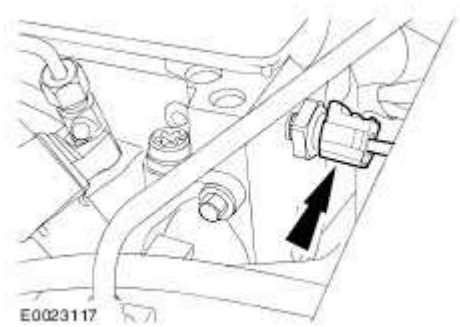
6. **6.** Check the oil pressure.

7. **7.** Detach the oil pressure gauge and the oil pressure gauge connector.

8. **8.** Coat the oil pressure switch with adhesive.



9. **9.** Install the oil pressure switch.



10. **10.** Connect the oil pressure switch electrical connector.

11. **11.** Apply soap solution to the ball clip mountings in the engine upper cover.
    - Soap solution (maximum concentration of soap in water 1:200).

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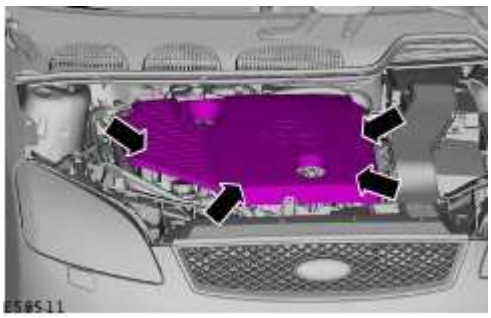

12. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. Failure to follow this instruction may cause the engine upper cover to be damaged.
    12. Put the engine cover into installation position and clip it in place by pressing at the places shown.
    - Make sure that the engine upper cover is fully engaged in the area of the fuel filter, if necessary apply more pressure in the areas shown.

Valve train analysis - static (engine off)

Remove the valve cover.

Check all valve train components for damage and wear. Ensure that only original components are installed and that all bolts and nuts have been tightened to the correct tightening torque.

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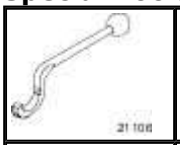
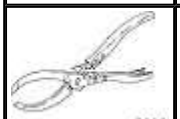
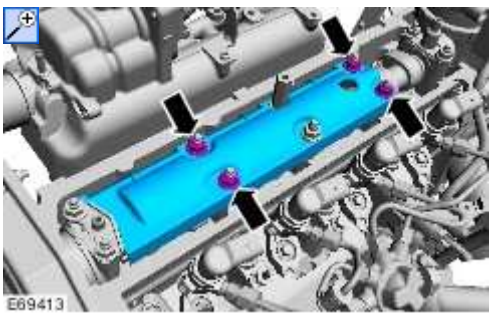
General Procedures

Special Tool(s)

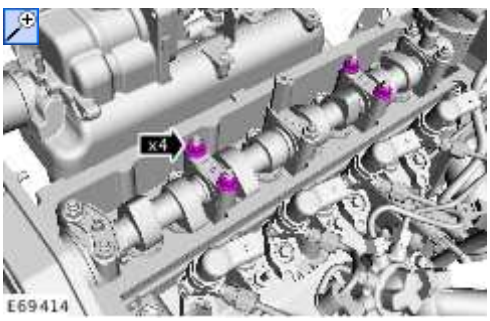
	303-195 Compressor, Valve Spring
	303-196 Pliers, Valve Shim

1. Remove the valve cover.

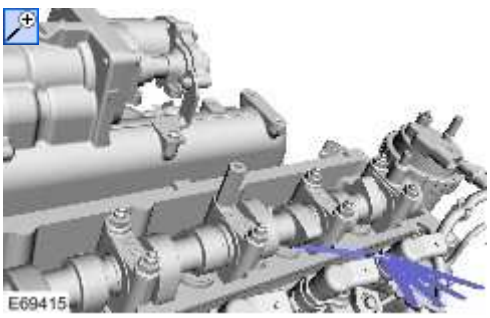
   Refer to: Valve Cover (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

2. 

3. *Torque:* 20 Nm



4. NOTE: Using a suitable feeler gauge, measure the valave clearance.
   - Rotate the crankshaft until the cam pair of the cylinder to be adjusted are pointing upwards.
   - Check the valve clearance and note the values.
   - If the values of one or more adjustment shims are outside the tolerance range, renew the adjustment shim as described in the following step.



5. NOTE: Rotate the crankshaft by a further 90 degrees.
   NOTE: The piston of the cylinder to be adjusted must not be at TDC.
   - Note the thickness of the adjustment shim,

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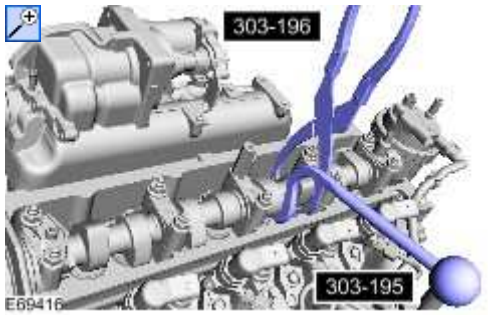

marked on the underside of the shim.
- Install the new adjustment shim to obtain the correct valve clearance.

Special Tool(s): 303-195, 303-196

6. To install, reverse the removal procedure.

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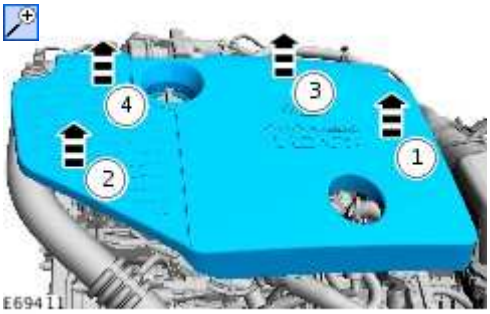
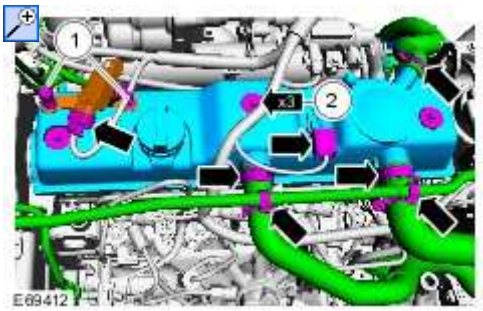
Removal and Installation

Removal

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



1.



2.
   1. *Torque:* 3 Nm
   2. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.

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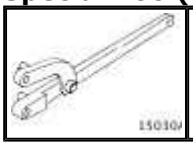
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench

General Equipment

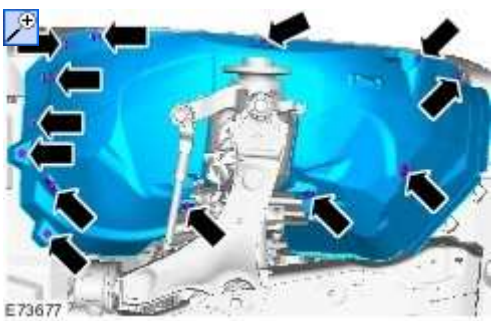
Dowel with a diameter of 4 mm

Removal

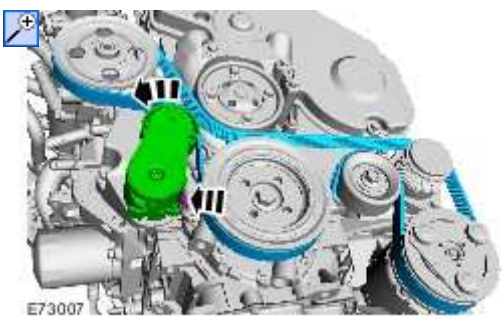
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front right wheel.

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

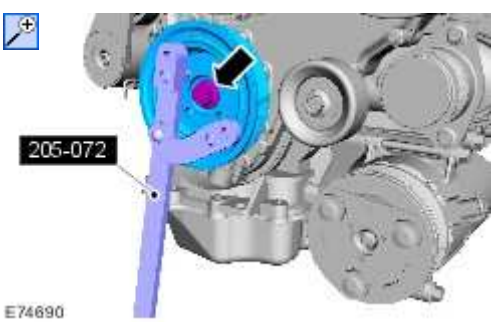
2. 

3. *General Equipment:* Dowel with a diameter of 4 mm



4. Discard the crankshaft pulley retaining bolt.

   Special Tool(s): 205-072
   Torque:
   Stage 1: 100 Nm
   Stage 2: 180°



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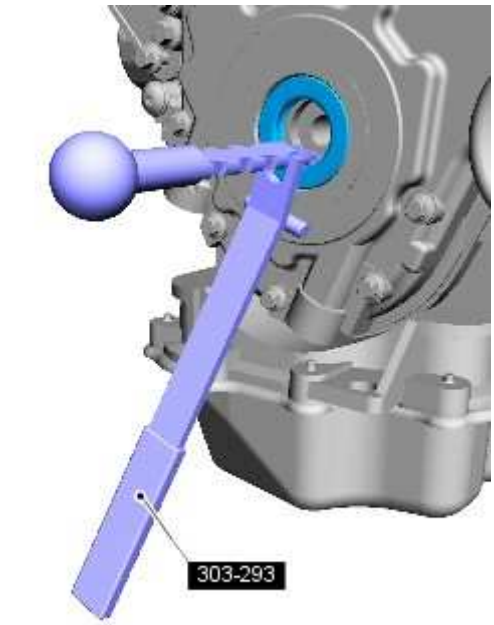
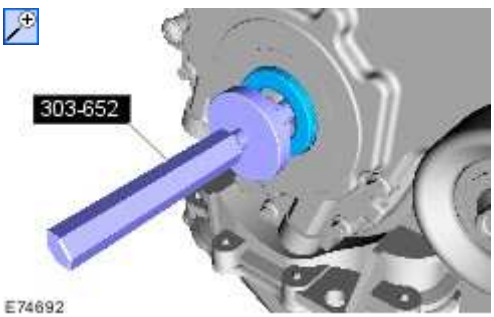


E74691

Installation



E74692

1.

2. To install, reverse the removal procedure.

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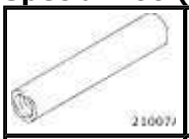
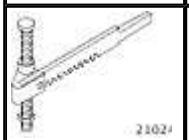
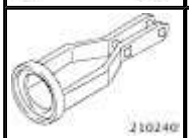
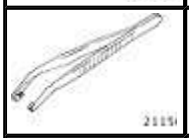
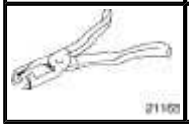
Removal and Installation

Special Tool(s)

	303-037 Installer, Valve Stem Seal
	303-060 Compressor, Valve Spring
	303-060-05 Adapter for 303-060
	303-362 Installer, Valve Stem Collets
	303-390 Pliers, Valve Stem Seal

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C912-A1

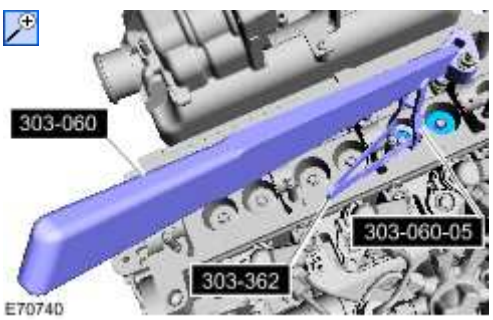
Removal

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

1. Remove the camshaft.

   Refer to: Camshaft (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

2. Position the apropriate piston at top dead center (TDC).
3. *Special Tool(s):* 303-060, 303-060-05, 303-362



4. *Special Tool(s):* 303-390

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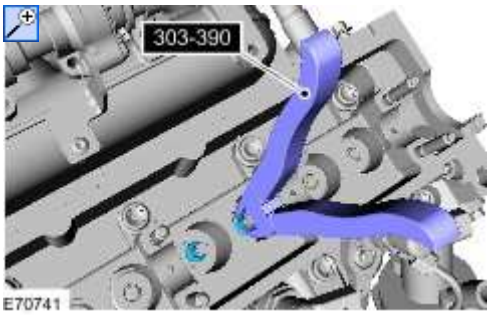
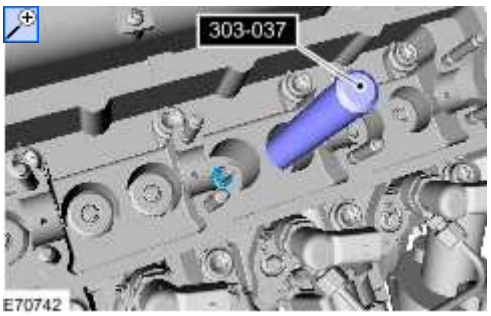


Installation

NOTE: Cover the collet grooves with adhesive tape during installation of the valve stem seals.



1. Coat the valve stem seals with clean engine oil.

   Material: Engine Oil - 5W-30 (WSS-M2C912-A1)

2. *Special Tool(s):* 303-037

3. To install, reverse the removal procedure.

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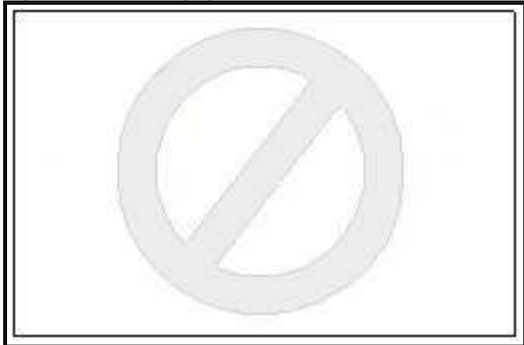
Removal and Installation

Special Tool(s)

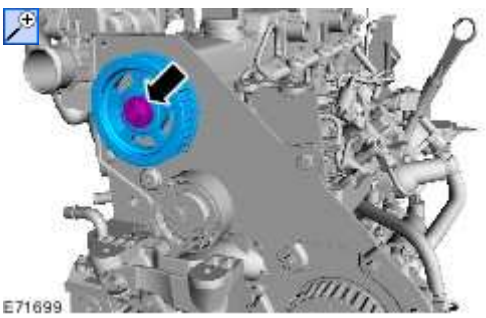
	303-199A Installer, Camshaft Seal
	303-293 Remover, Crankshaft Seal

Removal

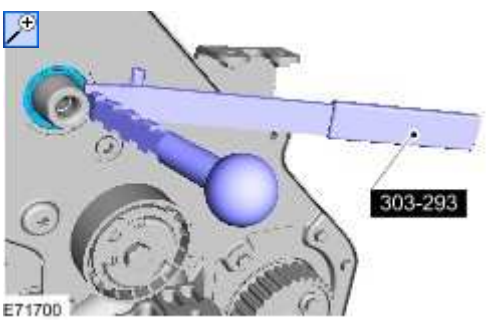
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the timing belt.

   Refer to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



2.



3. *Special Tool(s):* 303-293

Installation

1. *Special Tool(s):* 303-199A

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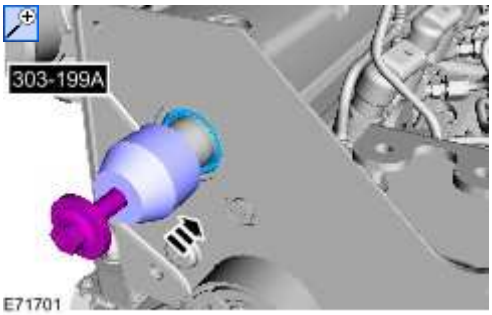

2. NOTE: Do not fully tighten the camshaft pulley retaining bolt at this stage.
   To install, reverse the removal procedure.

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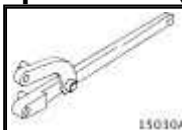
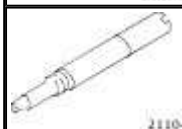
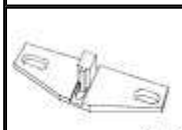
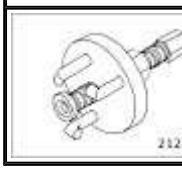
Removal and Installation

Special Tool(s)

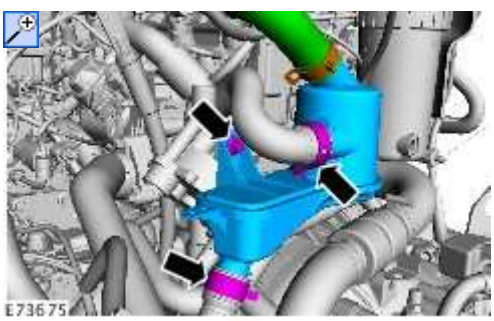
	205-072 Universal Flange Holding Wrench
	303-193 Timing Peg, Crankshaft TDC
	303-376B Alignment Plate, Camshaft
	303-393 Locking Tool, Flywheel
	303-651 Remover, Camshaft Sprocket

General Equipment

Cable ties
Trolley jack

Removal

1. Disconnect the battery.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Valve Cover (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
3. 
4.

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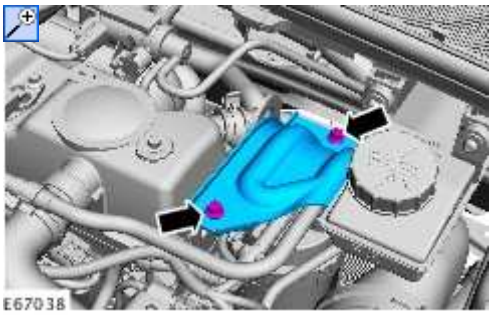
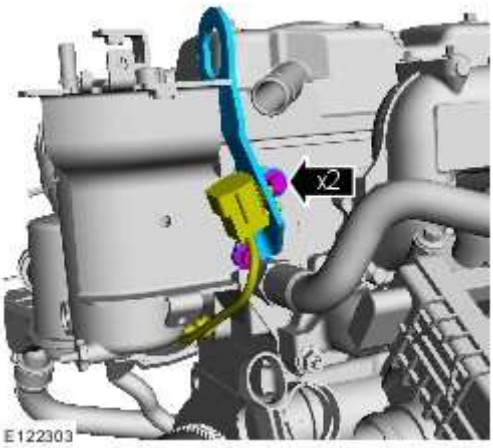
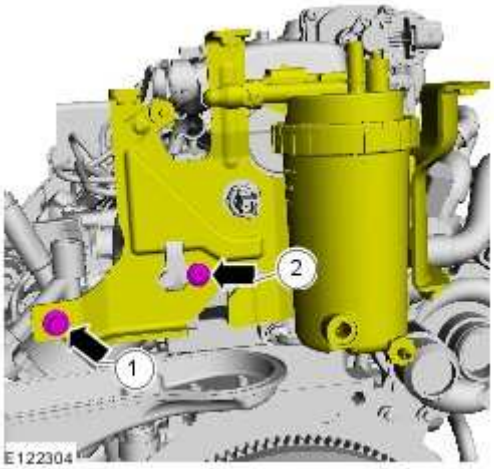
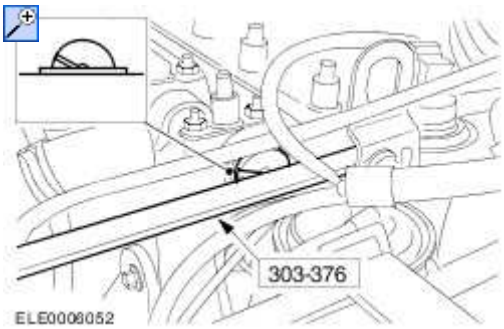


5.



6.





7. NOTE: Only rotate the camshaft in the normal direction of rotation.
Using the camshaft groove as a guide, rotate the crankshaft to 5 degrees before top dead center (TDC).

8. Remove the front right wheel.

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

9.

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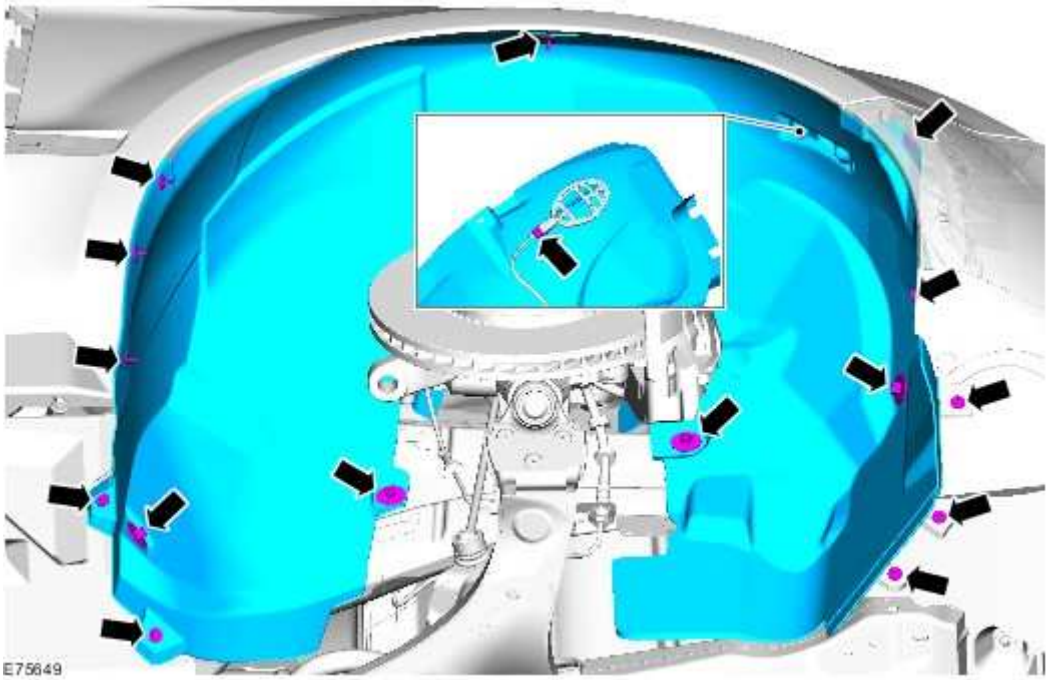

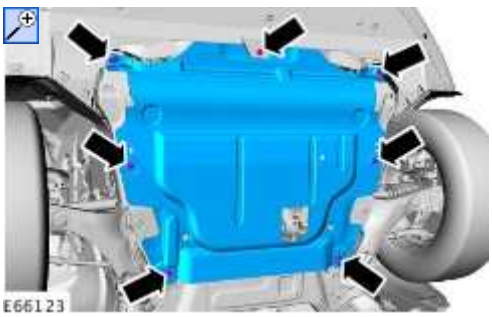

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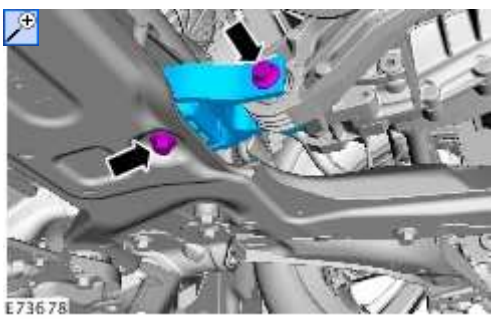
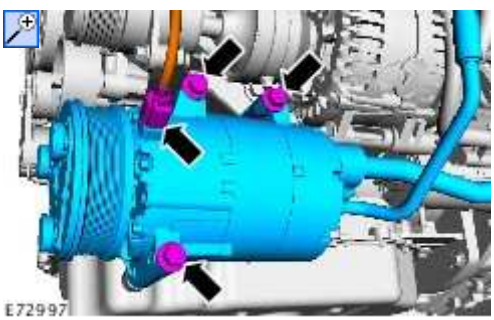


11.

12. Refer to: Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



13. Secure the air conditioning (A/C) compressor to one side.

General Equipment: Cable ties

14.

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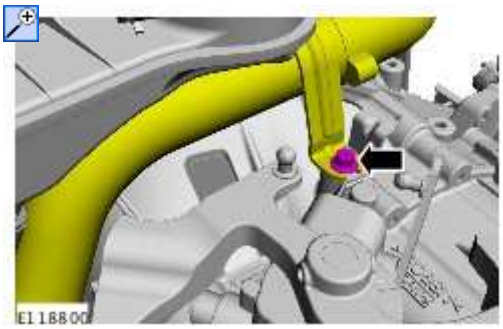

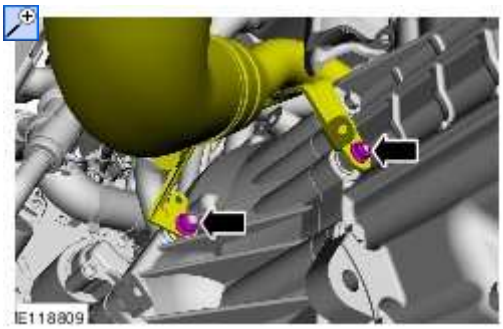

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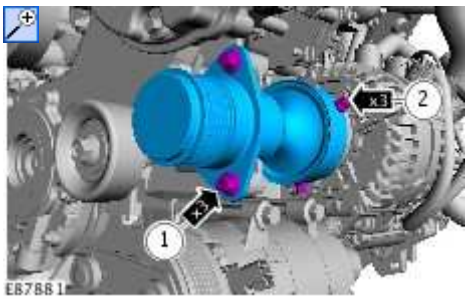
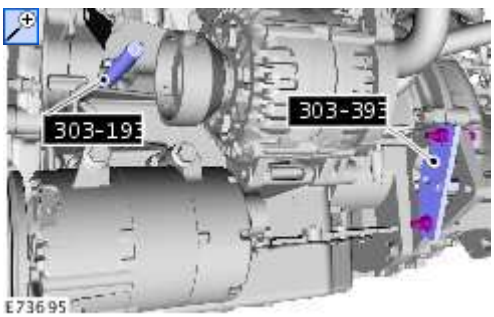


16.



17. CAUTIONS:

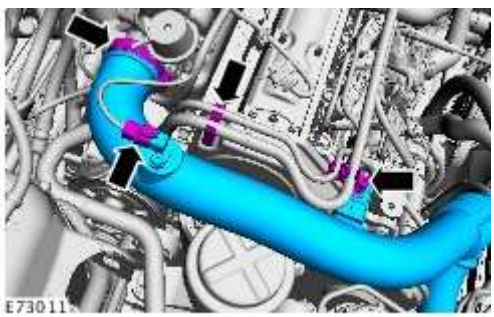
Make sure that the crankshaft is not rotated while the special tool is installed.

Only rotate the crankshaft clockwise.

1. Remove the cylinder block blanking plug and

   Install the Special Tool(s): 303-193
2. *Install the Special Tool(s):* 303-393

18. Refer to: Starter Motor (303-06D Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



19. Detach the charge air cooler outlet pipe and position it to one side.

20. *General Equipment:* Trolley jack

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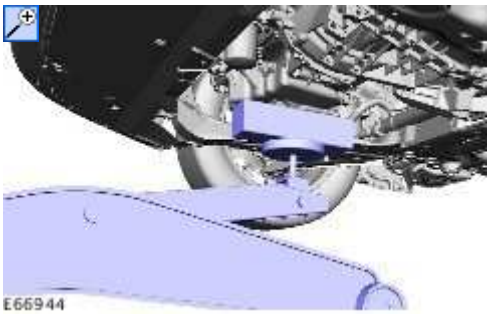
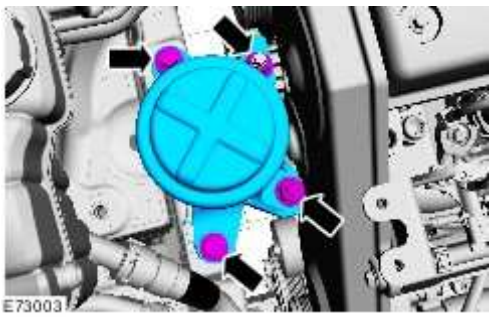


21.



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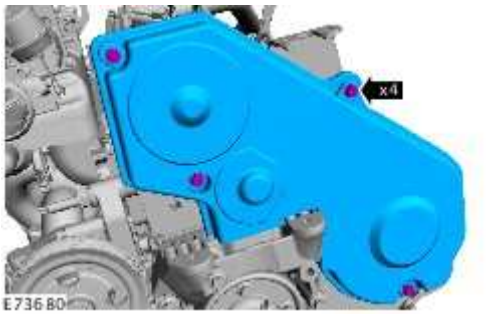
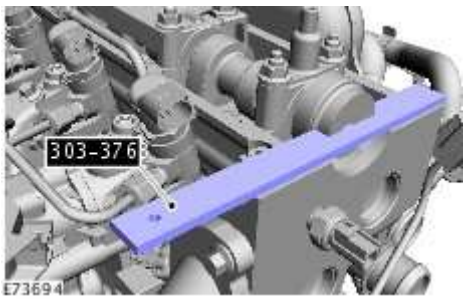


23. *Special Tool(s):* 303-376B



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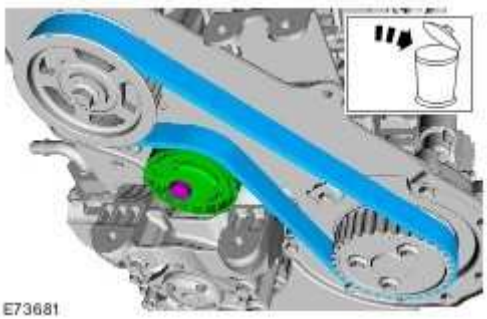

25. *Special Tool(s):* 205-072

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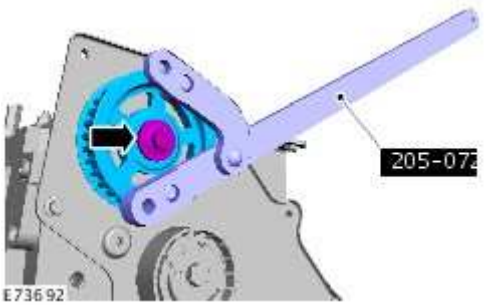
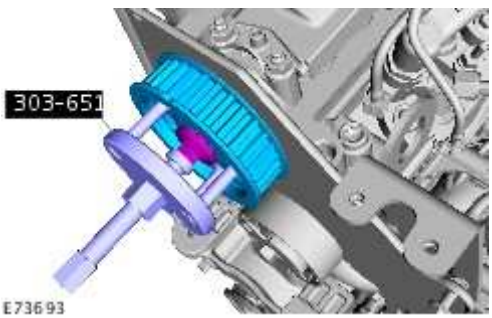
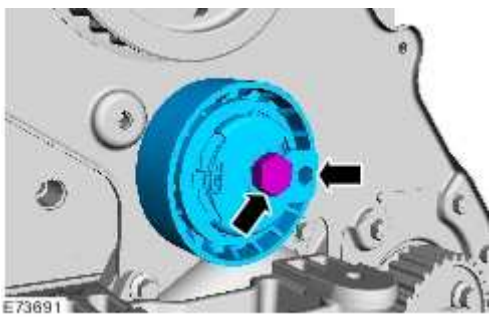


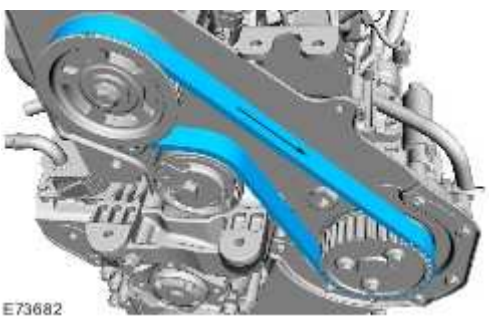


26. *Special Tool(s):* 303-651

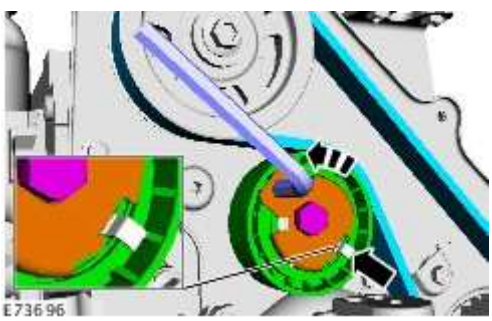
Installation



1.
- Check the timing belt tensioner and make sure that the timing belt tensioner pointer rotates clockwise freely.
- Move the timing belt tensioner adjustment arm to the 3 o'clock position.
- Do not fully tighten the timing belt tensioner retaining bolt at this stage.



2.
- The camshaft pulley must be able to rotate freely on the camshaft taper. Tighten the camshaft pulley bolt finger tight and then loosen by one-half turn.
- Install the timing belt with the direction arrows in the direction of engine rotation.



3. Tension the timing belt counterclockwise until the pointer is positioned between the sides of the window.

   Torque: 50 Nm

4. *Special Tool(s):* 205-072
   Torque: 50 Nm

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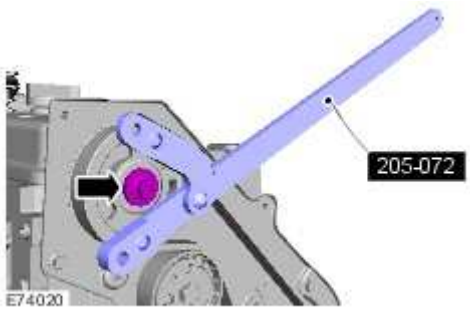
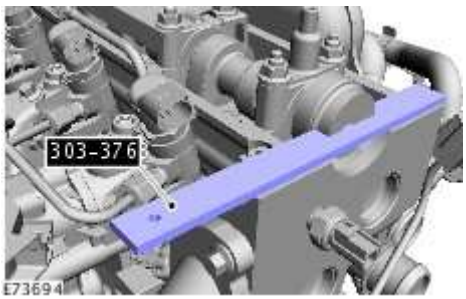


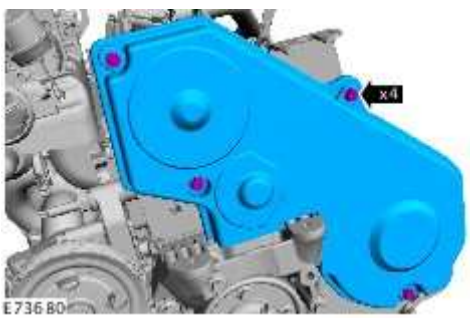
5. *Remove the Special Tool(s):* 303-376B, 303-193, 303-393
6.
    1. Rotate the crankshaft 2 revolutions. Replace the Timing Peg just before TDC on the second revolution.

       Install the Special Tool(s): 303-193
    2. Rotate the crankshaft slowly until the crankshaft stops at TDC.
7. Check that the timing belt tensioner pointer is positioned in the window, otherwise the timing belt tensioning steps must be repeated.



8. NOTE: If the special tool cannot be installed, the timing belt tensioning steps must be repeated.
   Install the Special Tool(s): 303-376B
9. Remove all special tools and install the cylinder block blanking plug.

   Remove the Special Tool(s): 303-376B, 303-193, 303-393
   Torque: 23 Nm



10. *Torque:* 7 Nm
11.
    1. *Torque:* 12 Nm
    2. *Torque:* 80 Nm
    3. NOTE: Only tighten the bolts finger tight at this stage.

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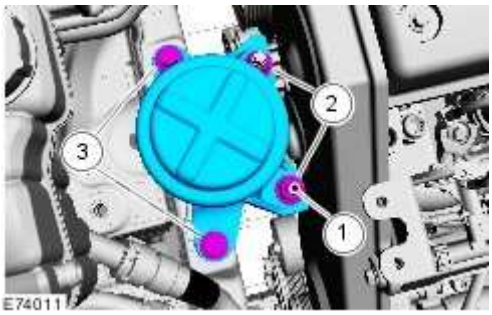
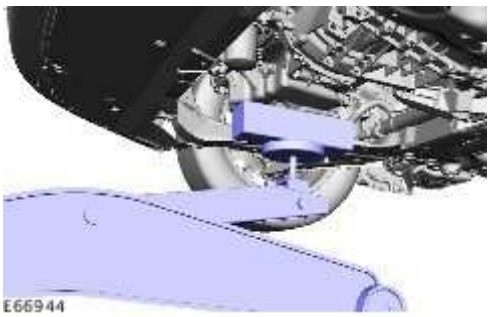
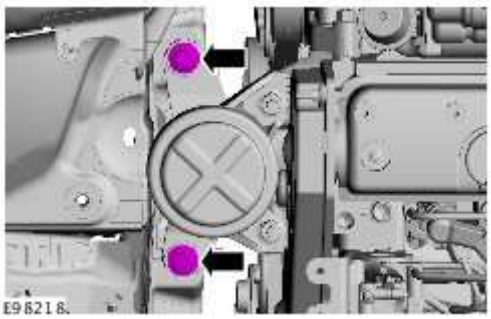


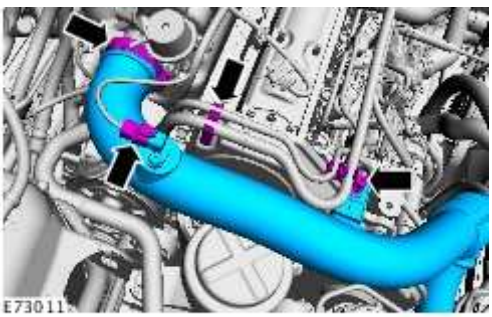


12. Lower and remove the Trolley jack.

    General Equipment: Trolley jack



13. *Torque:* 90 Nm



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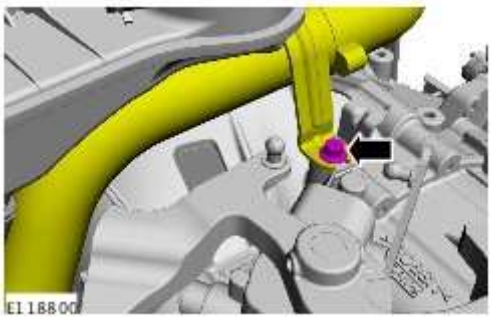

15. *Torque:* 24 Nm

16. *Torque:* 24 Nm

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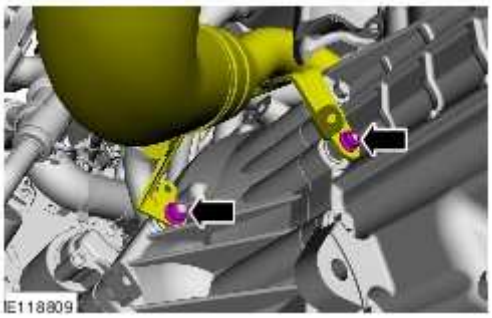
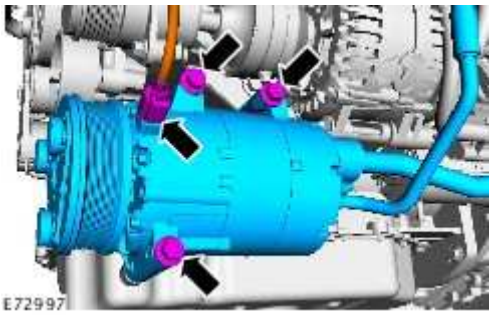
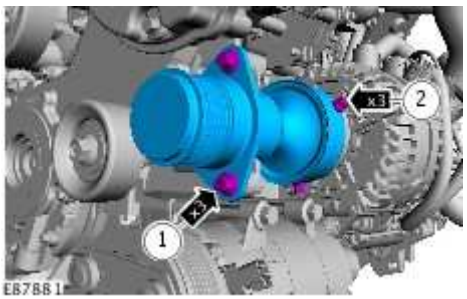


17. Refer to: Starter Motor (303-06D Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

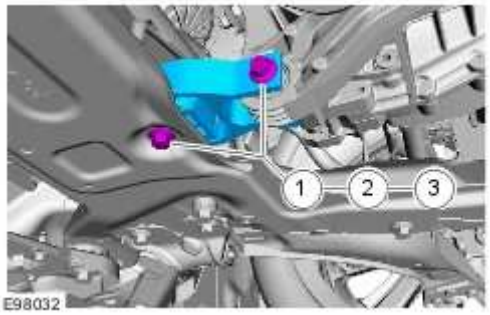


18. *Torque:* 25 Nm



19. *Torque:*
    1 27 Nm
    2 10 Nm

20. Refer to: Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



21.
    1. *Torque:* 35 Nm
    2. *Loosen:* 360°
    3. *Torque:* 85 Nm

22.

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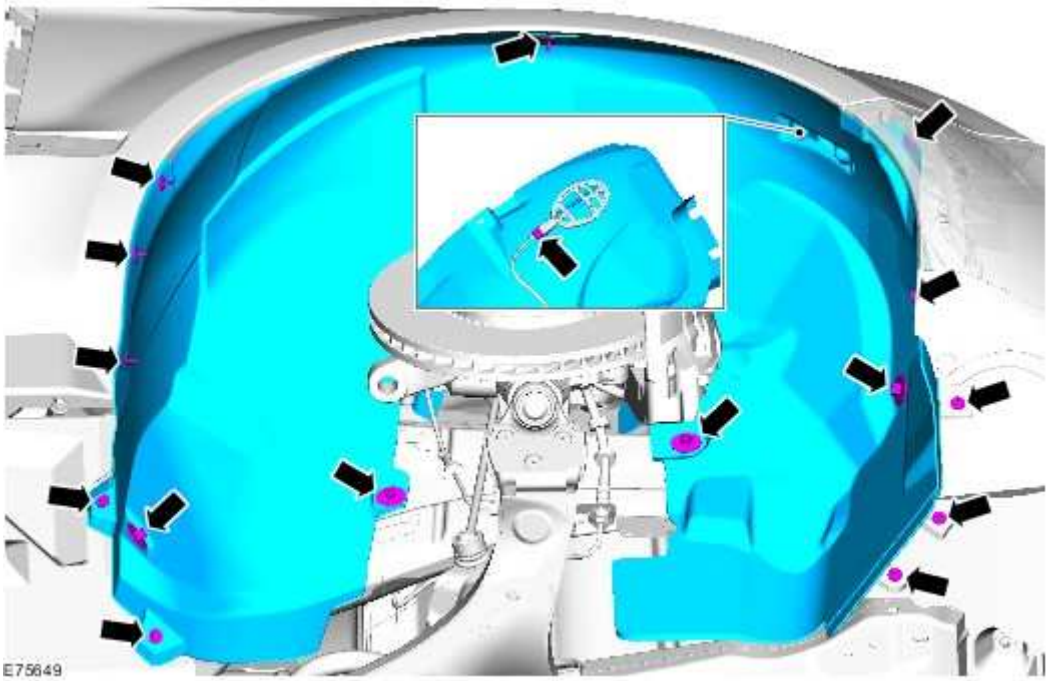
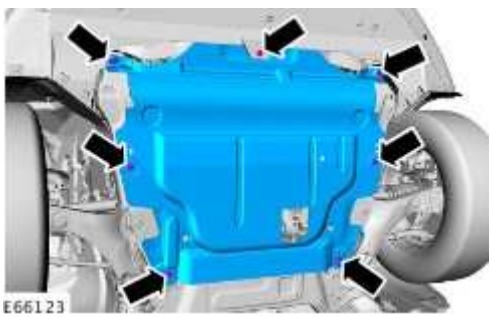


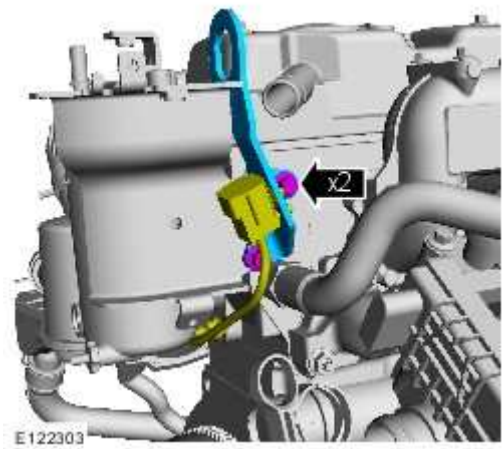


23.

24. Install the front right wheel.

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

25. *Torque:* 23 Nm



26. *Torque:*
    1 23 Nm
    1 10 Nm

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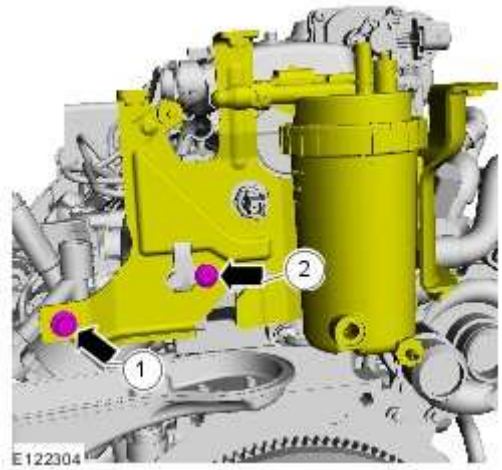
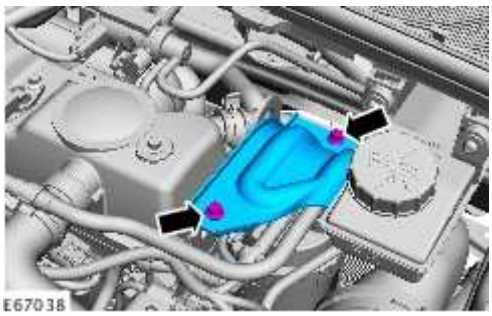
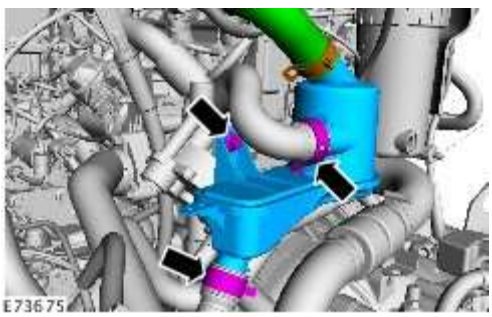




27. *Torque:* 10 Nm



28. *Torque:* 23 Nm

29. Install the following items:
    1. Refer to: Valve Cover (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
    2. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
30. Connect the battery.

    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

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Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Exhaust Manifold	S-MAX/Galaxy 2006.5 (02/2006-)

Print

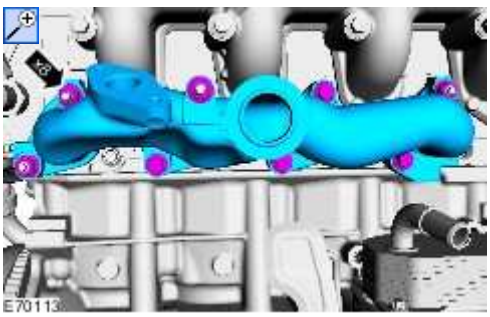
Removal and Installation

Removal

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

1. Remove the turbocharger.

   Refer to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08C Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



2. *Torque:* 20 Nm

Installation

1. To install, reverse the removal procedure.

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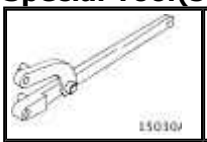
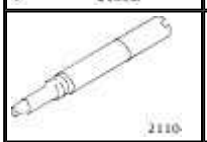
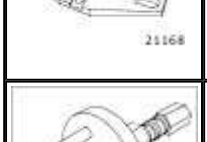
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-122 Lifting Bracket, Engine
	303-193 Timing Peg, Crankshaft TDC
	303-376B Alignment Plate, Camshaft
	303-393 Locking Tool, Flywheel
	303-651 Remover, Camshaft Sprocket

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C912-A1
Spoiler Adhesive Kit 2 Component	WSK-M5B401-A1 / 2U7J-M2G376-AA

General Equipment

Cable ties
Dowel with a diameter of 4 mm
Trolley jack

Removal

WARNINGS:

This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions.

Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

1. Refer to: Fuel Injection Component Cleaning (303-0
   Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

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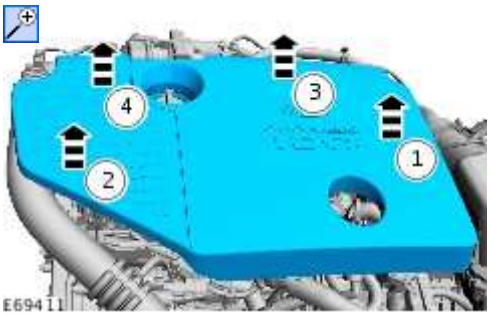
2. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

3.



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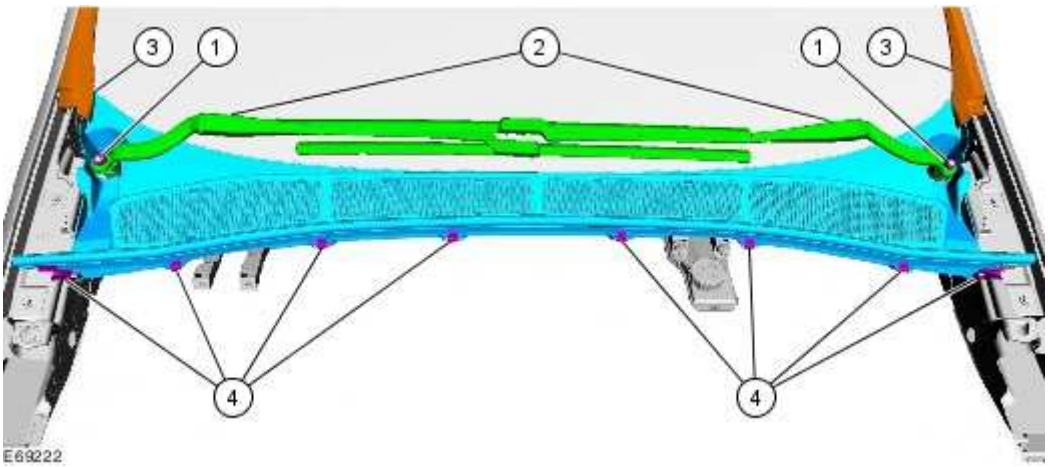

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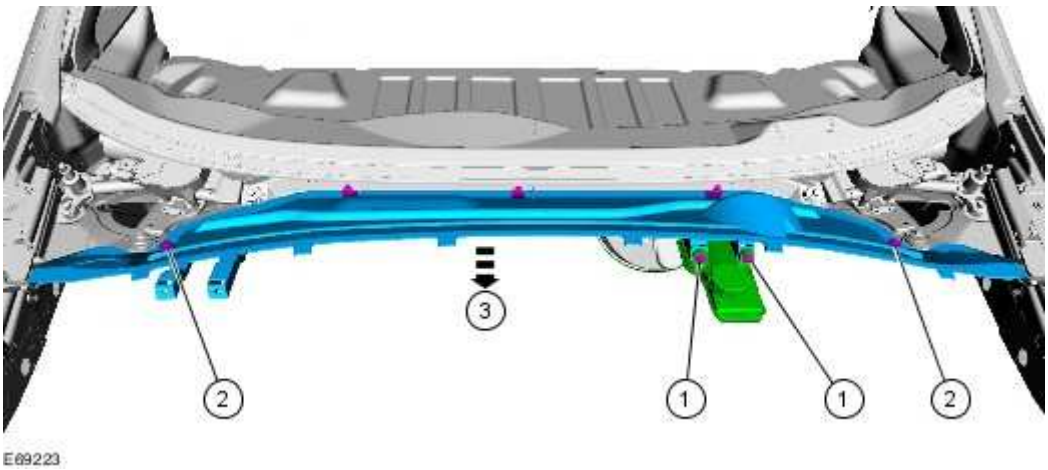

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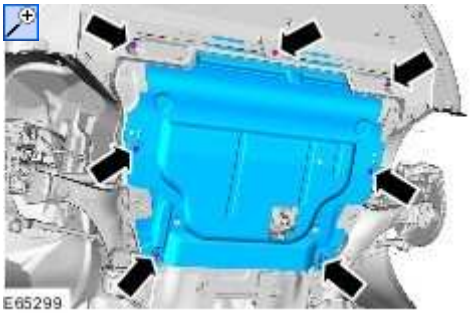

7.

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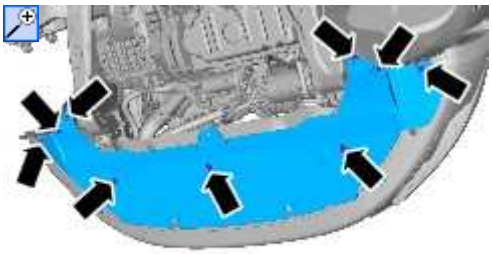


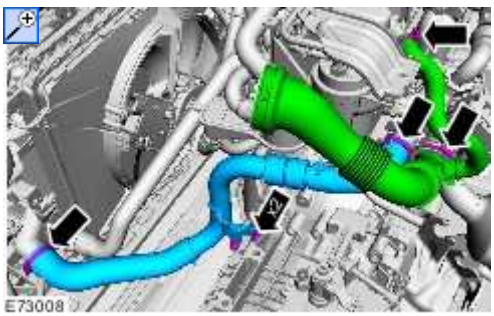
E68962

8. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

9. Remove the Air Cleaner.

   Refer to: Air Cleaner (303-12D Intake Air Distributio and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



E73008

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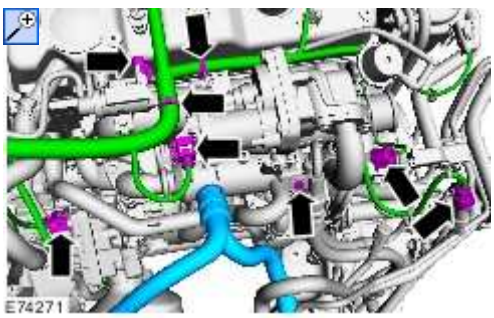

E74271

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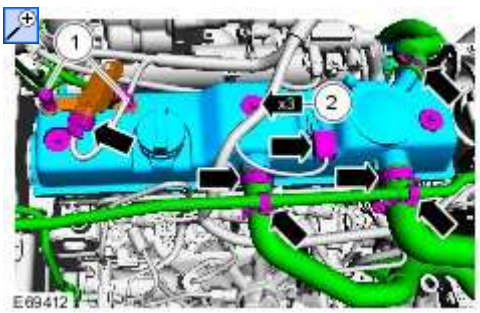

E69412

12.

13.

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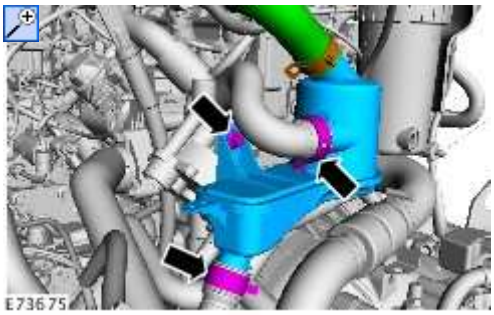
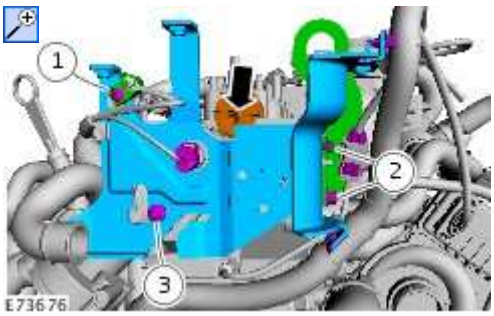


14. Remove the Fuel Filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



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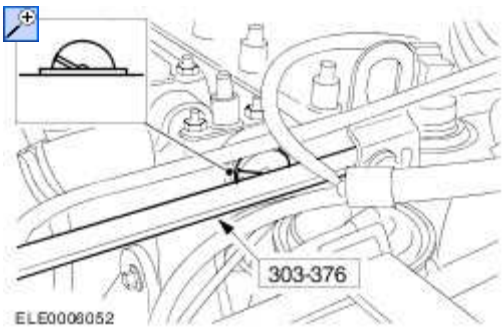
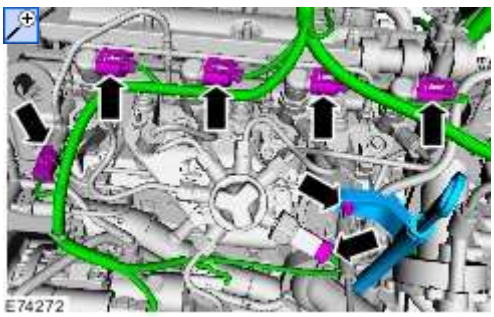


16. NOTE: Only rotate the camshaft in the normal direction of rotation.
    Using the camshaft groove as a guide, rotate the crankshaft to 5 degrees before top dead center (TDC



17.

18. CAUTION: Make sure that the area around the component is clean and free of foreign material.
    Refer to: Fuel Injection Component Cleaning (303-04 Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

19. Discard the high-pressure fuel supply lines.

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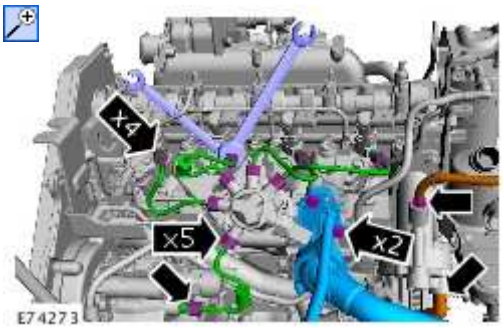
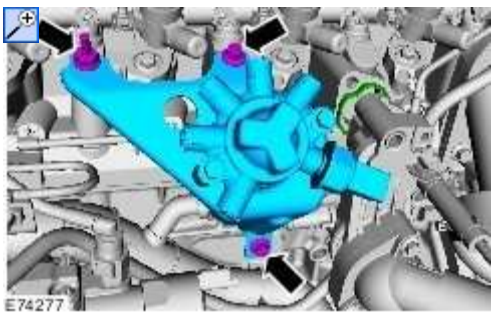
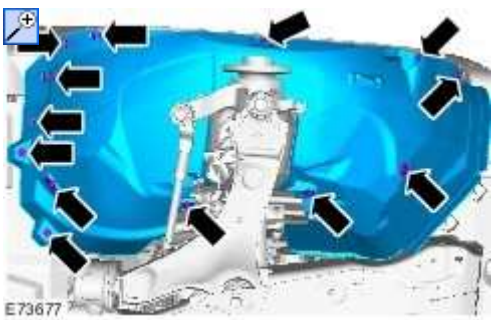




20. Discard the thermostat housing gasket.

21. Remove the front right wheel.

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



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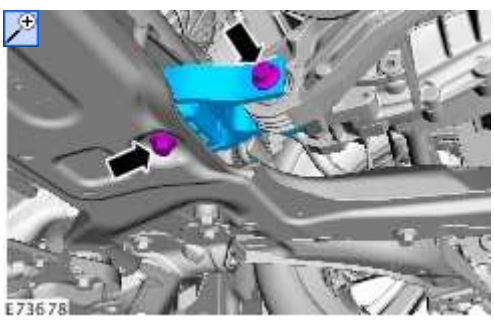

23.

24. CAUTIO
    Make sure that the exhaust flexible pipe not forcibly bent.

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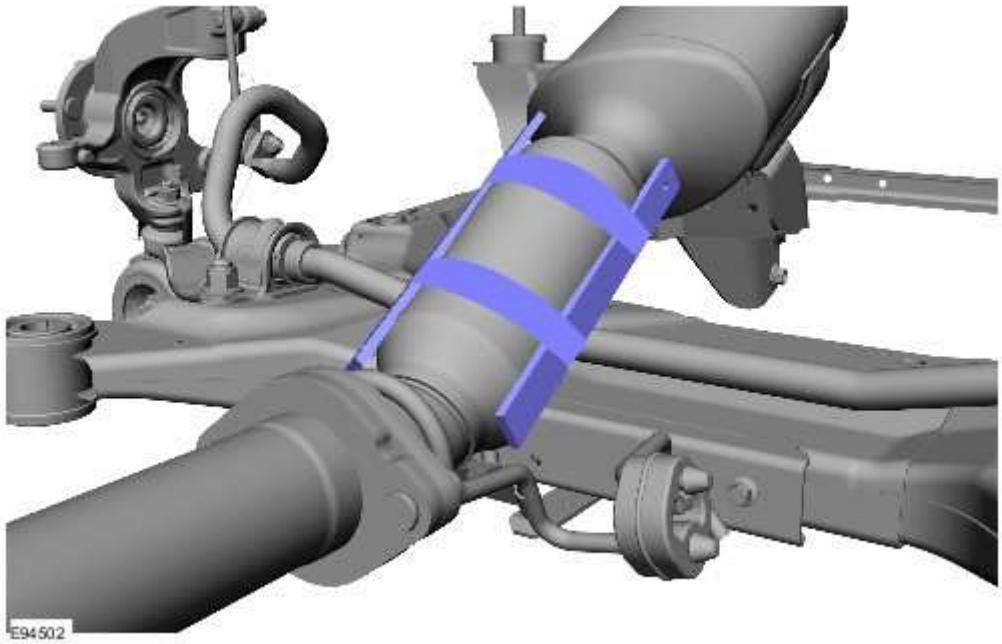

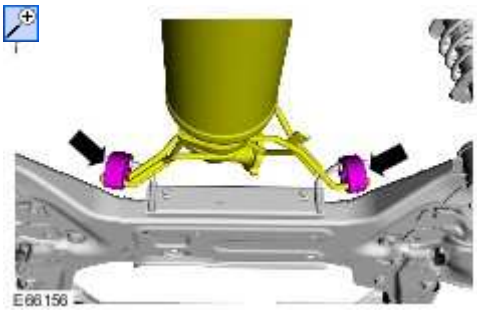

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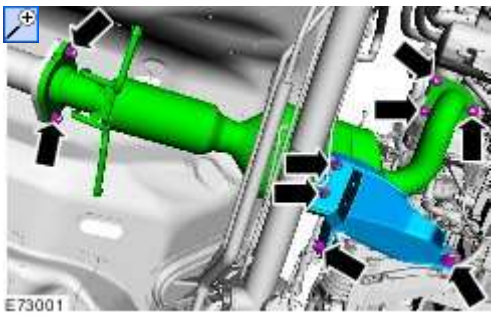
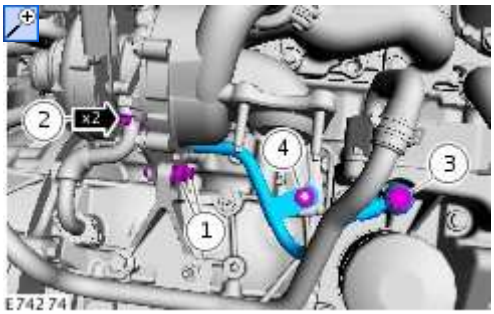


26. CAUTION: Twisting the exhaust flexible pipe more than 2 degrees may cause damage resulting in failure.



27.

28. *General Equipment:* Dowel with a diameter of 4 mm

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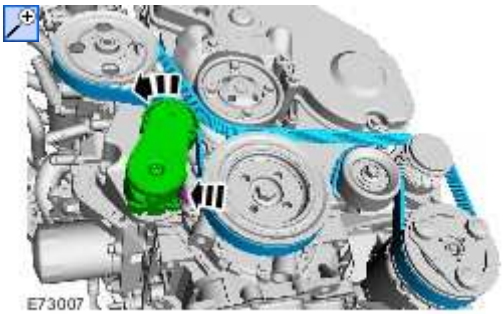

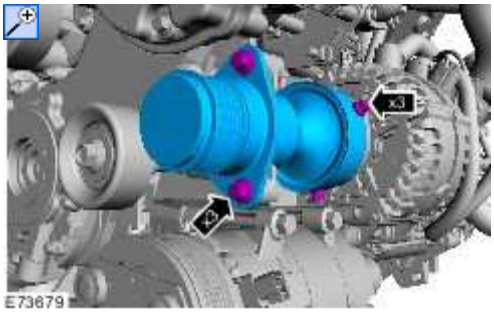

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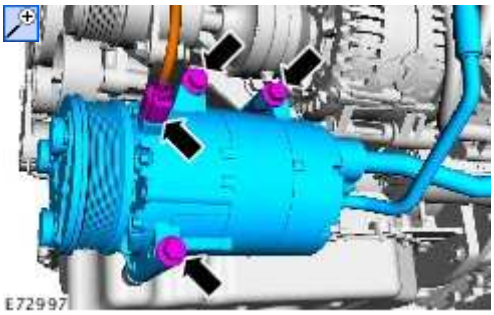
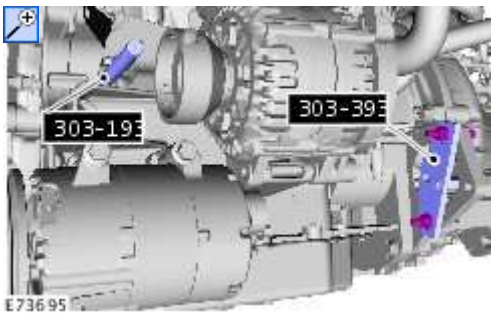


30. Secure the A/C compressor to one side.

General Equipment: Cable ties

31. Remove the starter motor.

Refer to: Starter Motor (303-06D Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



32. NOTE: Only rotate the crankshaft in the normal direction of rotation.
    1. Remove the cylinder block blanking plug and install the special tool.

       Special Tool(s): 303-193
    2. Rotate the crankshaft slowly until the cranksha stops.
    3. **Make sure that the crankshaft does not rotate during installation of the special tool.Make sure that the crankshaft is at th TDC position before locking the special tool.**Using the special tool, lock the crankshaf

       Special Tool(s): 303-393
33. Loosen the charge air cooler outlet pipe and put it aside.

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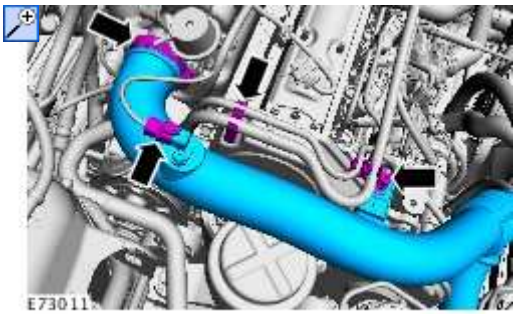
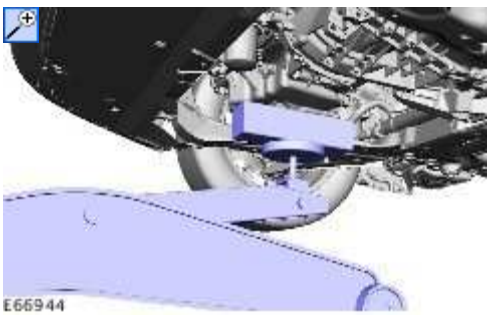
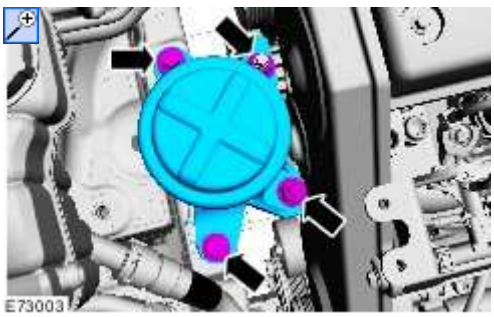




34. *General Equipment:* Trolley jack



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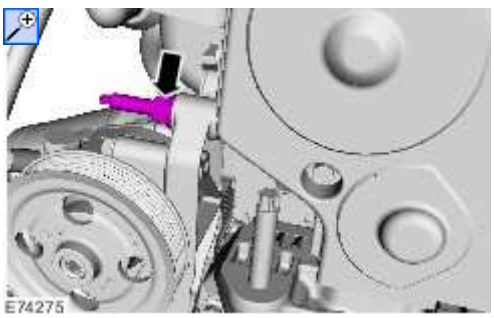

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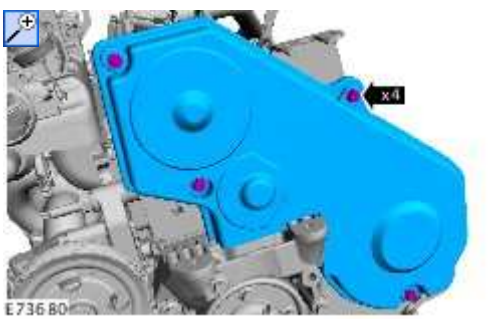

37.

38. *Special Tool(s):* 303-376B

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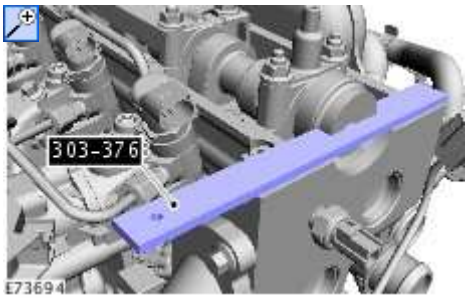

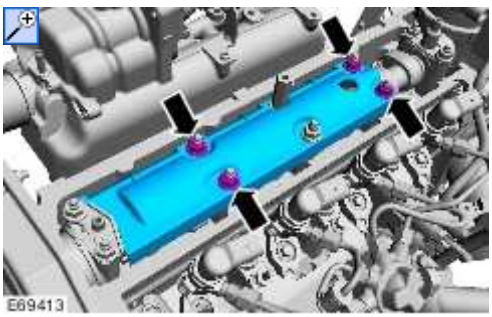

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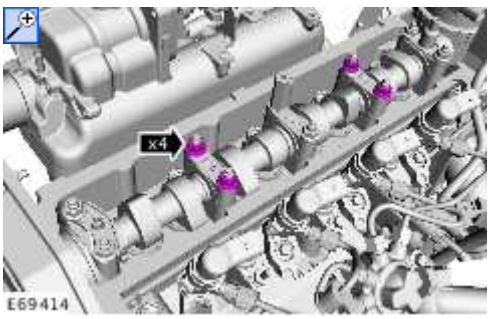
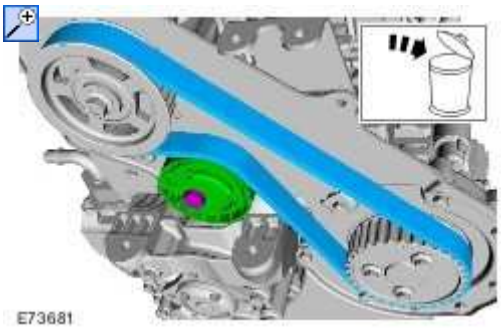
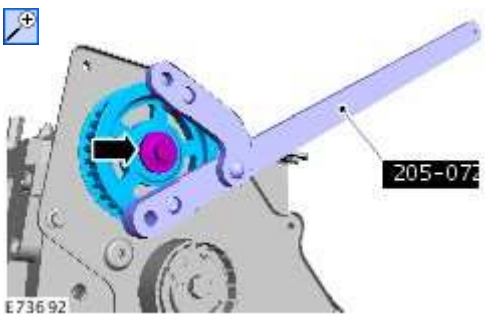


40. *Torque:* 20 Nm



41. Discard the timing belt.



42. Loosen the camshaft pulley retaining bolt by 5 turns

Special Tool(s): 205-072

43. *Special Tool(s):* 303-651

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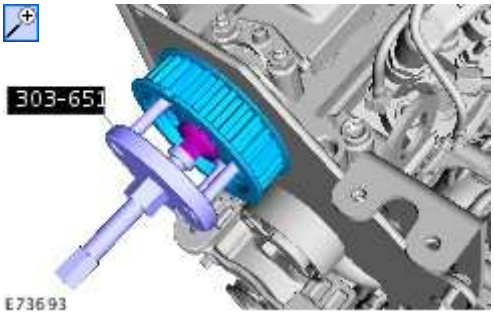

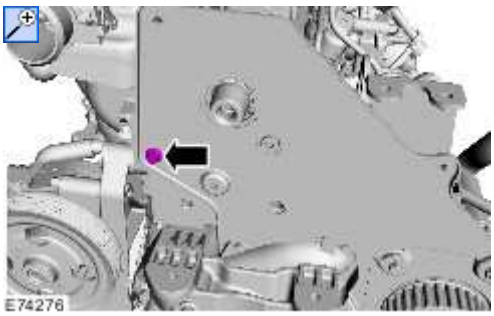

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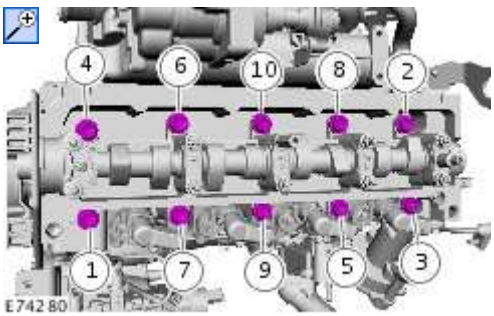
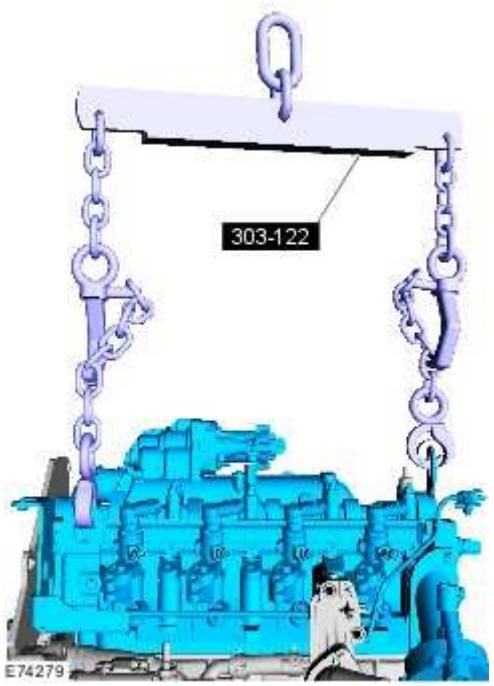


45. NOTE: Note the different lengths of the bolts.



46. *Special Tool(s):* 303-122

Installation

1. Clean the mating faces of the cylinder head and cylir block with cleaner.

   Material: Spoiler Adhesive Kit 2 Component (WSK-M5B401-A1 / 2U7J-M2G376-AA)

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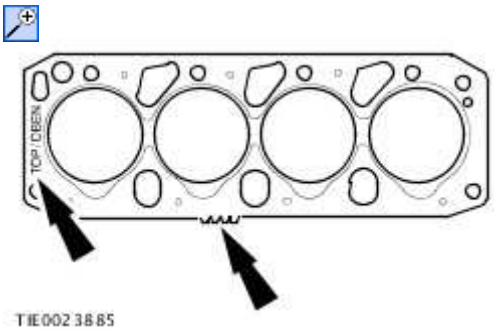
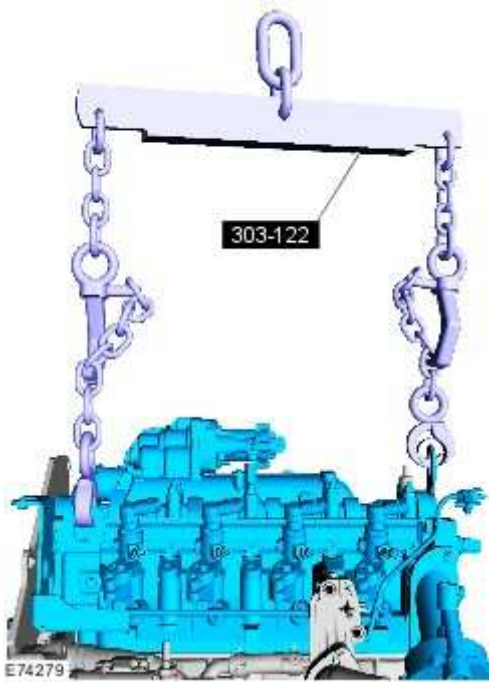
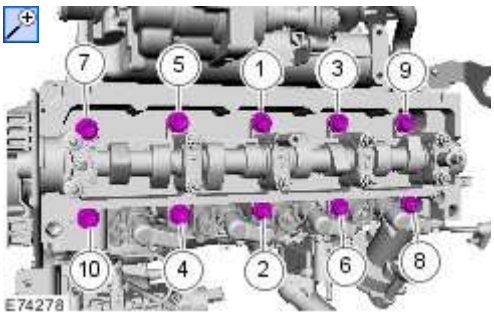


2. NOTE: The thickness and position of the new cylinder head gasket must be the same as that of the old one (hole/tooth and TOP/OBEN marked).



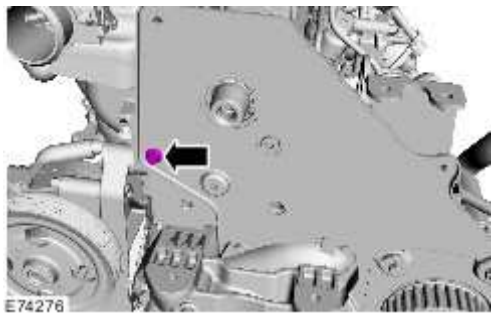
3. NOTE: The pistons must not be at TDC. Make sure that the special tool is engaged in the camshaft groove.
Special Tool(s): 303-122



4. CAUTIONS:

Make sure that new bolts are installed.

Make sure that the component is clean, free o foreign material and lubricant.
Torque:
Stage 1: 20 Nm
Stage 2: 54 Nm
Stage 3: 90°
Stage 4: M12x137 70°
M12x177 90°



5. *Torque:* 10 Nm

6.

- Check the timing belt tensioner and make sure that the timing belt tensioner pointer rotates clockwise freely.

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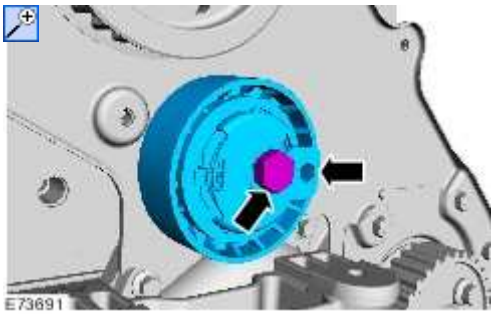
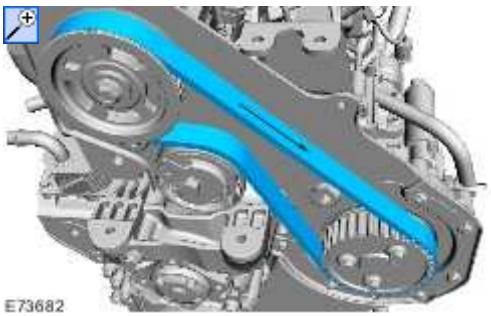
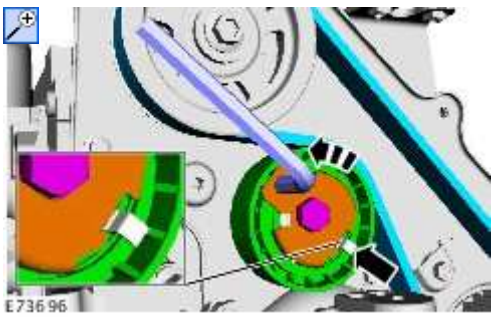


- Move the timing belt tensioner adjustment arr the 3 o'clock position.
- Do not fully tighten the timing belt tensioner retaining bolt at this stage.



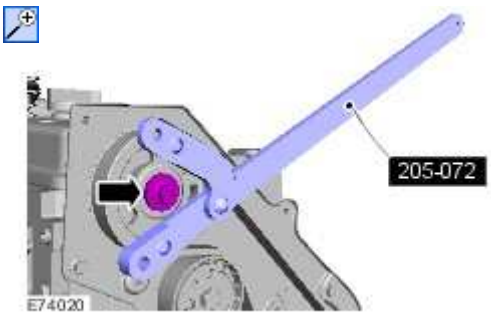
7.

- The camshaft pulley must be able to rotate fre on the camshaft taper. Tighten the camshaft pulley bolt finger tight and then loosen by one half turn.
- Install the timing belt with the direction arrow the direction of engine rotation.



8. Tension the timing belt counterclockwise until the pointer is positioned between the sides of the windo

   Torque: 50 Nm



9. *Special Tool(s):* 205-072
   Torque: 50 Nm

10. Remove the special tools.

    Special Tool(s): 303-376B, 303-193, 303-393

11.
    1. Rotate the crankshaft 2 revolutions. Replace tl Timing Peg just before TDC on the second revolution.

       Special Tool(s): 303-193
    2. Rotate the crankshaft slowly until the cranksh stops at TDC.

12. Check that the timing belt tensioner pointer is positioned in the window, otherwise the timing belt tensioning steps must be repeated.

13. NOTE: If the special tool cannot be installed, the timing belt tensioning steps must be repeated.

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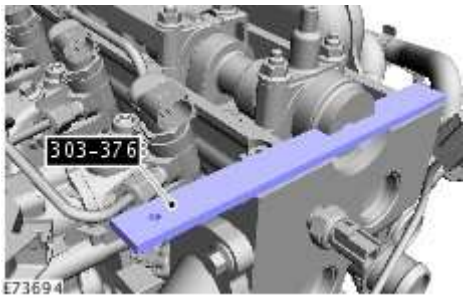
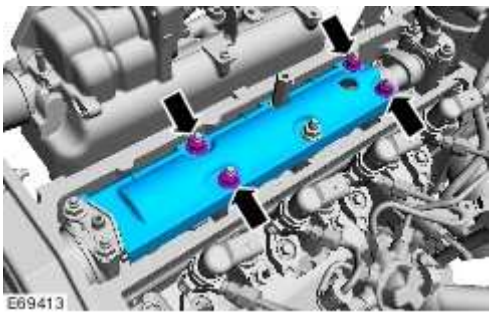


Install the special tool.

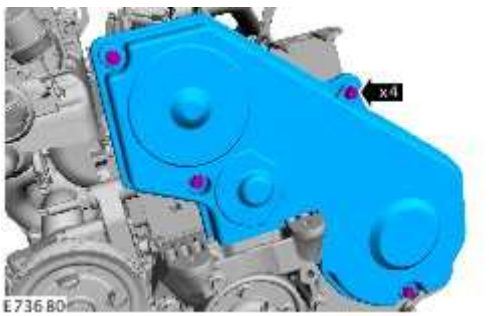
Special Tool(s): 303-376B

14. Remove all special tools and install the cylinder blocl blanking plug.

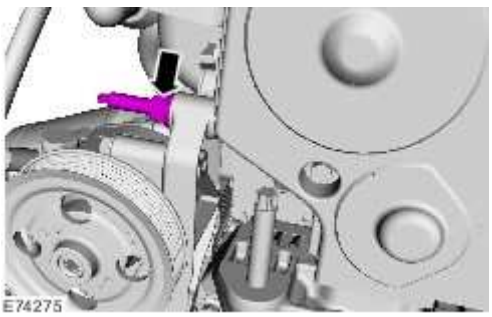
    Torque: 23 Nm



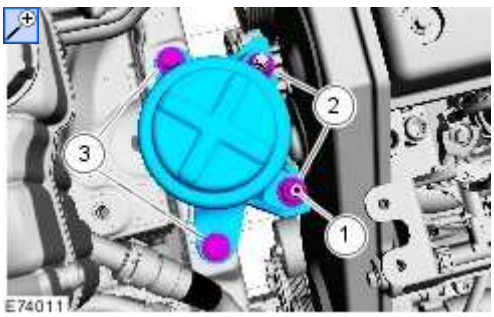
15. *Torque:* 20 Nm



16. *Torque:* 7 Nm



17. *Torque:* 23 Nm



18.
    1. *Torque:* 12 Nm
    2. *Torque:* 80 Nm
    3. NOTE: Only tighten the bolts finger tight at this stage.

19. Lower and remove the Trolley jack.

    General Equipment: Trolley jack

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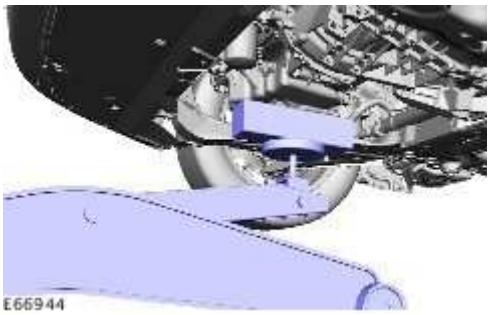
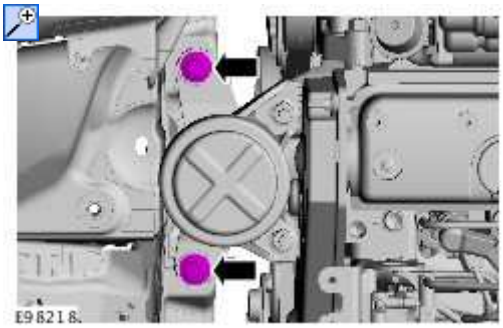
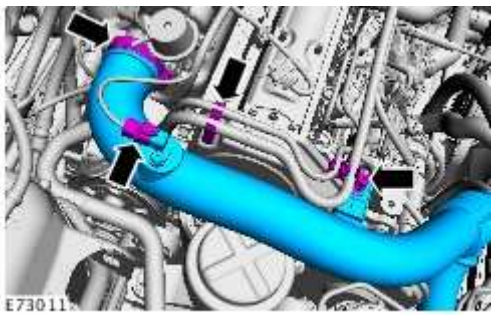




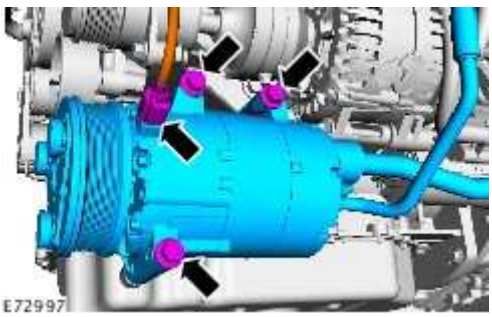
20. *Torque:* 90 Nm



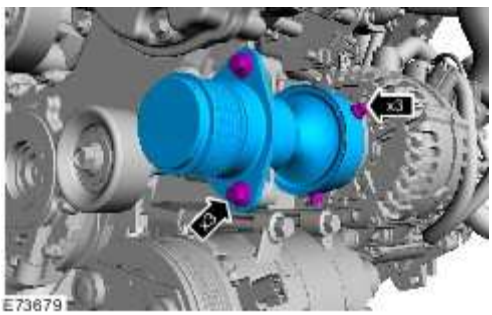
21.

22. Install the starter motor.

    Refer to: Starter Motor (303-06D Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



23. *Torque:* 25 Nm



24. *Torque:*
    driveshaft intermediate bearing retaining bolts 2 Nm
    vibration damper retaining bolts 10 Nm

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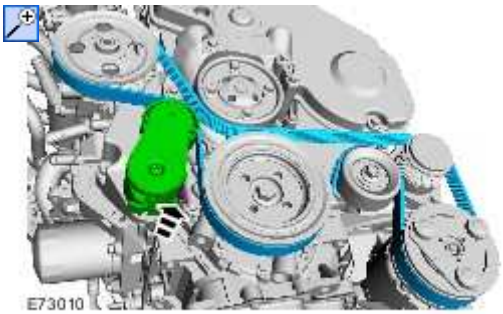

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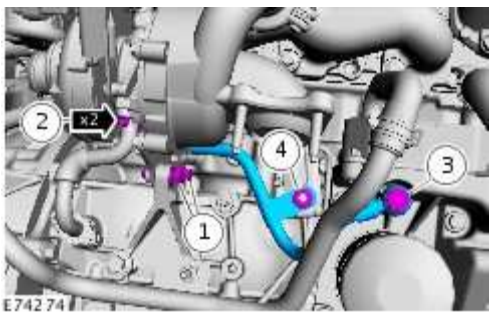
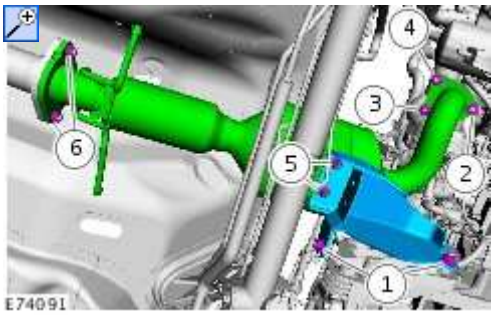
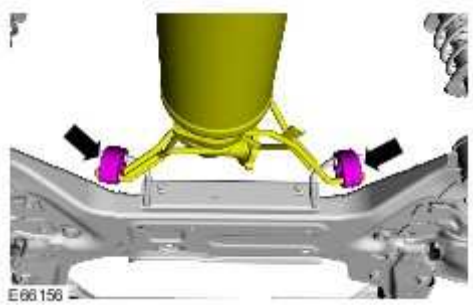


26. *Torque:*
    1 25 Nm
    2 9.8 Nm
    3 35 Nm
    4 23 Nm



27. CAUTION: Twisting the exhaust flexible pipe more than 2 degrees may cause damage resulting in failure.
Tighten all retaining nuts in the sequence show

    Torque:
    1-5 25 Nm
    6 51 Nm



28.

29. Remove the exhaust flexil pipe support wrap.

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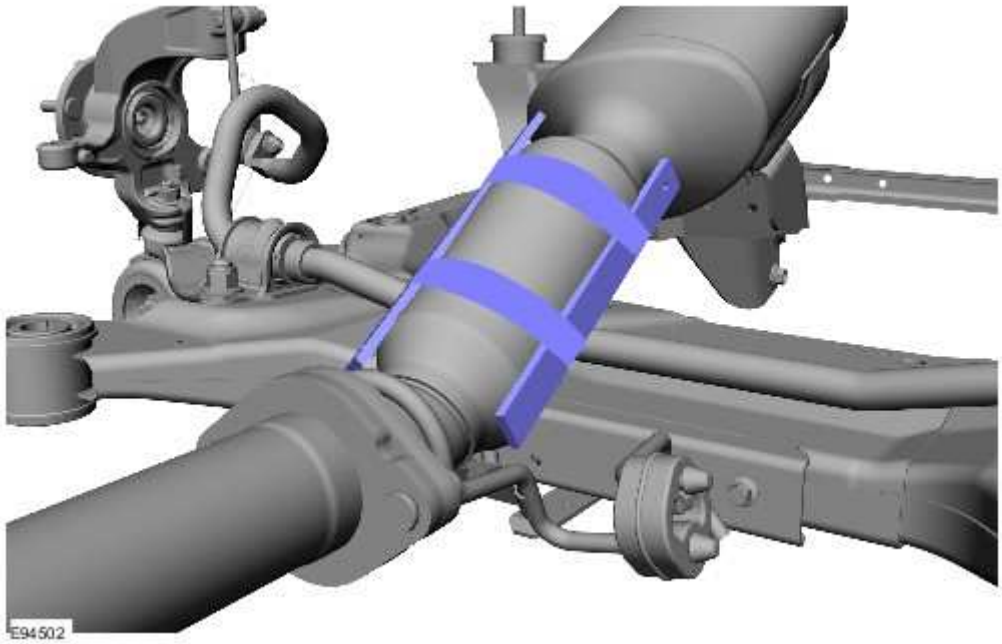
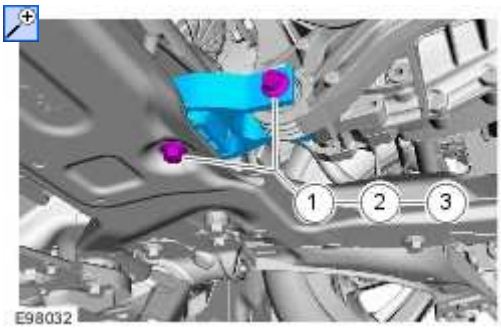
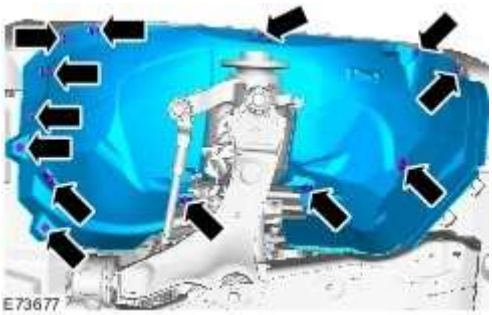




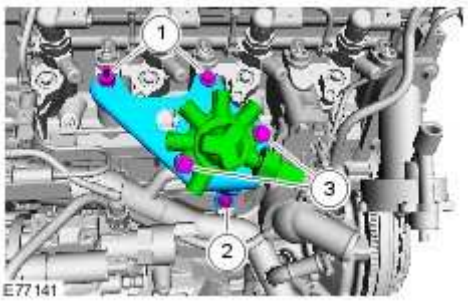
30.
1. *Torque:* 35 Nm
2. *Loosen:* 360°
3. *Torque:* 85 Nm



31.

32. Install the front right wheel.

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



33. Tighten the common rail support bracket retaining b in the sequence shown. Do not fully tighten the fuel supply manifold retaining bracket bolts at this stage.

Torque:
1-2 23 Nm
3 24 Nm

34. NOTE: The fuel supply line must be installed with the yellow identification collar adjacent to the fuel

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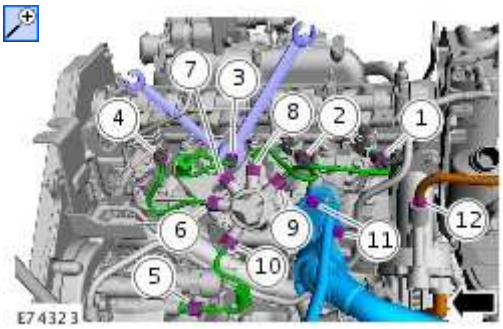
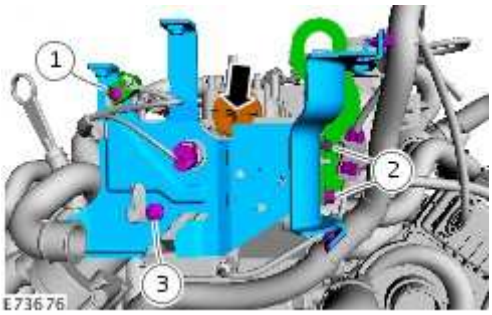


injector and the blue identification collar adjacent to the fuel rail.
NOTE: The fuel supply line must be installed with the yellow identification collar adjacent to the fuel pump and the blue identification collar adjacent to the fuel rail.
NOTE: The high-pressure fuel supply lines must be connected immediately after removing the blanking plugs.
NOTE: Do not allow the unions to hit the ends of the high-pressure fuel supply line. To aid installation of the new high-pressure fuel supply lines, the unions at the fuel rail end are colored gold.
Tighten the fuel injector high-pressure fuel supply lines in the sequence shown.

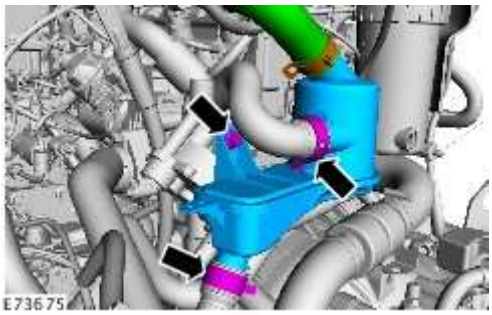
Torque:
1-5 25 Nm
6-10 38 Nm
thermostat housing 23 Nm
vacuum pipe 18 Nm



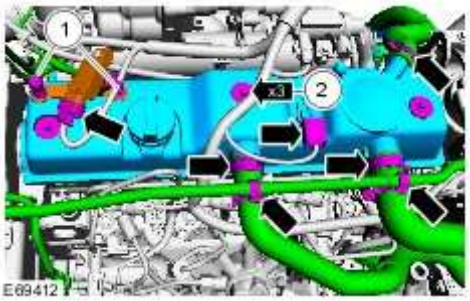
35. *Torque:*
1 7 Nm
2 23 Nm
3 23 Nm

36. Install the Fuel Filter.

Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



37. *Torque:* 23 Nm



38.
1. *Torque:* 3 Nm
2. *Torque:* 5 Nm

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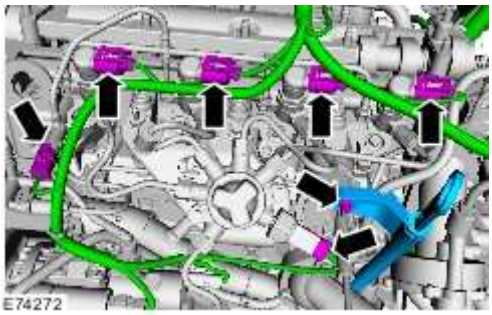
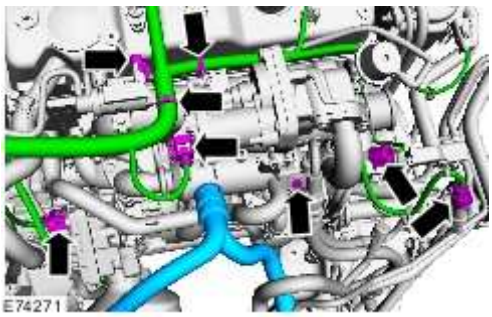
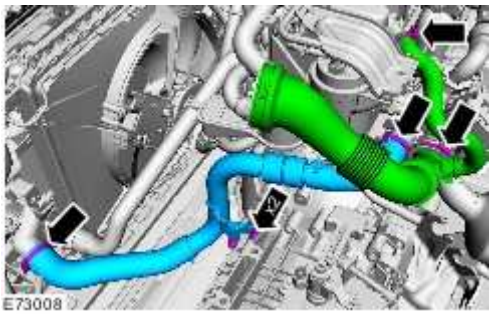


39. *Torque:* 10 Nm



40. *Torque:* 23 Nm



41. *Torque:* 24 Nm

42. Install the Air Cleaner.

    Refer to: Air Cleaner (303-12D Intake Air Distributio and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

43. Connect the battery ground cable.

    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

44. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures)
45. Change the engine oil and the oil filter.

    Material: Engine Oil - 5W-30 (WSS-M2C912-A1)

46. Bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

47.

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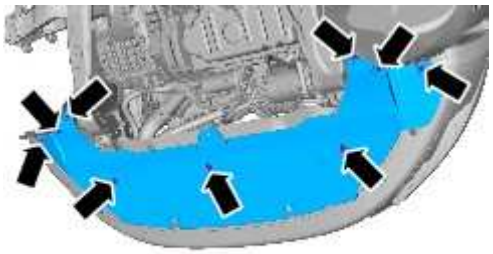

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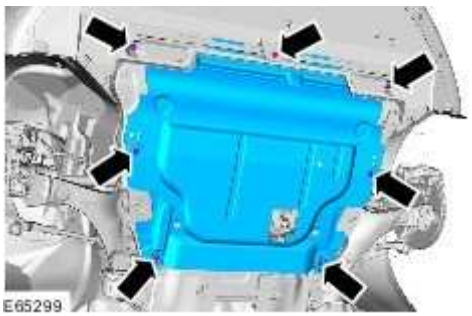
48.



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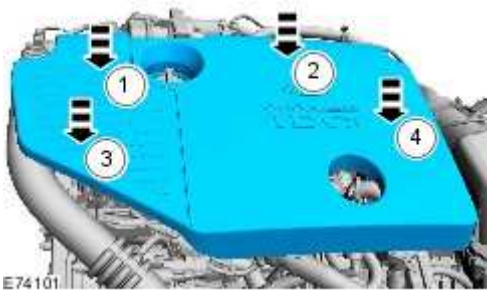

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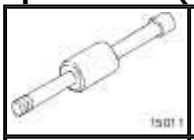
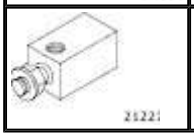
Removal and Installation

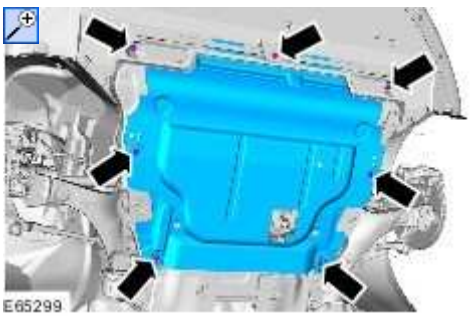
Special Tool(s)

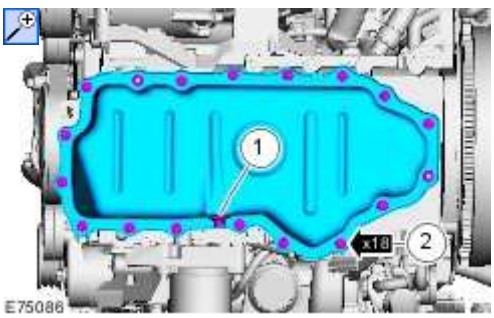
	205-047 Slide Hammer
	303-633 Adapter for 205-047

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C912-A1
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. 

3. 

NOTE: The seal is to be reused unless damaged.
Drain the engine oil into a suitable container.
4. CAUTION: Take extra care not to damage the mating faces.
Special Tool(s): 303-633, 205-047

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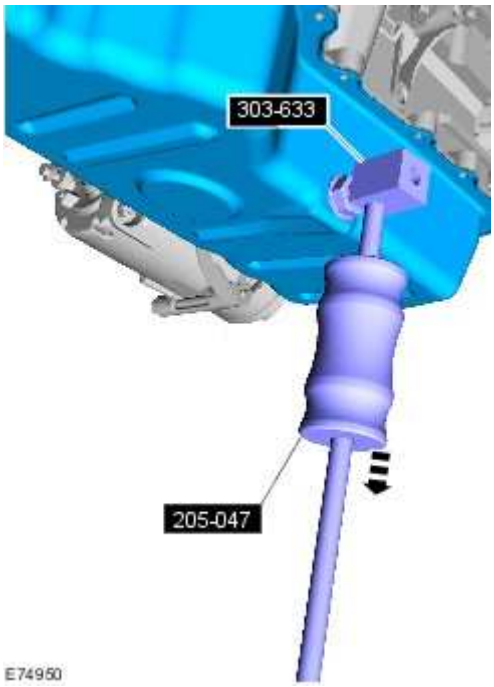
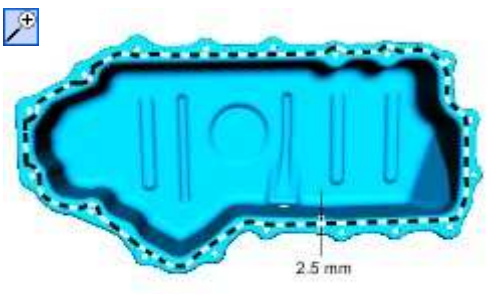
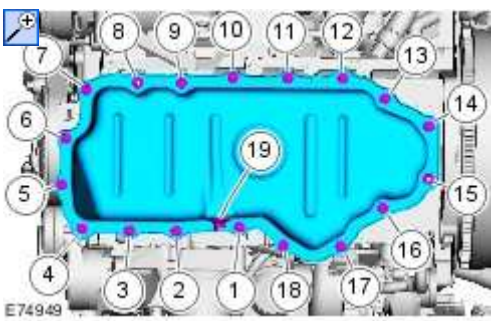
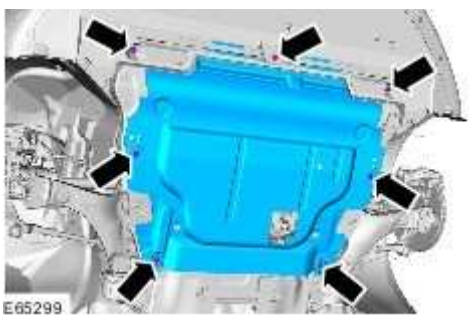


Installation







1. NOTE: Make sure that the mating faces are clean and free of foreign material.
2. CAUTION: Make sure that no excess sealant residue is evident.
   NOTE: The component must be installed within 5 minutes of applying the sealant.
   Apply a 2.5 mm diameter bead of sealant to the edge of the Oil Pan.

   Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)
3. Tighten the Oil Pan retaining nuts and bolts in the sequence shown.

   Torque:
   1-18
   Stage 1: 6.5 Nm
   Stage 2: 14 Nm
   19 36 Nm
4.
5. Fill the engine with engine oil.

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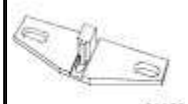
Removal and Installation

Special Tool(s)

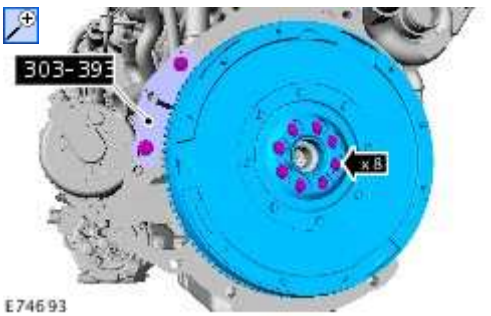
	303-393 Locking Tool, Flywheel

Removal

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

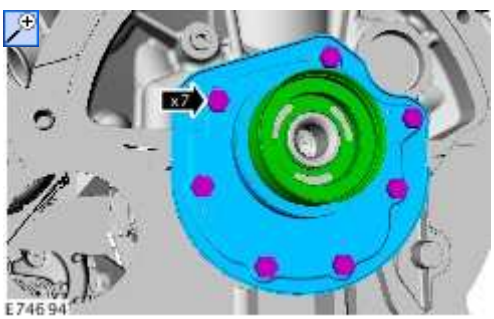
1. Remove the clutch disc and pressure plate.

   Refer to: Clutch Disc and Pressure Plate (308-01A Clutch - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal and Installation).



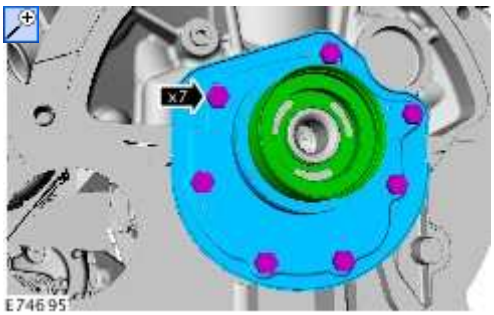
2. Discard the flywheel retaining bolts.

   Special Tool(s): 303-393
   Torque:
   Stage 1: 35 Nm
   Stage 2: 45°



3. Discard the crankshaft rear seal carrier.

Installation



1. NOTE: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Torque: 20 Nm

2. Inspect the flywheel.

   Refer to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch -

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General Information, Diagnosis and Testing).

3. To install, reverse the removal procedure.

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Removal

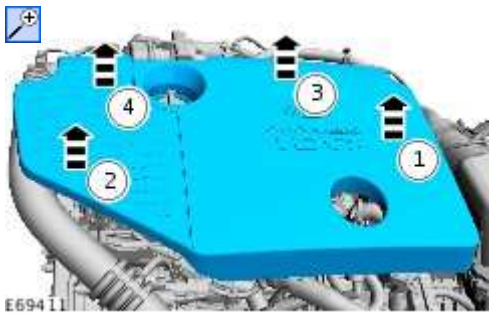
General Equipment

Cable ties
Vehicle/axle stands

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at

1. Refer to: Diesel Fuel System Health and Safety Preca

WARNING: Make sure that the fuel pressure has dropped to zero and that the fue



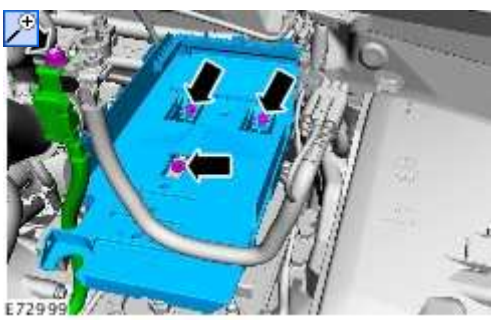
2.

3. Remove the air cleaner.

   Refer to: Air Cleaner (303-12D Intake Air Distributio Duratorq-TDCi (92kW/125PS) - Lynx, Removal and I

4. Remove the battery.

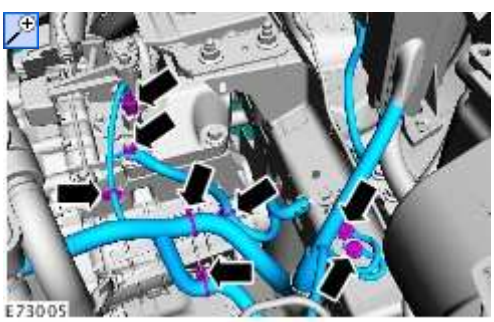
   Refer to: Battery (414-01 Battery, Mounting and Cal



5.

6. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleedi Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ger



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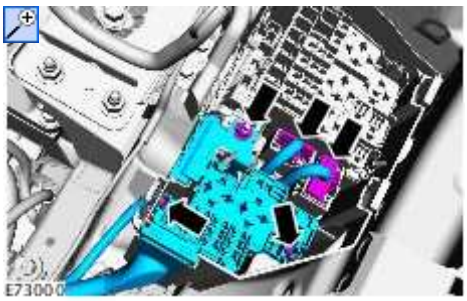
8.



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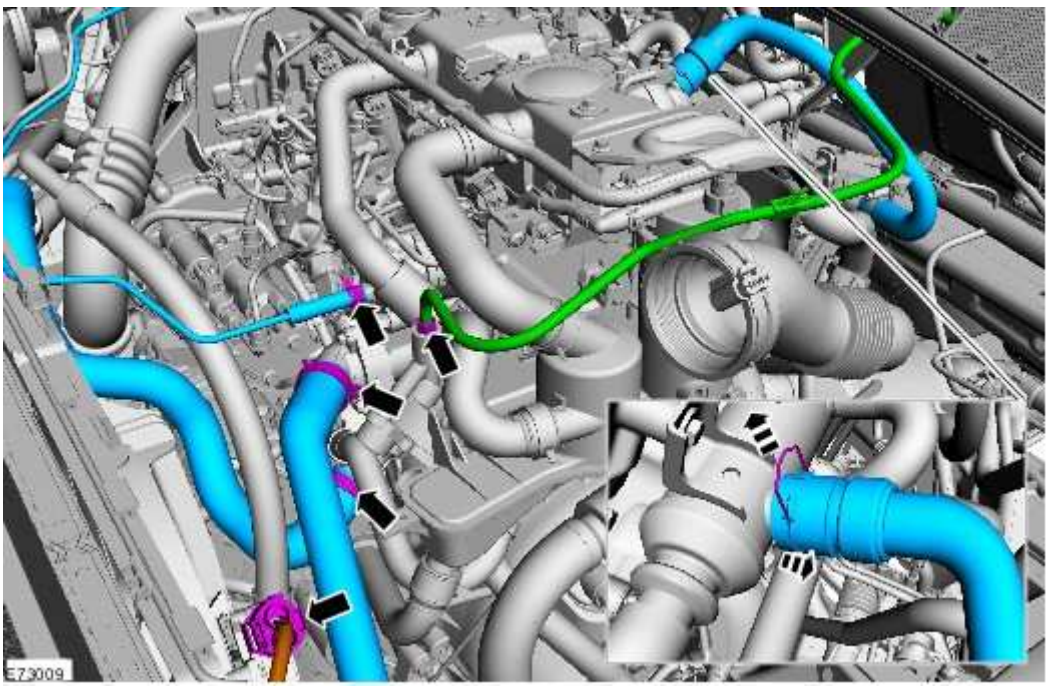

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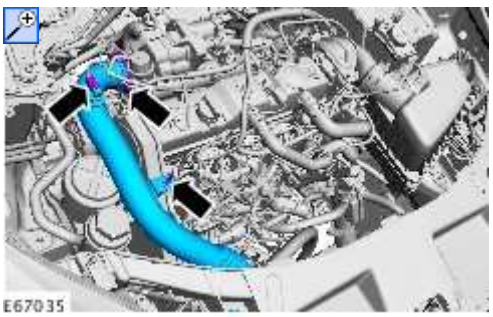

11.

12. CAUTION: Gearshift cables must not be kinke

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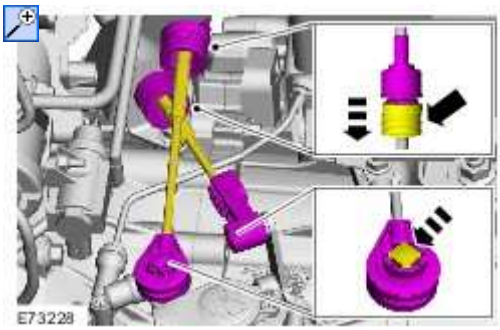
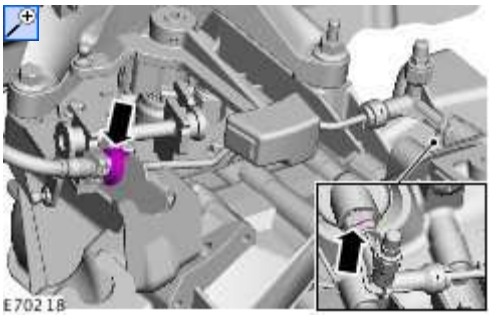
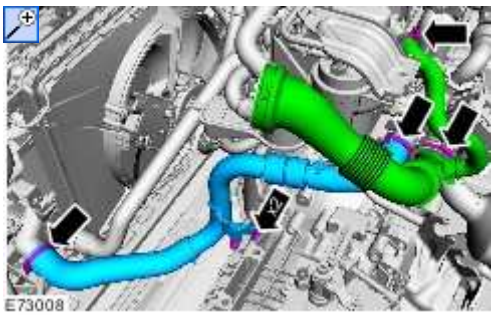




13. CAUTION: If the fluid is spilled on the paintwc
cold water.



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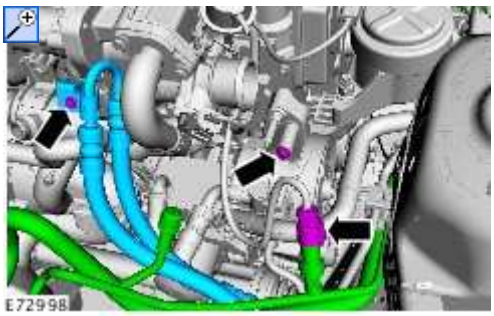

15.

16. Remove both front wheels.

    Refer to: Wheel and Tire (204-04 Wheels and Tires,

17. Remove the right-hand halfshaft.

    Refer to: Front Halfshaft RH (205-04 Front Drive Hal

18. Remove the left-hand halfshaft.

    Refer to: Front Halfshaft LH (205-04 Front Drive Hal

19. Remove the front subframe.

    Refer to: Front Subframe (502-00 Uni-Body, Subfrar

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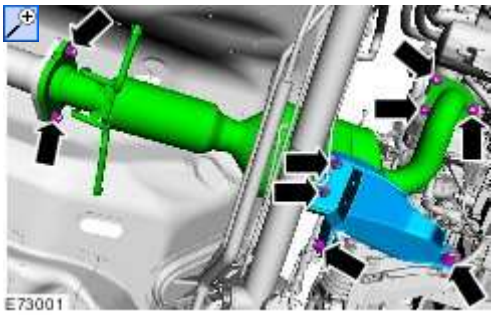
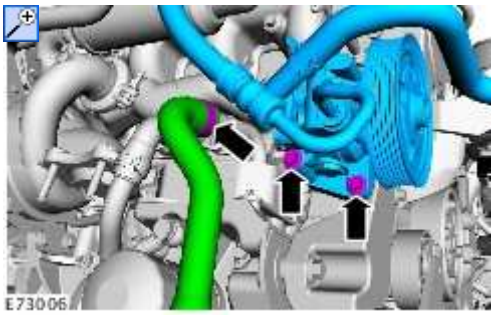


20. CAUTION: Twisting the exhaust flexible pipe r

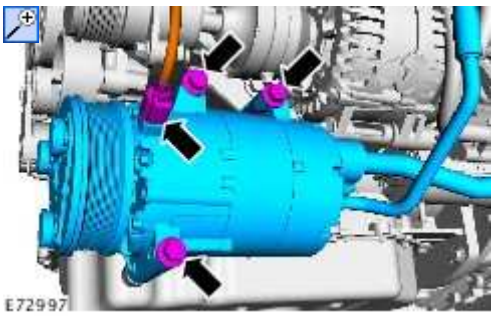
21. Remove the accessory drive belt.

Refer to: Accessory Drive Belt (303-05D Accessory D
TDCi (92kW/125PS) - Lynx, Removal and Installatio



22. Secure the Power Steering Pump to one side.

General Equipment: Cable ties

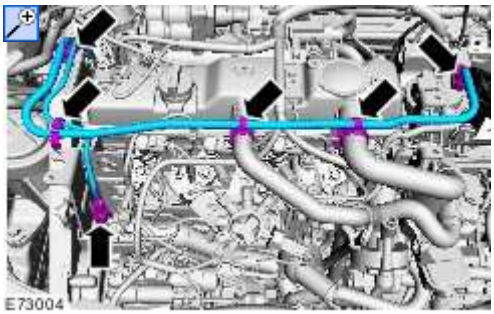


23. Secure the A/C compressor to one side.

General Equipment: Cable ties

24. Disconnect the PCM electrical connectors.

Refer to: Powertrain Control Module (PCM) (303-14E
Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ren



25. Disconnect the fuel supply line and fuel return line q

Refer to: Fuel Filter (310-01B Fuel Tank and Lines -
(92kW/125PS) - Lynx, Removal and Installation).

26. WARNING: Make sure that the engine and tra
suitable retaining straps.
Using a suitable workshop table.

General Equipment: Vehicle/axle stands
General Equipment: Cable ties

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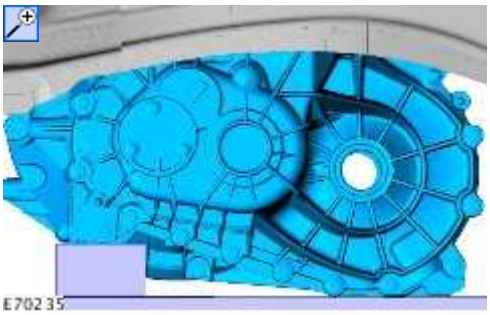

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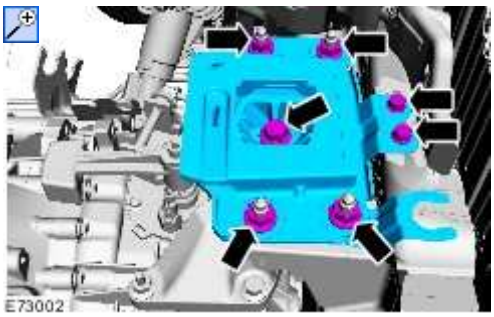
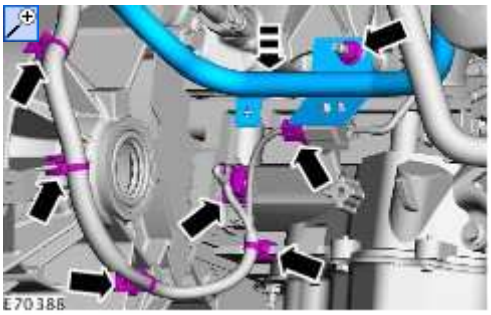


28. Remove also the engine front mount stud.

29. Raise the vehicle and remove the engine and transa:
30. Remove the starter motor.

    Refer to: Starter Motor (303-06D Starting System - (92kW/125PS) - Lynx, Removal and Installation).



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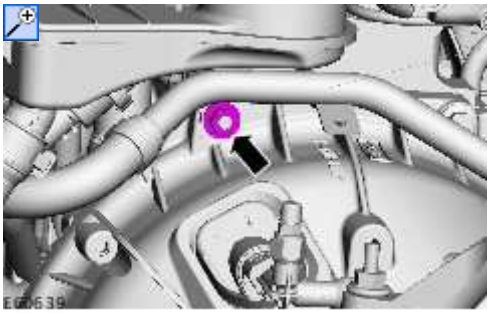

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33.

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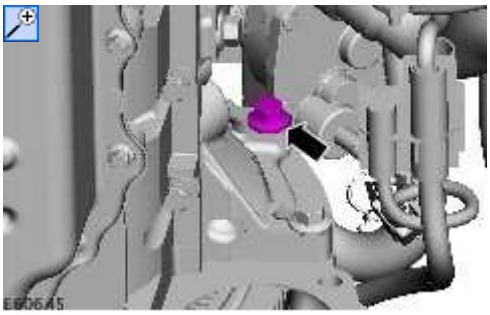

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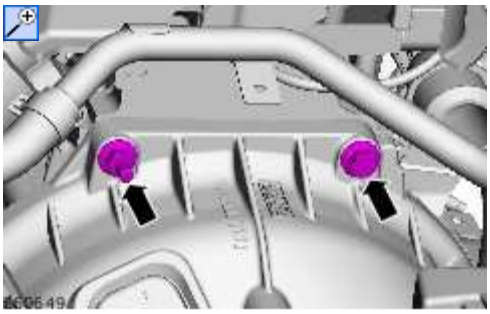

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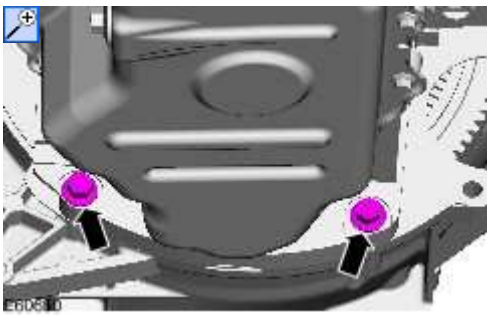

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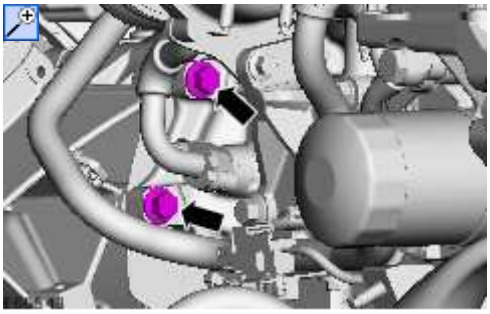

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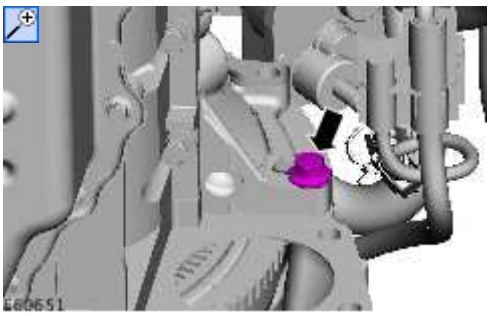

38. Remove the transaxle from the engine.

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Removal

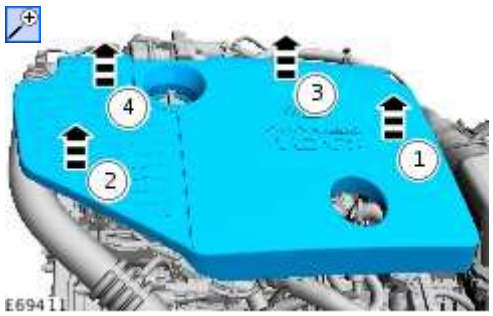
General Equipment

Cable ties
Vehicle/axle stands

WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at

1. Refer to: Diesel Fuel System Health and Safety Preca

WARNING: Make sure that the fuel pressure has dropped to zero and that the fue



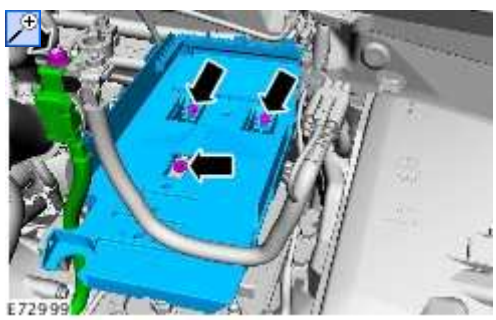
2.

3. Remove the air cleaner.

   Refer to: Air Cleaner (303-12D Intake Air Distributio Duratorq-TDCi (92kW/125PS) - Lynx, Removal and I

4. Remove the battery.

   Refer to: Battery (414-01 Battery, Mounting and Cal



5.

6. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleedi Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ger

7.

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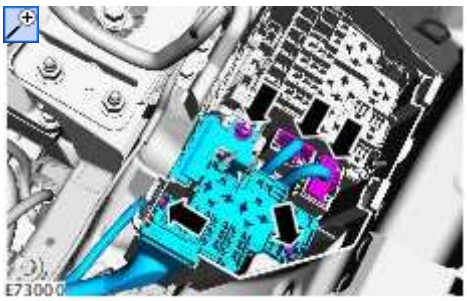
8.



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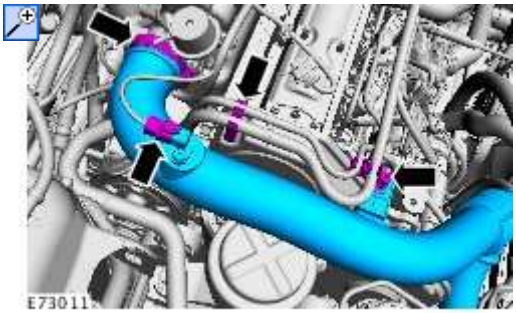
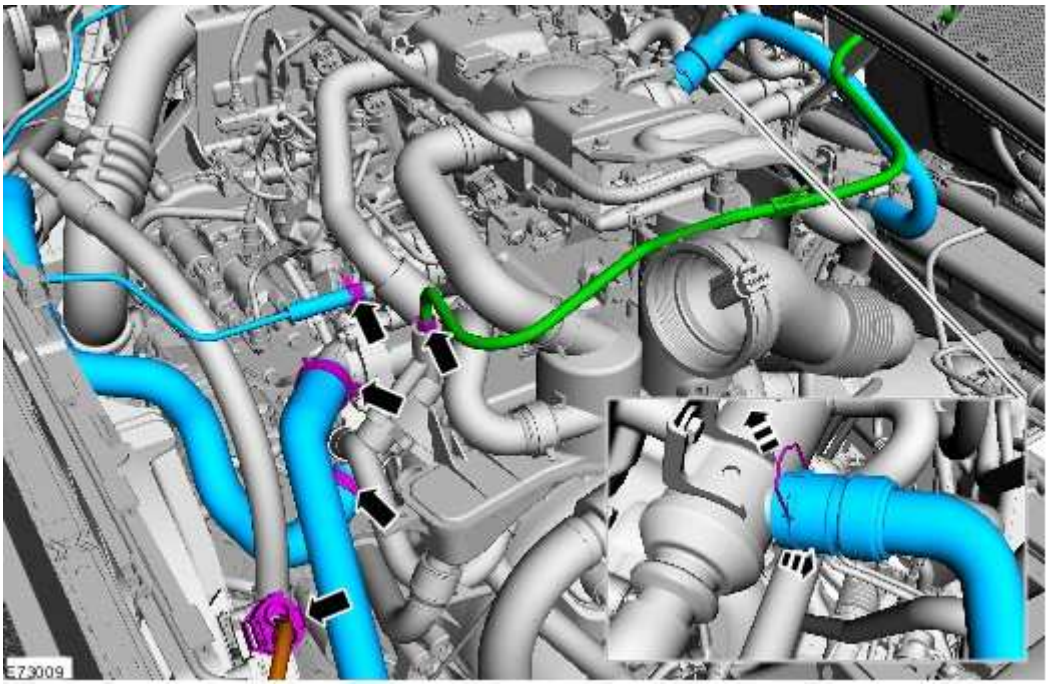


10. Secure the charge air cooler outlet pipe to one side.



11.

12. CAUTION: Gearshift cables must not be kinke

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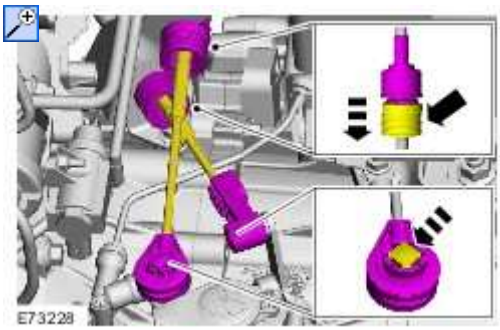
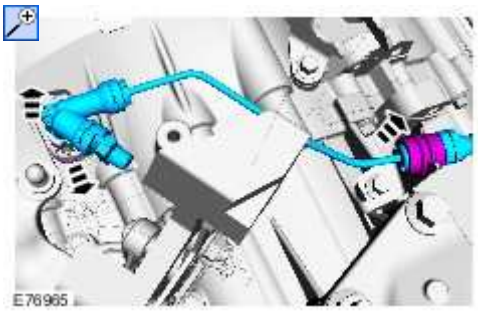
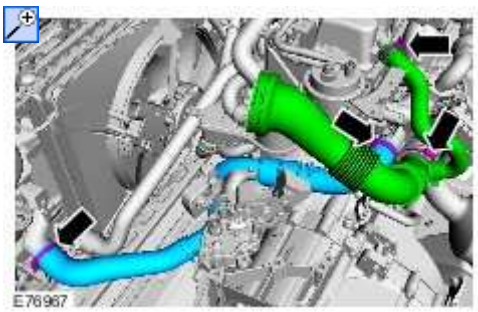




13. CAUTION: If the fluid is spilled on the paintwc cold water.



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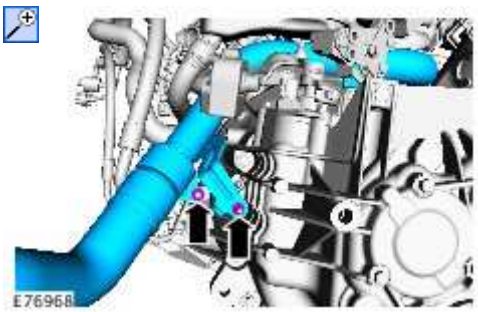

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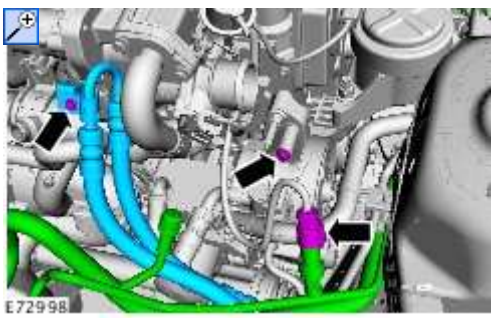

16.

17. Remove both front wheels.

    Refer to: Wheel and Tire (204-04 Wheels and Tires,

18. Remove the right-hand halfshaft.

    Refer to: Front Halfshaft RH (205-04 Front Drive Hal

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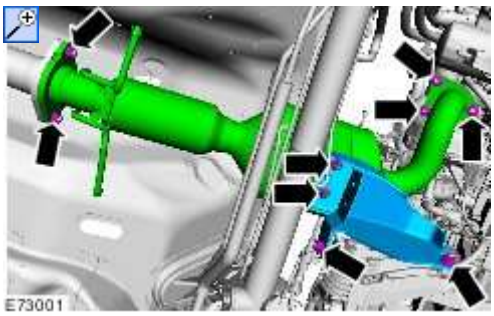
19. Remove the left-hand halfshaft.

    Refer to: Front Halfshaft LH (205-04 Front Drive Hal

20. Remove the front subframe.

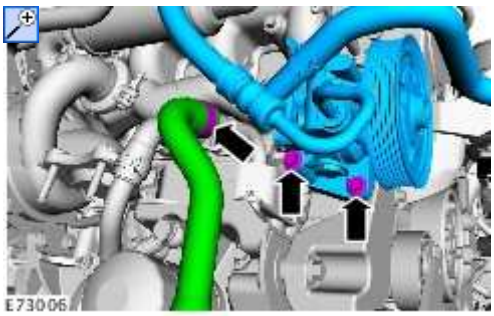
    Refer to: Front Subframe (502-00 Uni-Body, Subfrar



21. CAUTION: Twisting the exhaust flexible pipe r

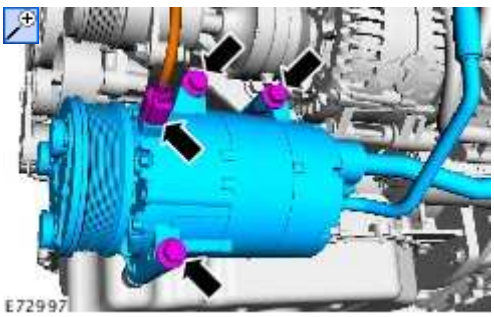
22. Remove the accessory drive belt.

    Refer to: Accessory Drive Belt (303-05D Accessory D
    TDCi (92kW/125PS) - Lynx, Removal and Installatio



23. Secure the Power Steering Pump to one side.

    General Equipment: Cable ties

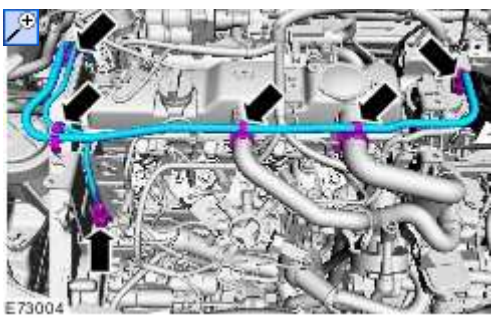


24. Secure the A/C compressor to one side.

    General Equipment: Cable ties

25. Disconnect the PCM electrical connectors.

    Refer to: Powertrain Control Module (PCM) (303-14E
    Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ren



26. Disconnect the fuel supply line and fuel return line q

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines -
    (92kW/125PS) - Lynx, Removal and Installation).

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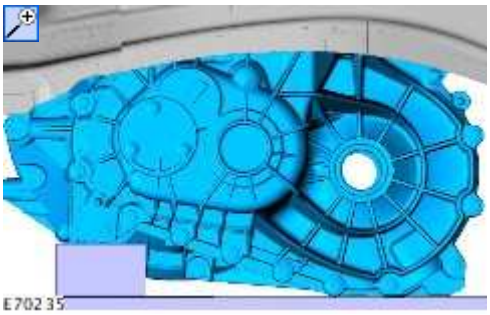
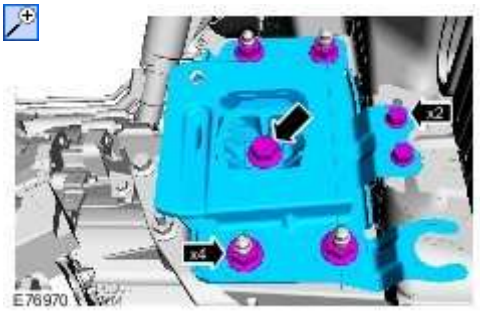


27. WARNING: Make sure that the engine and tra
suitable retaining straps.
Using a suitable workshop table.

General Equipment: Vehicle/axle stands
General Equipment: Cable ties



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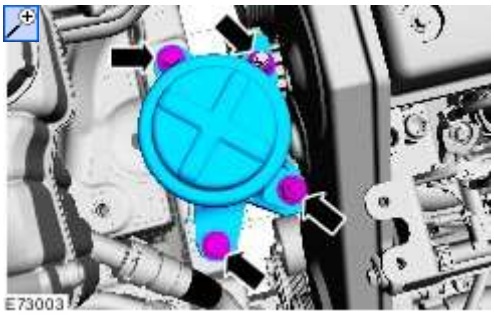
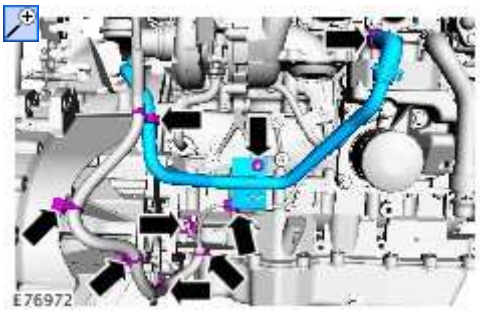


29. Remove also the engine front mount stud.

30. Raise the vehicle and remove the engine and transa
31. Remove the starter motor.

Refer to: Starter Motor (303-06D Starting System - (92kW/125PS) - Lynx, Removal and Installation).



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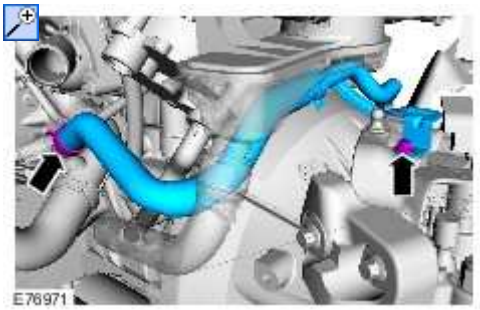

33.

34.

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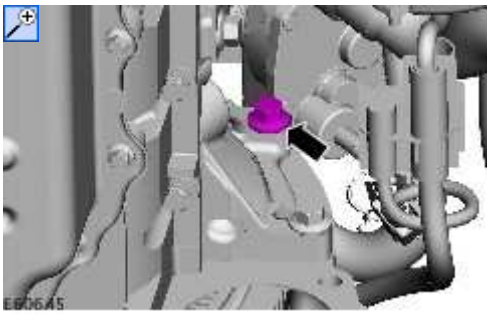

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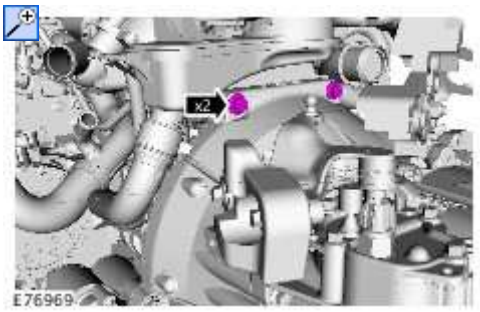

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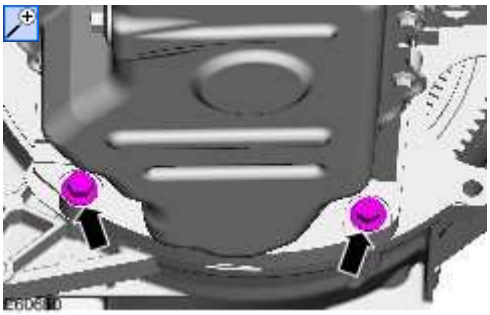

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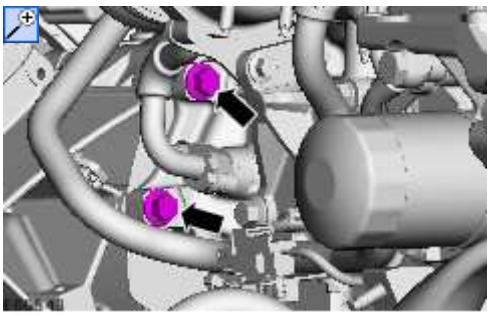

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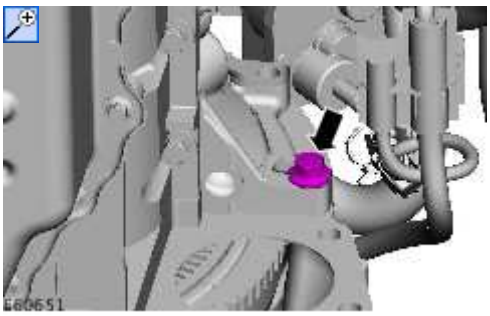

39. Remove the transaxle from the engine.

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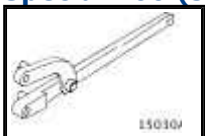
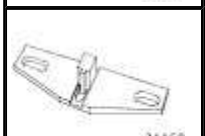
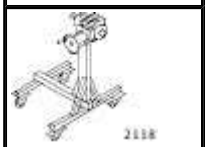
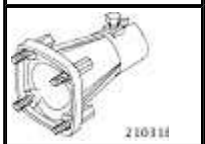
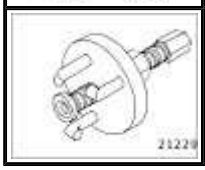
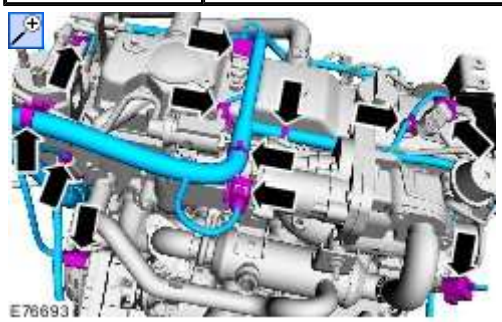
Print

Removal

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-393 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-651 Remover, Camshaft Sprocket



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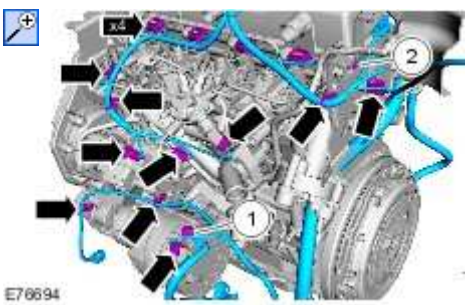

2.

3.

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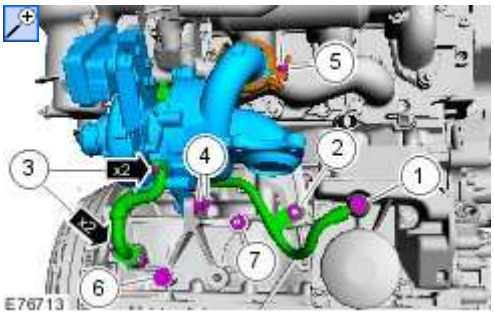

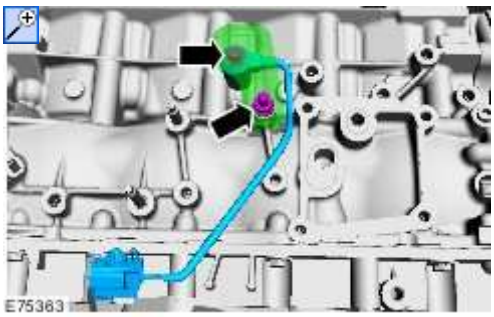

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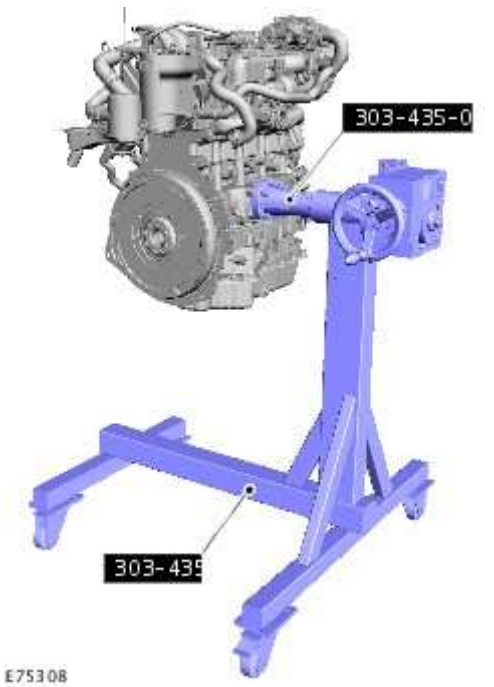
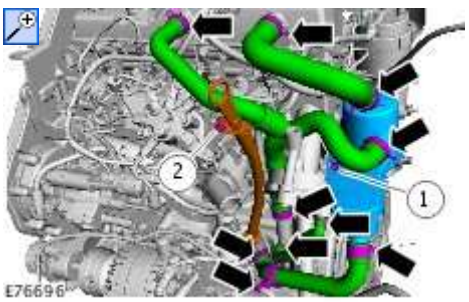


5. *Special Tool(s):* 303-435, 303-435-06



6.

7. Remove the Fuel Filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

8.

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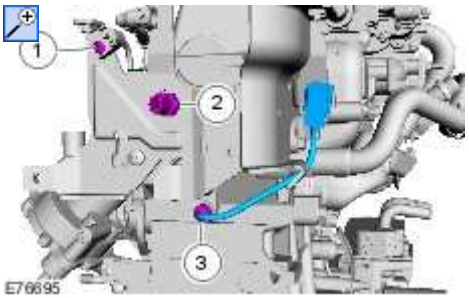

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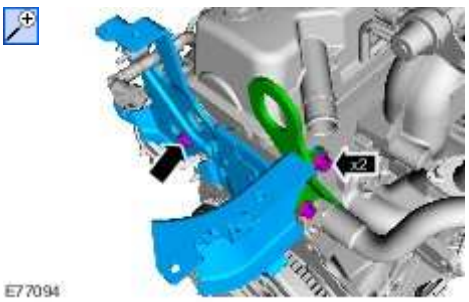

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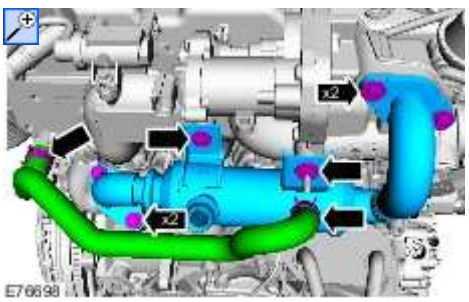

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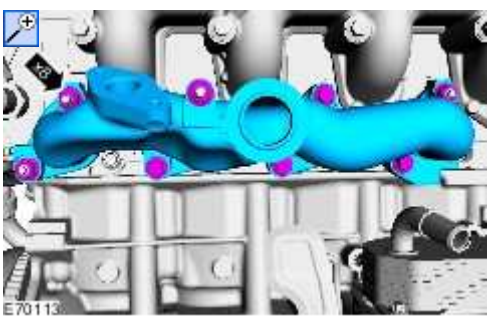

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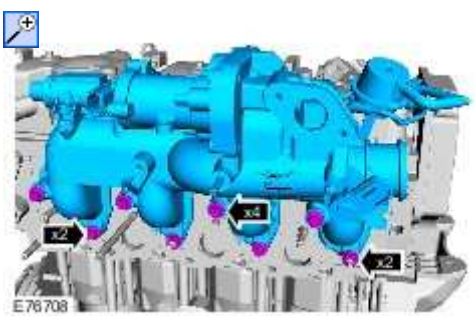

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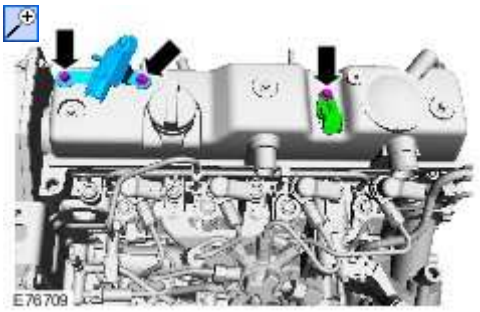
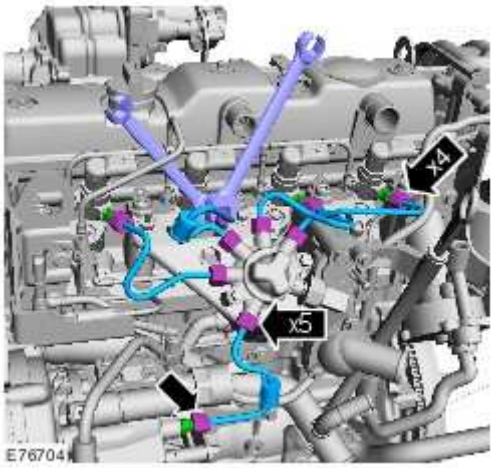


14. Clean the area around the fuel injection supply manifold, high pressure fuel supply lines and surrounding areas.

    Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



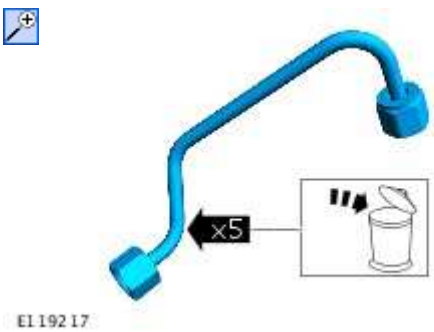
15. CAUTIONS:

    Use an open-ended wrench to prevent the component from turning.

    Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

    Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.

    Make sure that all openings are sealed. Use new blanking caps.



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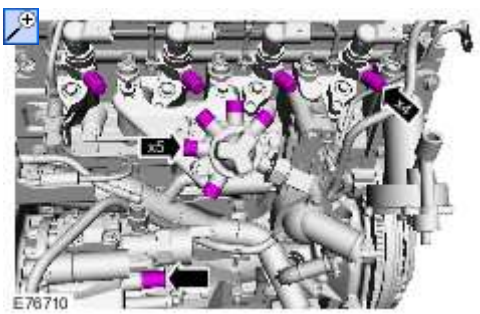

17. CAUTION: Make sure that all openings are sealed. Use new blanking caps.

18.

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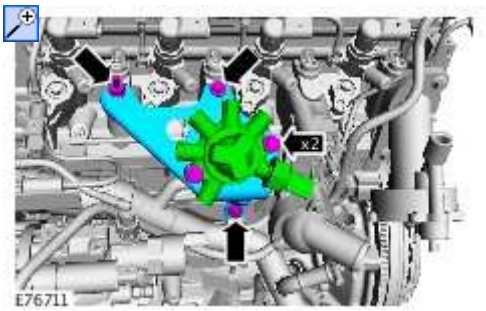

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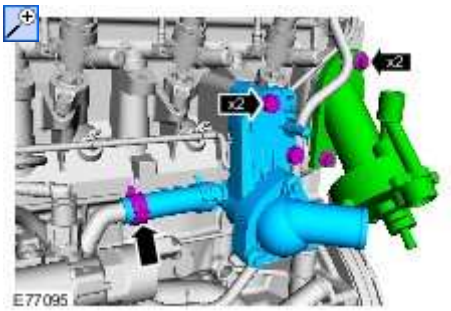
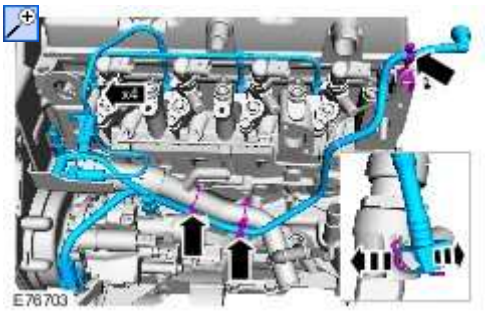
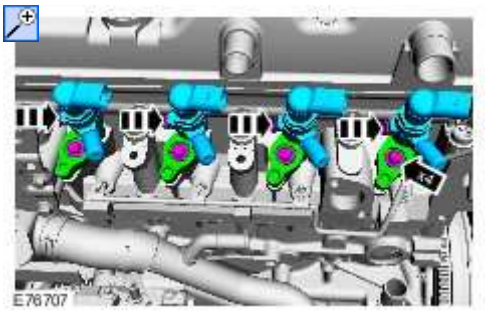




20. Discard the fuel injector fuel return line retaining clips.



21. NOTE: Note the position of each component before removal.
    - Install a clean blanking cap to the fuel injector fuel return line port.

22.

23.

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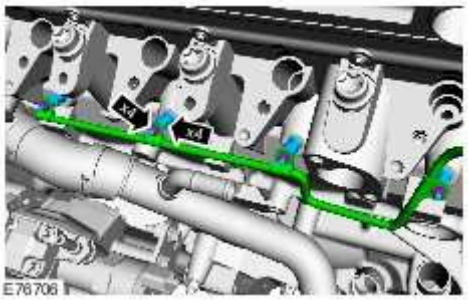
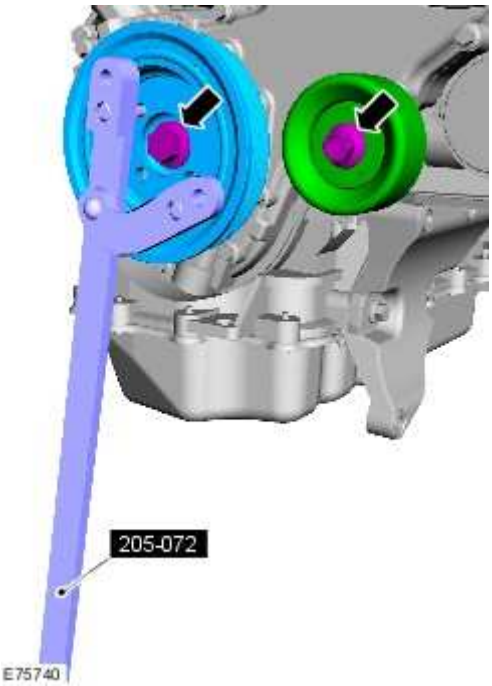
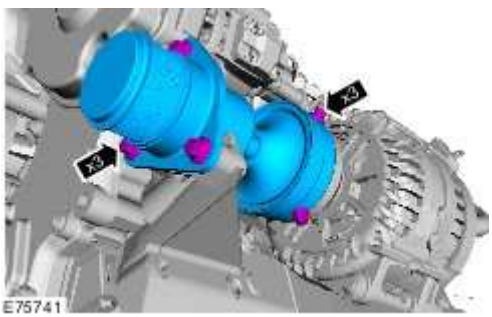




24. Discard the crankshaft pulley retaining bolt.

    Special Tool(s): 205-072



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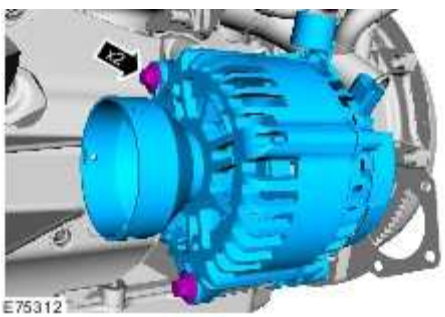

26.

27.

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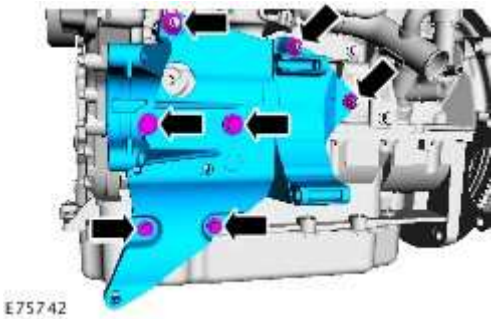
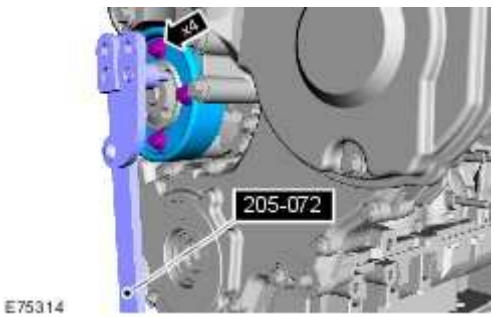
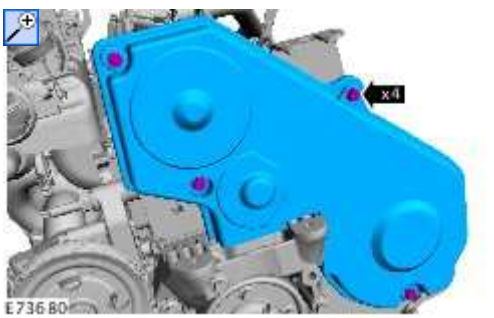




28. *Special Tool(s):* 205-072



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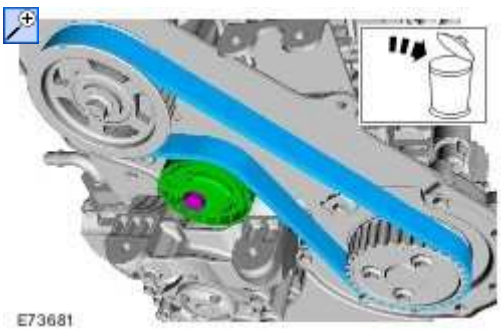
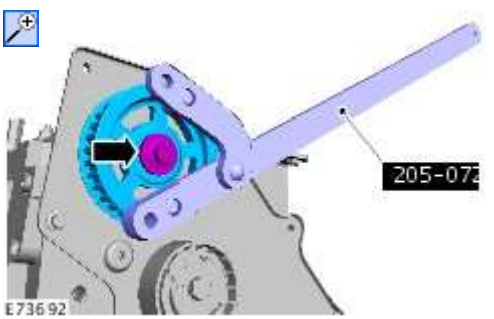


30. Discard the timing belt.



31. Loosen the camshaft pulley retaining bolt by 5 turns.

Special Tool(s): 205-072

32. *Special Tool(s):* 303-651

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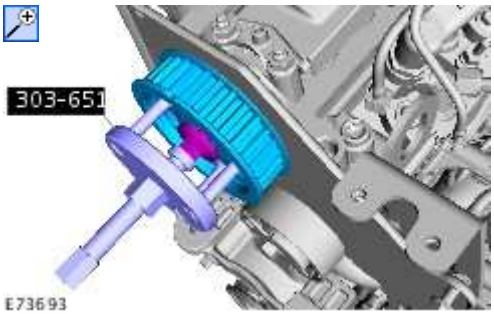
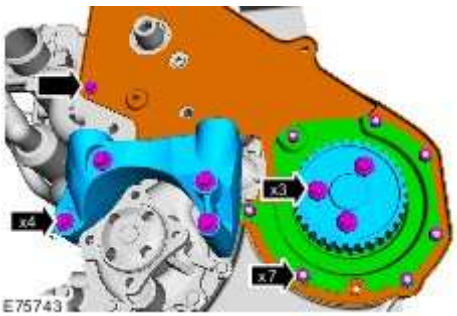


33. Discard the fuel pump seal retainer.



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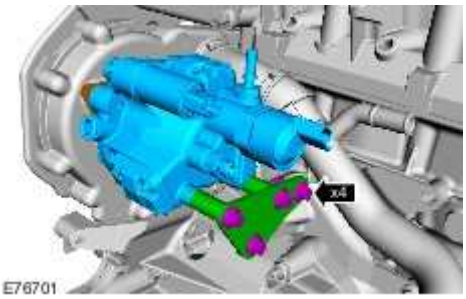

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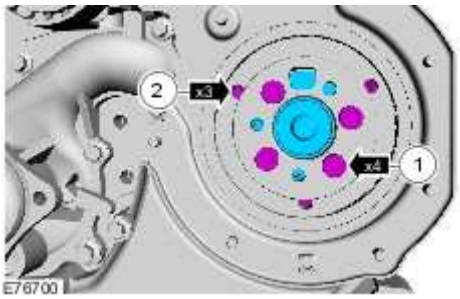
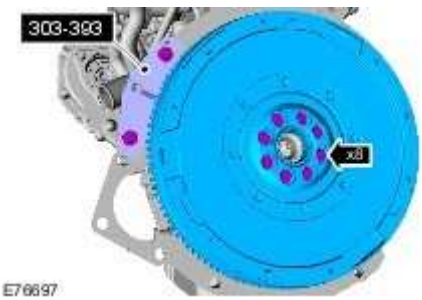


36. Remove the clutch disc and pressure plate.

    Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal and Installation).



37. Discard the flywheel retaining bolts.

    Special Tool(s): 303-393

38.

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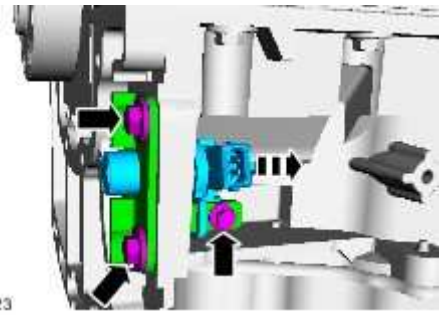
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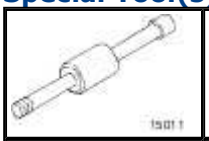
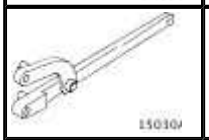
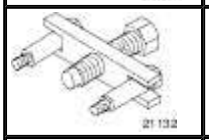
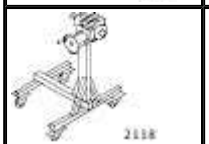
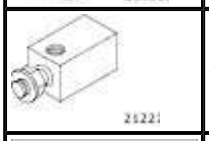
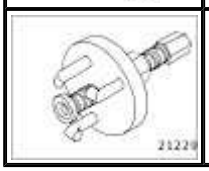
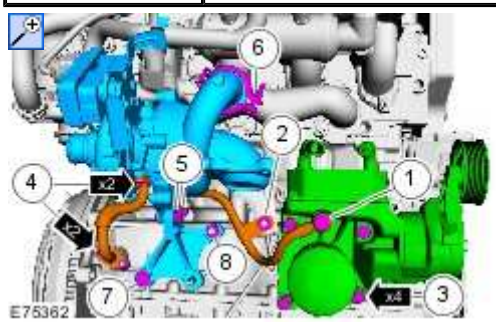
Print

Disassembly

Special Tool(s)

	205-047 Slide Hammer
	205-072 Universal Flange Holding Wrench
	303-249 Remover, Crankshaft Timing Pulley
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-633 Adapter for 205-047
	303-651 Remover, Camshaft Sprocket



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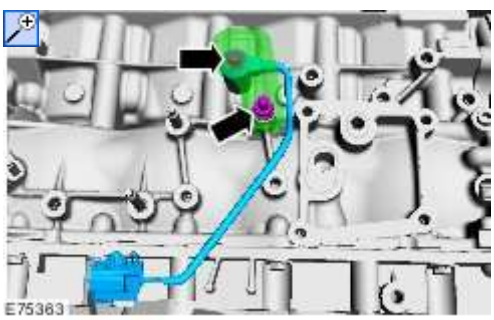

2.

3. *Special Tool(s):* 303-435, 303-435-06

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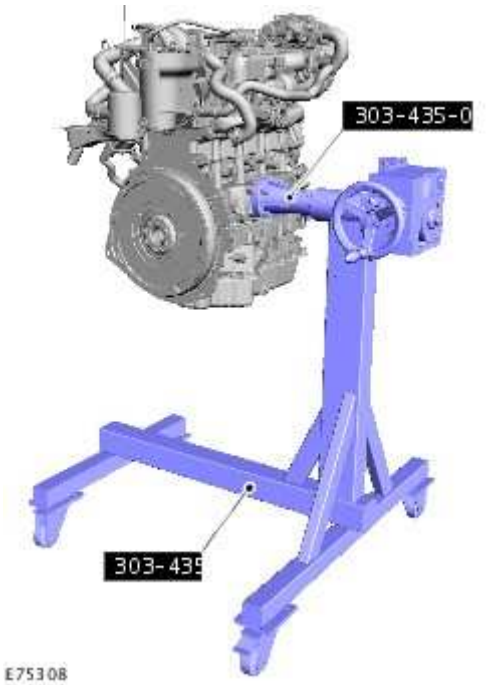

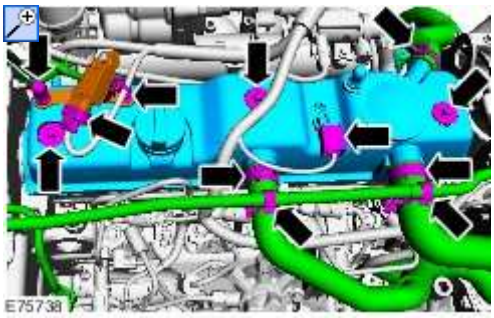

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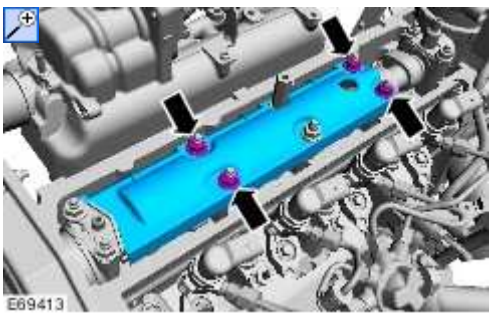

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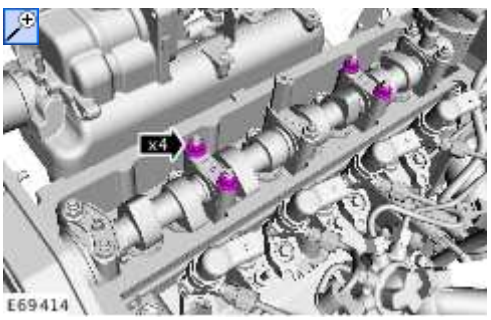

6. *Torque:* 20 Nm

7.

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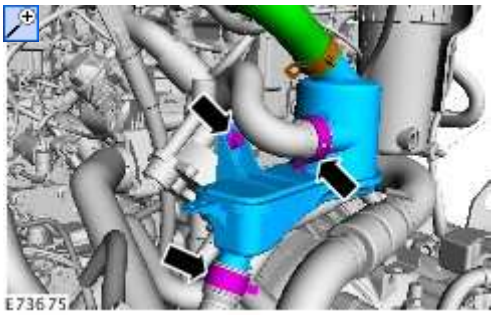
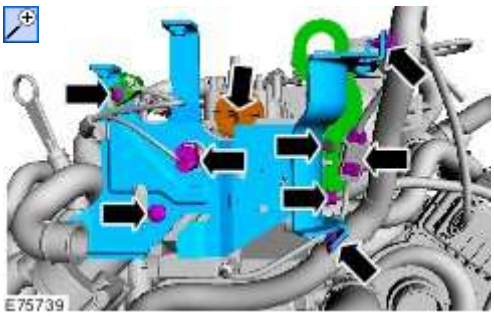
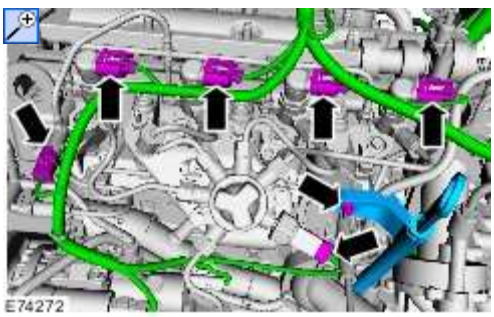


8. Remove the Fuel Filter.

   Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



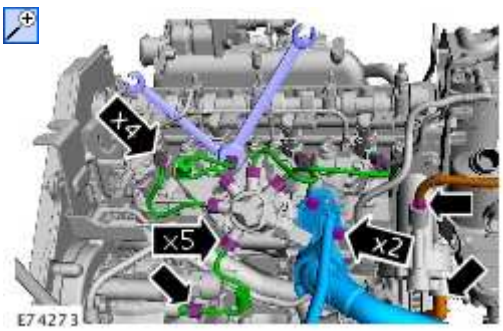
9. NOTE: Only rotate the camshaft in the normal direction of rotation.
   Using the camshaft groove as a guide, rotate the crankshaft to 5 degrees before top dead center (TDC).



10.

11. Clean the area around the fuel injection supply manifold, high pressure fuel supply lines and surrounding areas.

    Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



12. CAUTIONS:

    Use an open-ended wrench to prevent the component from turning.

    Make sure that all openings are sealed. Use new blanking caps.
    NOTE: The fuel supply line must be installed with the yellow identification collar adjacent to the fuel injector and the blue identification collar adjacent to the fuel rail.
    NOTE: The fuel supply line must be installed

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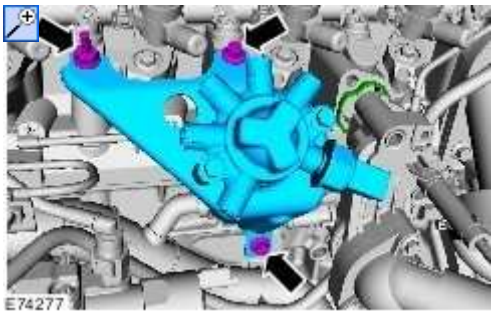
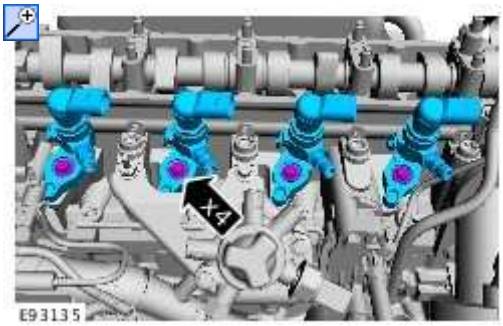
with the yellow identification collar adjacent to the fuel pump and the blue identification collar adjacent to the fuel rail.
Discard the high-pressure fuel supply lines.

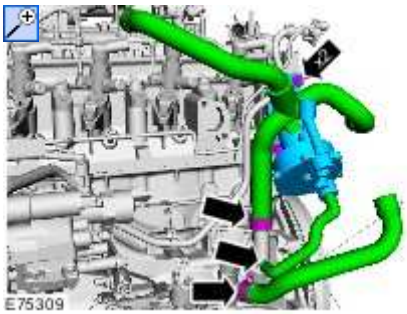


13. Discard the thermostat housing gasket.



14.

15. Discard the fuel injector sealing washers.



16.

17. Discard the crankshaft pulley retaining bolt.

Special Tool(s): 205-072

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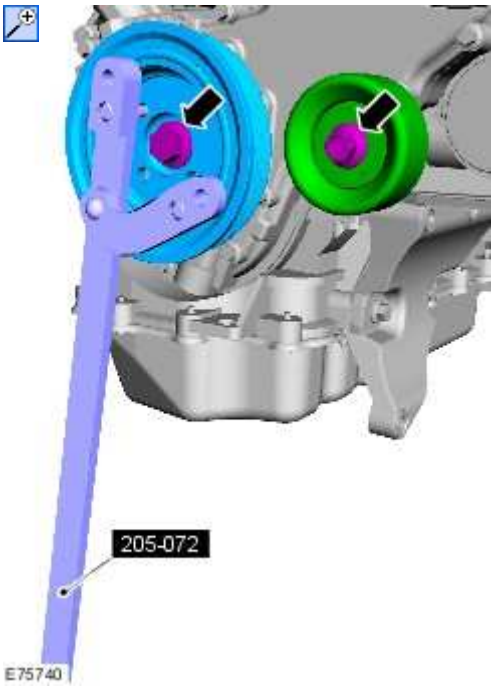

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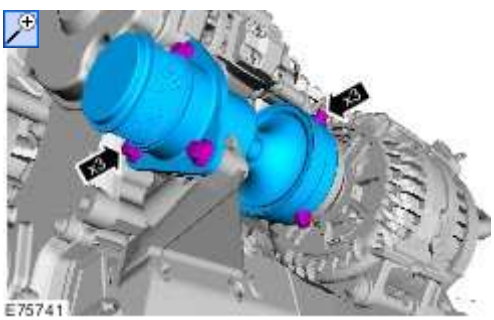

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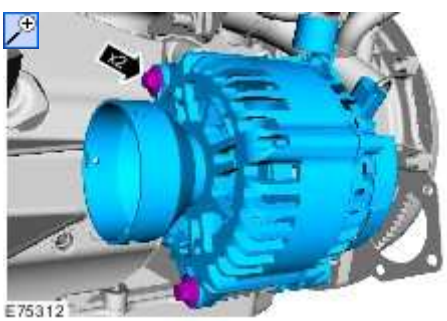

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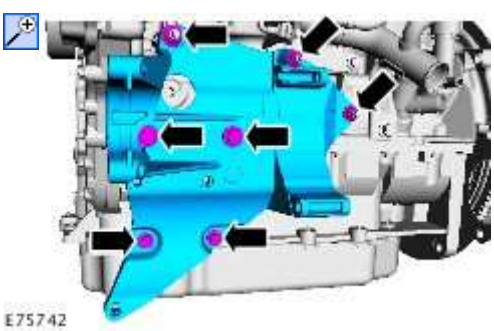

21. *Special Tool(s):* 205-072

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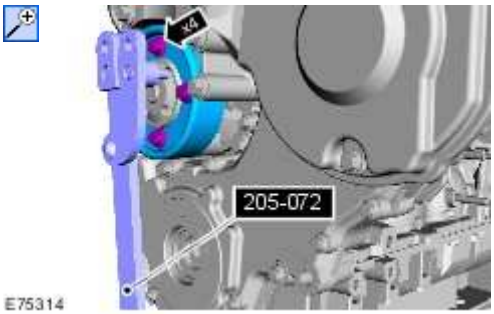

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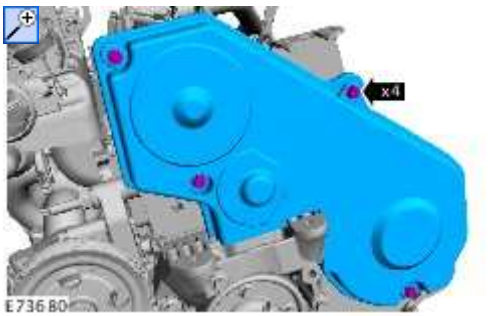
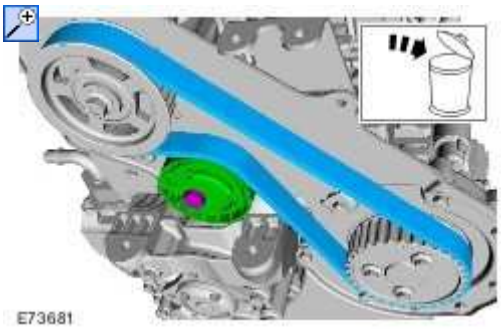
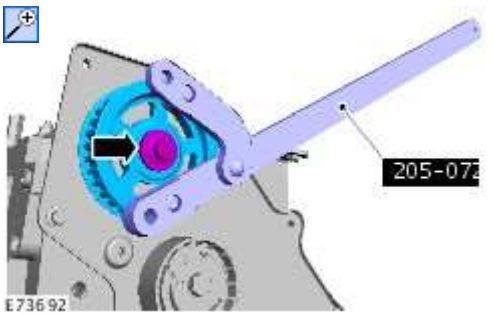


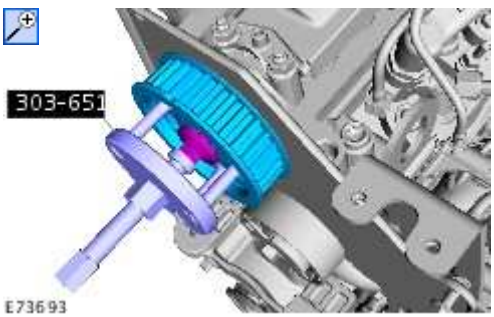


23. Discard the timing belt.



24. Loosen the camshaft pulley retaining bolt by 5 turns.

Special Tool(s): 205-072



25. *Special Tool(s):* 303-651

26. Discard the fuel pump seal retainer.

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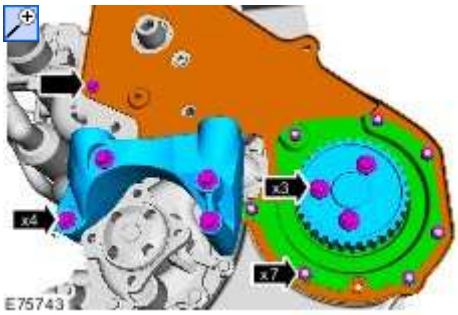

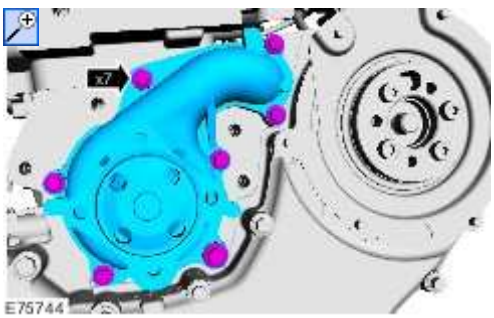

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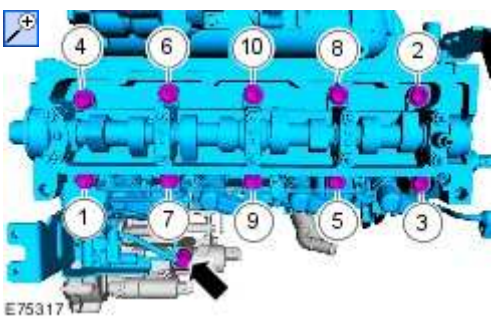
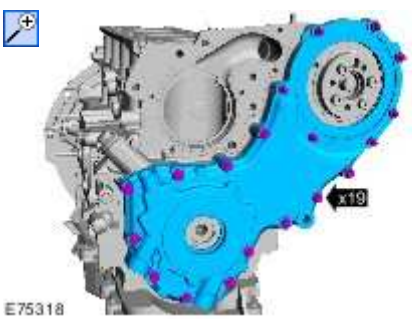


28. Discard the cylinder head retaining bolts.



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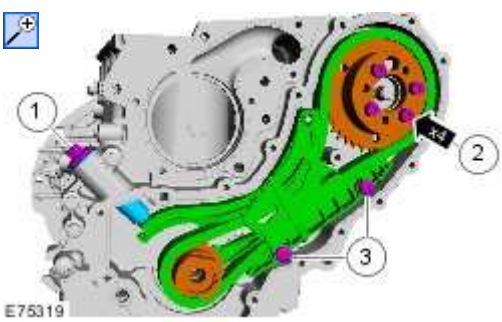

30.

Vehicles built up to 10/2007

31.

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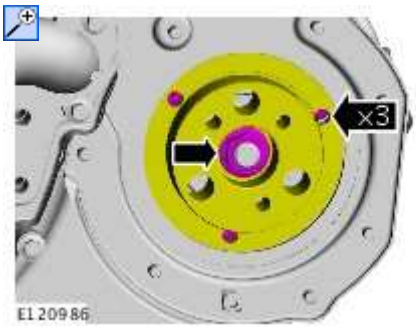
Vehicles built 10/2007 onwards



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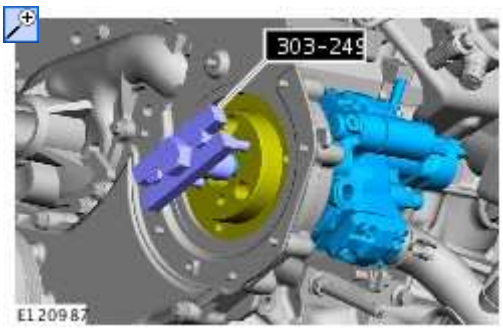
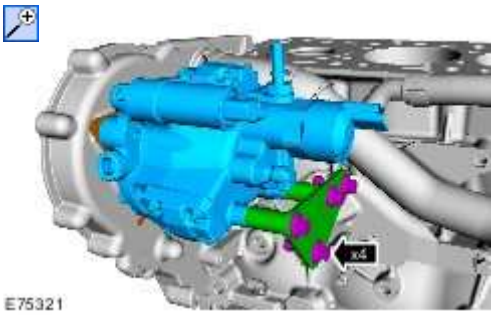


33. *Special Tool(s):* 303-249

All vehicles



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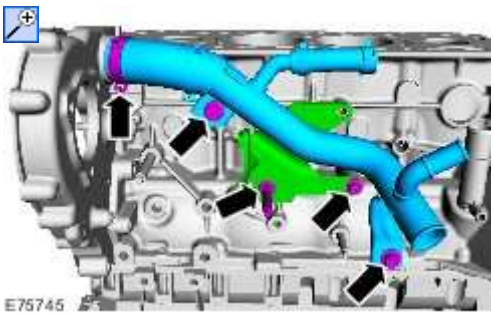

35.

36. Remove the Crankshaft Rear Seal.

    Refer to: Crankshaft Rear Seal (303-01F Engine -

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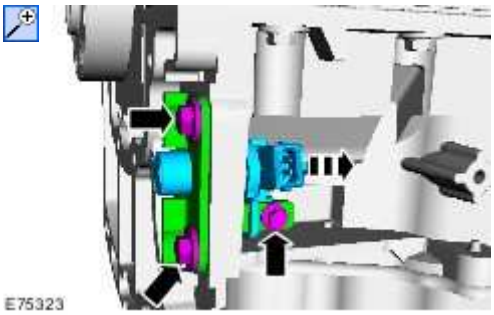
2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



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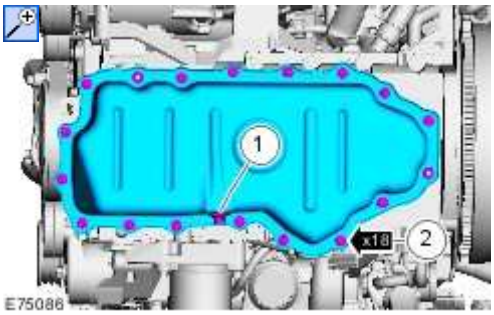
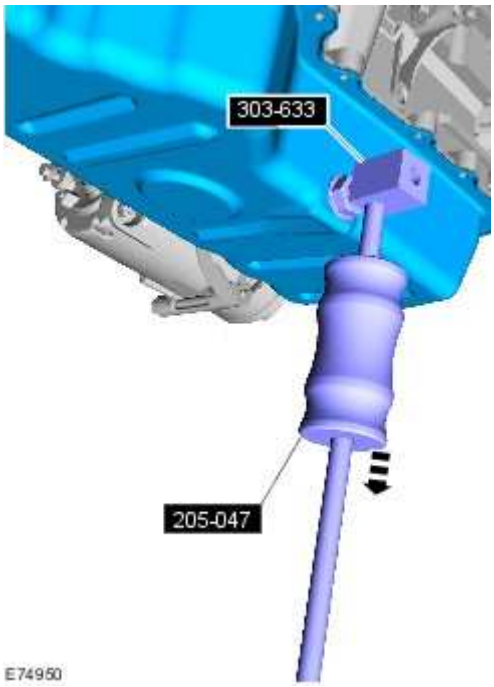
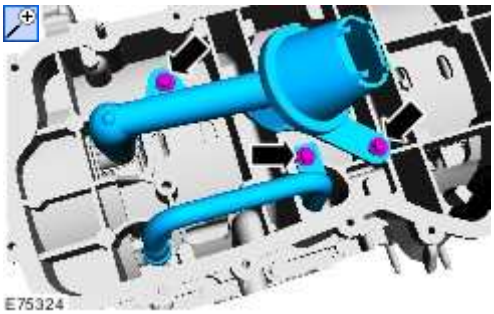


38. NOTE: The seal is to be reused unless damaged.
Drain the engine oil into a suitable container.

39. Remove the oil pan retaining nuts and bolts.



40. CAUTION: Take extra care not to damage the mating faces.
Special Tool(s): 303-633, 205-047



41.

42.

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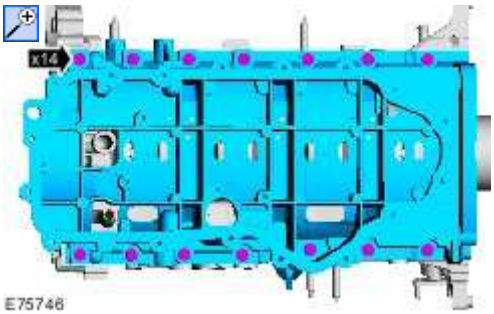
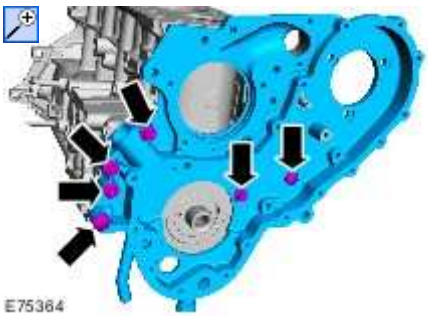
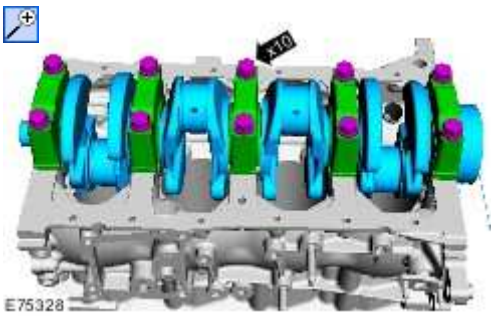




43.

44. NOTE: Note the position of each component before removal.
Discard the connecting rod bearing cap retaining bolts.



45. NOTE: Note the position of the bearing caps in relation to the rotation of the crankshaft. The bearing caps are not interchangeable.
Discard the crankshaft main bearing cap retaining bolts.

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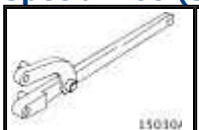
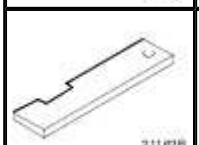
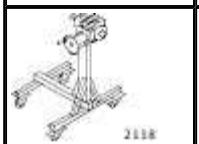
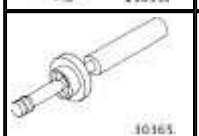
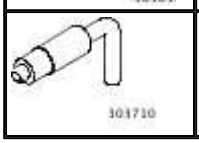
Print

Assembly

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-122 Lifting Bracket, Engine
	303-193 Timing Peg, Crankshaft TDC
	303-376B Alignment Plate, Camshaft
	303-393 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-652 Aligner, Oil Pump
	303-710 Timing Tool, Crankshaft

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C912-A1
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Spoiler Adhesive Kit 2 Component	WSK-M5B401-A1 / 2U7J-M2G376-AA

1. Coat the crankshaft main bearing journals, bearing shells and thrust half washers with clean engine oil.

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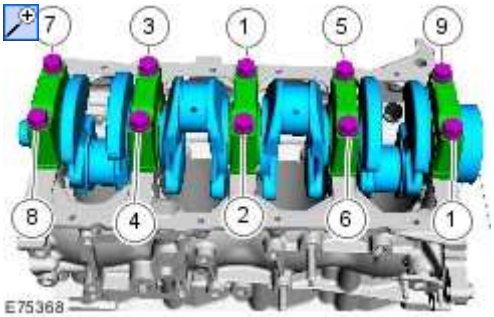
Material: Engine Oil - 5W-30 (WSS-M2C912-A1)



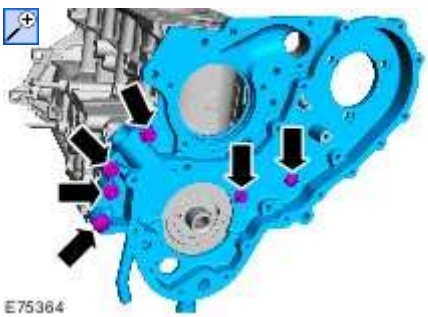
2. CAUTION: Make sure that new bearing cap retaining bolts are installed.
Tighten the crankshaft main bearing cap retaining bolts in the sequence shown.

Torque:
Stage 1: 45 Nm
Stage 2: 70 Nm
Stage 3: 60°

3.
- Coat the cylinder bores with clean engine oil.
- The piston ring gaps and oil supply ring elements must be distributed evenly around the circumference of the piston.
- Install the pistons with the arrows pointing towards the front of the engine.
- Using a suitable piston ring compressor, install the pistons.

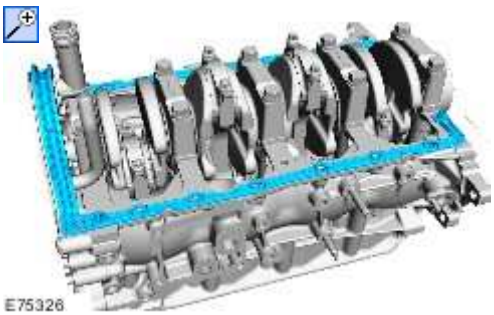
4.
- Lubricate the connecting rod journals with clean engine oil.
- The connecting rod identification marks must point towards the front of the engine.
- CAUTION: Make sure that new connecting rod bearing caps retaining bolts are installed.
Start tighten the connecting rod bearing caps retaining bolts finger tight.

Torque:
Stage 1: 27 Nm
Stage 2: 60°
Stage 3: 20°



5. **The chain housing bottom sealing flange surfaces must be within +/- 0,26mm of the cylinder block bottom sealing flange surfaces.**

Torque: 23 Nm



6.

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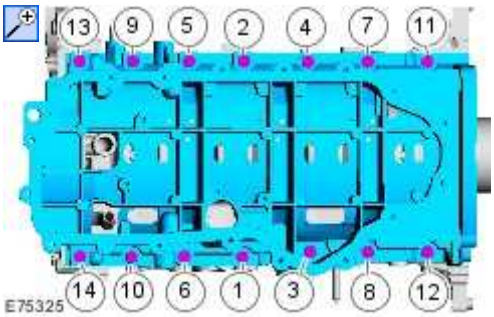
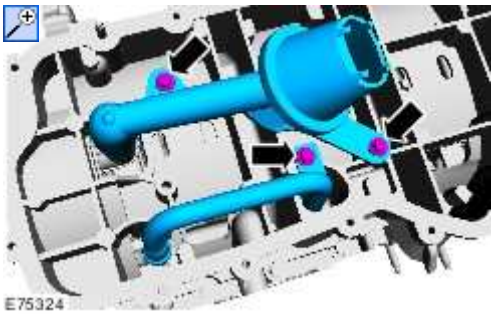


7.
- Align the ladder frame flush with the cylinder block.
- Tighten the ladder frame retaining bolts in the sequence shown.

Torque: 11 Nm

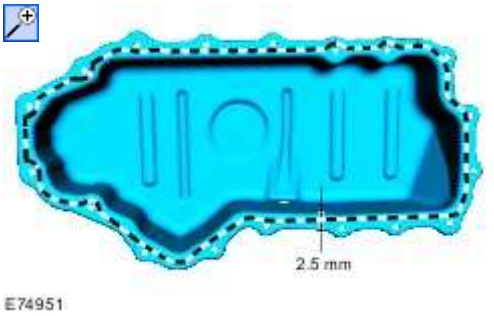


8. *Torque:* 10 Nm

9. Install the Crankshaft Rear Seal.

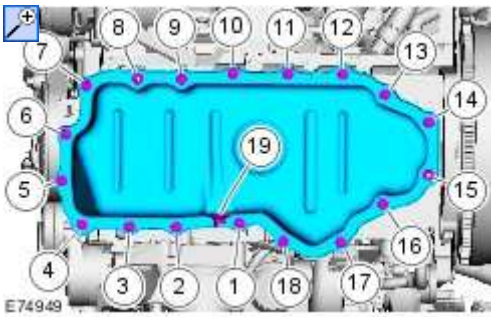
Refer to: Crankshaft Rear Seal (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

10. NOTE: Make sure that the mating faces are clean and free of foreign material.



11. CAUTION: Make sure that no excess sealant residue is evident.
NOTE: The component must be installed within 5 minutes of applying the sealant.
Apply a 2.5 mm diameter bead of sealant to the edge of the Oil Pan.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



12. Tighten the Oil Pan retaining nuts and bolts in the sequence shown.

Torque:
1-18
Stage 1: 6.5 Nm
Stage 2: 14 Nm
19 36 Nm

13. *Torque:*
1 23 Nm
2 48 Nm

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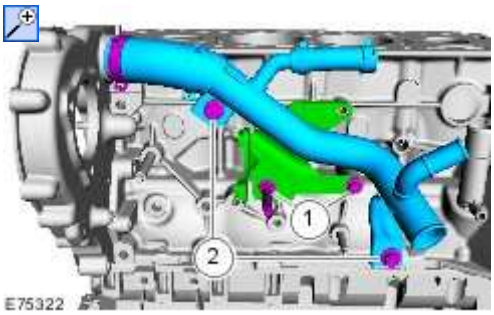
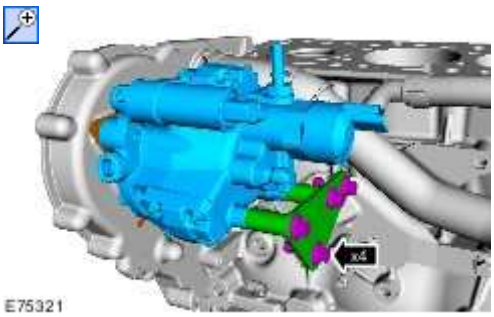
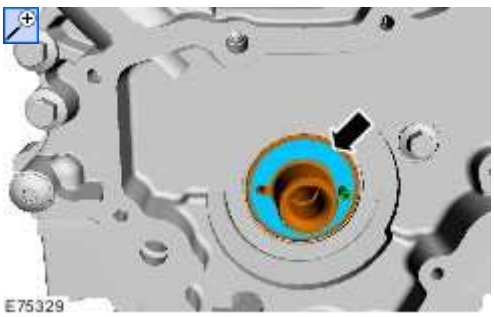




14. Install a new gasket

    Torque: 23 Nm

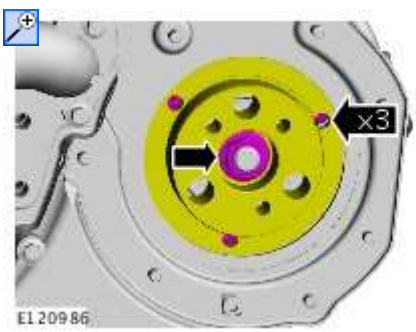


15.

Vehicles built up to 10/2007

16. *Torque:*
    Snug Torque 10 Nm
    Delay 2 Seconds 18 Nm
    Untighten 40°
    Final Torque 26 Nm

Vehicles built 10/2007 onwards



17.

18.
    1. *Torque:* 26 Nm
    2. *Torque:* 50 Nm

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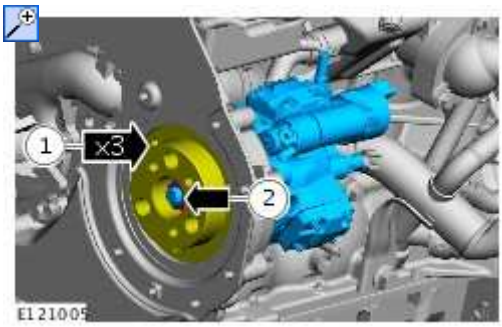
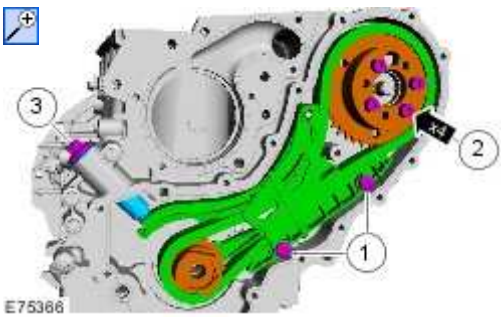
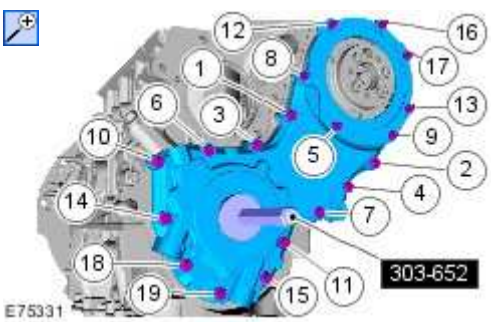


All vehicles



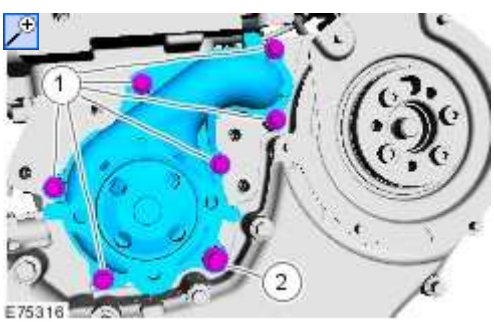
19. *Torque:*
    1 23 Nm
    2 24 Nm
    3 65 Nm

20.



21. Locate Alignment Tool into Oil Pump and Seal Pocket and align with Crank Sprocket. Start tighten the timing chain housing cover retaining bolts by hand, in the sequence shown.

    Special Tool(s): 303-652
    Torque:
    Alignment Tool 10 Nm
    1-5 10 Nm
    6 23 Nm
    7-19 10 Nm



22. *Torque:*
    1 10 Nm
    2 23 Nm

23. Clean the mating faces of the cylinder head and cylinder block with cleaner.

    Material: Spoiler Adhesive Kit 2 Component

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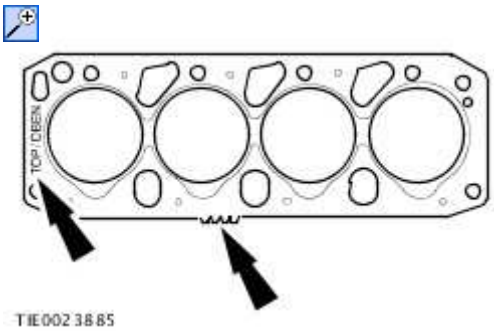
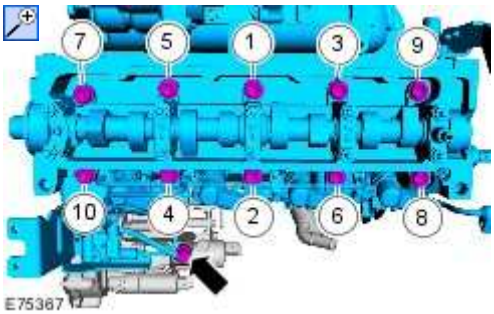
(WSK-M5B401-A1 / 2U7J-M2G376-AA)



24. NOTE: The thickness and position of the new cylinder head gasket must be the same as that of the old one (hole/tooth and TOP/OBEN marked).

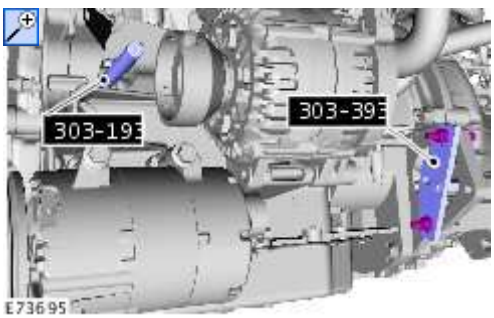


25. CAUTIONS:

⚠ Make sure that new unoiled cylinder head bolts are installed.

⚠ Place the two short cylinder head bolts on position 7 and 10
NOTE: The pistons must not be at TDC.
Tighten the cylinder head retaining bolts in the sequence shown in four stages.

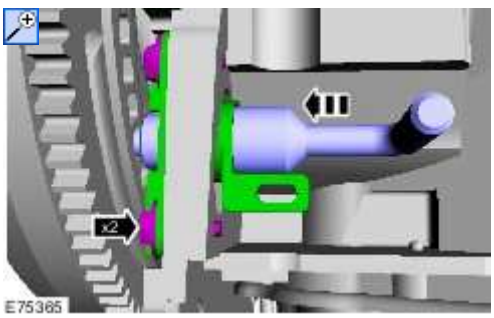
Torque:
Stage 1: 20 Nm
Stage 2: 54 Nm
Stage 3: 90°
Stage 4: M12x137 70°
M12x177 90°



26. NOTE: Only rotate the crankshaft in the normal direction of rotation.
1. Remove the cylinder block blanking plug and install the special tool.

   Special Tool(s): 303-193
2. Rotate the crankshaft slowly until the crankshaft stops.
3. **Make sure that the crankshaft does not rotate during installation of the special tool.Make sure that the crankshaft is at the TDC position before locking the special tool.**Using the special tool, lock the crankshaft.

   Special Tool(s): 303-393



27. Using the special tool, install the crankshaft position (CKP) sensor retaining bracket.

Special Tool(s): 303-710
Torque: 10 Nm

28. NOTE: Install a new crankshaft position (CKP) sensor.
NOTE: The CKP sensor must make contact

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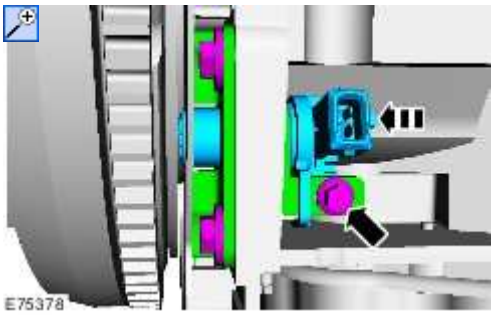
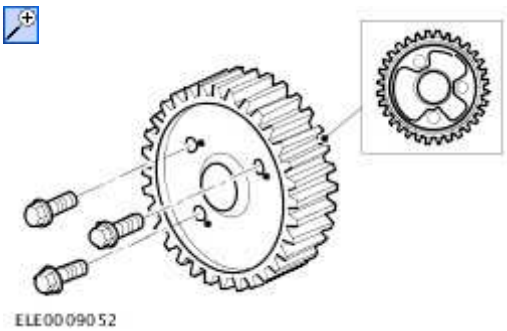
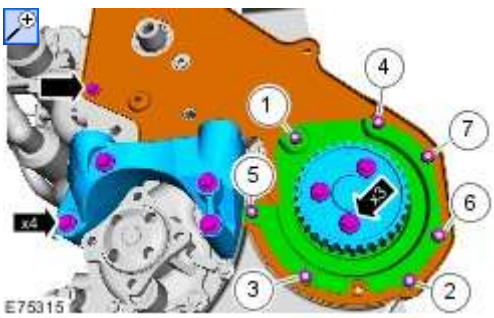


with the flywheel.
Torque: 6 Nm



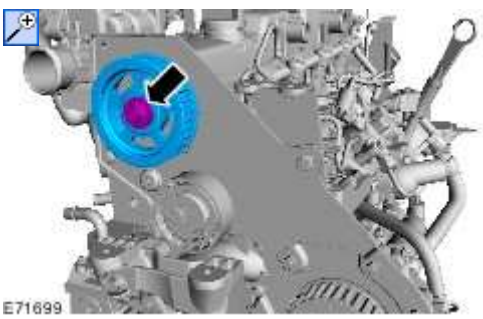
29. Attach the fuel pump pulley to the fuel pump sprocket. Apply sealant to the fuel pump pulley and to the outer edge of the fuel pump pulley retaining bolt holes.

Material: Flange Sealant - Anaerobic LP (WSK-M2G348-A7 / 5U7J-M2G348-BA)

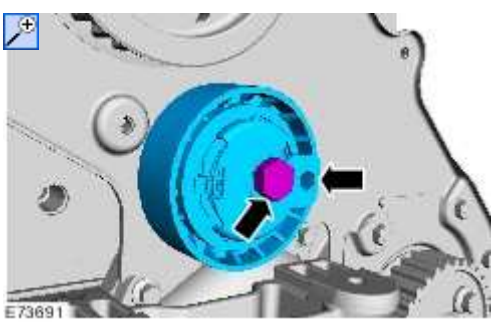


30. Tighten the fuel pump seal retainer retaining bolts in the sequence shown.

Torque:
1-7 and timing belt rear cover 10 Nm
Engine front mount bracket 28 Nm



31. Tighten the camshaft pulley bolt finger tight and then loosen by one-half turn.



32.

- Check the timing belt tensioner and make sure that the timing belt tensioner pointer rotates clockwise freely.
- Move the timing belt tensioner adjustment arm to the 3 o'clock position.
- Do not fully tighten the timing belt tensioner retaining bolt at this stage.

33.

- The camshaft pulley must be able to rotate freely on the camshaft taper.
- Install the timing belt with the direction arrows in the direction of engine rotation.

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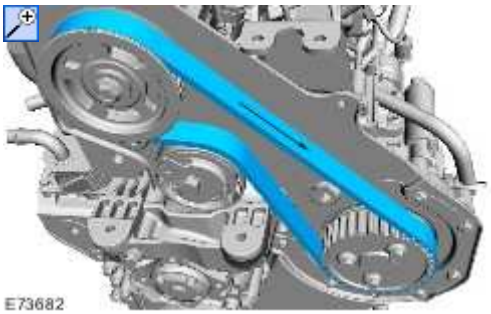
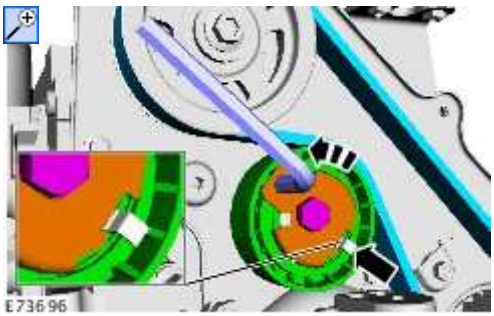
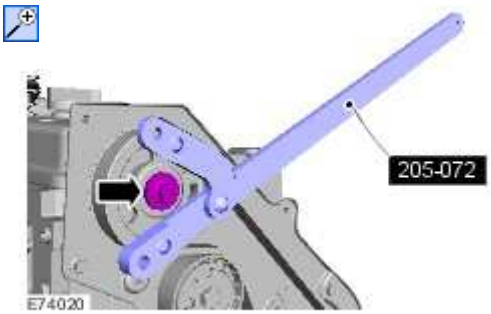




34. Tension the timing belt counterclockwise until the pointer is positioned between the sides of the window.

    Torque: 50 Nm



35. *Special Tool(s):* 205-072
    Torque: 50 Nm

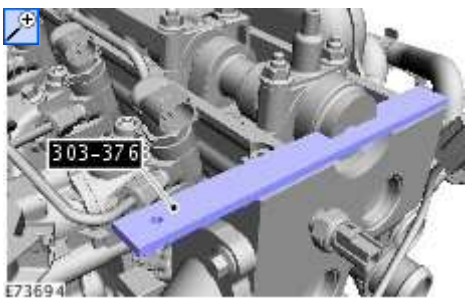
36. Remove the special tools.

    Special Tool(s): 303-376B, 303-193, 303-393

37.
    1. Rotate the crankshaft 2 revolutions. Replace the Timing Peg just before TDC on the second revolution.

       Special Tool(s): 303-193
    2. Rotate the crankshaft slowly until the crankshaft stops at TDC.

38. Check that the timing belt tensioner pointer is positioned in the window, otherwise the timing belt tensioning steps must be repeated.



39. NOTE: If the special tool cannot be installed, the timing belt tensioning steps must be repeated.
    Install the special tool.

    Special Tool(s): 303-376B

40. Remove the special tools and install the cylinder block blanking plug.

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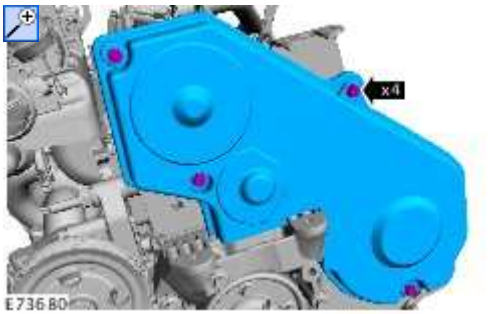
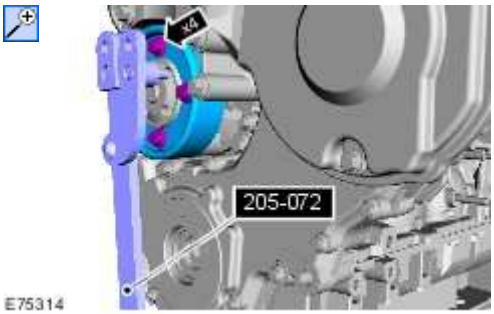
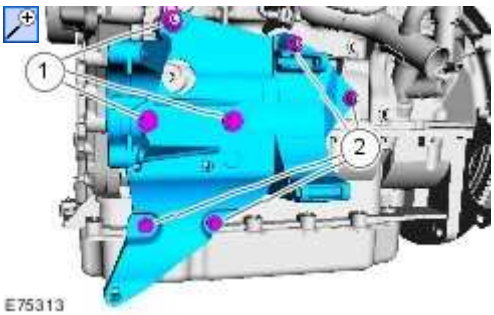
Special Tool(s): 303-376B, 303-193, 303-393
Torque: 23 Nm



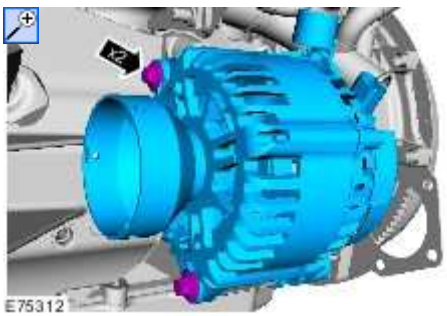
41. *Torque:* 7 Nm



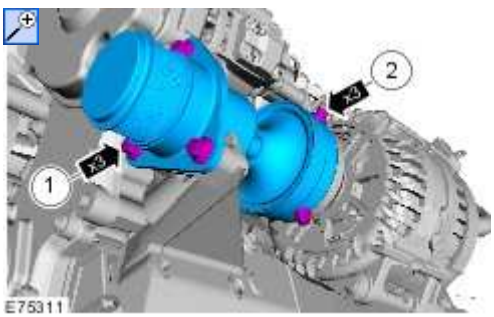
42. *Special Tool(s):* 205-072
Torque: 23 Nm



43. *Torque:*
1 23 Nm
2 15 Nm



44. *Torque:* 27 Nm



45. *Torque:*
1 27 Nm
2 10 Nm

46. CAUTION: Make sure that a new crankshaft pulley bolt is installed.
Special Tool(s): 205-072
Torque:
1

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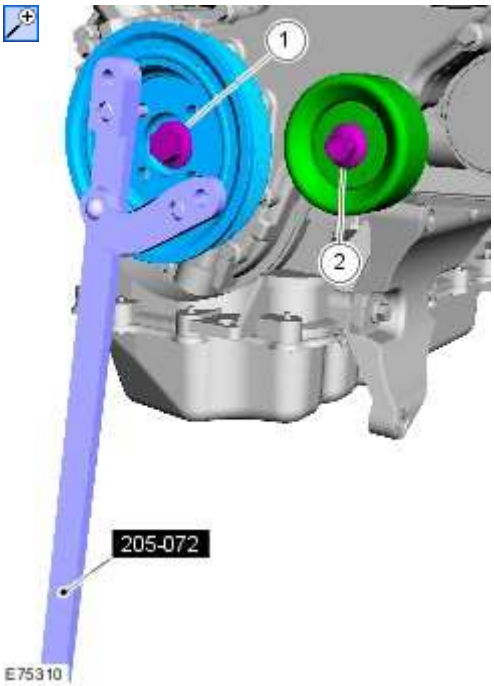
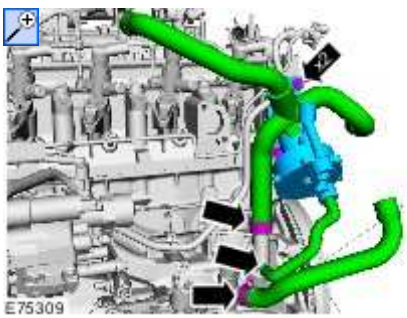


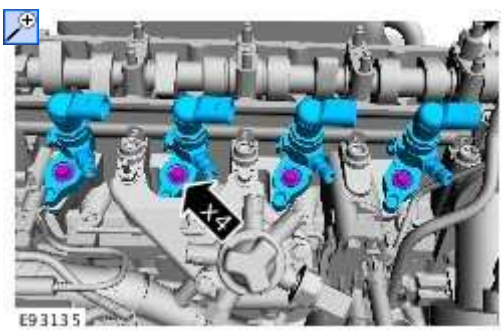
Stage 1: 100 Nm
Stage 2: 180°

2 47 Nm



47. *Torque:* 20 Nm

48. NOTE: Make sure that new components are installed.



49. *Torque:*
Stage 1: 5 Nm
Stage 2: 90°

50. NOTE: Do not fully tighten the fuel supply manifold retaining bracket bolts at this stage.
Torque: 23 Nm

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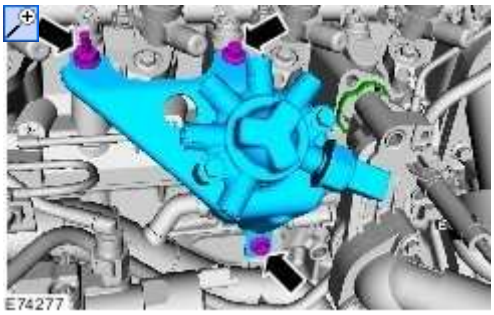
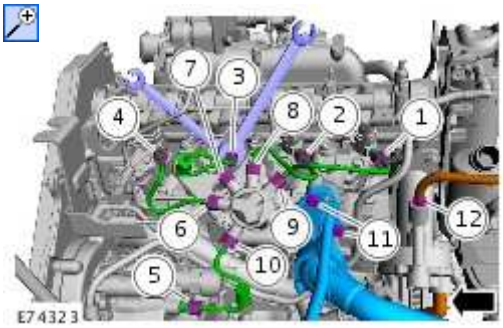




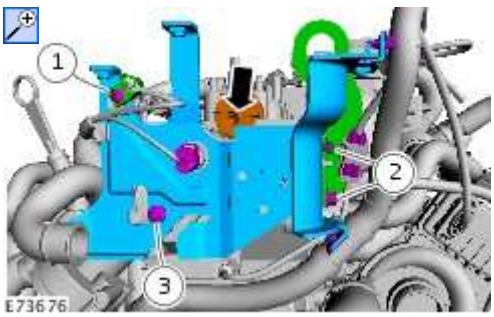
51. CAUTION: Use an open-ended wrench to prevent the component from turning.
NOTE: The high-pressure fuel supply lines must be connected immediately after removing the blanking plugs.
NOTE: Do not allow the unions to hit the ends of the high-pressure fuel supply line.
To aid installation of the new high-pressure fuel supply lines, the unions at the fuel rail end are colored gold.
    - Tighten the injector ends in sequence 4,3,2,1

      Torque: 25 Nm
    - Tighten the fuel pump end 5

      Torque: 25 Nm
    - Tighten rail end in sequence 1,2,3,4,5

      Torque: 38 Nm
    - Install a new thermostat housing gasket.

      Torque:
      thermostat housing 23 Nm
      vacuum pipe 18 Nm



52. *Torque:*
    1 7 Nm
    2 23 Nm
    3 23 Nm

53. Install the Fuel Filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

54. *Torque:* 23 Nm

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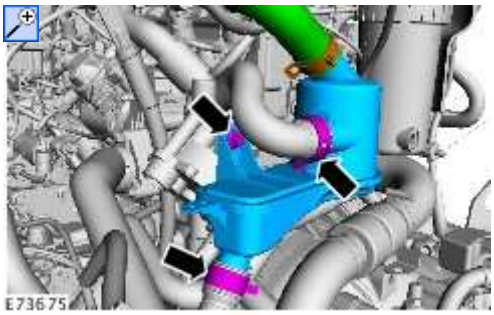
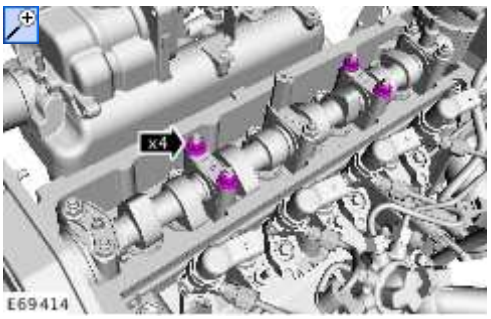
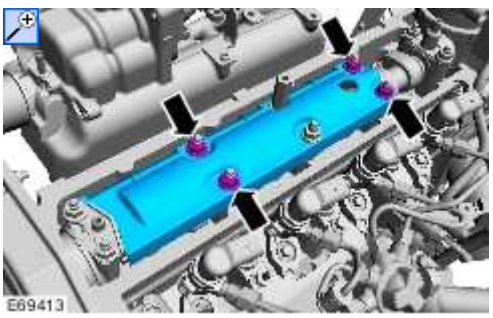


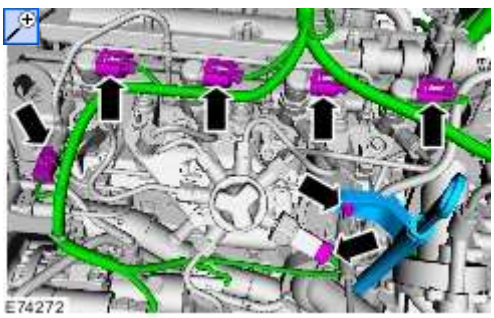
55.



56. *Torque:* 20 Nm

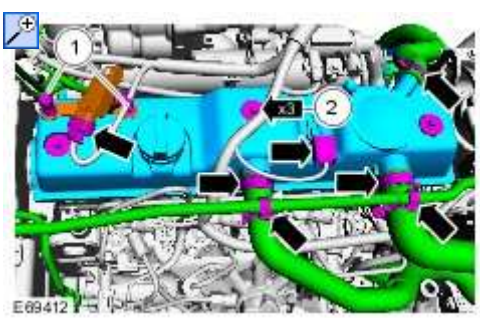


57. *Torque:* 10 Nm



58.

1. *Torque:* 3 Nm
2. *Torque:* 5 Nm



59. *Special Tool(s):* 303-122

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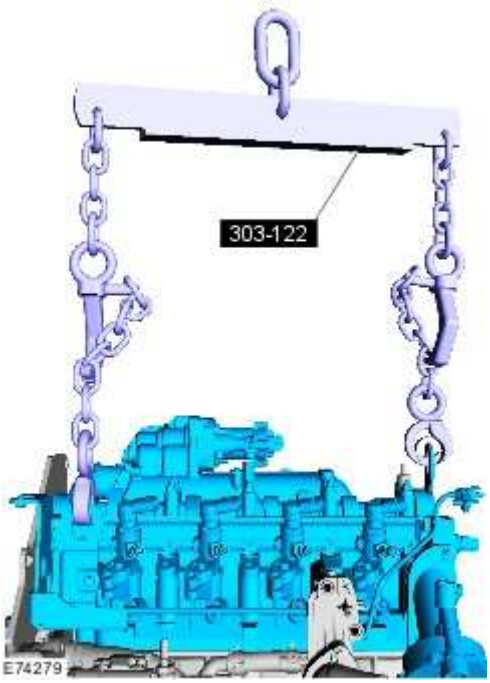
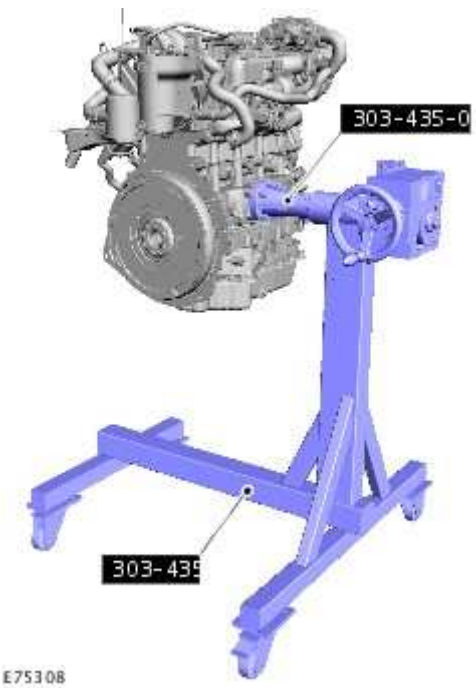
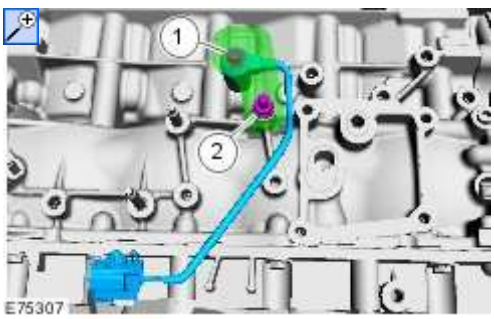




60. Remove the Special Tools.

    Special Tool(s): 303-435, 303-435-06



61. *Torque:*
    1 20 Nm
    2 23 Nm

62. Make sure that the Gap between the Ears of the V-Band Clamp is between 3-6 mm.

    Torque:
    1 25 Nm
    2 45 Nm

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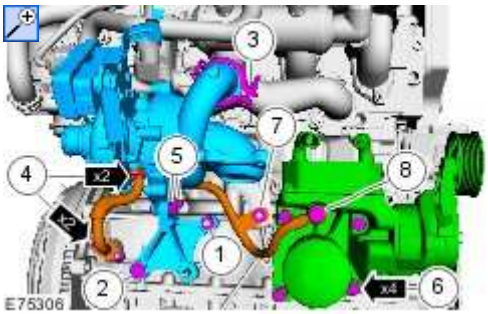

3 4.5 Nm
4 10 Nm
5 25 Nm
6 23 Nm
7 23 Nm
8 35 Nm

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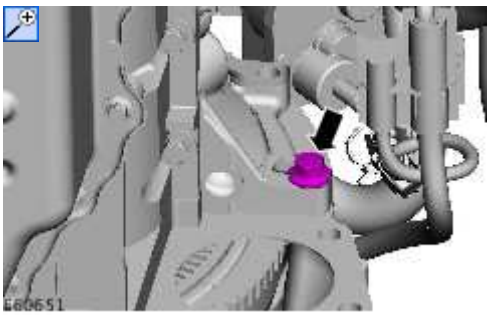
Installation

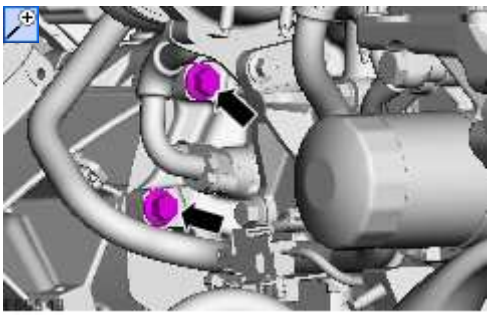
General Equipment

Cable ties
Vehicle/axle stands

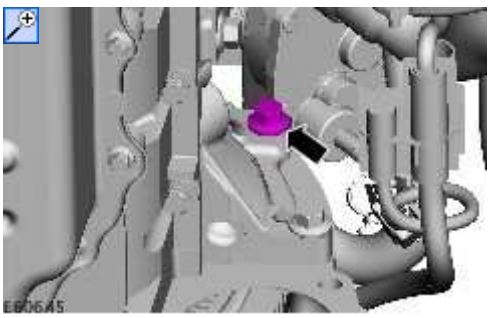
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at

1. Refer to: Diesel Fuel System Health and Safety Preca
2. Install the transaxle to the engine.
3. *Torque:* 48 Nm

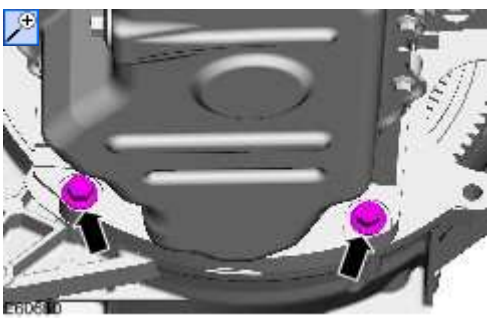




4. *Torque:* 48 Nm



5. *Torque:* 48 Nm



6. *Torque:* 48 Nm

7. *Torque:* 48 Nm

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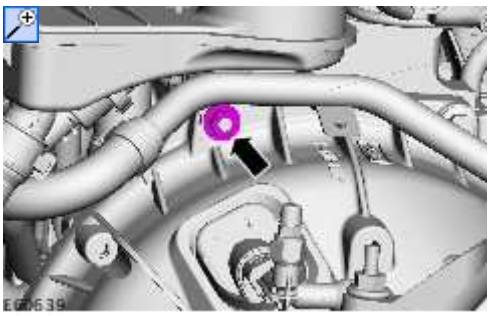
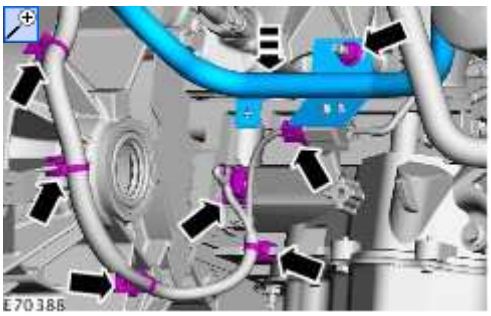


8. *Torque:* 24 Nm



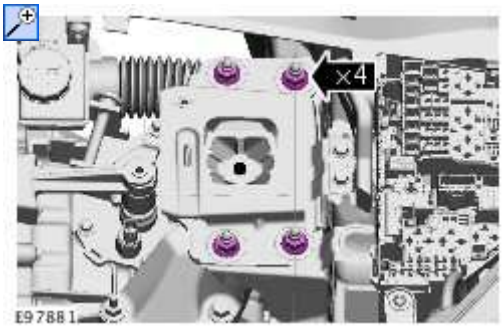
9. *Torque:* 25 Nm

10. Install the starter motor.

    Refer to: Starter Motor (303-06D Starting System - (92kW/125PS) - Lynx, Removal and Installation).

11. WARNING: Make sure that the engine and tra
    suitable retaining straps.
    Secure the engine and transaxle assembly on a suita

    General Equipment: Vehicle/axle stands
    General Equipment: Cable ties



12. *Loosen:* 2 turn(s)

13. *Torque:* 133 Nm

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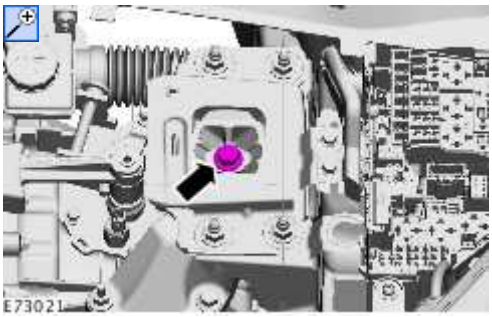
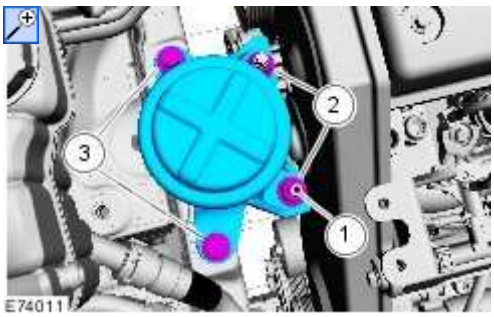
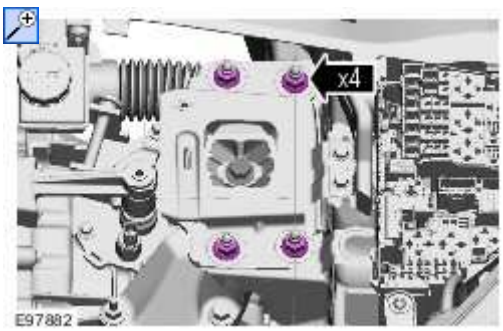




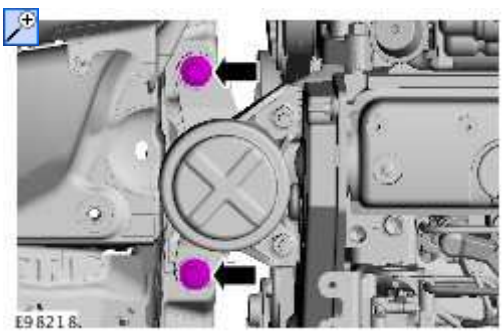
14.
1. *Torque:* 12 Nm
2. *Torque:* 80 Nm
3. NOTE: Only tighten the bolts finger tight at t

15. Raise the vehicle and remove the Vehicle/axle stand

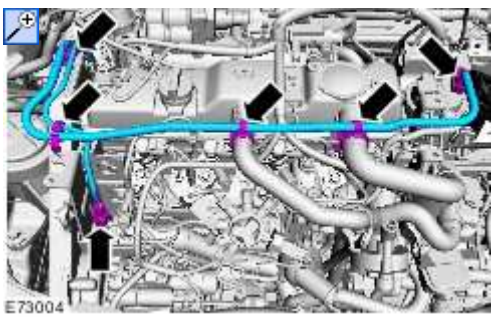
General Equipment: Vehicle/axle stands



16. *Torque:* 80 Nm



17. *Torque:* 90 Nm



18. Connect the fuel supply line and fuel return line quic

Refer to: Fuel Filter (310-01B Fuel Tank and Lines - (92kW/125PS) - Lynx, Removal and Installation).

19. Connect the PCM electrical connectors.

Refer to: Powertrain Control Module (PCM) (303-14E

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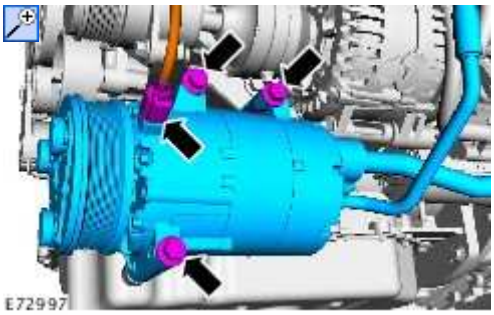
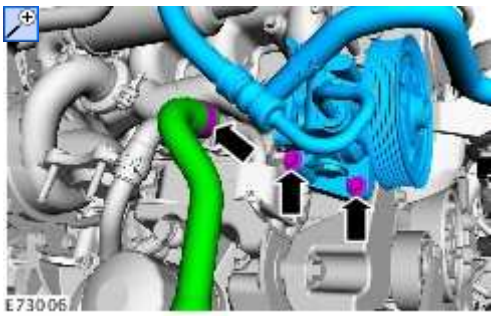
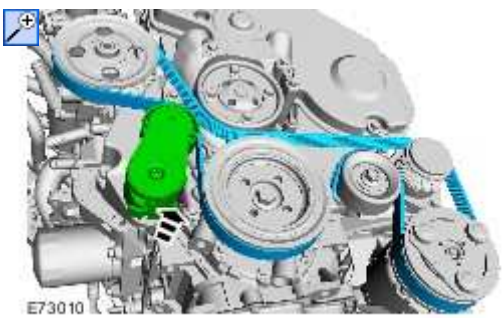


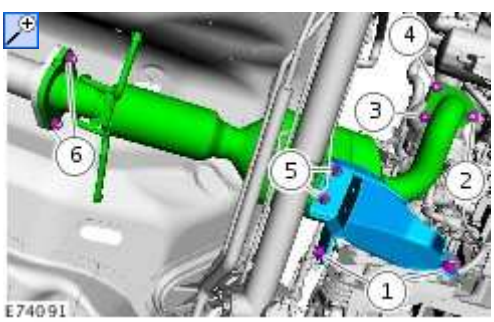
20. *Torque:* 25 Nm



21. *Torque:* 23 Nm



22.



23. CAUTION: Twisting the exhaust flexible pipe r
Tighten all retaining nuts in the sequence show

Torque:
1-5: 25 Nm
6: 51 Nm

24. Remove the front subframe.

Refer to: Front Subframe (502-00 Uni-Body, Subfrar

25. Install the left-hand halfshaft.

Refer to: Front Halfshaft LH (205-04 Front Drive Hal

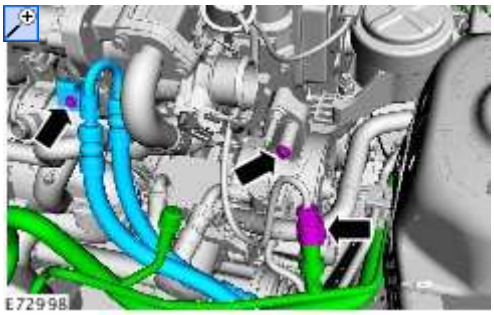
26. Install the right-hand halfshaft.

Refer to: Front Halfshaft RH (205-04 Front Drive Hal

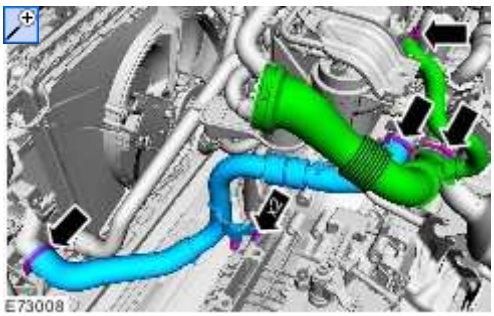
27. Install both front wheels.

Refer to: Wheel and Tire (204-04 Wheels and Tires,

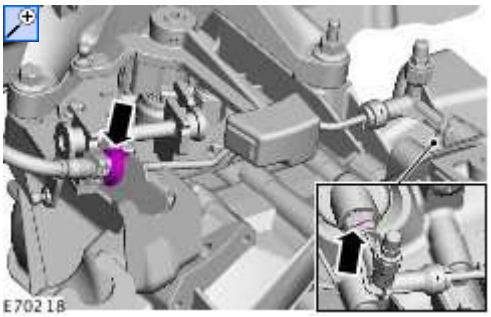
http://lynx.su



28. *Torque:* 23 Nm

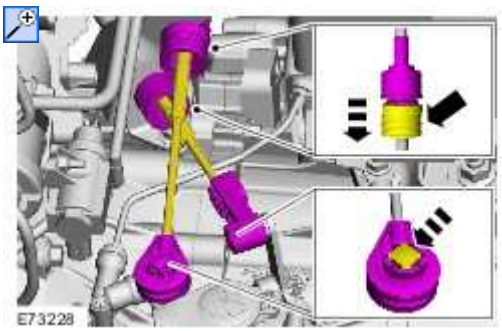


29. *Torque:* 24 Nm



30. CAUTION: If the fluid is spilled on the paintwc
cold water.
Bleed the clutch system.

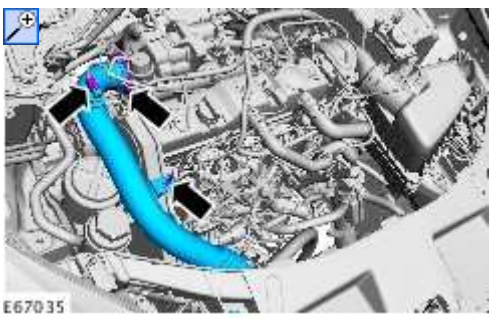
Refer to: Clutch System Bleeding (308-00, General I



31. CAUTION: Gearshift cables must not be kinke
Install the gearshift cables.

32. Adjust the gearshift cables.

Refer to: Gearshift Cable Adjustment - Vehicles With
Transmission/Transaxle and Clutch - General Inform



33.

34.

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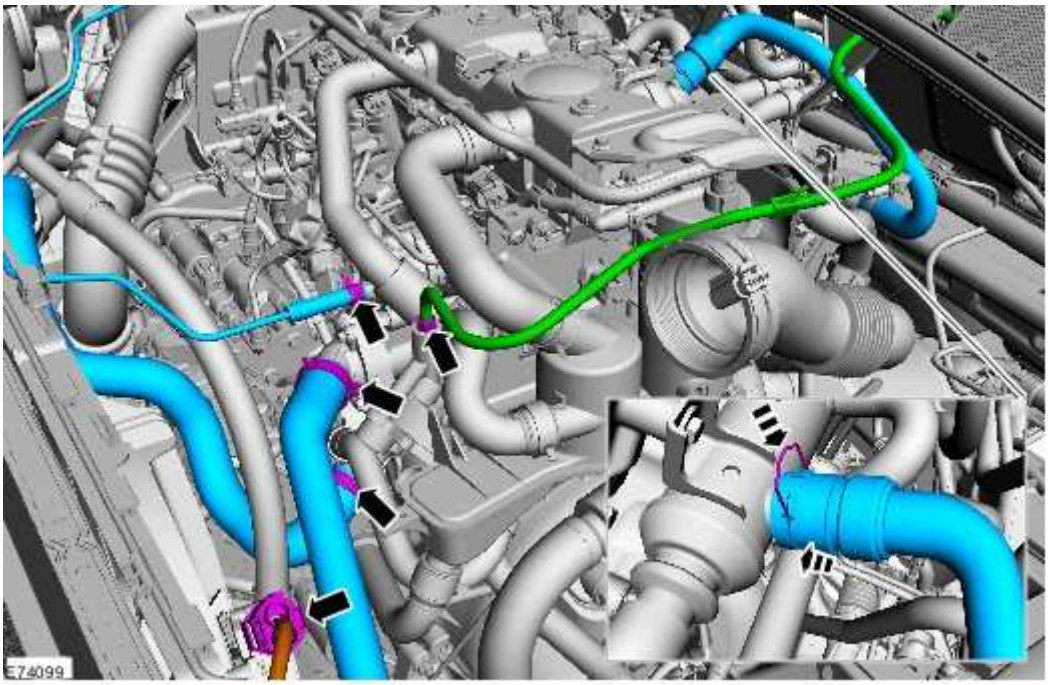
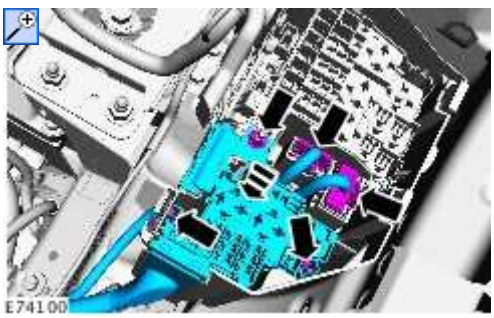
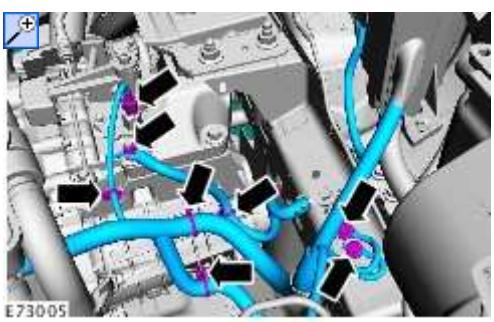




35.

36.



37.

38. *Torque:* 12 Nm

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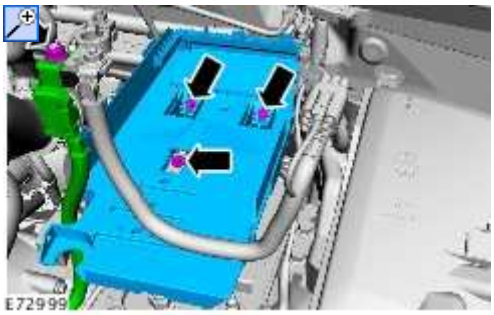


39. Install the battery.

    Refer to: Battery (414-01 Battery, Mounting and Cal

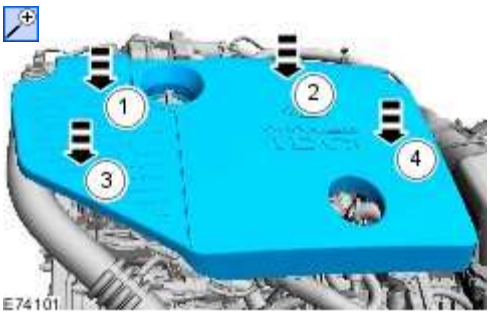
40. Bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleedi
    Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ger

41. Install the air cleaner.

    Refer to: Air Cleaner (303-12D Intake Air Distributio
    Duratorq-TDCi (92kW/125PS) - Lynx, Removal and I

42.



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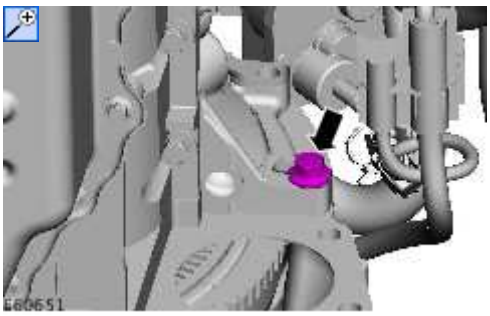
Installation

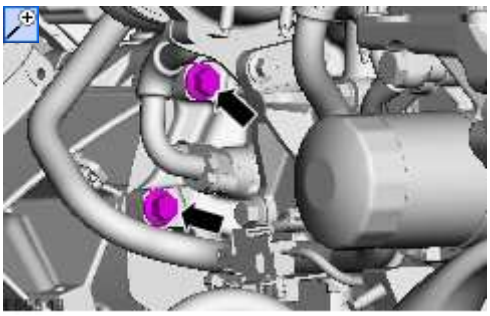
General Equipment

Cable ties
Vehicle/axle stands

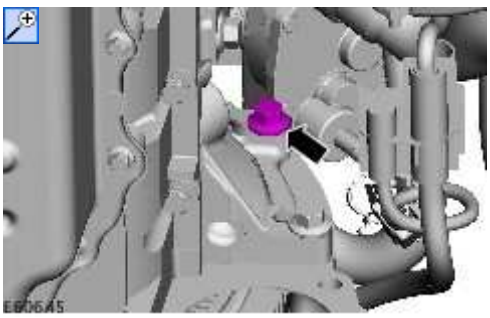
WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at

1. Refer to: Diesel Fuel System Health and Safety Preca
2. Install the transaxle to the engine.
3. *Torque:* 48 Nm

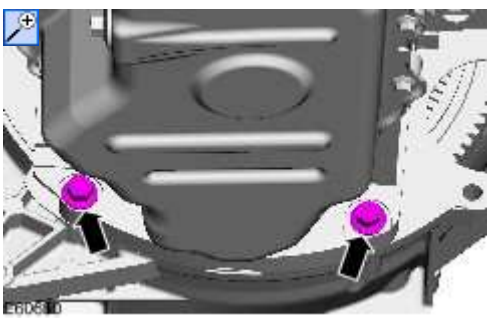




4. *Torque:* 48 Nm



5. *Torque:* 48 Nm



6. *Torque:* 48 Nm

7. *Torque:* 48 Nm

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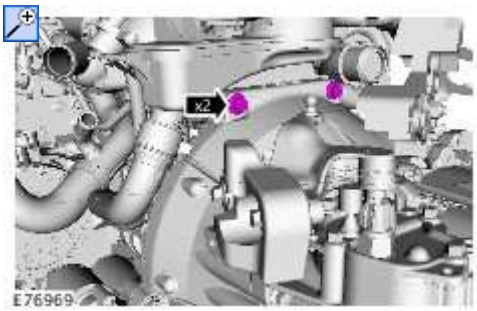
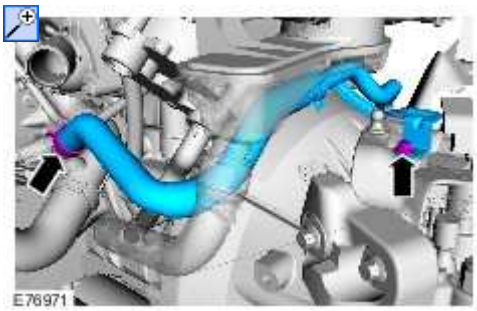
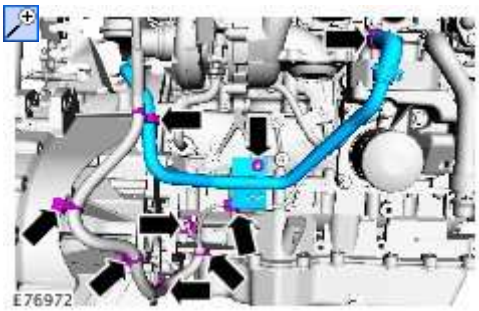




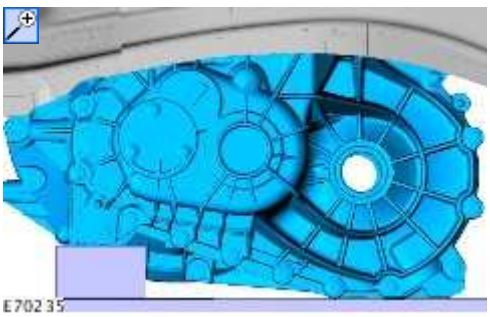
8. *Torque:* 24 Nm



9. *Torque:* 25 Nm

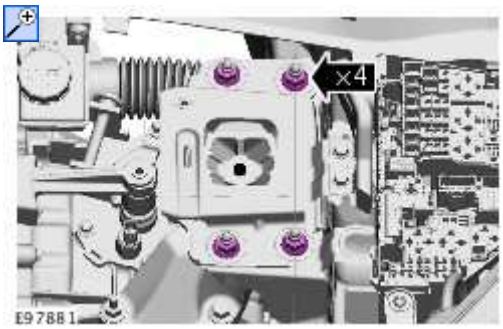
10. Install the starter motor.

    Refer to: Starter Motor (303-06D Starting System - (92kW/125PS) - Lynx, Removal and Installation).



11. WARNING: Make sure that the engine and tra
    suitable retaining straps.
    Secure the engine and transaxle assembly on a suita

    General Equipment: Vehicle/axle stands
    General Equipment: Cable ties



12. *Loosen:* 2 turn(s)

13. *Torque:* 133 Nm

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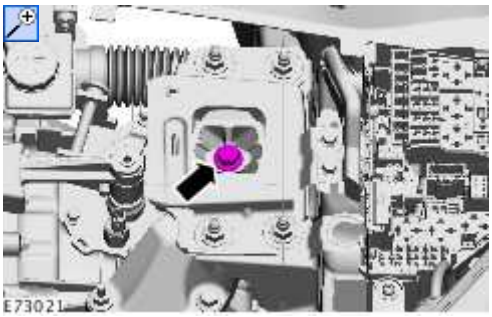
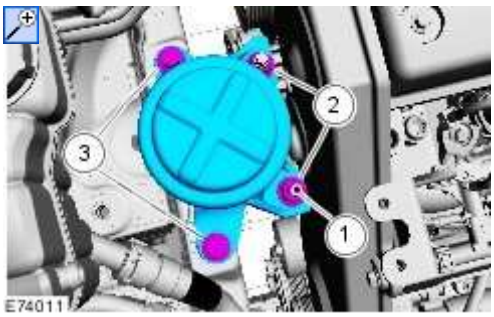
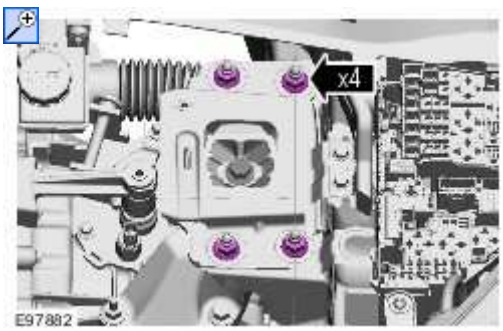




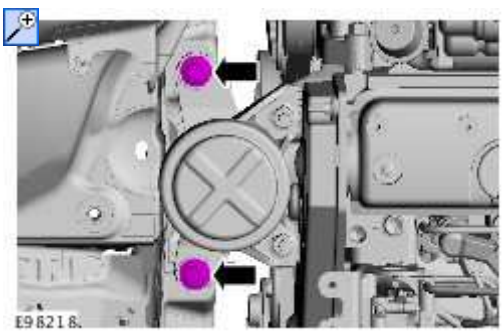
14.
1. *Torque:* 12 Nm
2. *Torque:* 80 Nm
3. NOTE: Only tighten the bolts finger tight at t

15. Raise the vehicle and remove the Vehicle/axle stand

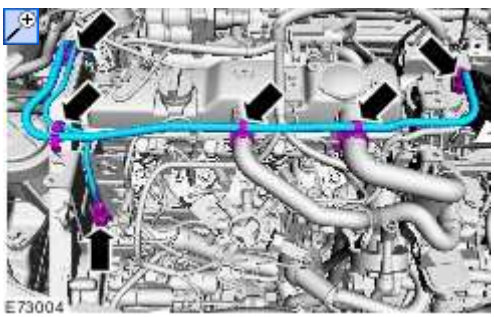
General Equipment: Vehicle/axle stands



16. *Torque:* 80 Nm



17. *Torque:* 90 Nm



18. Connect the fuel supply line and fuel return line quic

Refer to: Fuel Filter (310-01B Fuel Tank and Lines - (92kW/125PS) - Lynx, Removal and Installation).

19. Connect the PCM electrical connectors.

Refer to: Powertrain Control Module (PCM) (303-14E

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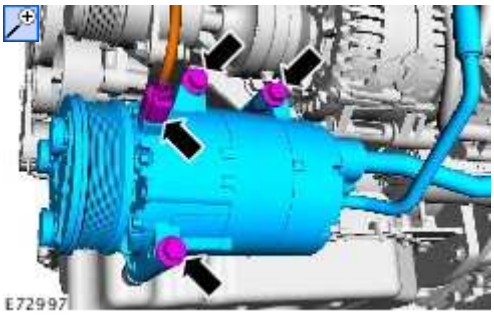
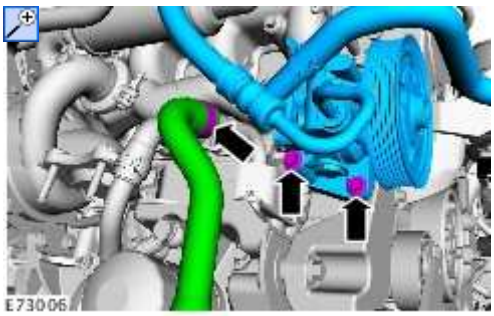
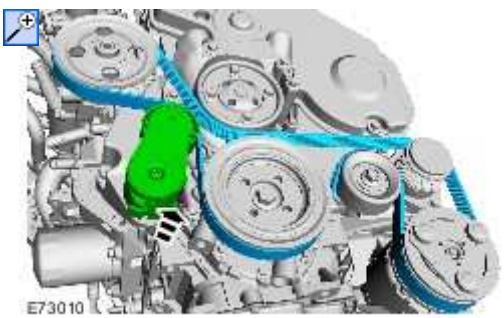


20. *Torque:* 25 Nm



21. *Torque:* 23 Nm



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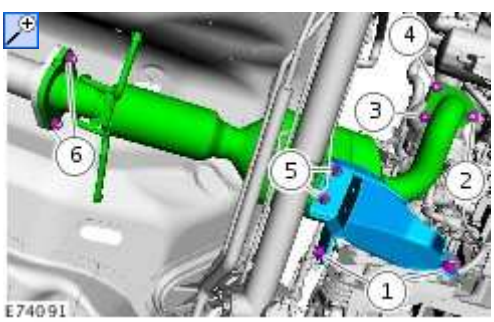


23. CAUTION: Twisting the exhaust flexible pipe r
Tighten all retaining nuts in the sequence show

Torque:
1-5: 25 Nm
6: 51 Nm

24. Remove the front subframe.

Refer to: Front Subframe (502-00 Uni-Body, Subfrar

25. Install the left-hand halfshaft.

Refer to: Front Halfshaft LH (205-04 Front Drive Hal

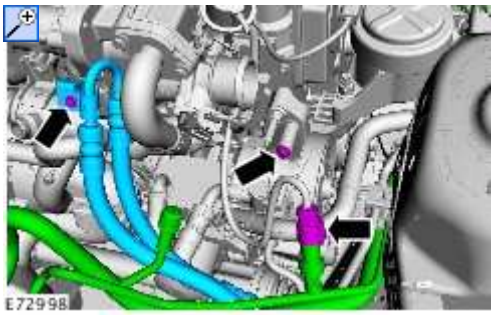
26. Install the right-hand halfshaft.

Refer to: Front Halfshaft RH (205-04 Front Drive Hal

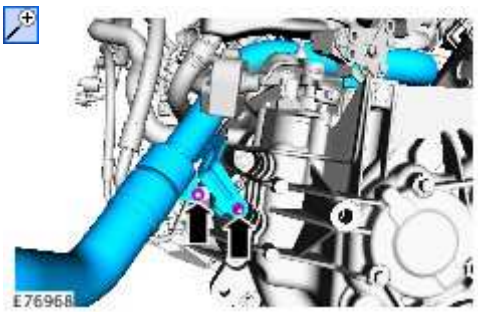
27. Install both front wheels.

Refer to: Wheel and Tire (204-04 Wheels and Tires,

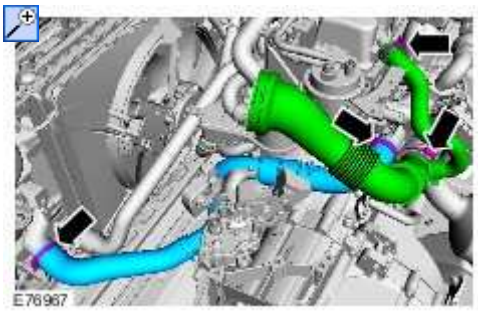
http://lynx.su



28. *Torque:* 23 Nm



29. *Torque:* 24 Nm



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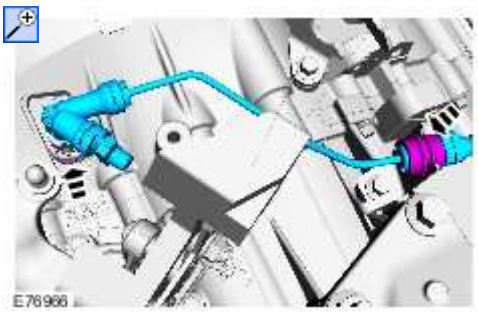
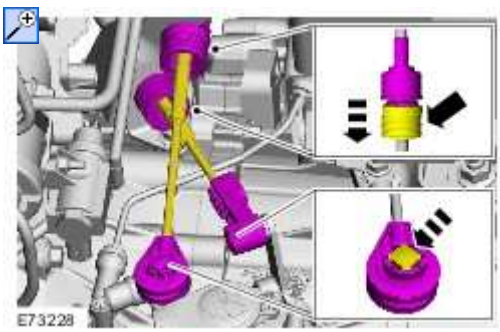


31. CAUTION: If the fluid is spilled on the paintwc
cold water.
Bleed the clutch system.

Refer to: Clutch System Bleeding (308-00, General I



32. CAUTION: Gearshift cables must not be kinke
Install the gearshift cables.

33. Adjust the gearshift cables.

Refer to: Gearshift Cable Adjustment - Vehicles With
Transmission/Transaxle and Clutch - General Inform

34.

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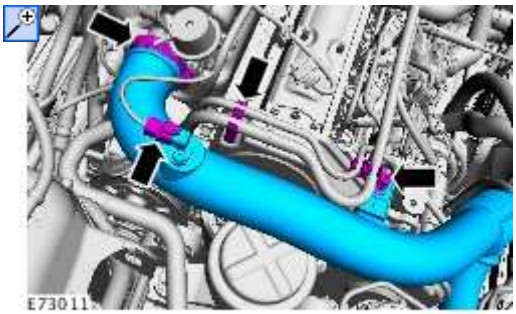

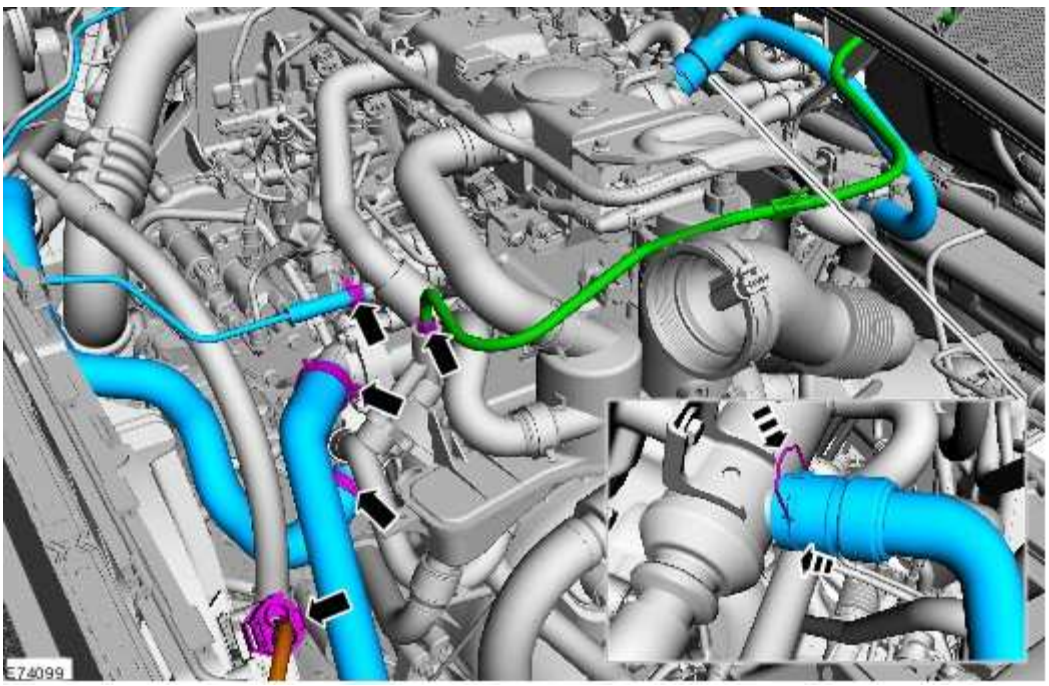

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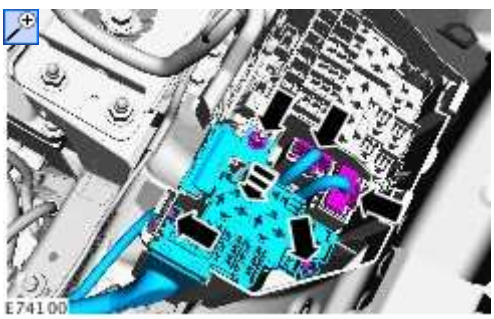

36.

37.

38.

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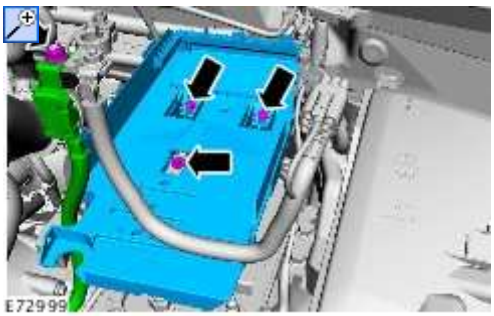


39. *Torque:* 12 Nm

40. Install the battery.

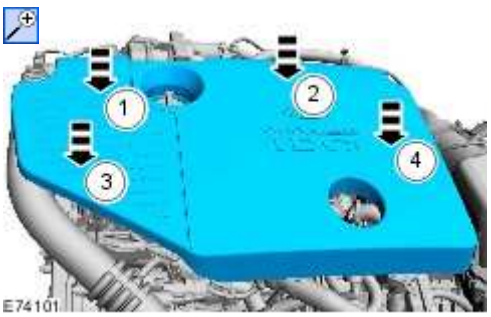
    Refer to: Battery (414-01 Battery, Mounting and Cal

41. Bleed the cooling system.

    Refer to: Cooling System Draining, Filling and Bleedi
    Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Ger

42. Install the air cleaner.

    Refer to: Air Cleaner (303-12D Intake Air Distributio
    Duratorq-TDCi (92kW/125PS) - Lynx, Removal and I



43.

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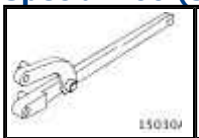
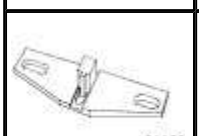
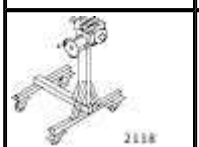
Print

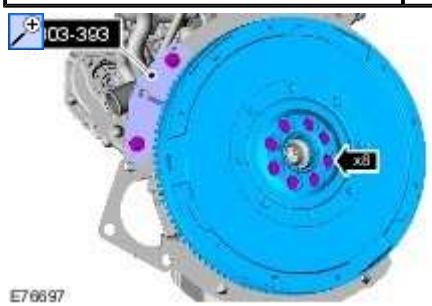
Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-122 Lifting Bracket, Engine
	303-193 Timing Peg, Crankshaft TDC
	303-376B Alignment Plate, Camshaft
	303-393 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-710 Timing Tool, Crankshaft

Materials

Name	Specification
Flange Sealant - Anaerobic LP	WSK-M2G348-A7 / 5U7J-M2G348-BA



1. CAUTION: Make sure that new bolts are installed.
   Special Tool(s): 303-393
   Torque:
   Stage 1: 35 Nm
   Stage 2: 45°

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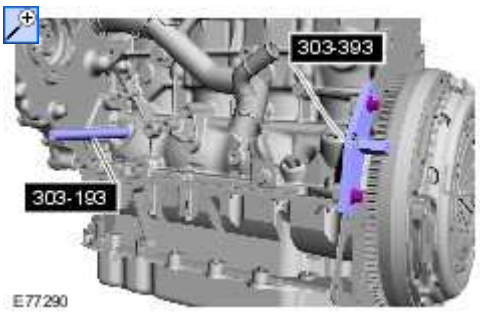
2. Install the clutch disc and pressure plate.

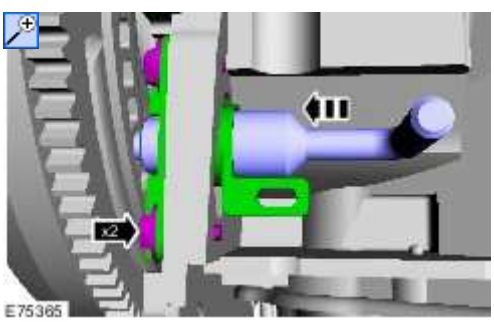
   Refer to: Clutch Disc and Pressure Plate (308-01B Clutch - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal and Installation).



3. NOTE: Only rotate the crankshaft in the normal direction of rotation.
   1. Remove the cylinder block blanking plug and install the special tool.

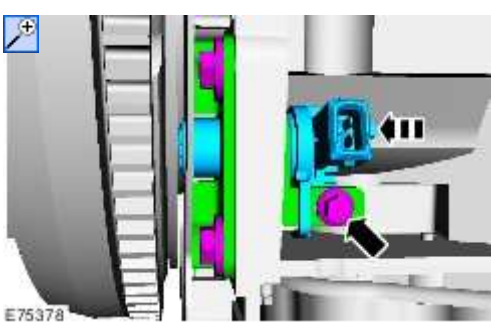
      Special Tool(s): 303-193
   2. Rotate the crankshaft slowly until the crankshaft stops.
   3. **Make sure that the crankshaft does not rotate during installation of the special tool.Make sure that the crankshaft is at the TDC position before locking the special tool.**Using the special tool, lock the crankshaft.

      Special Tool(s): 303-393

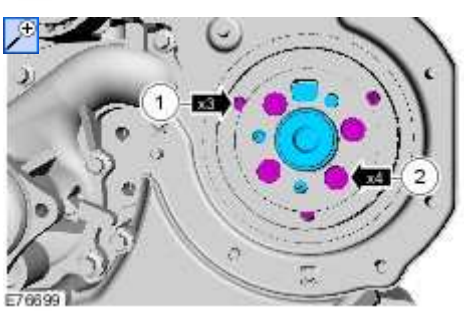


4. Using the special tool, install the crankshaft position (CKP) sensor retaining bracket.

   Special Tool(s): 303-710
   Torque: 10 Nm



5. NOTE: Install a new crankshaft position (CKP) sensor.
   NOTE: The CKP sensor must make contact with the flywheel.
   Torque: 6 Nm



6.
   - 1.

     Torque:
     Snug Torque 10 Nm
     Delay 2 Seconds 18 Nm
     Untighten 40°
     Final Torque 26 Nm
   - 2.

     Torque: 33 Nm

7. Install a new gasket

   Torque: 23 Nm

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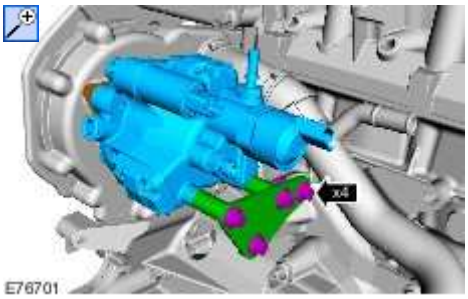
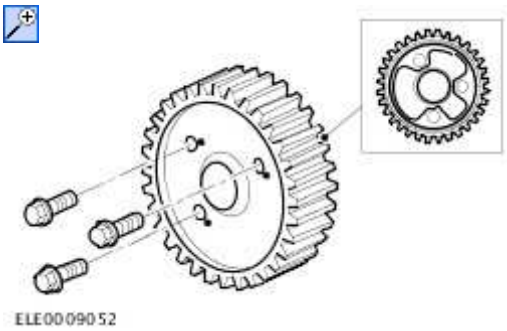
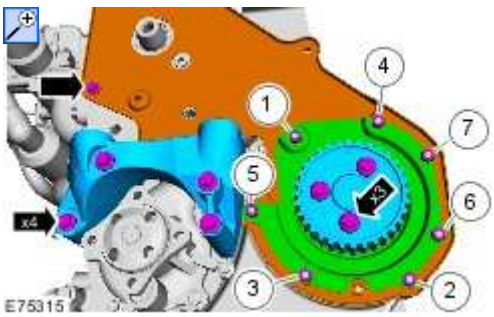




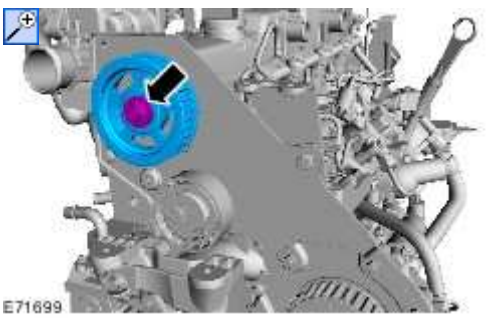
8. Attach the fuel pump pulley to the fuel pump sprocket. Apply sealant to the fuel pump pulley and to the outer edge of the fuel pump pulley retaining bolt holes.

   Material: Flange Sealant - Anaerobic LP (WSK-M2G348-A7 / 5U7J-M2G348-BA)

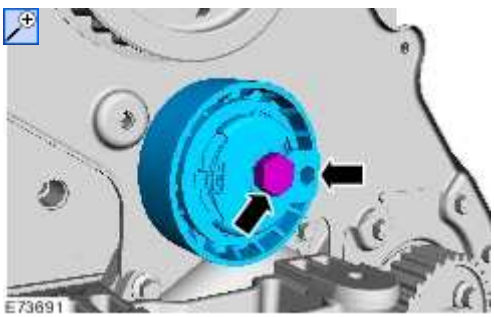


9. Tighten the fuel pump seal retainer retaining bolts in the sequence shown.

   Torque:
   1-7 and timing belt rear cover 10 Nm
   Engine front mount bracket 28 Nm



10. Tighten the camshaft pulley bolt finger tight and then loosen by one-half turn.



11.
- Check the timing belt tensioner and make sure that the timing belt tensioner pointer rotates clockwise freely.
- Move the timing belt tensioner adjustment arm to the 3 o'clock position.
- Do not fully tighten the timing belt tensioner retaining bolt at this stage.

12.
- The camshaft pulley must be able to rotate freely on the camshaft taper.
- Install the timing belt with the direction arrows in the direction of engine rotation.

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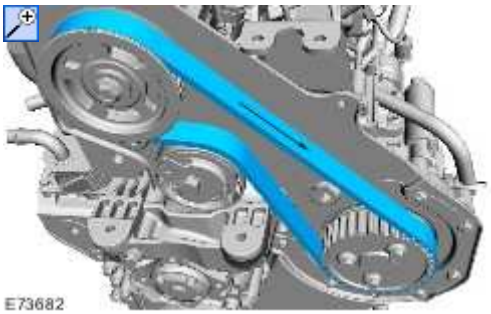
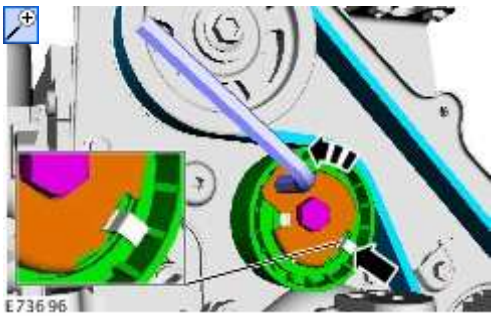
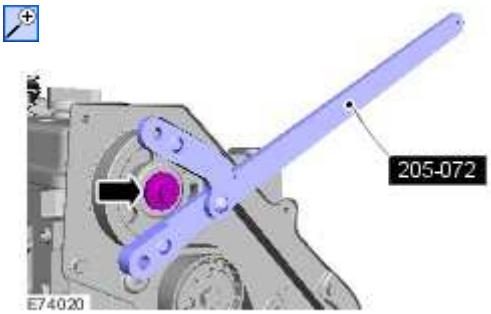




13. Tension the timing belt counterclockwise until the pointer is positioned between the sides of the window.

    Torque: 50 Nm



14. *Special Tool(s):* 205-072
    Torque: 50 Nm

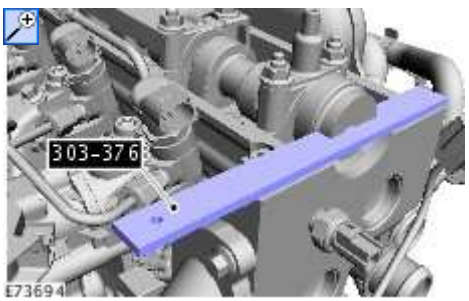
15. Remove the special tools.

    Special Tool(s): 303-376B, 303-193, 303-393

16.
    1. Rotate the crankshaft 2 revolutions. Replace the Timing Peg just before TDC on the second revolution.

       Special Tool(s): 303-193
    2. Rotate the crankshaft slowly until the crankshaft stops at TDC.

17. Check that the timing belt tensioner pointer is positioned in the window, otherwise the timing belt tensioning steps must be repeated.



18. NOTE: If the special tool cannot be installed, the timing belt tensioning steps must be repeated.
    Install the special tool.

    Special Tool(s): 303-376B

19. Remove the special tools and install the cylinder block blanking plug.

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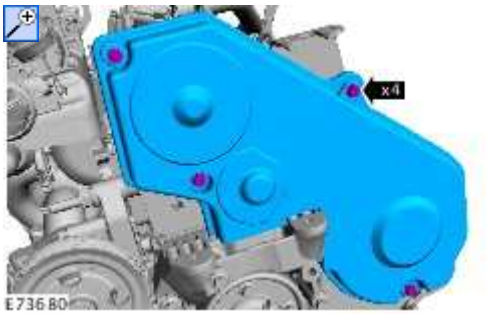
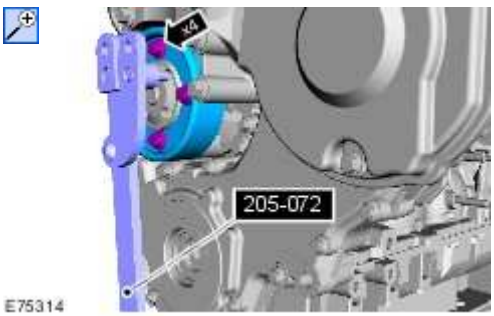
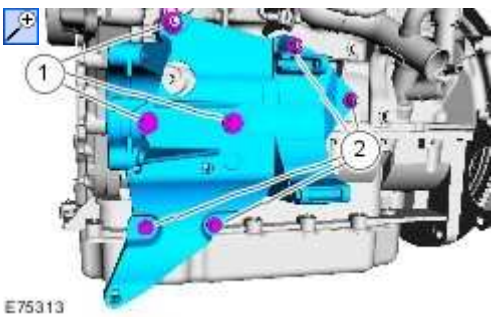
Special Tool(s): 303-376B, 303-193, 303-393
Torque: 23 Nm



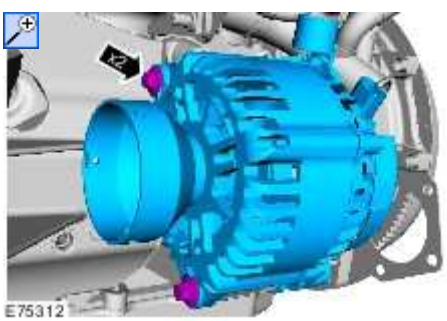
20. *Torque:* 7 Nm



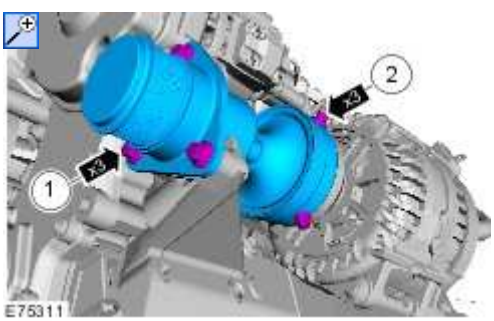
21. *Special Tool(s):* 205-072
Torque: 23 Nm



22. *Torque:*
1 23 Nm
2 15 Nm



23. *Torque:* 27 Nm



24. *Torque:*
1 27 Nm
2 10 Nm

25. CAUTION: Make sure that a new crankshaft pulley bolt is installed.
Special Tool(s): 205-072
Torque:
1

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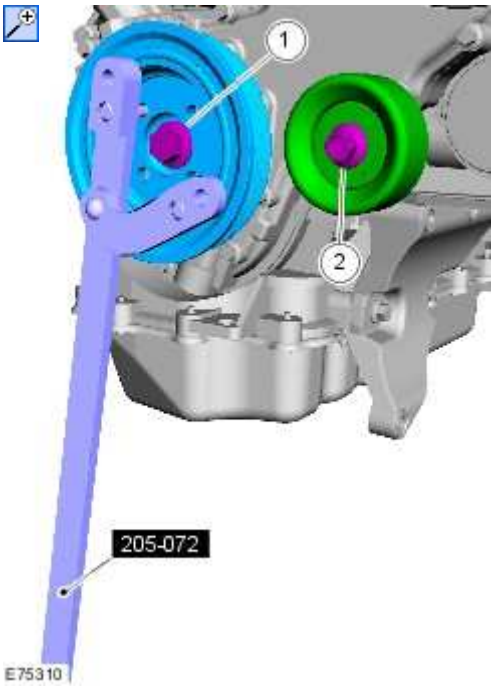
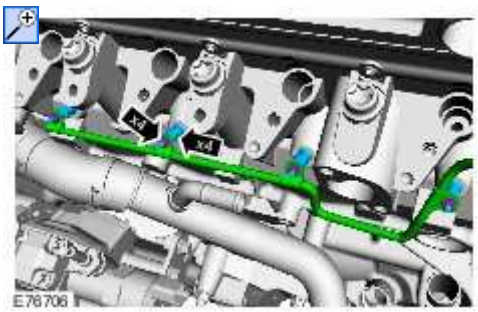
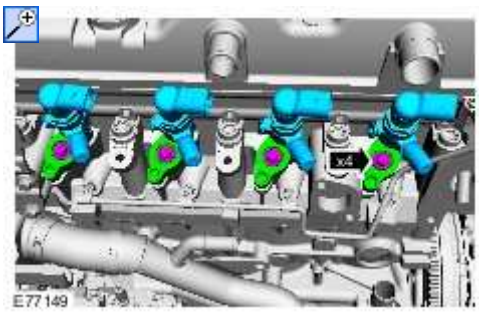


Stage 1: 100 Nm
Stage 2: 180°
2 47 Nm



26. *Torque:*
Glow plugs 15 Nm
Glow plug wire electrical connector retaining nuts 2,5 Nm

27. NOTE: Make sure that new components are installed.



28. NOTE: Make sure that these components are installed to the noted removal position.
Torque: 37 Nm

29. Push the fuel injector fuel return line gently into the fuel injector. Make sure that new fuel injector fuel return line clips are installed. Do not distort the fuel injector fuel return line retaining clip when installing it to the fuel injector. Failure to follow this instruction may result in fuel leaks.

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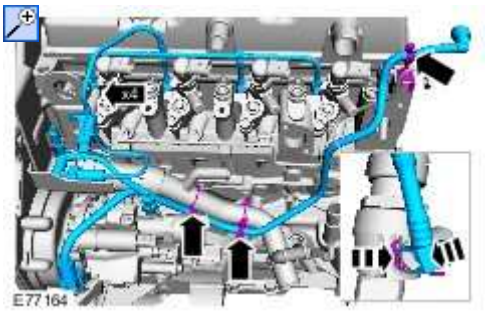
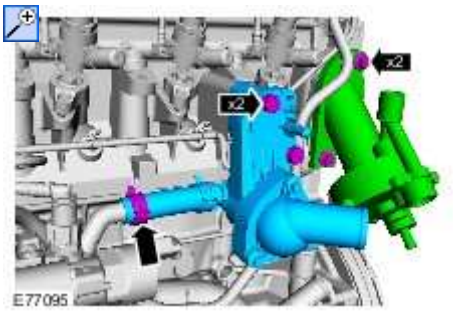
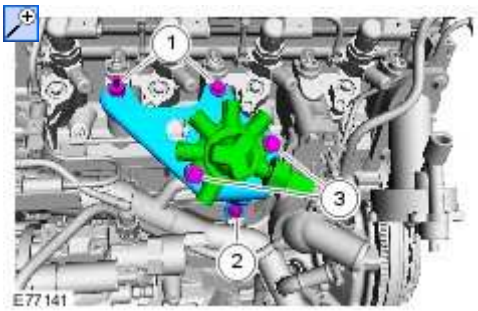


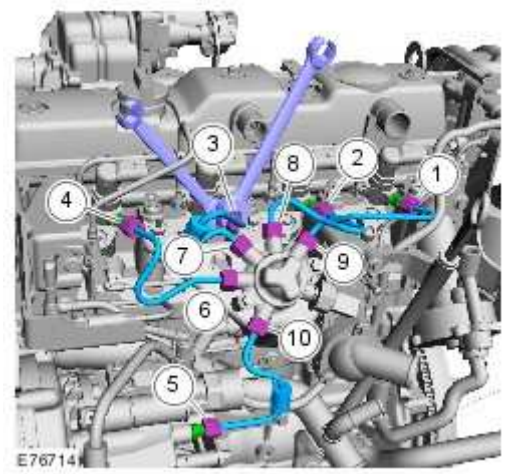


30. *Torque:* 23 Nm



31. Tighten the common rail support bracket retaining bolts in the sequence shown. Do not fully tighten the fuel supply manifold retaining bracket bolts at this stage.

Torque:
1-2 23 Nm
3 24 Nm



32. CAUTION: Use an open-ended wrench to prevent the component from turning.
NOTE: Make sure that new components are installed.
NOTE: The fuel supply line must be installed with the yellow identification collar adjacent to the fuel injector and the blue identification collar adjacent to the fuel rail.
NOTE: The fuel supply line must be installed with the yellow identification collar adjacent to the fuel pump and the blue identification collar adjacent to the fuel rail.
NOTE: The high-pressure fuel supply lines must be connected immediately after removing the blanking plugs.
NOTE: Do not allow the unions to hit the ends of the high-pressure fuel supply line.
To aid installation of the new high-pressure fuel supply lines, the unions at the fuel rail end are colored gold.
Tighten the fuel injector high-pressure fuel supply lines in the sequence shown.

Torque:
1-5 25 Nm
6-10 38 Nm

33. *Torque:* 5 Nm

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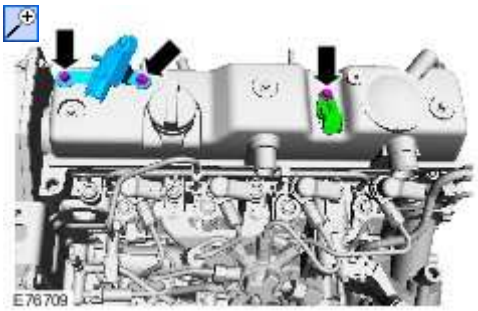
34. *Torque:* 3 Nm



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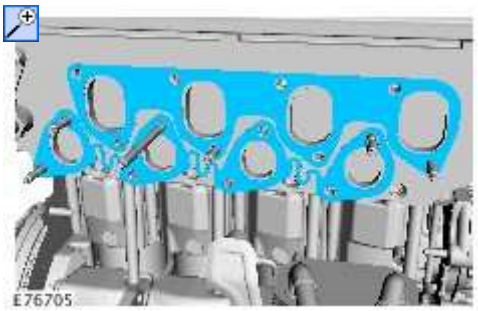
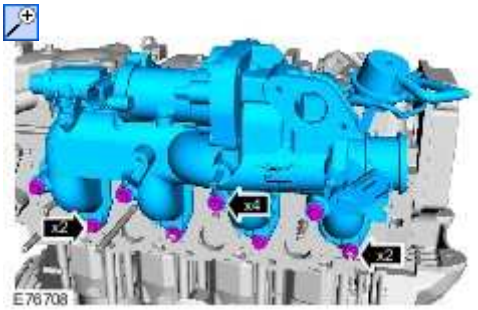
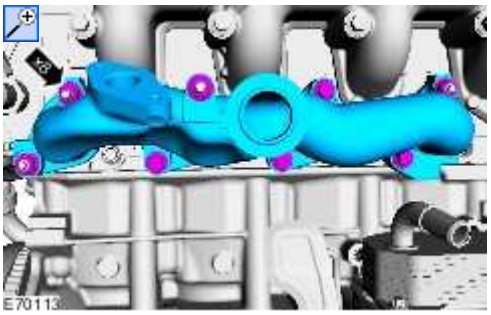


36. *Torque:* 24 Nm



37. *Torque:* 20 Nm



38. *Torque:* 23 Nm

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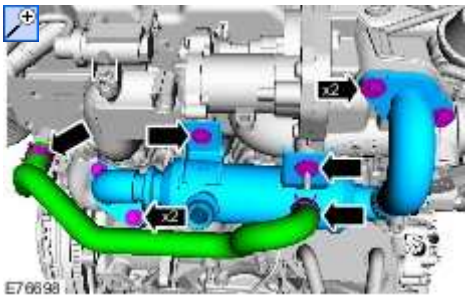
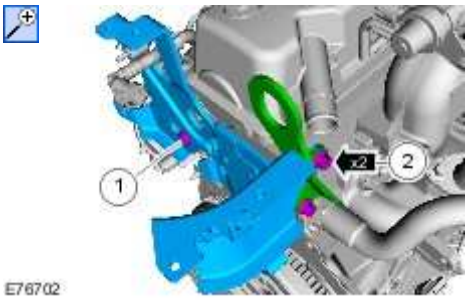
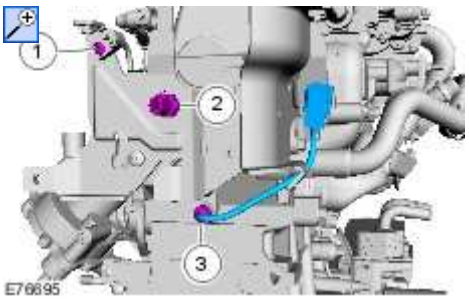




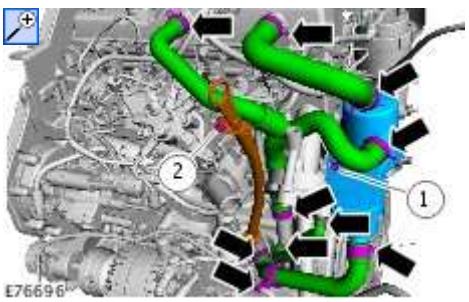
39. *Torque:*
    1 23 Nm
    2 23 Nm



40. *Torque:*
    1 7 Nm
    2 20 Nm
    3 20 Nm

41. Install the Fuel Filter.

    Refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



42. *Torque:*
    1 23 Nm
    2 10 Nm

43. *Special Tool(s):* 303-122

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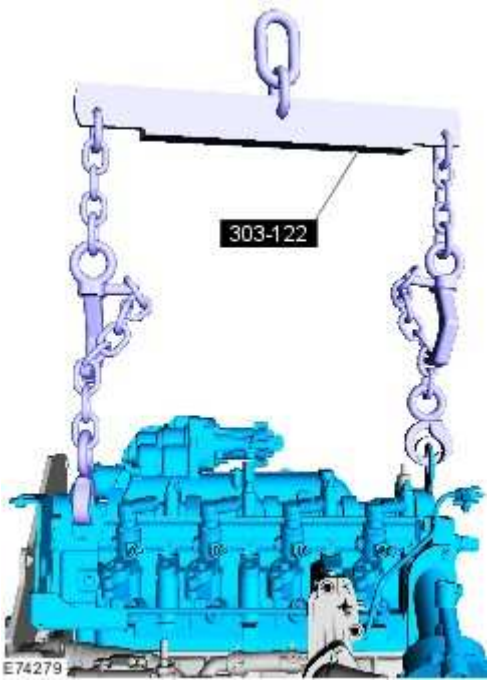
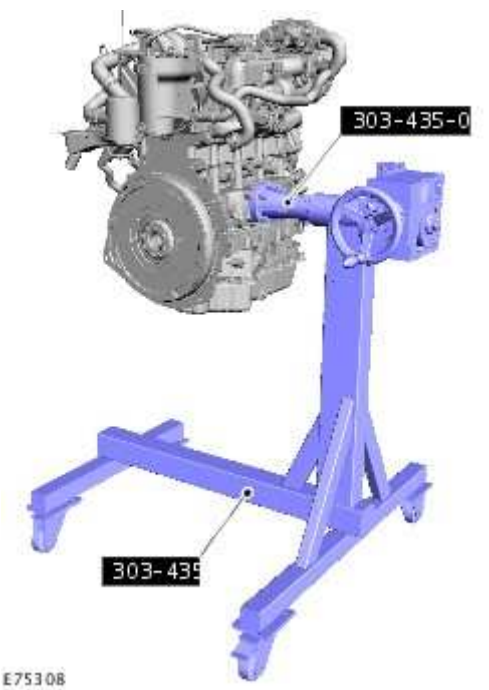
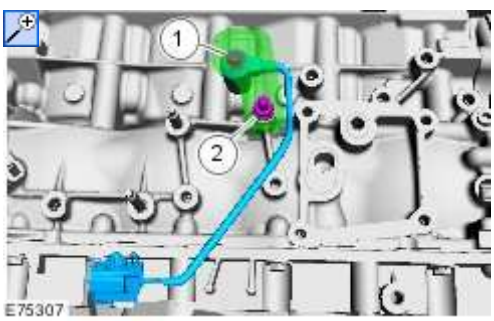


44. Remove the Special Tools.

    Special Tool(s): 303-435, 303-435-06





45. *Torque:*
    1 20 Nm
    2 23 Nm

46. Make sure that the Gap between the Ears of the V-Band Clamp is between 3-6 mm.

    Torque:
    1 25 Nm
    2 45 Nm

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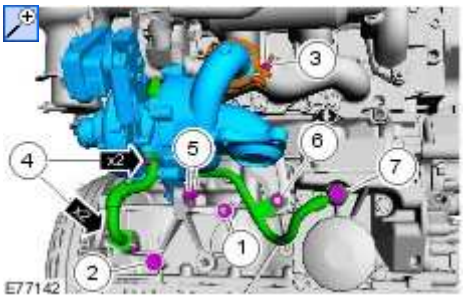
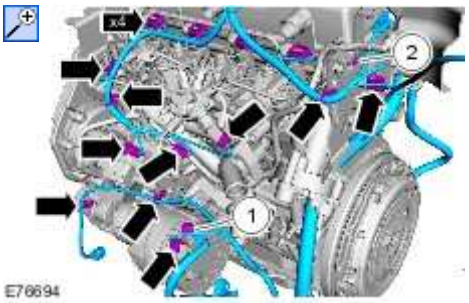
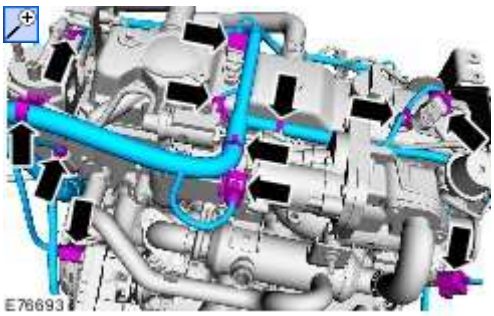


3 4.5 Nm
4 10 Nm
5 25 Nm
6 23 Nm
7 35 Nm



47. *Torque:*
1 15 Nm
2 4 Nm



48.

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Engine Data

Description
Engine code
Firing order
Emission level
Bore
Stroke
Cubic capacity
Compression ratio
Power output at 4000 rpm
Torque at 1750 rpm
Maximum engine speed (intermittent)
Maximum engine speed (continous)
Idle speed
Oil consumption

Lubricants, Fluids, Sealers and Adhesives

Item	
Engine oil	
Coolant	
Sealant	

Engine Oil Capacity

Initial fill including oil filter	
Service fill including oil filter	
Service fill without oil filter	

Cylinder Block

	Description
Cylinder bore diameter	
Main bearing parent bore diameter	
Main bearing clearance - radial	

Pistons

	Description
Piston diameter	
Piston clearance in cylinder	
Piston ring end gaps	
— upper compression ring	
— lower compression ring	
— oil control ring	

Piston ring gap position: The piston ring gaps must be distributed evenly around the

Crankshaft

	Description
Main bearing journal diameter	
Connecting rod bearing journal diameter	
Crankshaft end play	

Connecting Rod

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Description
Big end bore diameter
Small end bore diameter
Connecting rod bearing clearance

Piston Pin

Description
Piston pin length
Piston pin diameter

Camshaft

Description
Camshaft end float
Camshaft bearing journal diameter

Valves

Des
Valve stem diameter
Valve guide
Valve stem to valve guide clearance — intake valve
Valve stem to valve guide clearance — exhaust valve

Cylinder Head

Description
Thickness of cylinder head gasket with piston protrusion of 0.55 - 0.60
Thickness of cylinder head gasket with piston protrusion of 0.61 - 0.65
Thickness of cylinder head gasket with piston protrusion of 0.66 - 0.70
Thickness of cylinder head gasket with piston protrusion of 0.71 - 0.75
Maximum distortion — measured longitudinally and diagonally

Oil Pressure Specifications

Oil pressure at 2000 rpm
Oil pressure at 4000 rpm
(

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Engine Data

Description
Engine code
Firing order
Emission level
Bore
Stroke
Cubic capacity
Compression ratio
Power output at 4000 rpm
Torque at 1750 rpm
Maximum engine speed (intermittent)
Maximum engine speed (continous)
Idle speed
Oil consumption

Lubricants, Fluids, Sealers and Adhesives

Item
Ford Formula E SAE 10W-30 Motoröl
Coolant
Sealant

Engine Oil Capacity

Initial fill including oil filter
Service fill including oil filter
Service fill without oil filter

Cylinder Block

Description
Cylinder bore diameter
Main bearing parent bore diameter
Main bearing clearance - radial

Pistons

Description
Piston diameter
Piston clearance in cylinder
Piston ring end gaps
— upper compression ring
— lower compression ring
— oil control ring

Piston ring gap position: The piston ring gaps must be distributed evenly around the

Crankshaft

Description
Main bearing journal diameter
Connecting rod bearing journal diameter
Crankshaft end play

Connecting Rod

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	Description
Big end bore diameter	
Small end bore diameter	
Connecting rod bearing clearance	

Piston Pin

	Description
Piston pin length	
Piston pin diameter	

Camshaft

	Description
Camshaft end float	
Camshaft bearing journal diameter	

Valves

	Des
Valve stem diameter	
Valve guide	
Valve stem to valve guide clearance — intake valve	
Valve stem to valve guide clearance — exhaust valve	

Cylinder Head

	Description
Thickness of cylinder head gasket with piston protrusion of 0.55 - 0.60	
Thickness of cylinder head gasket with piston protrusion of 0.61 - 0.65	
Thickness of cylinder head gasket with piston protrusion of 0.66 - 0.70	
Thickness of cylinder head gasket with piston protrusion of 0.71 - 0.75	
Maximum distortion — measured longitudinally and diagonally	

Oil Pressure Specifications

Oil pressure at 2000 rpm	
Oil pressure at 4000 rpm	

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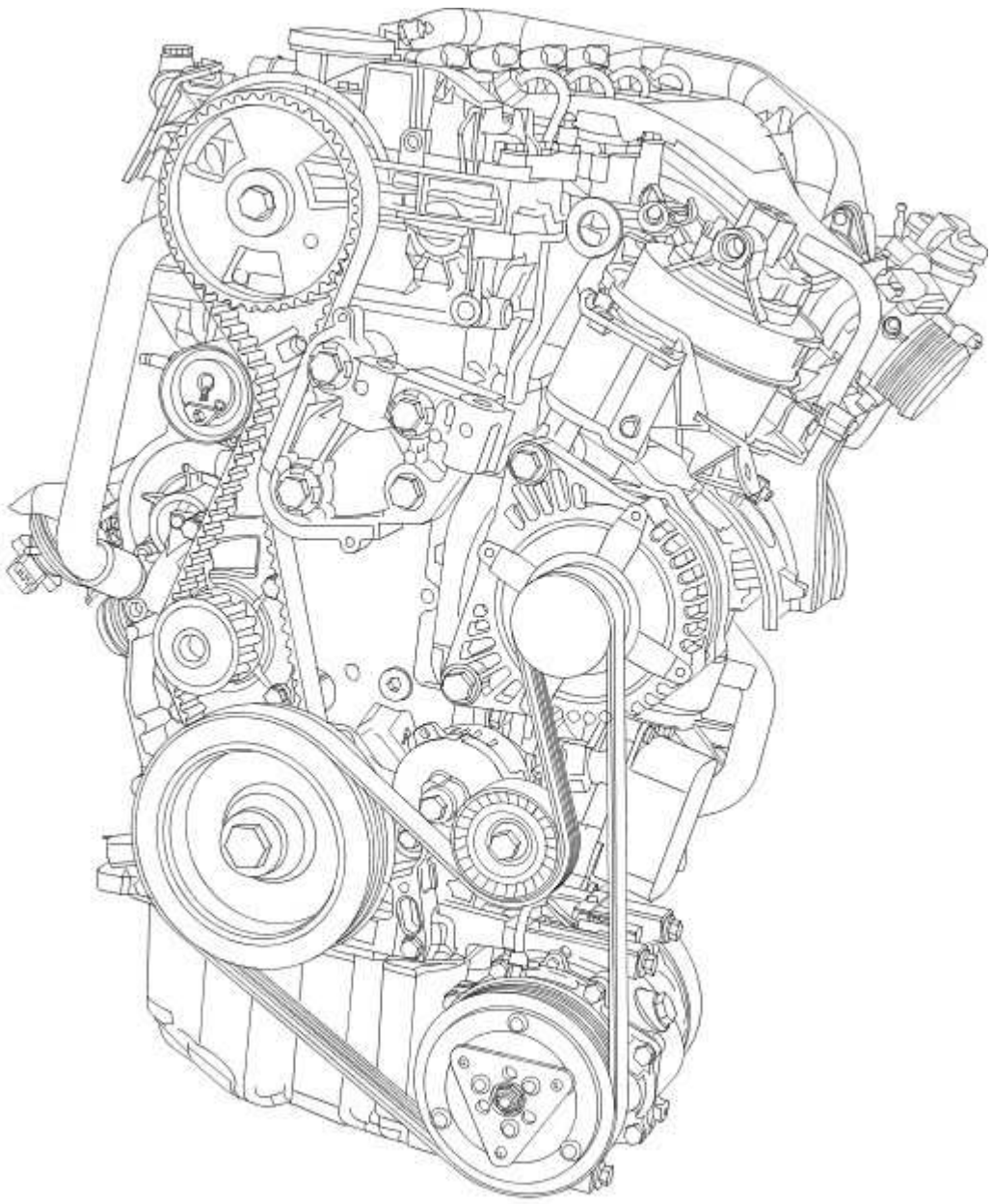
Description and Operation

Overview



E42210

General

The 2.0L Duratorq TDCi (DW10) engine uses the Siemens common rail direct fuel injection process.

The cylinder head is made of two parts. The upper and lower parts are made of aluminium and are bolted to each other. The lower section houses four valves per combustion chamber and the valve gear and camshafts.

The valves are actuated by means of two overhead camshafts and roller followers with

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hydraulic tappets.

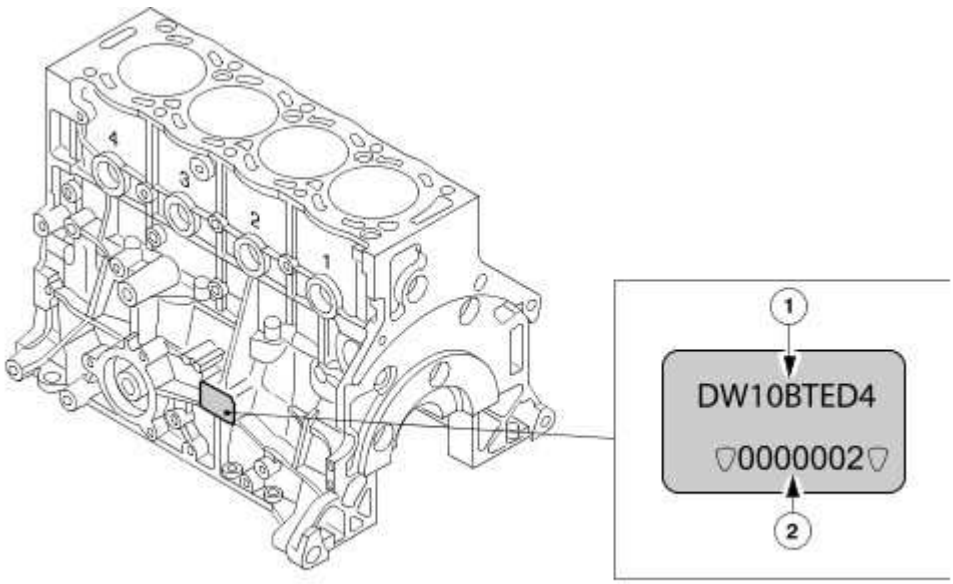
The exhaust camshaft and the coolant pump are driven by a toothed belt. The fuel pump is flange-mounted directly onto the exhaust camshaft. The exhaust camshaft drives the inlet camshaft via a short timing chain.

The oil pump is located inside the oil pan and is driven by the crankshaft via an oil pump chain.

The vacuum pump is flange-mounted onto the inlet camshaft and is driven directly.

Engine identification

NOTE: Cylinder 1 is located on the transmission side.
The serial number of the engine and the engine code are located on the intake side of the cylinder block (in line with the second cylinder).



E42211

Item	Part Number	Description
1	-	Engine code
2	-	Engine serial number

Cylinder head ancillary components

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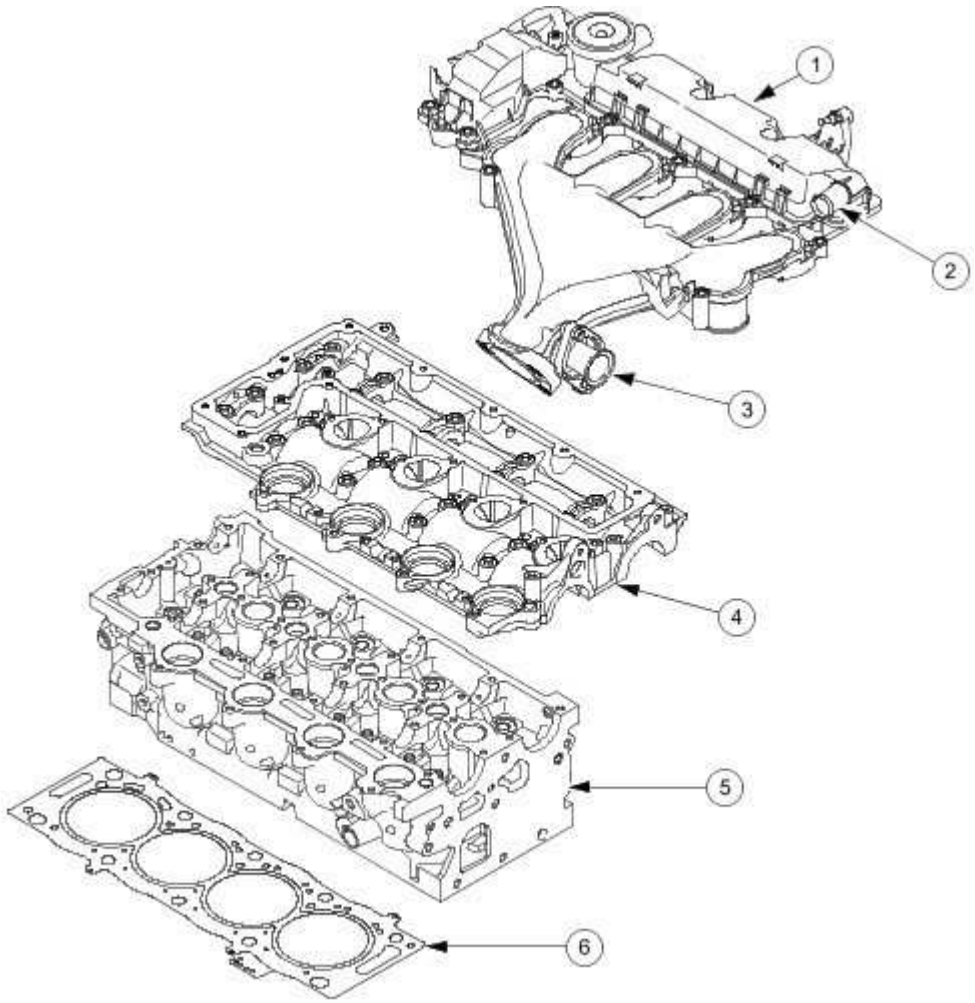
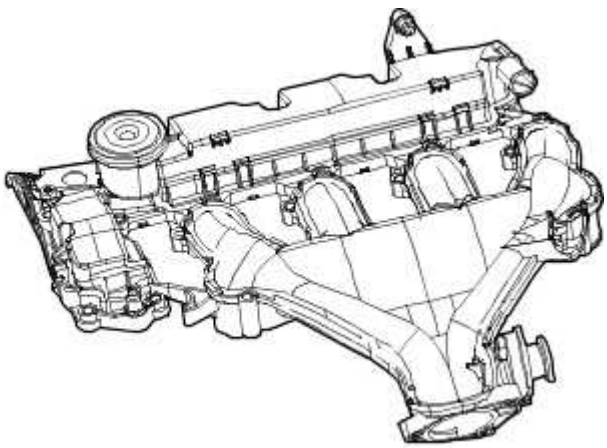


E42280

Item	Part Number	Description
1	-	Valve cover
2	-	positive crankcase ventilation (PCV) connection
3	-	exhaust gas recirculation (EGR) connection
4	-	Cylinder head (upper part)
5	-	Cylinder head (lower part)
6	-	Cylinder head gasket

Valve cover



E41209

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The valve cover and the inlet manifold form one assembly and are made of plastic.

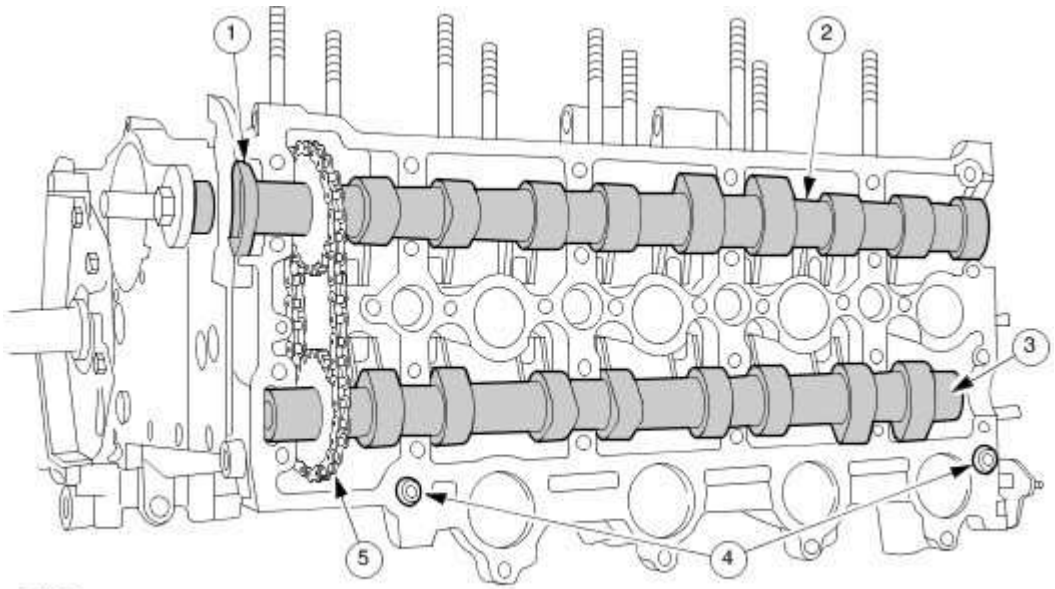
The PCV valve is also located on the valve cover.

It is sealed off from the cylinder head with a separate seal.

The cylinder head's intake ports and injector ports are each sealed off from the inlet manifold by four sealing rings.

NOTE: Refer to the current service literature for precise details of how to assemble the valve cover and inlet manifold.
Before re-installing the valve cover and the inlet manifold, carefully check the sealing rings for damage and renew if necessary.

Cylinder head



E42213

Item	Part Number	Description
1	-	Seal
2	-	Exhaust camshaft
3	-	Inlet camshaft
4	-	Alignment sleeves
5	-	Timing chain

The aluminium cylinder head has four valves per combustion chamber. The valve seats and guides are made of sintered steel.

The inlet ports are located on the front of the cylinder head, the exhaust ports at the back (with respect to the direction of travel).

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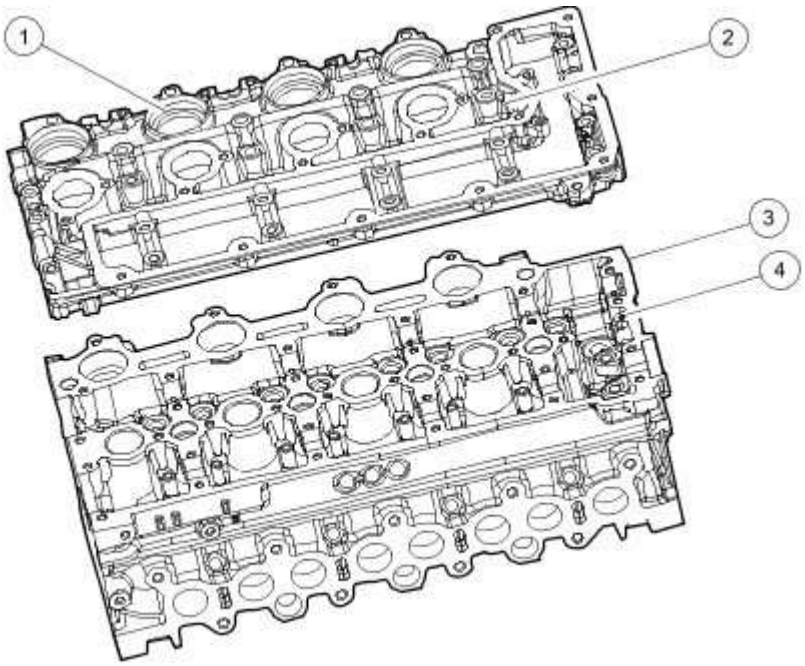

E41317

Item	Part Number	Description
1	-	Inlet ports
2	-	Cylinder head upper part
3	-	Cylinder head lower part
4	-	Oil supply hole

NOTE: The upper and lower parts of the cylinder head are matched to each other and cannot be renewed separately.
NOTE: It is important to ensure that the oil supply holes are not blocked by sealant when the two parts of the cylinder head are brought together.
The cylinder head is made of two separate parts. This special design ensures that the overall structure is stronger.

The upper and lower parts of the cylinder head are milled in a single operation and are accurately positioned with two alignment sleeves.

The lower part of the cylinder head is bolted to the cylinder block.

The upper halves of the camshaft mountings are incorporated into the upper part of the cylinder head. Here the camshafts run directly in aluminium, without additional bearing shells.

The upper part of the cylinder head features top-entry intake ports.

The two individual parts are sealed using a one-component, silicone-based sealant when they are joined together.

Valve train

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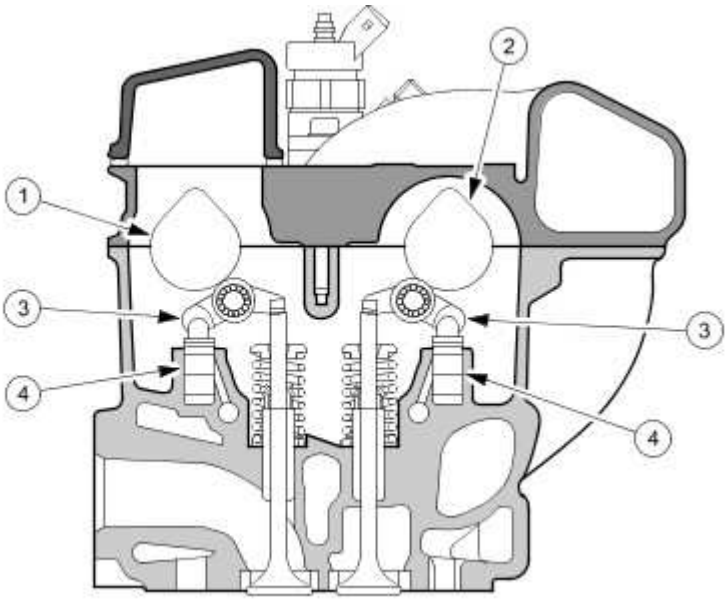


E42214

Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Inlet camshaft
3	-	Roller cam follower
4	-	Hydraulic tappet

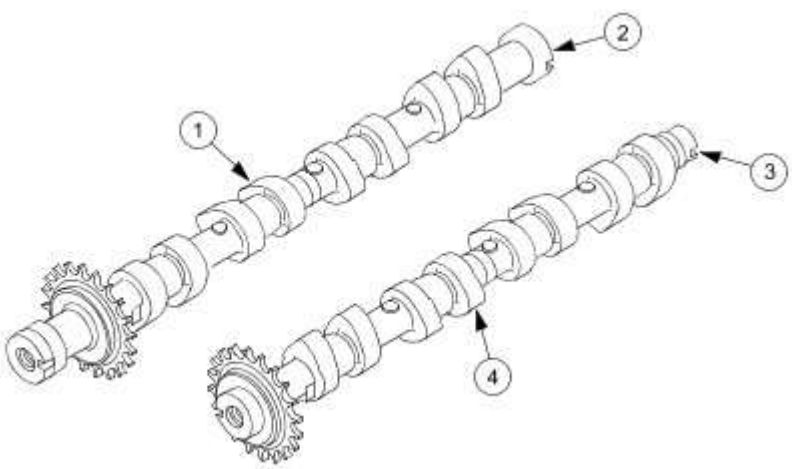
The inlet valves are made entirely of one material. The heads and stems of the exhaust valves are manufactured from different materials and are joined to one another by means of friction welding.

By using roller followers, it has been possible to keep valve actuation friction losses low.

Valve clearance adjustment is done automatically by the hydraulic tappets. As a result, there is no need to adjust the valve clearances.

The hydraulic tappets are connected with the engine's oil circuit by oil ports cast into the cylinder head.

Camshafts



E42945

Item	Part Number	Description
1	-	Exhaust camshaft
2	-	Drive - fuel pump

-

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3		Drive - vacuum pump
	4 -	Inlet camshaft

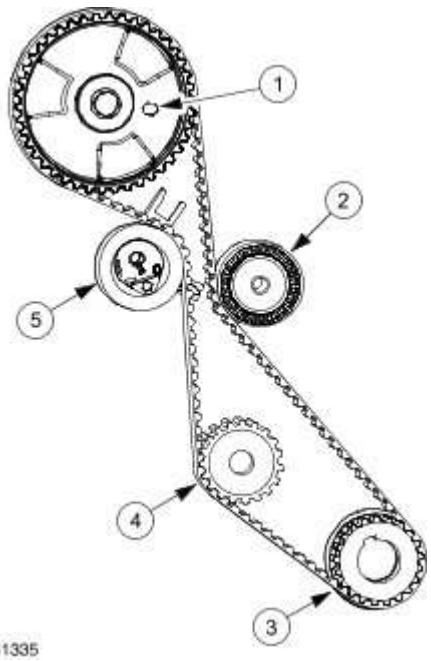
The inlet and exhaust camshafts are made from steel tubes. The cams and ends of the camshaft are shrunk on.

Each camshaft runs directly in aluminium in five bearings, without additional bearing shells.

The vacuum pump is flange-mounted onto the rear of the inlet camshaft and is driven directly.

The fuel pump is flange-mounted onto the rear of the exhaust camshaft and is also driven directly.

Camshaft drive



E41335

Item	Part Number	Description
1	-	Bore for timing peg
2	-	Idler pulley
3	-	Crankshaft timing pulley
4	-	Coolant pump pulley
5	-	Tensioning pulley

NOTE: A spacer shim is located between the cylinder block and the idler pulley (2); this must be re-fitted when carrying out installation work.
The exhaust camshaft is driven by a toothed belt. The toothed belt also drives the coolant pump.

The toothed belt drive has an automatic tensioning pulley. The tensioning pulley operates by spring force.

A feather key specifies the installation position of the exhaust camshaft timing pulley and the crankshaft timing pulley.

A hole is located on the exhaust camshaft timing pulley into which can be inserted the timing pin (special tool) to adjust the timing.

Timing chain tensioner

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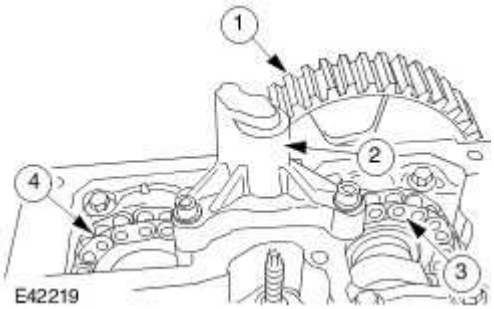
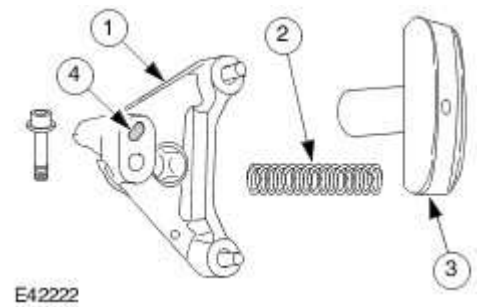


Item	Part Number	Description
1	-	Timing belt pulley - exhaust camshaft
2	-	Timing chain tensioner
3	-	Exhaust camshaft sprocket
4	-	Inlet camshaft sprocket

The timing chain tensioner is attached to the upper part of the cylinder head, between the camshaft sprockets.

Two securing bolts are used to secure the chain tensioner.



Item	Part Number	Description
1	-	Timing chain tensioner housing
2	-	Spring
3	-	Timing chain guide
4	-	Oil bore

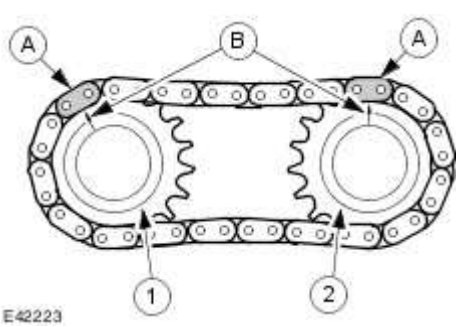
The timing chain guide is made of plastic.

Timing chain guide wear is compensated for by a spring loaded timing chain tensioner.

Because the timing chain tensioner is connected to the engine oil supply circuit, the components are lubricated and chain noise is reliably prevented.

A second timing chain guide is attached to the cylinder head lower section.

Timing chain



Part Number

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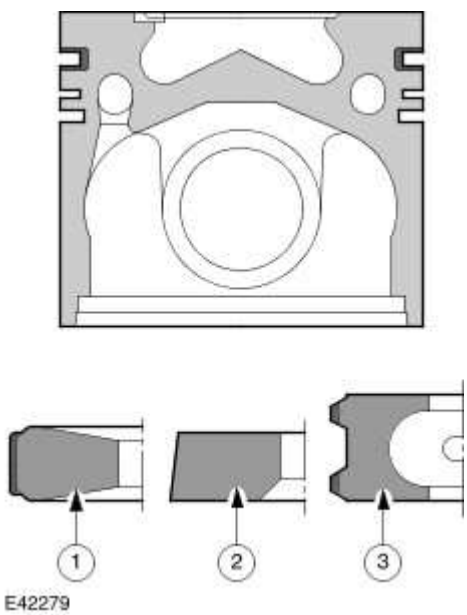
Item		Description
	1 -	Exhaust camshaft
2	-	Inlet camshaft
(A)	-	Bright chrome-finished chain links
(B)	-	Markings on the sprockets

The inlet camshaft is driven via a timing chain.

The timing chain is tensioned using an automatic chain tensioner.

The timing chain has two bright chrome-finished chain links (A). When installed, these two markings must align with the arrow marks (B) on the sprockets.

Pistons and piston rings



Item	Part Number	Description
1	-	Upper compression ring
2	-	Lower compression ring
3	-	Oil scraper ring

The light alloy pistons have a combustion chamber incorporated into the centre of the piston crown. This optimises swirling of the fuel/air mixture.

Two recesses are incorporated into each piston crown.

In order to minimise friction, particularly during the running-in phase, the piston stem has a graphite-based coating.

The piston pin is a floating fit and is held in position by two snap rings.

Cylinder block

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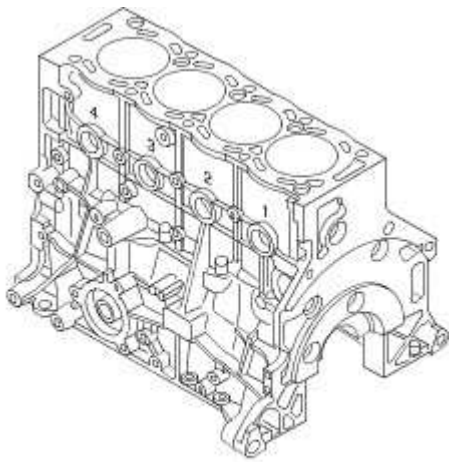


E42378

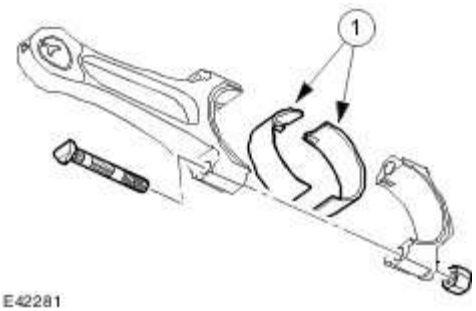
NOTE: Refer to the current service literature for the exact procedure and the correct measurements for machining.
The cylinder block is made of cast iron and has no cylinder liners.

The running surfaces of the cylinders are worked directly into the cylinder block.

The mating face of the cylinder block with the cylinder head can be re-worked.

Two holes are provided in the cylinder block, for the guide sleeves used to secure the cylinder head gasket.

Connecting rods



E42281

Item	Part Number	Description
1	-	Big-end bearing shells

NOTE: Refer to the current service literature for the exact procedure and the correct tightening torques for installing the big end bearings.
The connecting rods are made of forged steel.

The big-end bearing caps are cut and machined at the joins to the connecting rod.

The big end bearing shells have retaining lugs to prevent radial movement.

The retaining nuts are tightened in three stages. In the third stage the nuts are tightened to a specified angle.

The connecting rods and big-end bearing caps are paired and must not be mixed up.

Crankshaft main bearings

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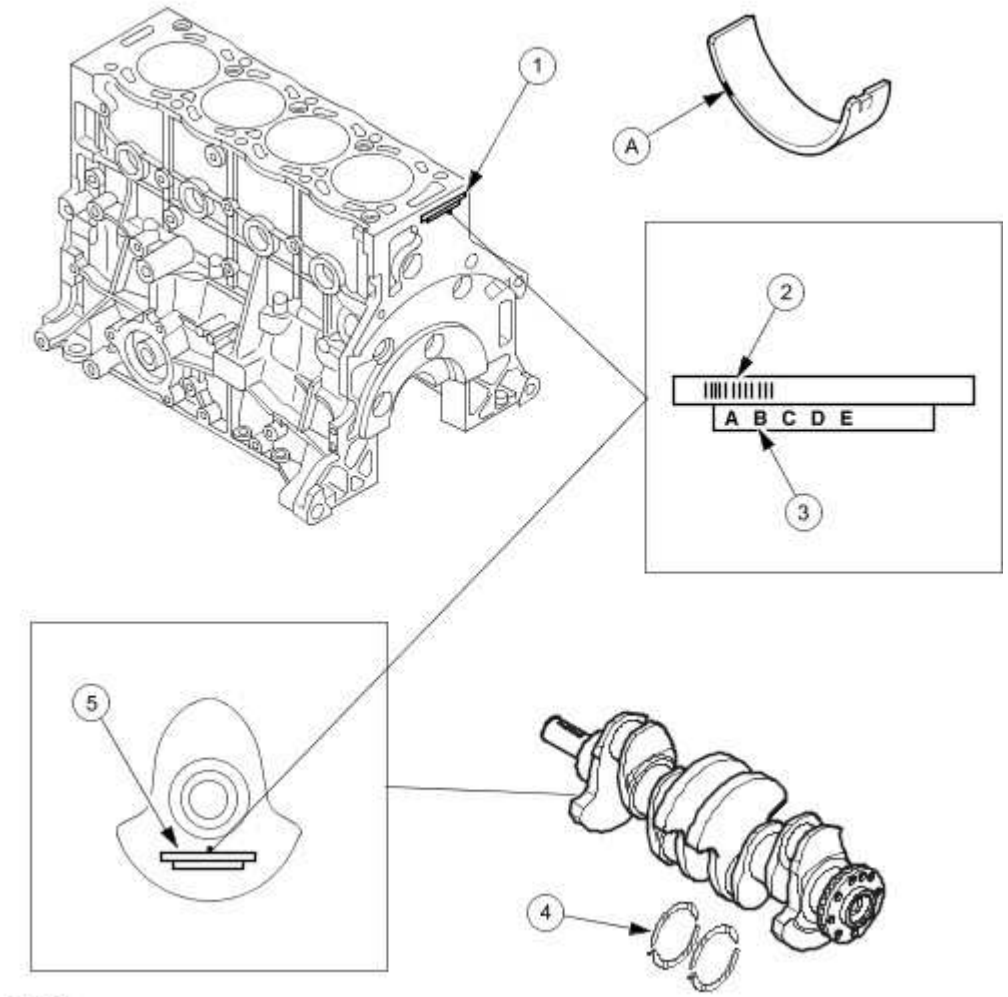

E42217

Item	Part Number	Description
A	-	Colour marking
1	-	Marking
2	-	Barcode
3	-	Alphanumerical code
4	-	Thrust washers
5	-	Marking

For accurate adjustment of the crankshaft bearing clearance, the crankshaft bearing shells in the crankshaft main bearing caps are available in five different thicknesses.

The upper crankshaft main bearings (cylinder block side) are only available in one thickness.

Marks on the cylinder block (1) and on the crankshaft (timing side) (4) indicate the thicknesses of the crankshaft bearing shells installed.

The barcode (2) is for production and the alphanumeric code (3) for service operations.

Retaining lugs on the crankshaft bearing shells prevent radial movement.

NOTE: The crankshaft main bearing caps must be installed in the correct position.
NOTE: Cylinder 1 is located on the transmission side.

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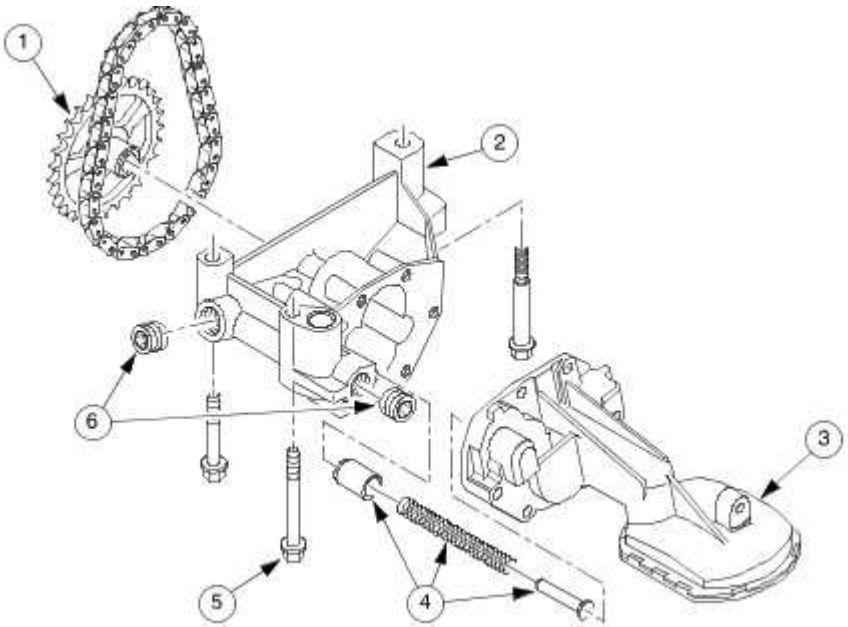
Numbers on the crankshaft main bearing caps specify where they should be installed. When installing them, the crankshaft main bearing cap marked "1F" must be nearest the transmission.

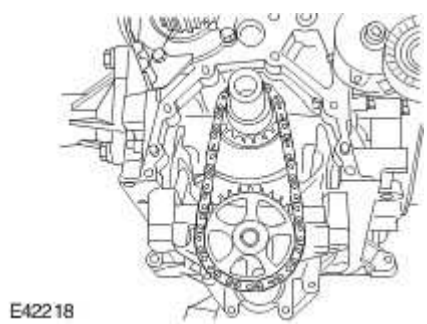
Axial play is restricted by means of two thrust plates on the crankshaft main bearing of cylinder 1.

The thrust plates have lubricating grooves which must be pointing towards the main bearing when installing them.

Oil pump



Item	Part Number	Description
1	-	Oil pump sprocket
2	-	Oil pump housing
3	-	Oil strainer
4	-	Pressure relief valve
5	-	Retaining bolts
6	-	Blanking plug



The oil pump is located on the front face of the engine and is housed inside the oil pan.

It is a rotor pump and is driven by the crankshaft via a short oil pump chain.

An oil pressure control valve is incorporated in the oil pump housing. It opens when the oil pressure reaches about 8 bar.

Oil filter/oil cooler unit

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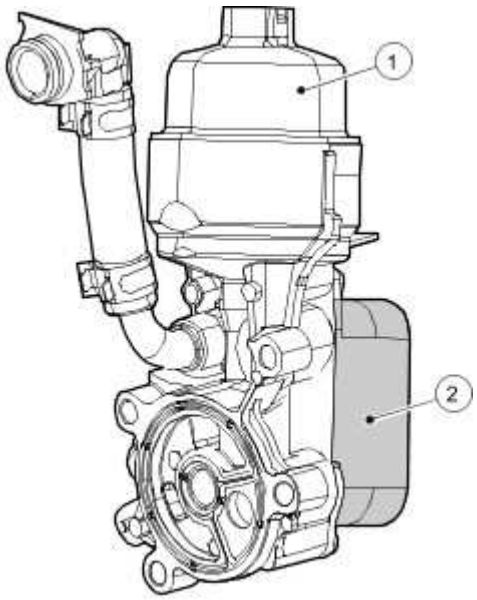


E41206

Item	Part Number	Description
1	-	Oil filter housing
2	-	Oil cooler

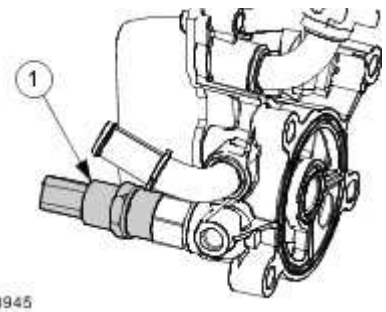
The oil cooler is an oil/coolant heat exchanger.

The oil filter/oil cooler unit is located on the side of the cylinder block in line with cylinder 2.

The oil filter element has a blanking plug which seals off the drain hole in the oil filter housing.

When changing the oil filter cartridge, the plug is removed with the oil filter cartridge. The oil can return to the oil pan through the housing, so that no pollution can be caused by leaking oil.

The oil filter/oil cooler unit is connected directly with the engine's coolant circuit by means of an adapter and connecting hose.



E43945

Item	Part Number	Description
1	-	Oil pressure switch

The oil pressure switch is on the right-hand side, beside the oil/coolant heat exchanger.

The oil pressure switch monitors the minimum oil pressure of 0.5 bar. If the system does not reach this pressure, the oil filter remains closed, for safety reasons.

Oil spray tubes

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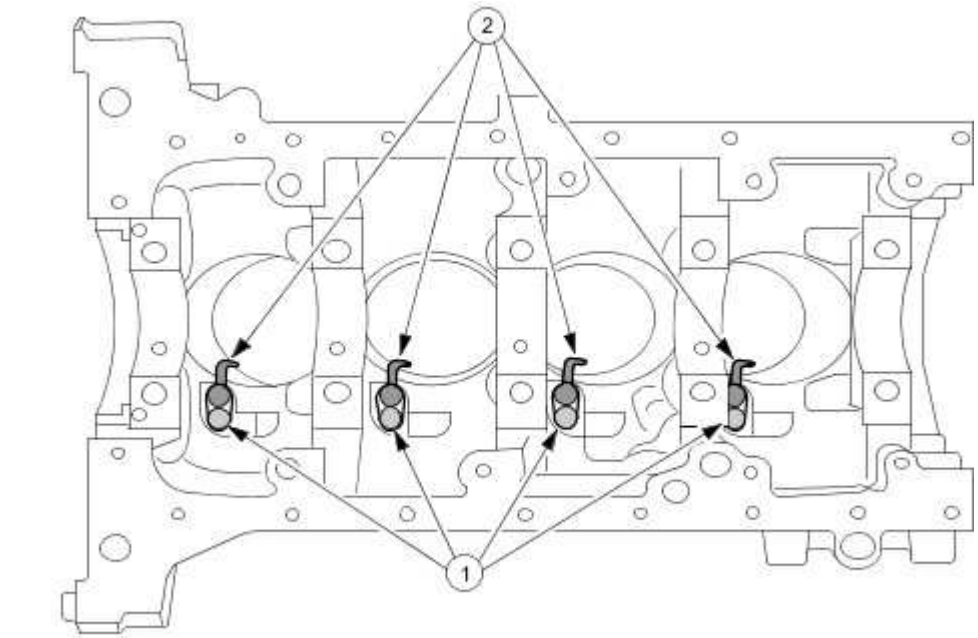

E42379

Item	Part Number	Description
1	-	Banjo bolts
2	-	Oil spray tubes

The piston skirts are cooled from below using oil from the oil spray tubes. The oil spray tubes are secured in the cylinder block with banjo bolts.

The banjo bolts are connected to the engine oil circuit.

Valves are built into the banjo bolts, and from a minimum oil pressure of about 0.5 bar they supply the oil spray tubes.

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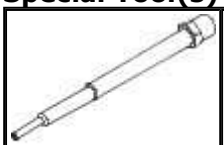
Diagnosis and Testing

Special Tool(s)

 E42936	Compression Test Adapter 303-1056

General Equipment

Ford diagnostic equipment

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Oil leaks • Fuel system leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts	• Fuse(s) • Loose or corroded connector(s) • Control module • Damaged or worn switch(es)

Symptom Chart

Symptom	Possible Sources	Action
Loss of oil	* Oil leaks on components that are either coated in oil themselves or on components local to them.	* CHECK for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if an oil leak is not evident. INSTALL new gaskets or components as required.
	* Internal or external leak at the oil cooler.	* CHECK the coolant expansion tank for a film of oil on the coolant surface. INSTALL a new oil cooler or oil cooler gasket.
	* Leak at the crankshaft seal.	* INSTALL a new crankshaft seal.
	* Leaks from oil carrying components or basic engine.	* CHECK for cracks in oil-carrying components of the basic engine by means of a UV leak test. INSTALL new components or seals as

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		necessary.
Oil consumption	* Use of the wrong type of engine oil.	* DETERMINE the last type of engine oil used and compare with the specification. Change the engine oil to the specification. REFER to: Specifications (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Specifications).
	* Faulty positive crankcase ventilation (PCV) system. - Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes more oil to enter the combustion chamber. - PCV oil separator is faulty and engine oil can enter the combustion chamber through the intake manifold.	* CHECK if the PCV system is operating correctly and repair as necessary. REFER to: Engine Emission Control (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Turbocharger seals.	* INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Damaged gaskets or mating surfaces. - Cylinder head gasket is damaged or mating face are warped. - Valve stem seals are worn and engine oil can enter the combustion chamber between the valve stem and the valve stem guide.	* CHECK the gaskets and mating surfaces for damage. - Remove the cylinder head. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).CHECK the mating faces, cylinder head gasket and the evenness of the cylinder head and engine block mating faces. - INSTALL new valve seals. REFER to: Valve Stem Seals (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Piston ring or cylinder liner wear.	* INSTALL new components as necessary.
	* Damaged cylinder liners or excessive clearance of engine components. - Pistons. - Piston rings (clearance in groove and end gap). - Cylinder liners.	* CHECK the running surfaces and clearances of the individual engine components. INSTALL new components as necessary. INSTALL a new cylinder block if necessary. * Check the pistons and piston rings.
Coolant	* Cooling system	* Check the cooling system components.

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consumption	components.	REFER to: Engine Cooling (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Oil cooler.	* INSTALL a new oil cooler.
	* Damaged gaskets or warped mating faces.	* CHECK the cylinder head gasket for damage. CHECK the cylinder head for distortion.
	* Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	* DETERMINE the damaged engine component (s) and install new component(s) as necessary.
Engine will not crank	* Battery or cables.	* CHECK the battery, bracket and cables.
	* Starter motor or cables.	* CHECK the starting system. REFER to: Starting System (303-06E Starting System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
Engine cranks but will not start	* Fuel tank is empty.	* CHECK the fuel level.
	* Water in fuel.	* Drain the water from the fuel system.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Engine intake air system.	* CHECK the intake air system.
	* Glow plug faulty.	* CHECK the glow plugs. INSTALL new glow plugs as necessary. REFER to: Glow Plug (303-07D Glow Plug System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Engine management system.	* CHECK the engine management system.
	* Incorrect valve timing.	* CHECK and adjust the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Broken or damaged timing belt/timing chain or pulley/sprocket.	* CHECK the timing belt/timing chain and sprockets/pulleys. INSTALL new components as necessary. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Very poor power output or fuel consumption too high or engine	* Fuel charging system.	* CHECK the fuel charging system. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi

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running rough.		(100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Engine intake air system.	* CHECK the intake air system.
	* Exhaust system blocked.	* CHECK the exhaust system. REFER to: Exhaust System (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Description and Operation).
	* Engine management system.	* CHECK the engine management system.
	* Turbocharger.	* CHECK the turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Incorrect valve timing. Timing belt/timing sprocket or pulley/sprocket damaged.	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Noisy running	* Engine auxiliary components loose or damaged.	* CHECK engine auxiliary components for damage or looseness. CHECK and adjust valve timing. INSTALL new components as necessary.REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Noisy running, misfiring or knocking	* Water in fuel or fuel contaminated.	* CHECK the fuel system for water or other contamination.
	* Valve timing incorrect, timing belt/chain or pulley/sprocket damaged.	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Noisy running or valve train noise	* Valve clearance too large due to faulty valve tappets or worn valve train components.	* INSTALL new hydraulic lash adjusters. REFER to: Camshafts (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Timing belt or timing chain damaged.	* INSTALL a new timing belt or timing chain. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L

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		Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Timing belt or timing chain incorrectly tensioned.	* CHECK the timing belt tension. INSTALL a new timing belt or timing chain as necessary. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Noisy running or engine noise	* Engine components - Pistons. - Piston rings. - Connecting rod big end, main bearing or thrust bearing journals. - Connecting rods bent or damaged.	* CHECK the engine components for wear or damage. Make sure all components are within specification. INSTALL new components as necessary. REFER to: Specifications (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Specifications).

Engine - Oil Leaks

NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.
If the oil leak cannot be identified clearly by a visual inspection, carry out an ultraviolet (UV) test:

Ultraviolet (UV) Testing

1. **1.** Clean the engine and transmission with a suitable cleaning fluid.
2. **2.** Pour the UV-test fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.
3. **3.** Start the engine and let it run for about five minutes.
4. **4.** Switch off the engine.

NOTE: If no leak can be found, road test the vehicle under various loads and check the engine for leaks again.

5. **5.** Check the engine for oil leaks using a suitable UV lamp.
6. **6.** Rectify any leaks found and check the engine for oil leaks.

Measure the compression pressure

WARNING: Do not carry out any repairs to the fuel injection system without checking that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater. Failure to follow these instructions may result in personal injury.
NOTE: The powertrain control module (PCM) receives an error message when the fuel pump relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory using the Ford diagnostic equipment after completing the compression test.
NOTE: Valve clearance must be set correctly before performing a compression test. Make sure the engine is at the normal operating temperature.

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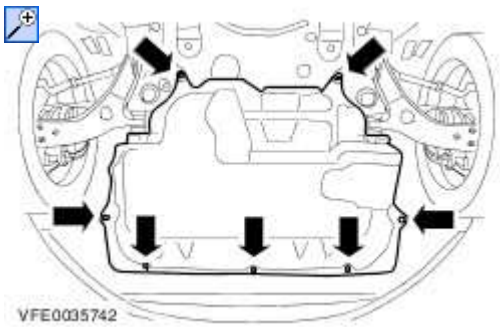
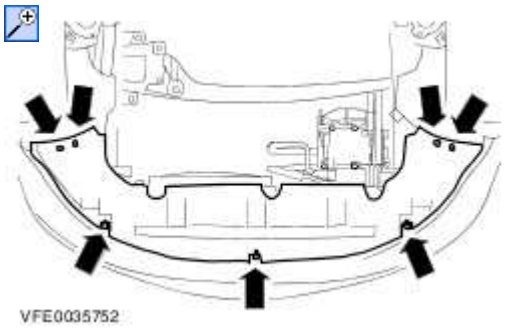
NOTE: The varying design of compression checking devices and fluctuating starter motor speeds normally only allows for a comparison to be made of the compression pressures in all cylinders.

1. **1.** Using datalogger in the Ford diagnostic equipment, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater.

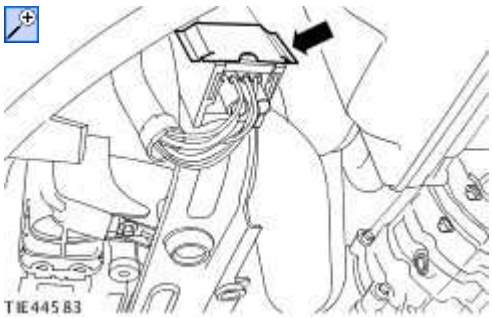
2. **2.** Raise and support the vehicle. REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).



3. **3.** Remove the engine undershield.



4. **4.** Remove the radiator undershield.



5. **5.** Remove the glow plug relay.

6. **6.** Lower the vehicle.

7. **7.** Remove the cowl panel grille.
   REFER to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

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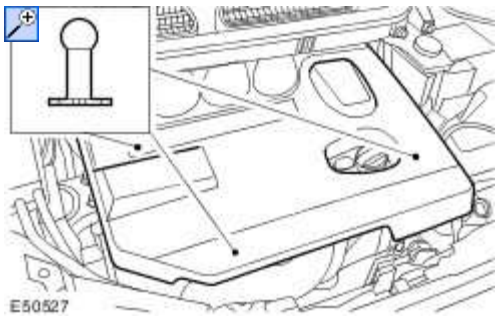
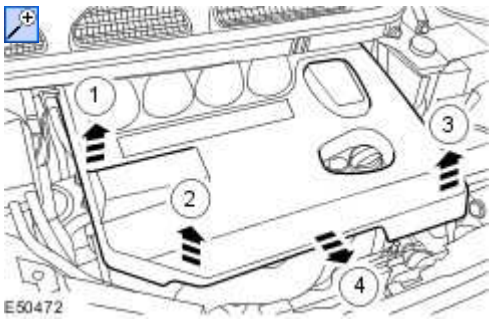
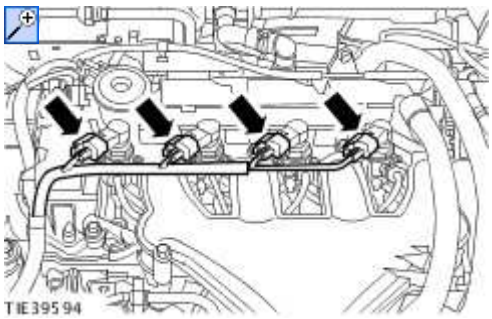


8. NOTE: The engine upper cover is held in place by 3 ball clips. The ball clips are not vertical, but are angled backwards by approximately 20 degrees.
   8. Location of the engine upper cover ball clips.



9. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. If the ambient temperature is below 0°C, detach the engine upper cover with extreme caution. Failure to follow this instruction may cause the engine upper cover to be damaged.
   NOTE: Only remove and install the engine upper cover in the sequence shown.
   9. Remove the engine upper cover.
   - Detach the engine upper cover ball clips in the sequence shown.



10. CAUTION: Do not disconnect the fuel injection pump electrical connectors and crank the engine.
    10. Disconnect the fuel injector electrical connectors.

11. **11.** Remove the exhaust gas recirculation (EGR) cooler. REFER to: Exhaust Gas Recirculation (EGR) Cooler (303-08C Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

12. **12.** Remove the EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L

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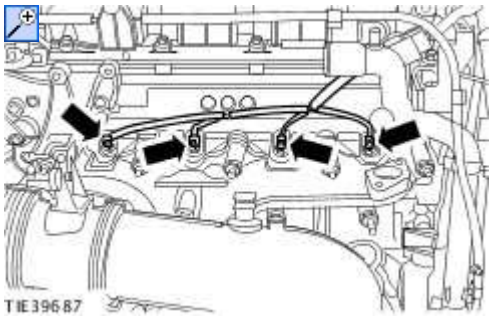
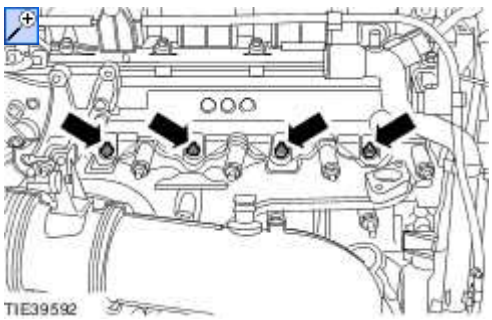
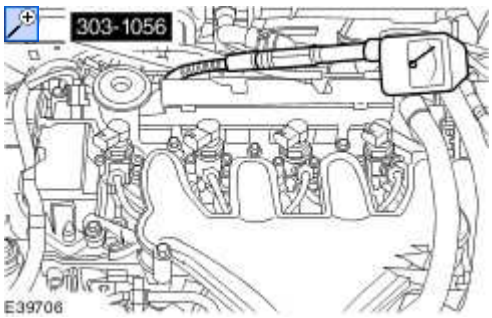
Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



13. **13.** Remove the glow plug power supply.



14. **14.** Remove the glow plugs.



15. **15.** Install the special tool and a suitable compression tester into the glow plug bore.

NOTE: Crank the engine with the starter motor until the pointer on the compression tester stops rising.

16. **16.** Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions.

17. **17.** Detach the compression tester and the special tool.

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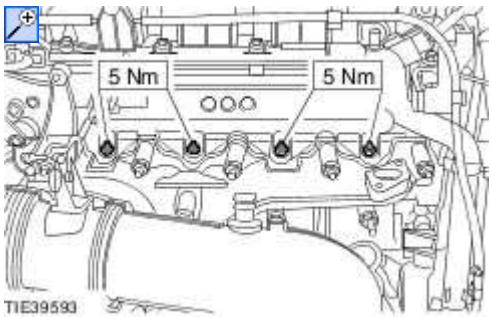
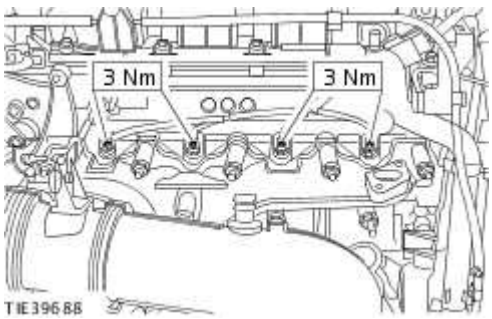


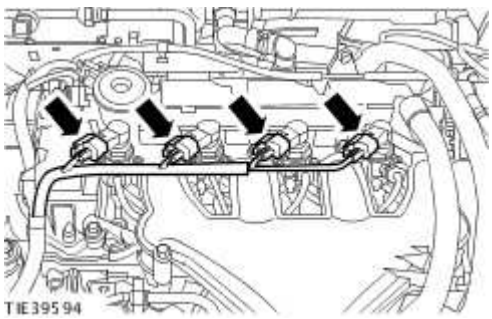
18. **18.** Install the glow plugs.



19. **19.** Install the glow plug power supply.

20. **20.** Install the EGR valve.
    REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

21. **21.** Install the EGR cooler. REFER to: Exhaust Gas Recirculation (EGR) Cooler (303-08C Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



22. **22.** Connect the fuel injector electrical connectors.

23. **23.** Apply soap solution to the ball clip mountings in the engine upper cover.
    - Soap solution (maximum concentration of soap in water 1:200).

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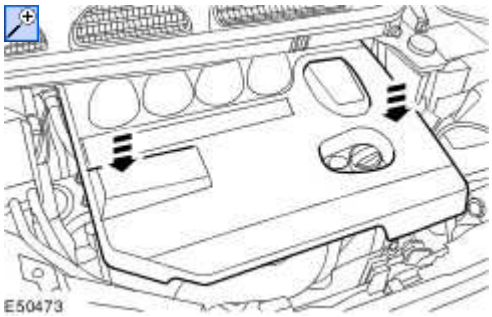
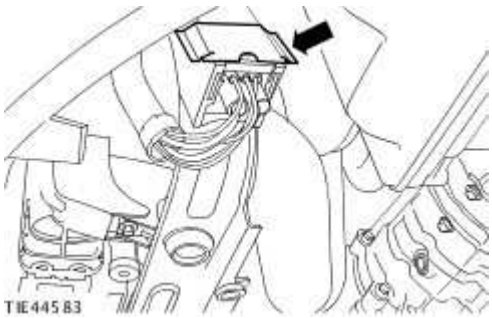


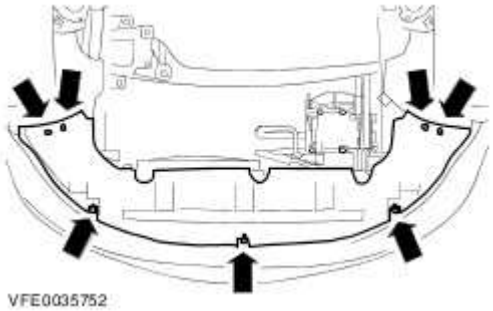
24. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. Failure to follow this instruction may cause the engine upper cover to be damaged.
24. Put the engine cover into installation position and clip it in place by pressing at the places shown.
    - Make sure that the engine upper cover is fully engaged in the area of the fuel filter, if necessary apply more pressure in the areas shown.

25. **25.** Install the cowl panel grille.
REFER to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

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



27. **27.** Install the glow plug relay.



28. **28.** Install the radiator undershield.

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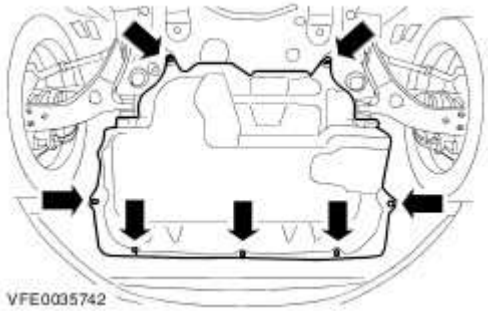


29. **29.** Install the engine undershield.

30. **30.** Lower the vehicle.

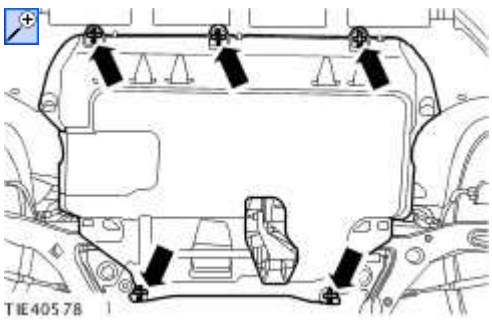
31. **31.** Reset the PCM fault memory.

Measure the oil pressure (21 113 0)

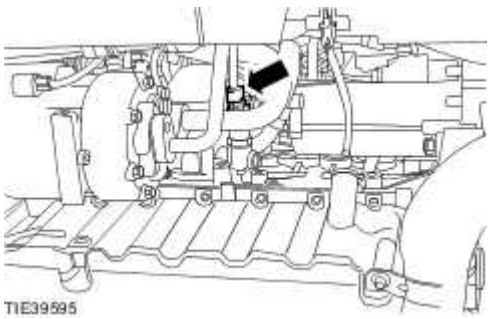
The oil pressure depends on various factors (engine speed, oil temperature, oil viscosity, amount of oil filter contamination etc.).

Measure the oil pressure

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



2. **2.** Remove the engine under shield.



3. **3.** Disconnect the oil pressure switch electrical connector.

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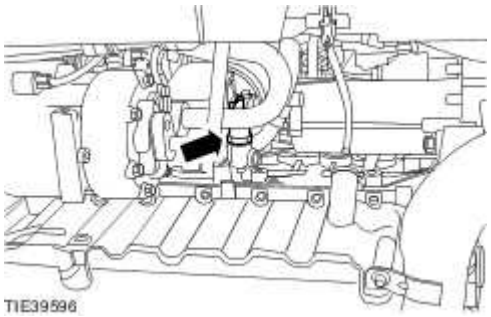
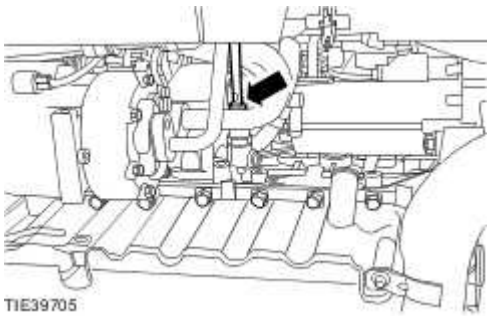
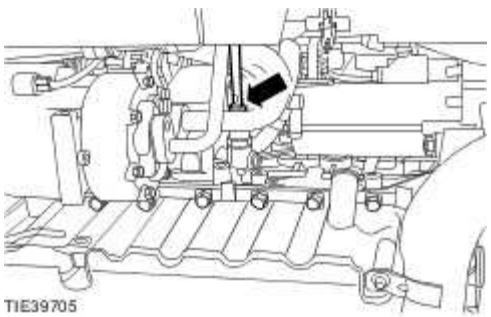


4. **4.** Remove the oil pressure switch.



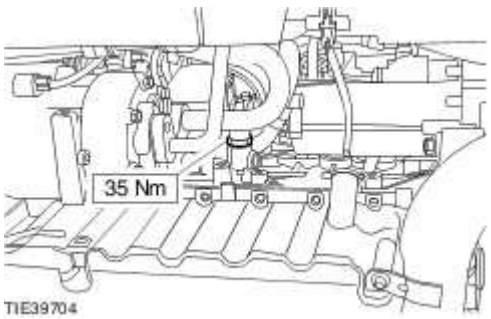
5. **5.** Attach the oil pressure gauge with the oil pressure gauge connector.

6. NOTE: Measure the oil pressure at the specified engine speed. Measure the oil pressure at an oil temperature of 80° C.
   NOTE: Measure the oil pressure at 2000 rpm and at 4000 rpm.
   NOTE: Oil pressure at 2000 rpm: 2.0 bar.
   NOTE: Oil pressure at 4000 rpm: 4.0 bar.
   6. Check the oil pressure.



7. **7.** Detach the oil pressure gauge and the oil pressure gauge connector.

8. **8.** Coat the oil pressure switch with adhesive.



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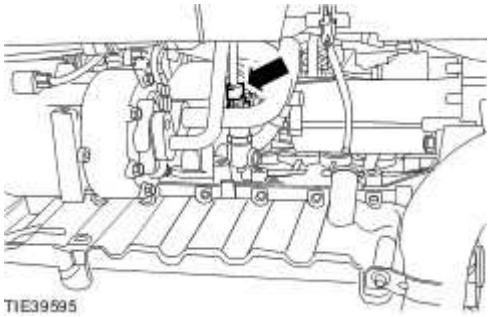
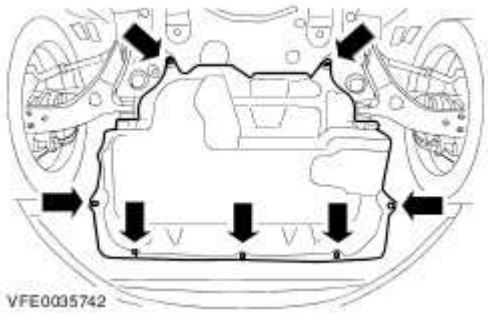
9. **9.** Install the oil pressure switch.



10. **10.** Connect the oil pressure switch electrical connector.



11. **11.** Install the engine under shield.

12. **12.** Lower the vehicle.

Valve train analysis - static (engine off)

Remove the valve cover.

Check all valve train components for damage and wear. Ensure that only original components are installed and that all bolts and nuts have been tightened to the correct tightening torque. REFER to: Specifications (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Specifications).

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Removal and Installation

Removal

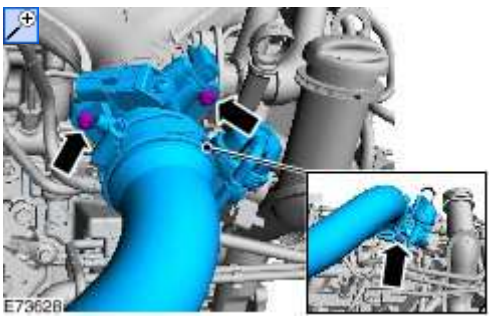
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the cowl panel grille.

   Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

2. Disconnect the battery ground cable.

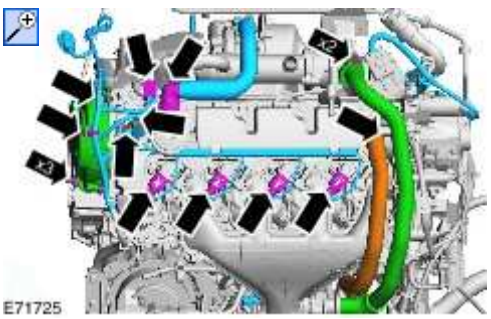
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



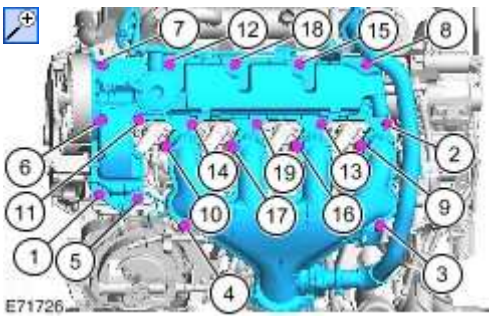
3. *Torque:* 10 Nm

4. Clean the area around the fuel injectors.

   Refer to: Fuel Injection Component Cleaning (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, General Procedures).



5. *Torque:* 10 Nm



6.

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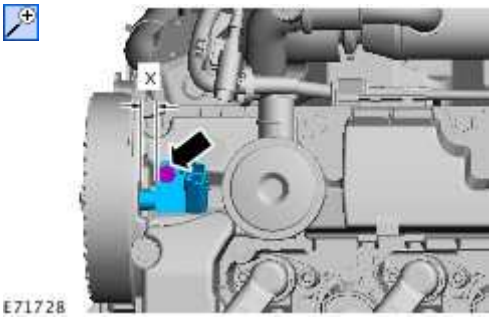
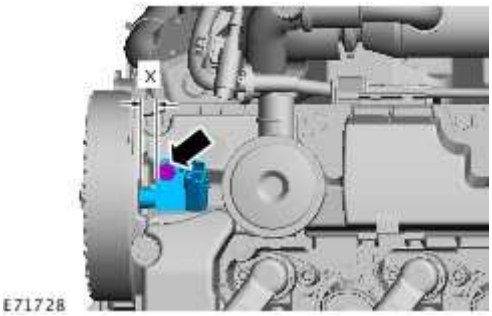
Installation

1. *Torque:*
   Stage 1: 5 Nm
   Stage 2: 9 Nm



2. If installing a new camshaft position (CMP) sensor, position the CMP sensor so that the tip of the sensor is in contact with the camshaft pulley and tighten the retaining bolt.

   Torque: 2 Nm



3. If installing the original CMP sensor, position the CMP sensor so that the tip of the sensor is in contact with the camshaft pulley.

   Torque: 2 Nm

4.
   - Measure the distance between the CMP sensor and the intake manifold (X).
   - Pull back the CMP sensor until the distance between the CMP sensor and the intake manifold = X + 1.2 mm, and tighten the retaining bolt.

5. To install, reverse the removal procedure.

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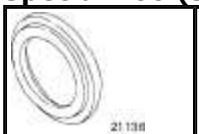
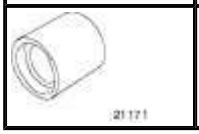
Removal and Installation

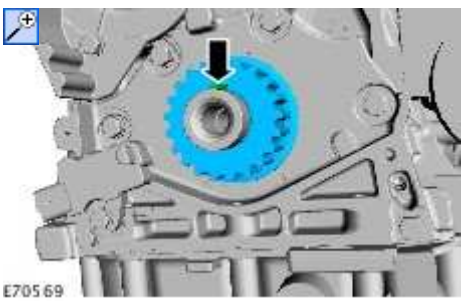
Special Tool(s)

	303-255 Installer, Timing Cover Seal
	303-293 Remover, Crankshaft Seal
	303-395 Installer, Crankshaft Seal

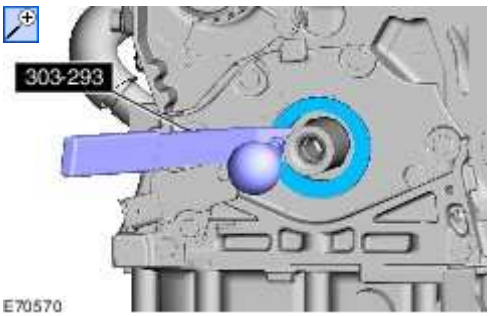
Removal

1. Remove the timing belt.

   Refer to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

2. 

3. *Special Tool(s):* 303-293



Installation

1. *Special Tool(s):* 303-255, 303-395

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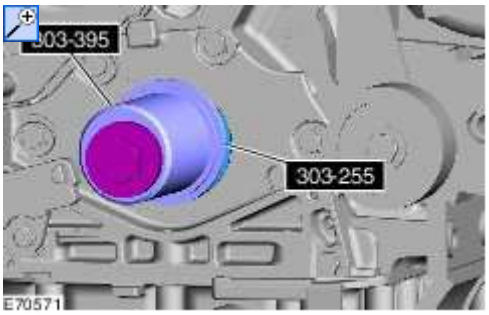

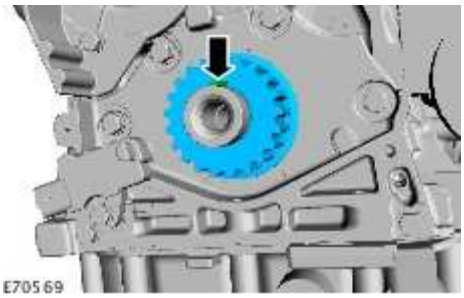

2.

3. Install the timing belt.

   Refer to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

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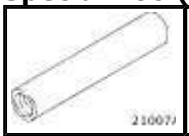
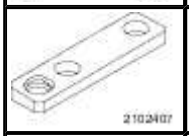
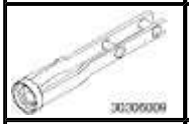
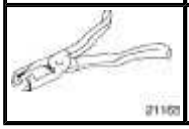
Removal and Installation

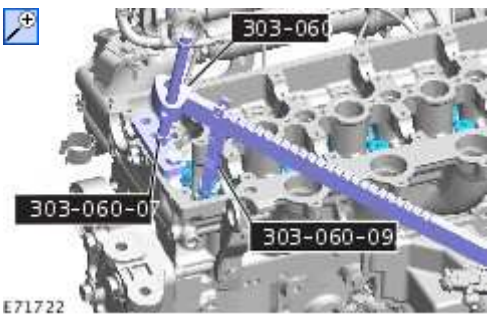
Special Tool(s)

	303-037 Installer, Valve Stem Seal
	303-060 Compressor, Valve Spring
	303-060-07 Adapter for 303-060
	303-060-09A Adapter for 303-060
	303-390 Pliers, Valve Stem Seal

Removal

1. Remove the camshafts.

   Refer to: Camshafts (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
2. Position the appropriate piston at top dead center (TDC).
3. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A



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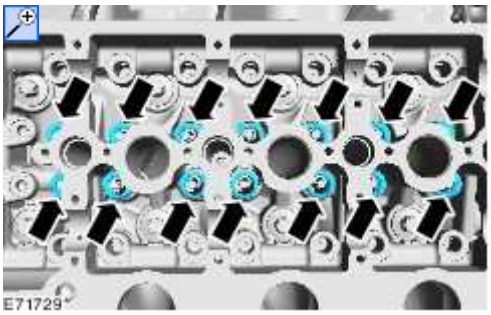
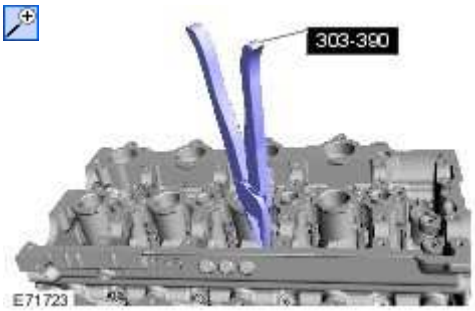
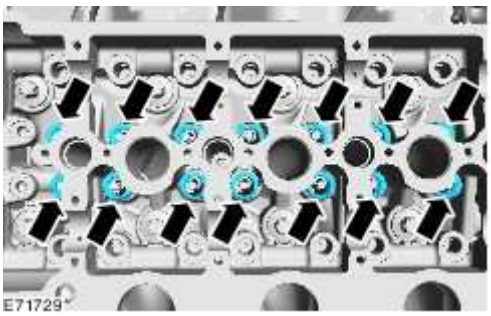




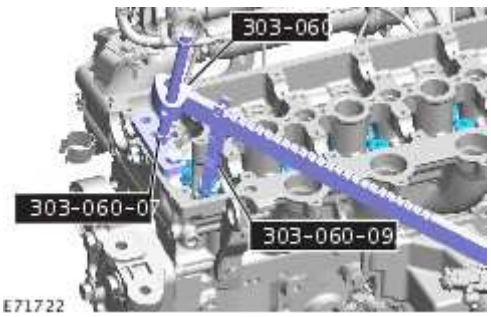
5. *Special Tool(s):* 303-390

Installation

1. *Special Tool(s):* 303-037



2.



3. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

4. Install the camshafts.

   Refer to: Camshafts (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission

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	Requirements: Stage IV, Removal and Installation).

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Removal and Installation

Special Tool(s)

	100-010 Remover, O-Ring Seal

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

1. Remove the following items:
    1. Refer to: Intake Manifold (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    2. Refer to: Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    3. Refer to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    4. Refer to: Camshaft Seal (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

2.

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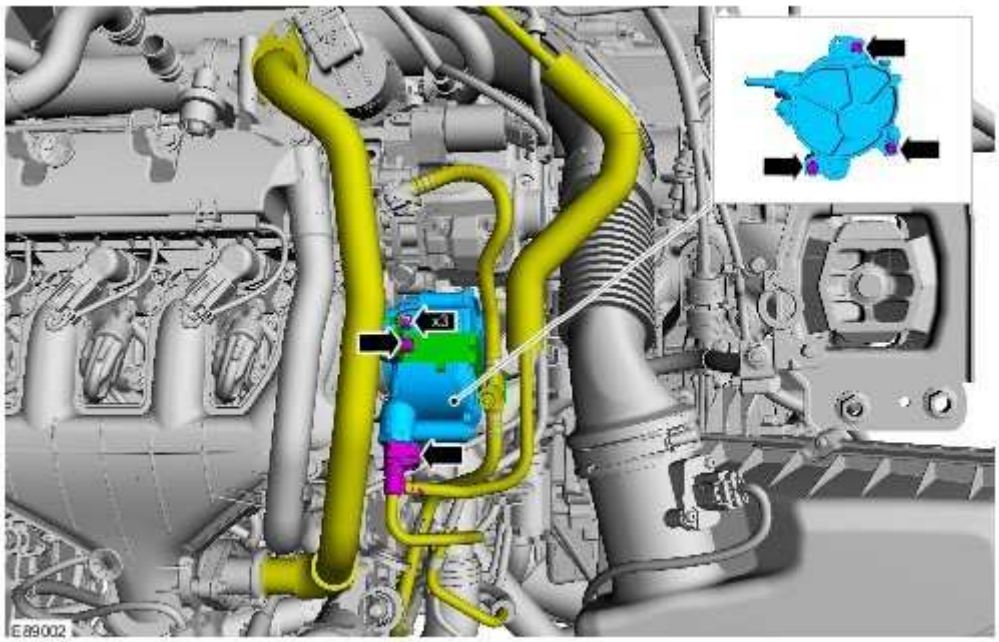
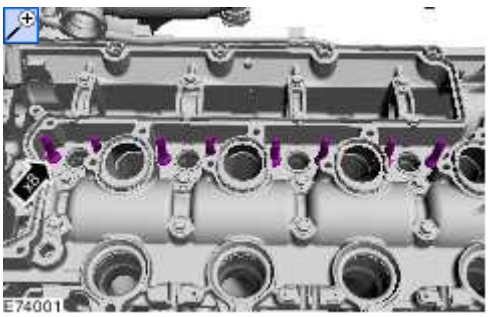
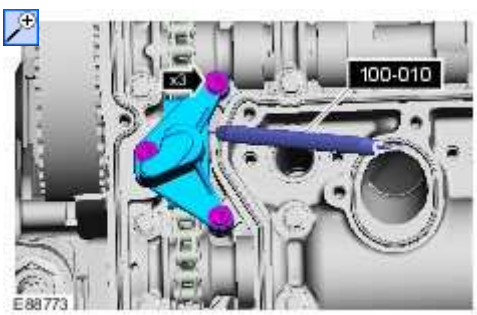
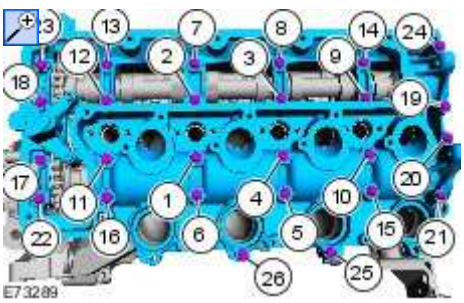




3.



4. *Install the Special Tool(s):* 100-010



5.

6. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

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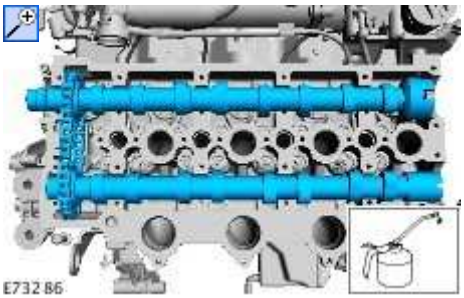
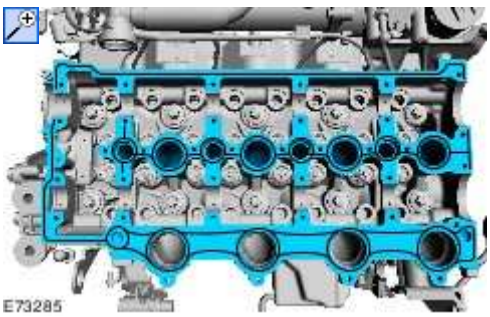
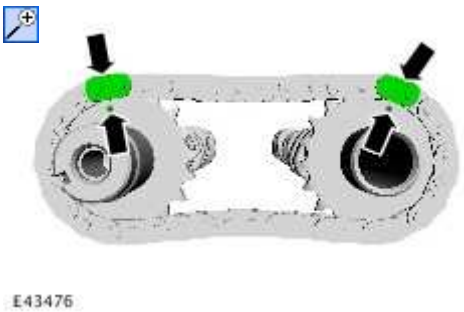


Installation



1. NOTE: The component must be installed within 5 minutes of applying the sealant.
   Apply a 3 mm bead of sealant to the cylinder head.

   Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



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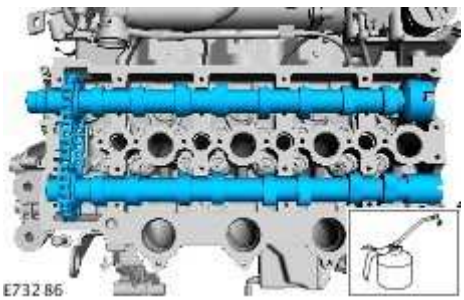

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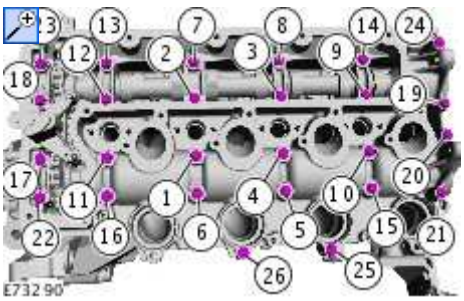

4. *Torque:*
   Stage 1: 5 Nm
   Stage 2: 10 Nm

5. *Remove the Special Tool(s):* 100-010
   Torque: 6 Nm

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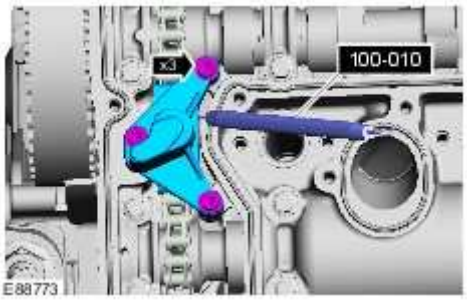
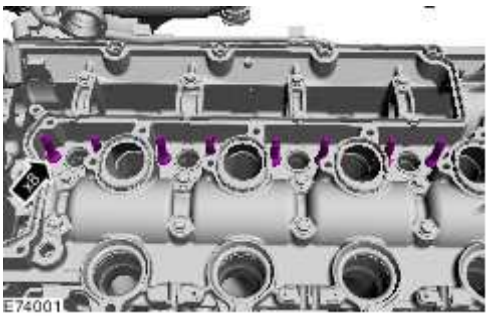
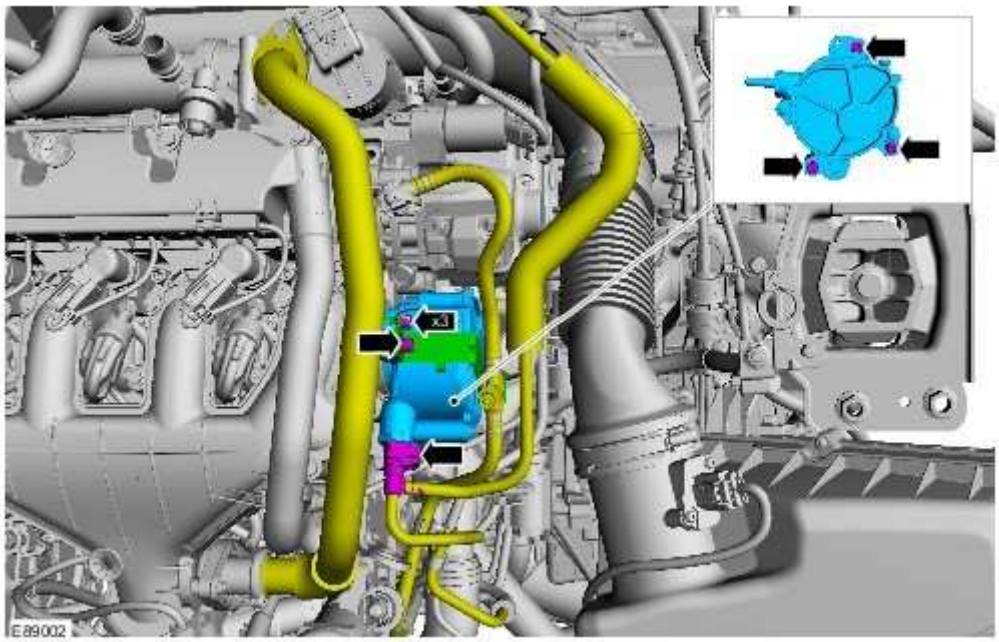




6. *Torque:* 10 Nm



7. *Torque:* 25 Nm

8. Install the following items:
    1. Refer to: Camshaft Seal (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    2. Refer to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    3. Refer to: Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-

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TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

4. Refer to: Intake Manifold (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

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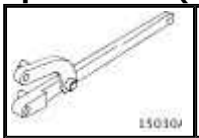
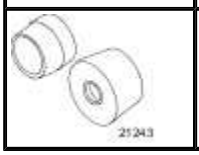
Removal and Installation

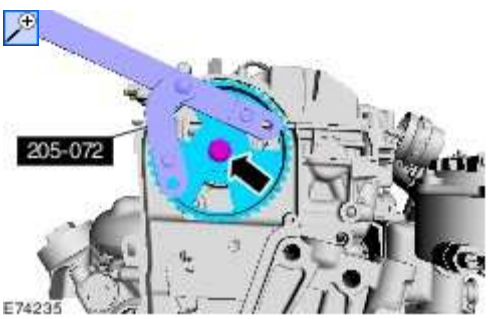
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-174 Gauge, Bolt Angle
	303-293 Remover, Crankshaft Seal
	303-684 Installer, Crankshaft Front Seal

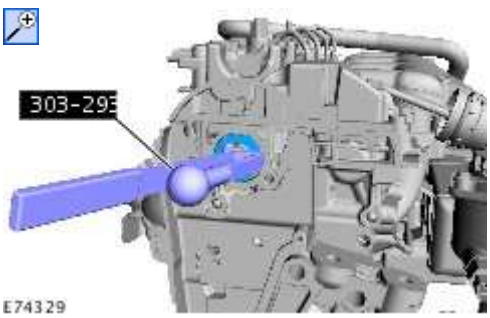
Removal

1. Remove the timing belt.

   Refer to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



2. *Special Tool(s):* 205-072



3. *Special Tool(s):* 303-293

Installation

1. *Special Tool(s):* 303-684

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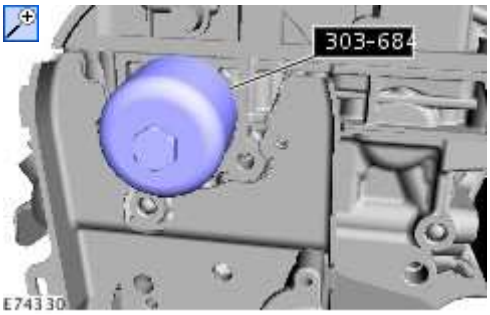

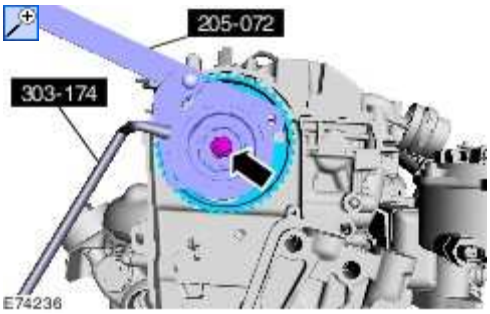

2. *Special Tool(s):* 303-174, 205-072
   Torque:
   Stage 1: 20 Nm
   Stage 2: 60°

3. Install the timing belt.

   Refer to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

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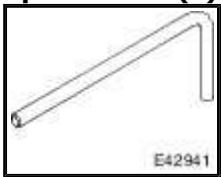
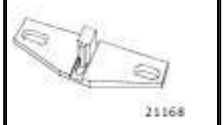
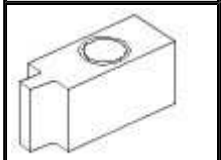
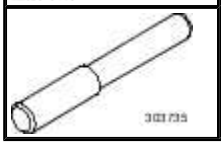
Removal and Installation

Special Tool(s)

 E42941	303-1059 Alignment Peg, Crankshaft
 21168	303-393 Locking Tool, Flywheel
 E42909	303-393-01 Adapter for 303-393
	303-735 Alignment Peg, Camshaft

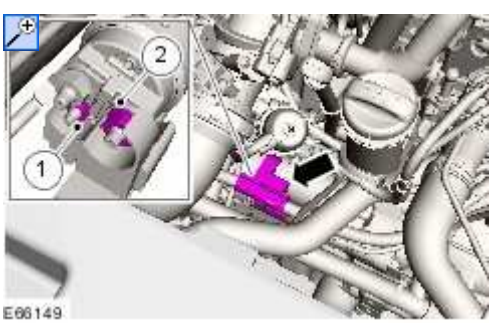
General Equipment

Trolley jack

Removal

1. Disconnect the battery.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
3. 

E66149

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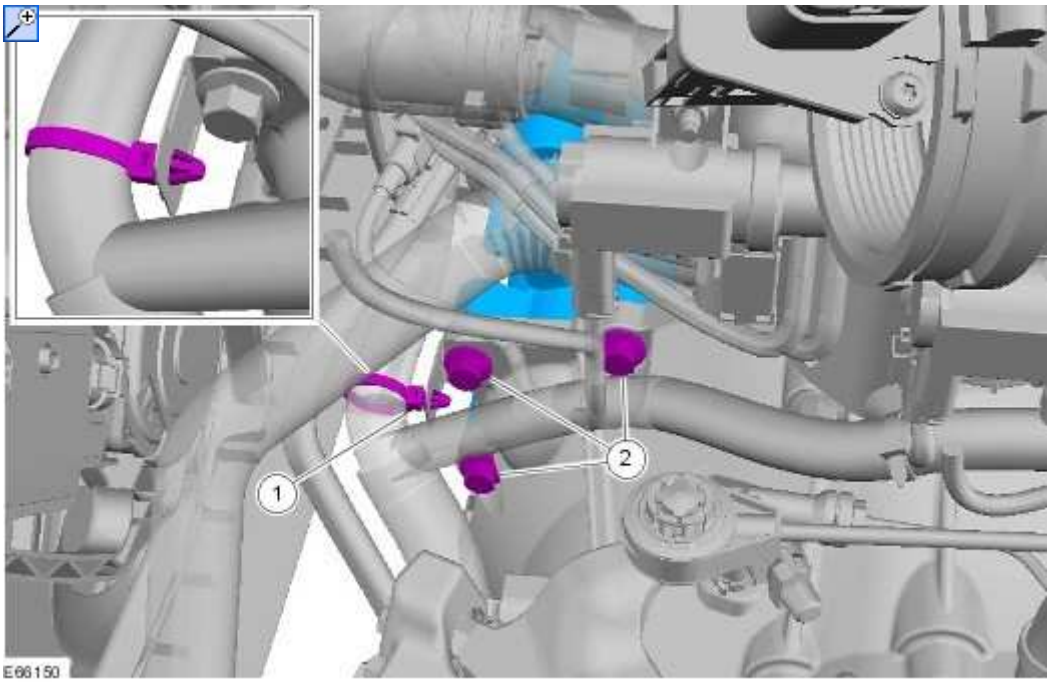
4.



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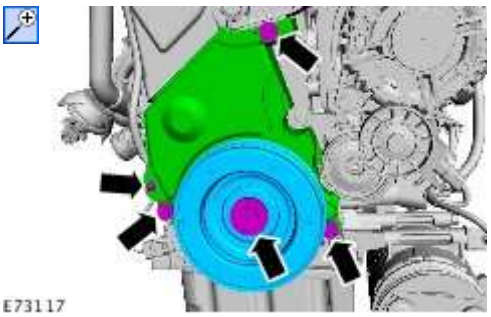
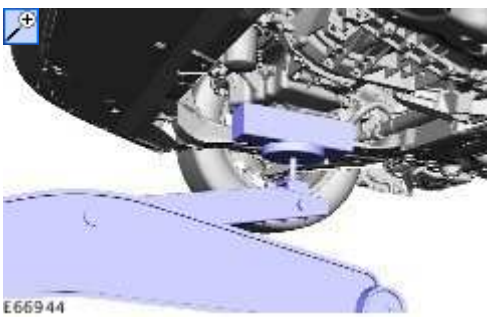
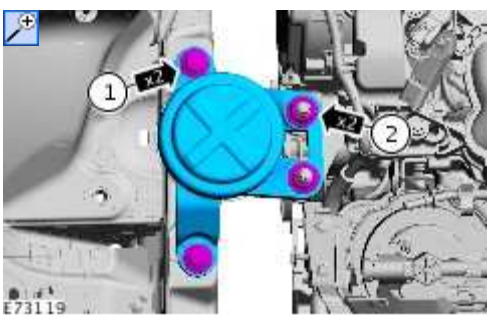


6. *General Equipment:* Trolley jack



7.



8.

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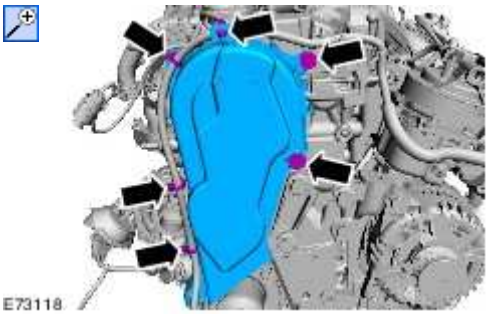
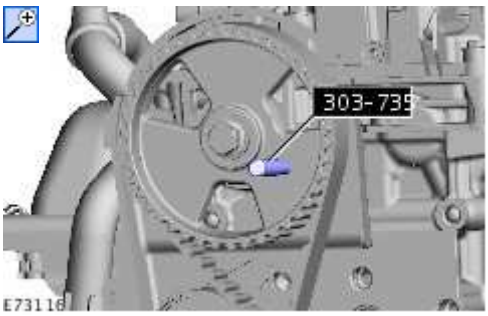
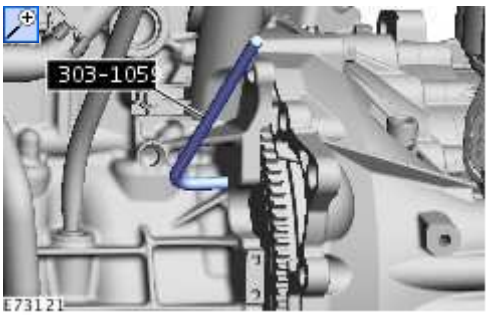
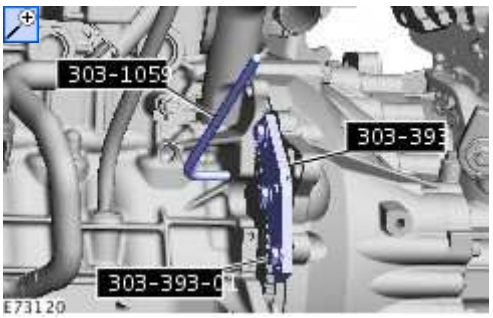




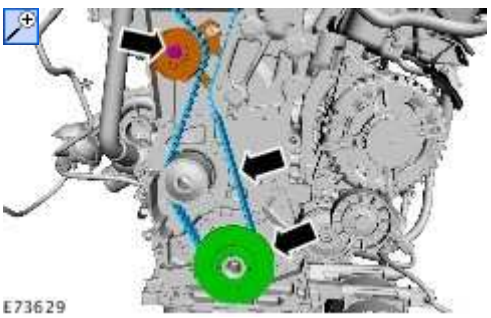
9. *Special Tool(s):* 303-735



10. CAUTION: Make sure that the crankshaft is not rotated while the special tool is installed.
Special Tool(s): 303-1059



11. *Special Tool(s):* 303-1059, 303-393, 303-393-01



12. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.

13.

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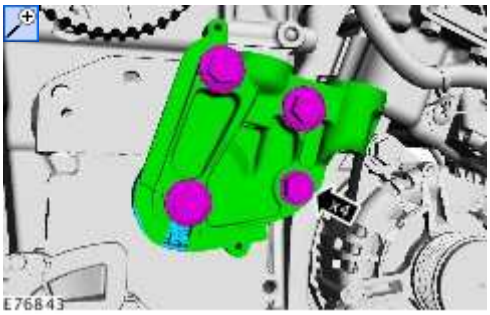
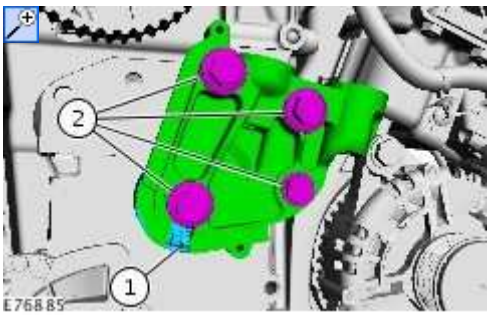
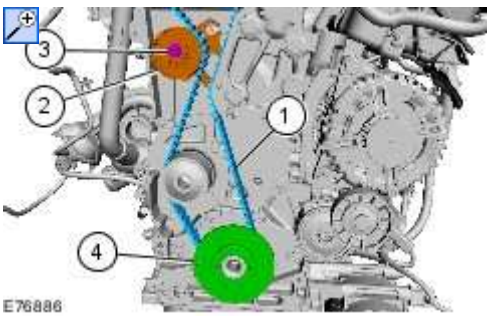


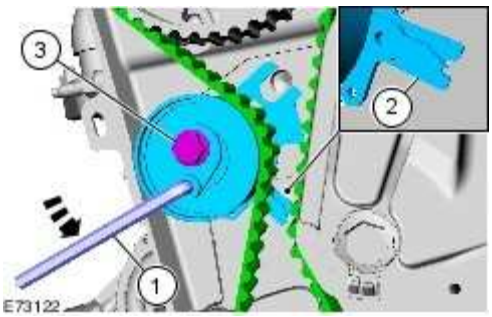
Installation



1.
   1. NOTE: Make sure that a new component is installed.
   2. *Torque:* 56 Nm



2.
   1. NOTE: Make sure that a new component is installed.
   2. NOTE: Make sure that a new component is installed.
   3. NOTE: Only tighten the bolt finger tight at this stage.
   4. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.



3.
   1. Allen key, 6mm
   3. *Torque:* 21 Nm

4. *Torque:* 50 Nm

5. Remove the special tools.

   Special Tool(s): 303-1059, 303-393, 303-393-01

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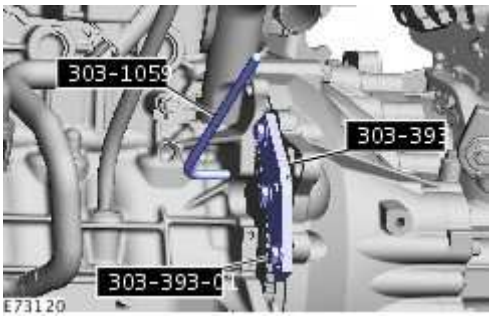
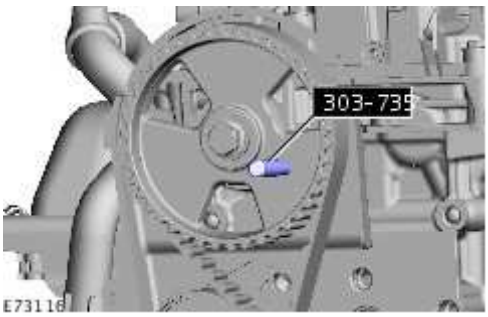
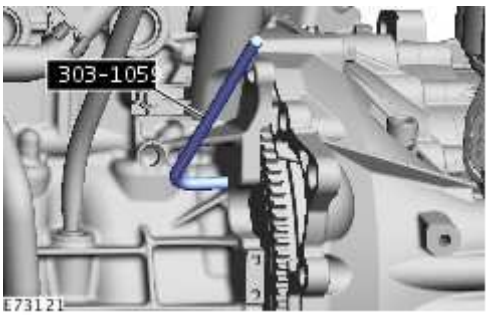




6. Remove the special tool.

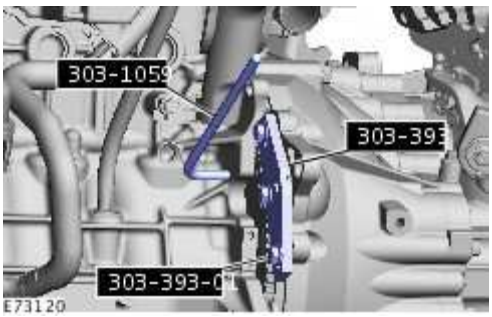
   Special Tool(s): 303-735

7. CAUTION: Only rotate the crankshaft clockwise.
   Rotate the crankshaft 4 revolutions.



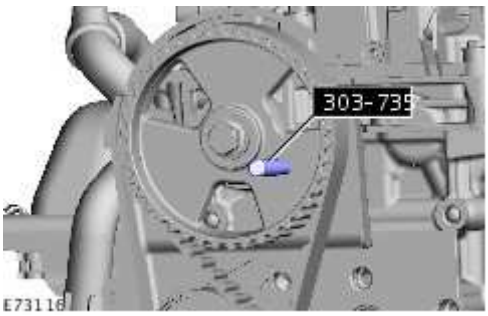
8. NOTE: The special tool can only be installed if the valve timing is correct.
   Install the special tool.

   Special Tool(s): 303-1059



9. Install the special tools.

   Special Tool(s): 303-1059, 303-393, 303-393-01



10. NOTE: The special tool can only be installed if the valve timing is correct.
    Install the special tool.

    Special Tool(s): 303-735

11.

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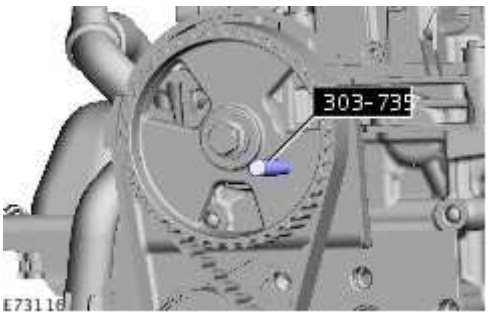
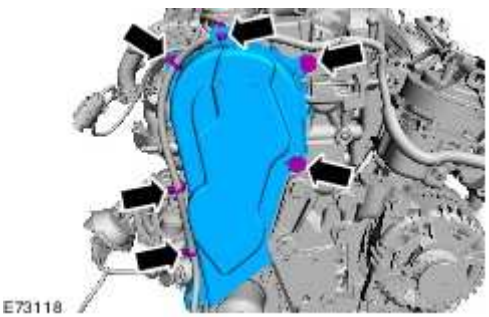
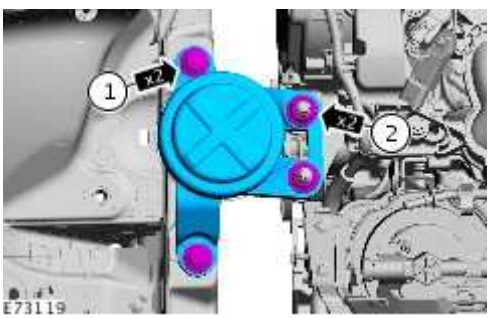


12. Remove the special tool.

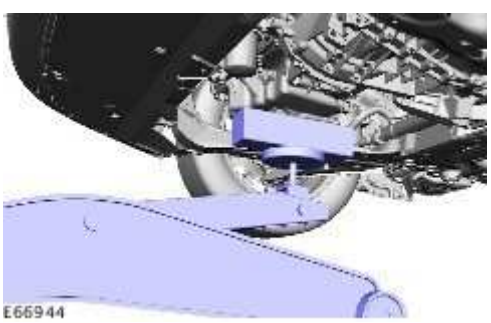
    Special Tool(s): 303-735



13. *Torque:* 7 Nm



14.
    1. NOTE: Only tighten the bolts finger tight at this stage.
    2. *Torque:* 133 Nm



15. Lower and remove the Trolley jack.

    General Equipment: Trolley jack

16. *Torque:* 90 Nm

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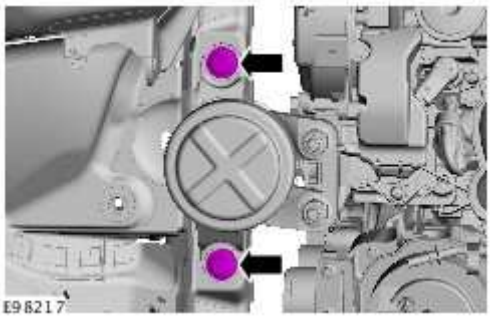
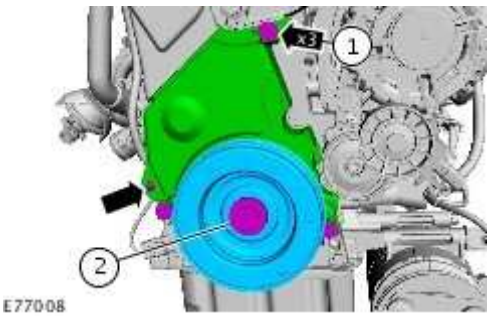
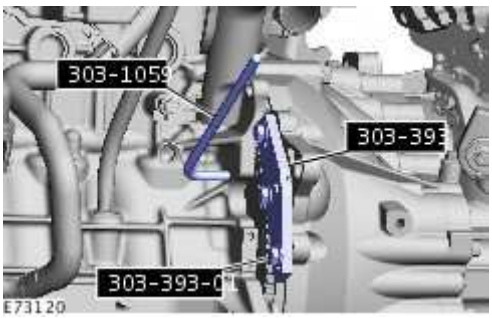




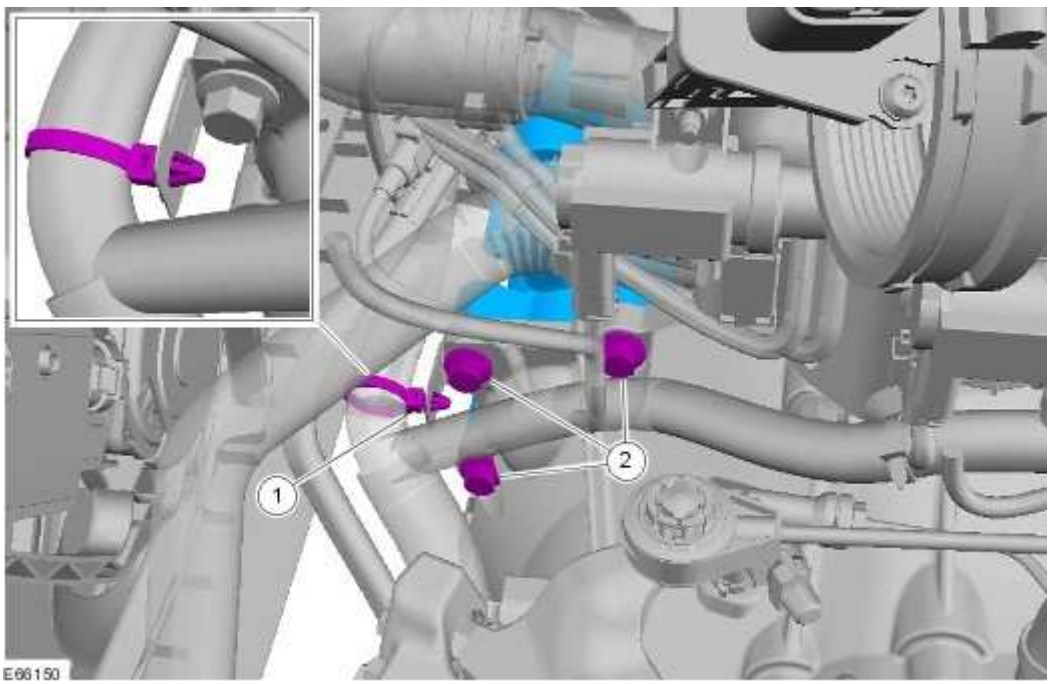
17.

1. *Torque:* 7 Nm
2. NOTE: Make sure that a new component is installed.
   Torque:
   Stage 1: 70 Nm
   Stage 2: 60°



18. Remove the special tools.

Special Tool(s): 303-1059, 303-393, 303-393-01



19. *Torque:* 40 Nm

20.

1. *Torque:* 6 Nm
2. *Torque:* 12 Nm

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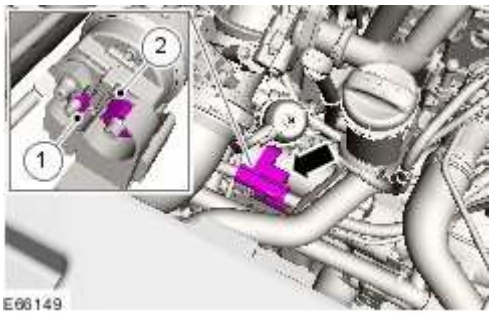

21. Install the accessory drive belt.

    Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

22. Connect the battery.

    Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

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Removal and Installation

Removal

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

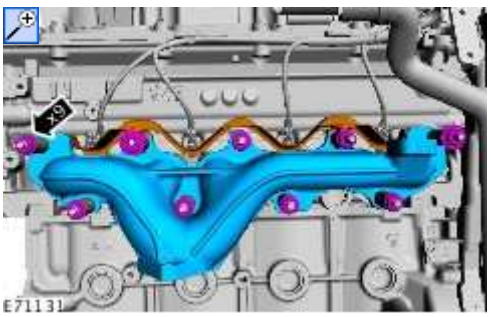
1. Disconnect the battery.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the following items:
   1. Exhaust gas recirculation (EGR) cooler.

      Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
   2. Turbocharger

      Refer to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



3. NOTE: Install new nuts and a new gasket.
   Torque: 30 Nm

Installation

1. To install, reverse the removal procedure.

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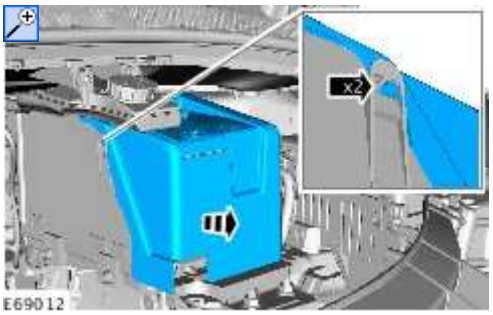
Removal and Installation

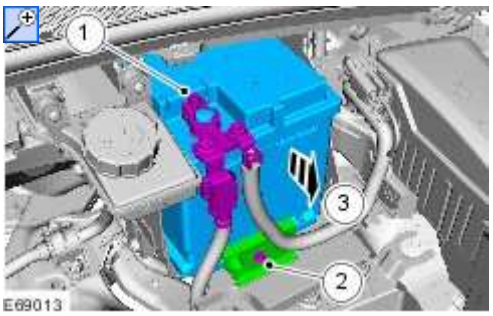
Removal

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

1. Remove the catalytic converter.

   Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

2. 

3. 

   Torque:
   1 5 Nm
   2 10 Nm

4. *Torque:* 5 Nm

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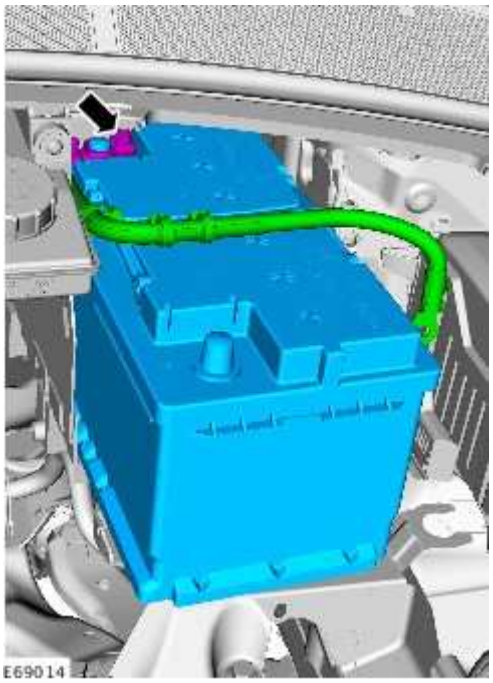

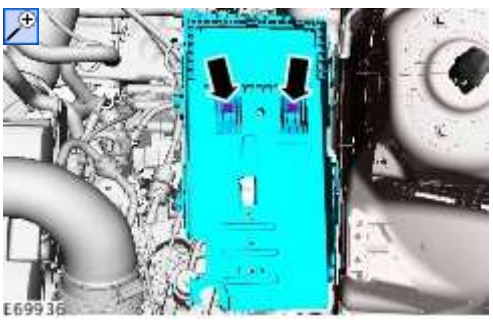

5.

6. Remove the following items:
    1. Fuel filter

       Refer to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
    2. Thermostat housing

       Refer to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
    3. Exhaust manifold

       Refer to: Exhaust Manifold (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

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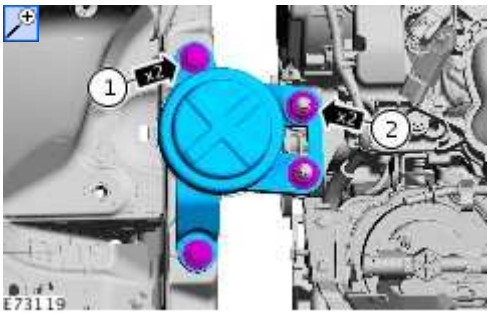
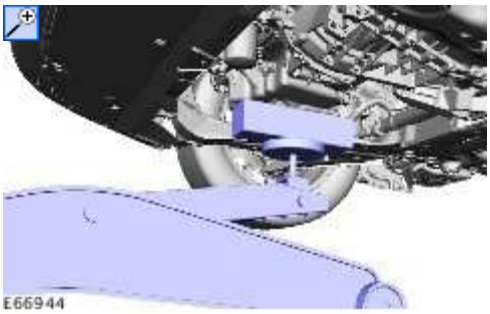


7. NOTE: Only tighten the bolts finger tight at this stage.



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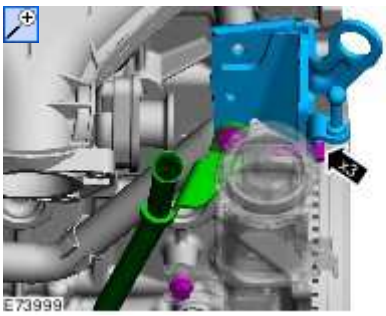
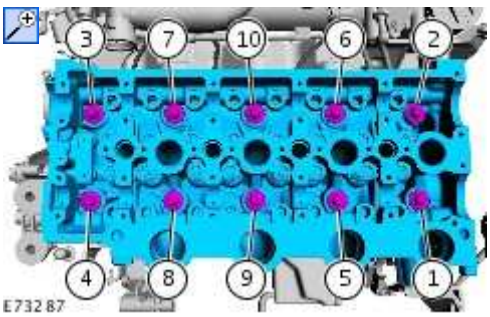


9. *Torque:* 10 Nm

10. Remove the camshafts.

    Refer to: Camshafts (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



11.

Installation

1. NOTE: Make sure that a new component is installed.

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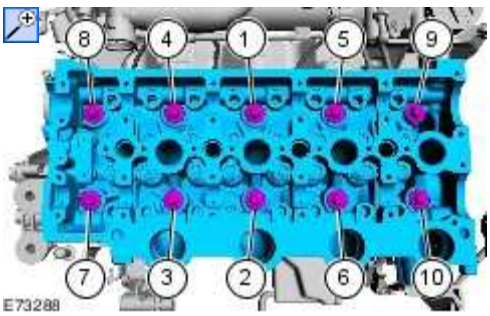
E73625



E73288

2. CAUTION: Make sure that new cylinder head bolts are installed.
   Tighten the cylinder head bolts in two stages in the sequence indicated.

   Torque:
   Stage 1: 60 Nm
   Stage 2: 220°

3. To install, reverse the removal procedure.

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Removal and Installation

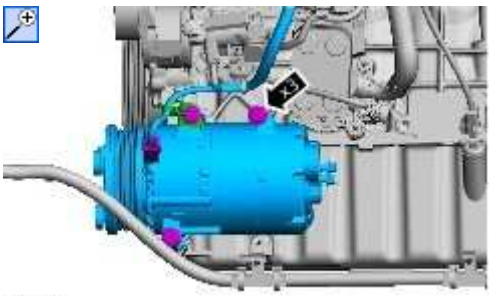
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

1. Raise and support the vehicle.

   Refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05E Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
3. 
E73855
4.
E73856
5.

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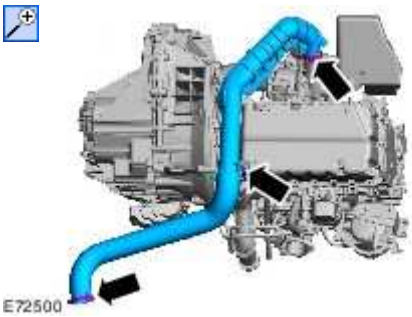
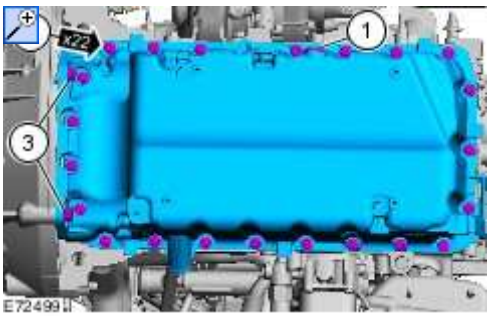
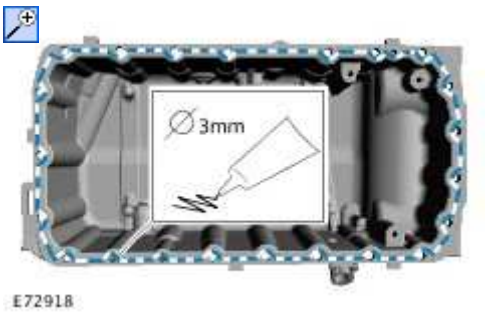


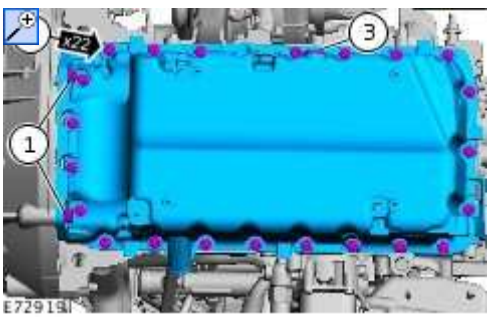


6.

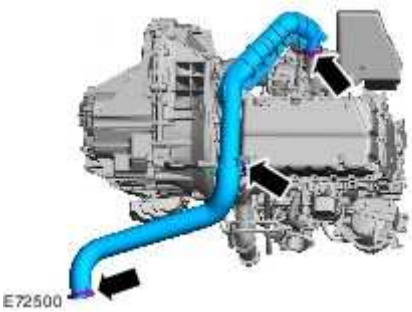
Installation



1. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



2. Install the following items:
    1. *Torque:* 48 Nm
    2. *Torque:* 16 Nm
    3. *Torque:* 34 Nm



3. *Torque:* 10 Nm

4. *Torque:* 48 Nm

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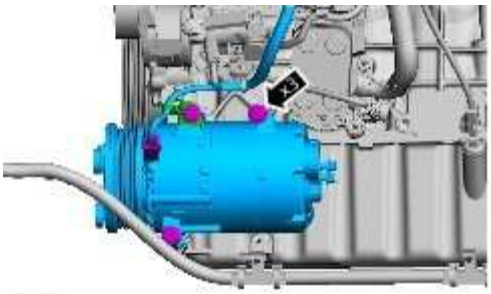
E73856



E73855

5. *Torque:* 28 Nm

6. Install the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05E Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

7. Fill the engine with engine oil.

   Material: Engine Oil - 5W-30 (WSS-M2C913-B)

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Removal and Installation

Materials

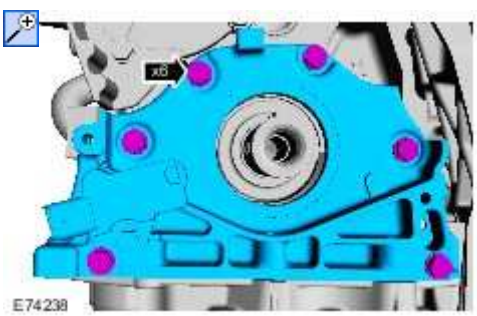
Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal

1. Remove the following items:
   1. Oil pan.

      Refer to: Oil Pan (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
   2. Crankshaft front seal.

      Refer to: Crankshaft Front Seal (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



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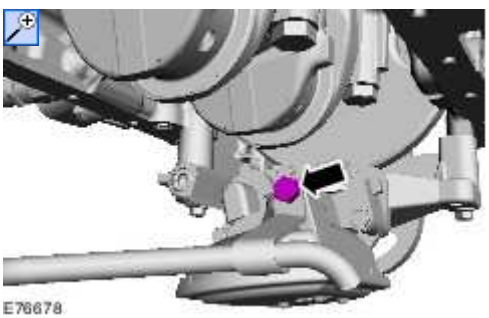

3.

4.

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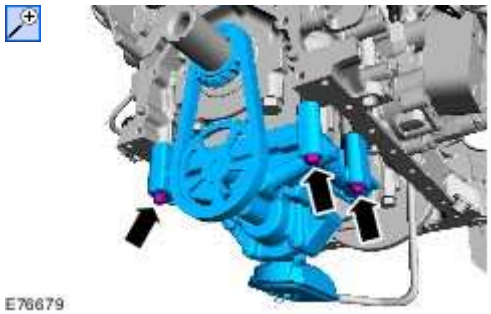
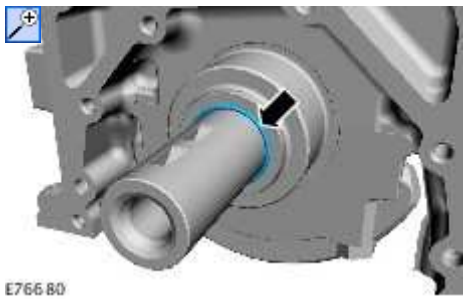
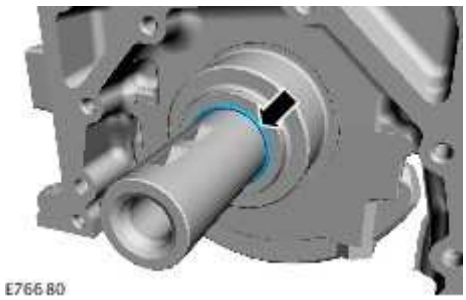

E76679

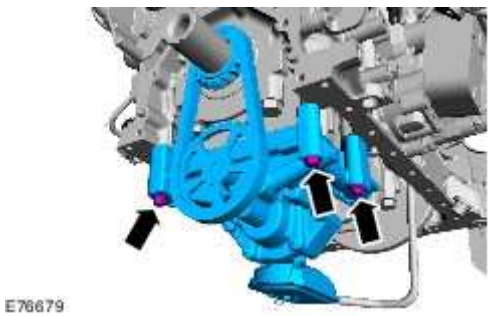

E76680

5.

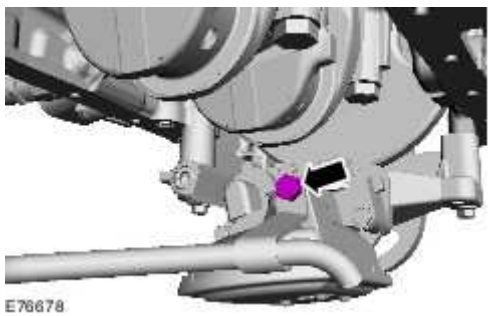
Installation


E76680

1. NOTE: Make sure that a new component is installed.


E76679

2. *Torque:* 16 Nm


E76678

3. *Torque:* 12 Nm

4. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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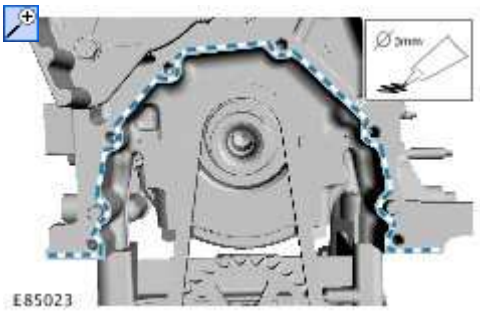

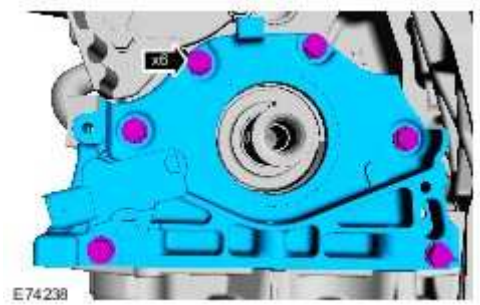

5. NOTE: The component must be installed within 5 minutes of applying the sealant.
   Torque: 14 Nm

6. Install the following items:
   1. Oil pan.

      Refer to: Crankshaft Front Seal (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
   2. Crankshaft front seal.

      Refer to: Oil Pan (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

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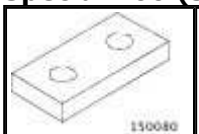
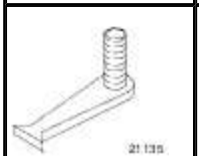
Removal and Installation

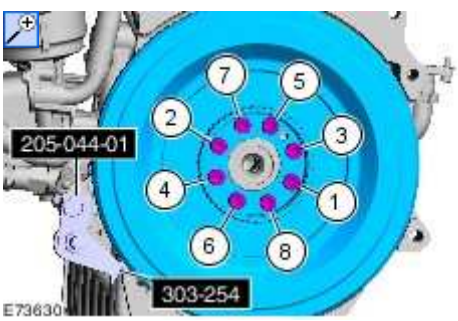
Special Tool(s)

	205-044-01 Adapter for 205-044
	205-307 Installer, Wheel Speed Sensor Ring
	303-254 Locking Tool, Flywheel
	303-293 Remover, Crankshaft Seal

Removal

1. Remove the transmission.

   Refer to: Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal).



2. *Special Tool(s):* 205-044-01, 303-254

3. *Special Tool(s):* 303-293

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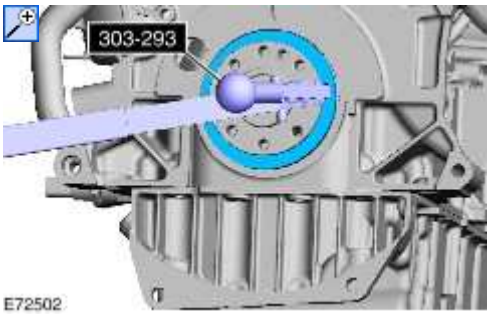
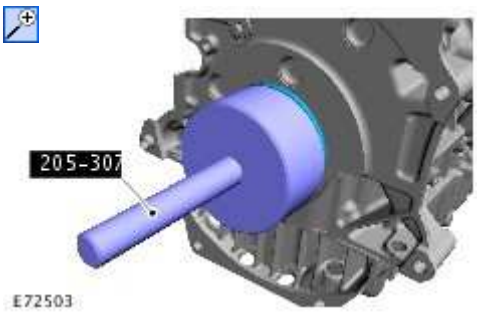


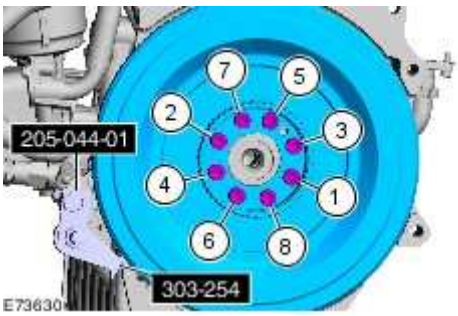
Installation



1. *Special Tool(s):* 205-307

2. Inspect the flywheel.

   Refer to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).



3. *Special Tool(s):* 205-044-01, 303-254
   Torque: 48 Nm

4. Install the transmission.

   Refer to: Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation).

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Removal

General Equipment

Hose clamp remover/installer
Mounting table set

1. Remove the following items:
    1. Air Cleaner

       Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
    2. Battery

       Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    3. Cowl Panel Grille

       Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
    4. Charge Air Cooler

       Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
    5. Radiator

       Refer to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
2.

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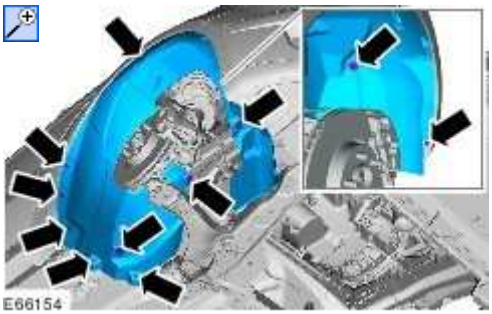

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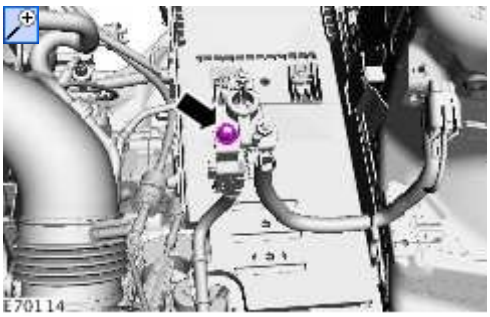

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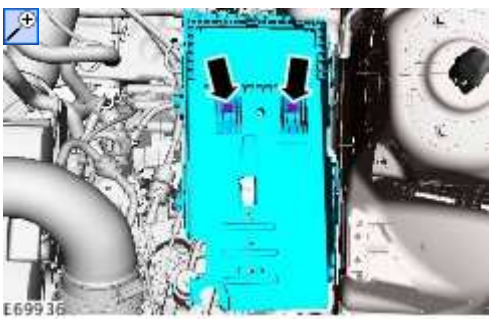

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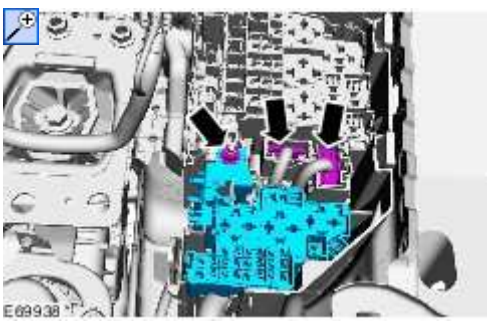

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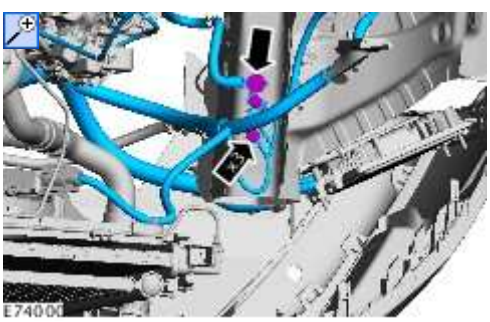

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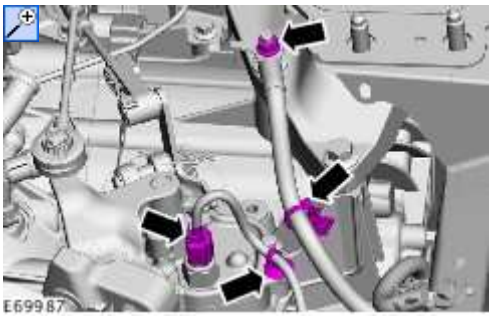

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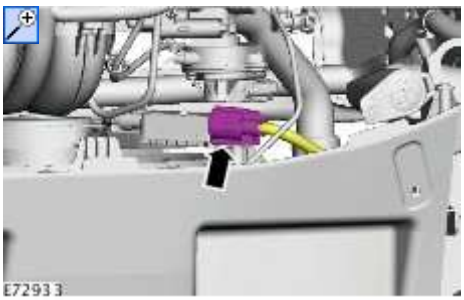
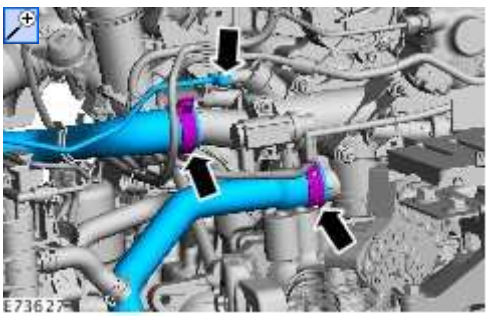
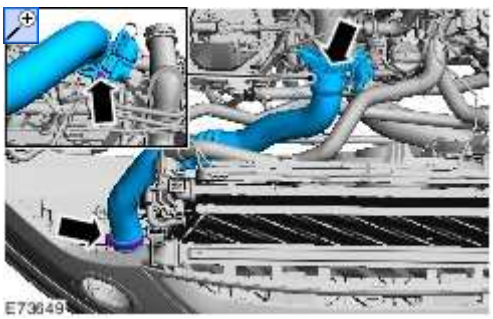




9. *General Equipment:* Hose clamp remover/installer



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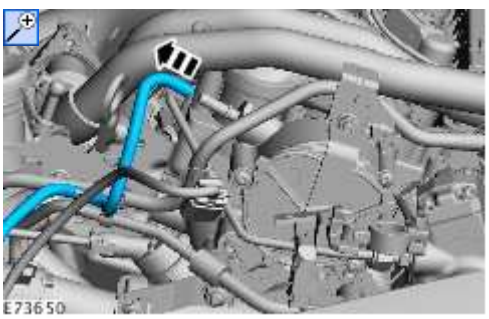

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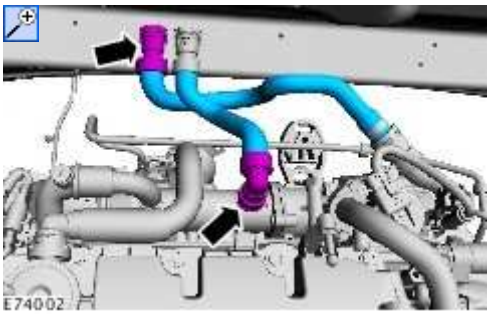

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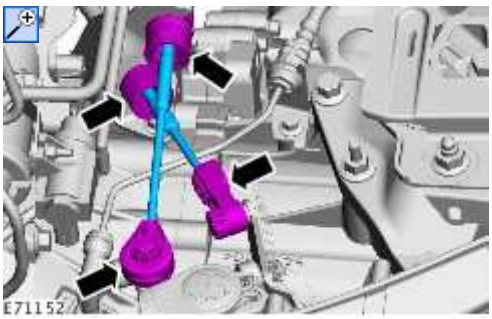

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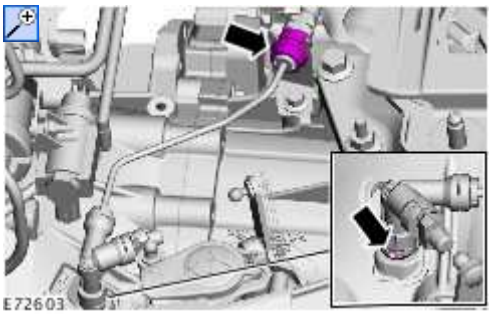
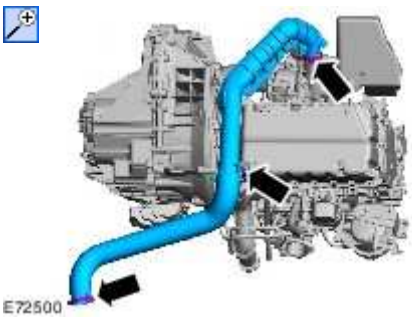


15. *General Equipment:* Hose clamp remover/installer



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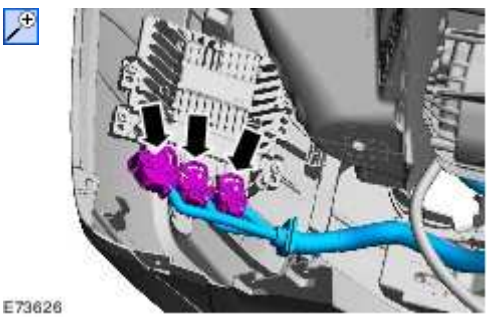

17. Remove the following items:
    1. Catalytic Converter.

       Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission

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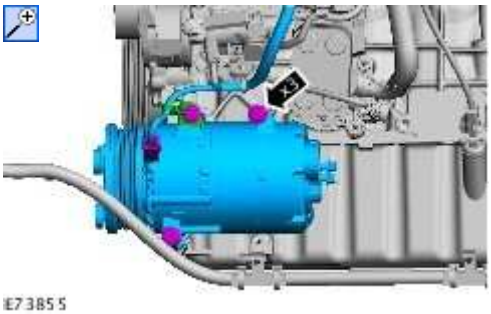
Requirements: Stage IV, Removal and Installation).

2. Front Drive Halfshafts

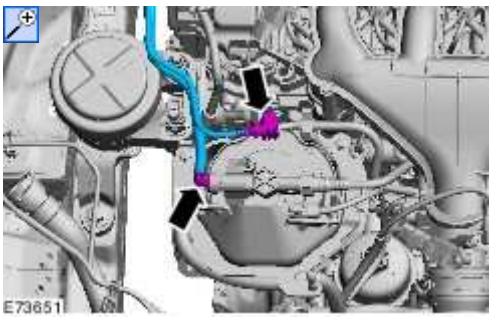
   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

3. Front Subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

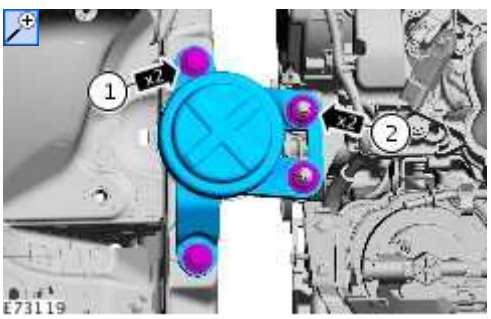


18. Detach the air conditioning (A/C) compressor and secure to one side.



19. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

20. *General Equipment:* Mounting table set



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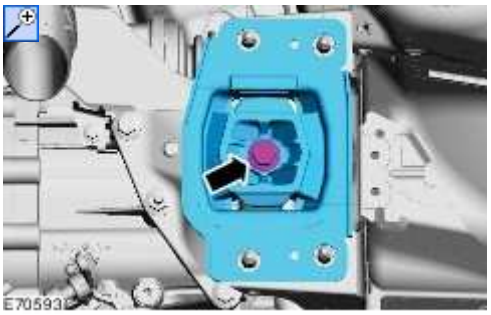

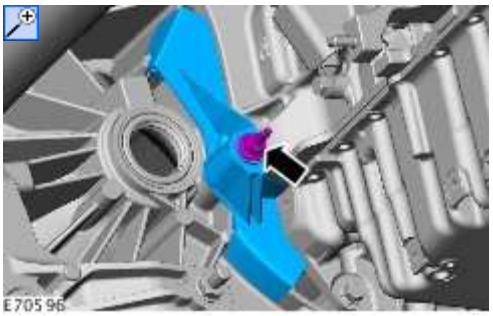

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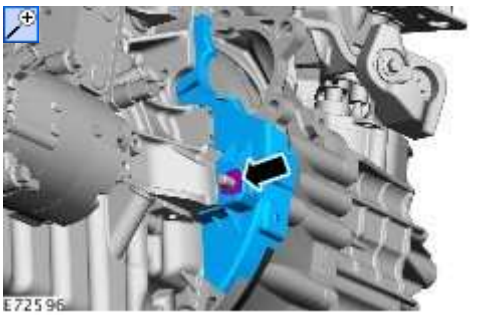

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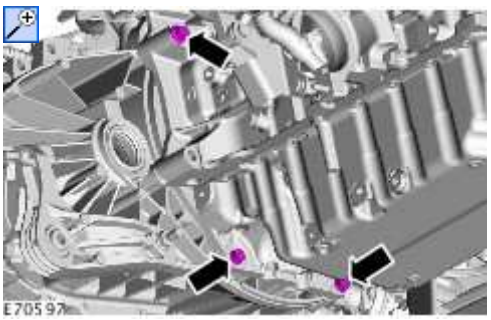

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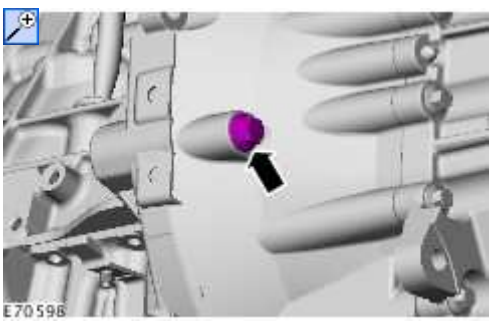

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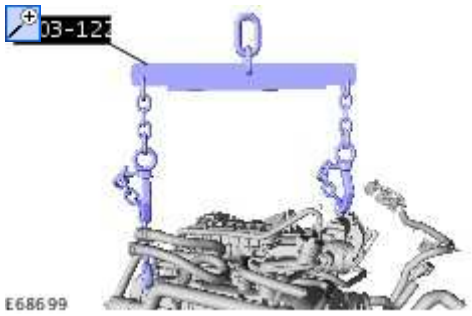

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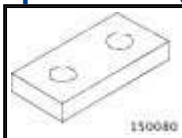
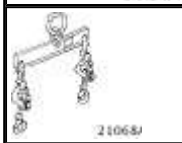
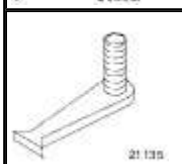
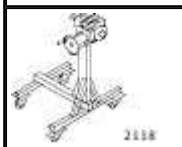
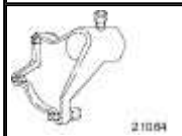
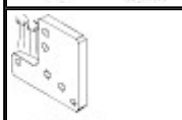
Removal

Special Tool(s)

	205-044-01 Adapter for 205-044
	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-04 Mounting Bracket for 303-435
	303-435-12A Mounting Plate for 303-435-04

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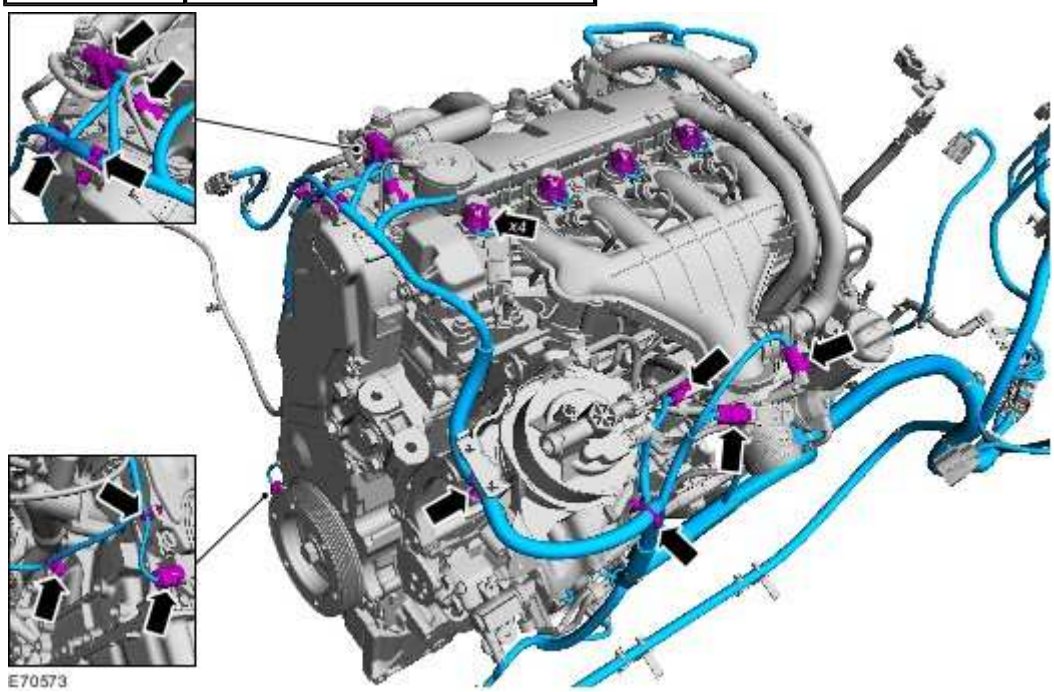

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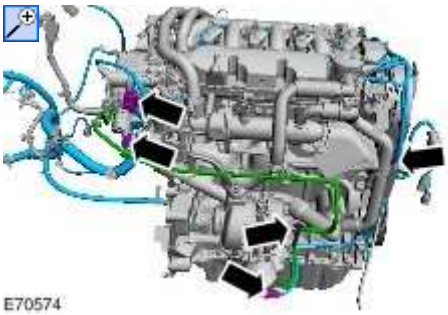

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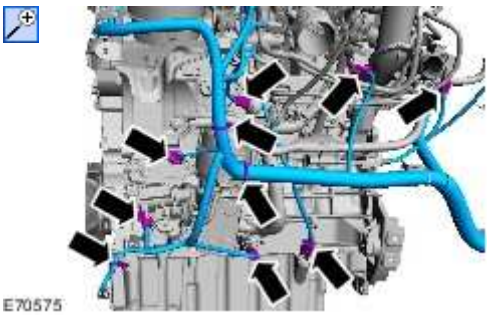

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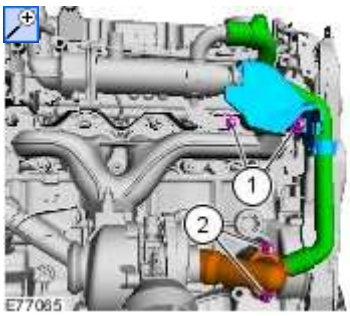

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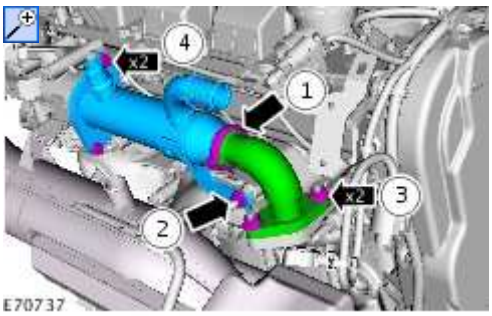

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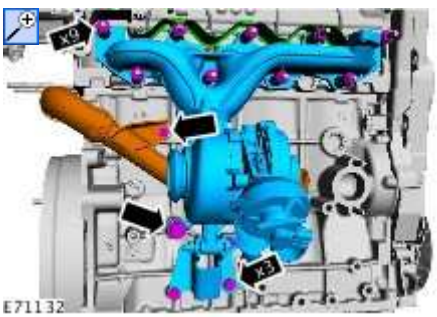

7. *Special Tool(s):* 303-435, 303-435-04, 303-435-12A

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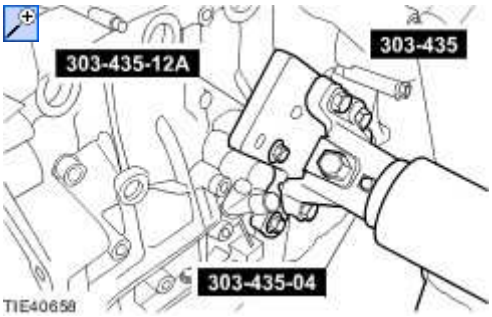
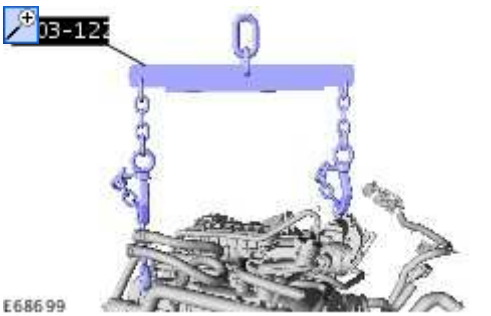
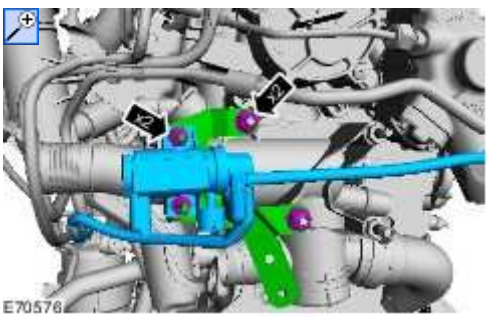




8. Remove the special tool.

   Special Tool(s): 303-122



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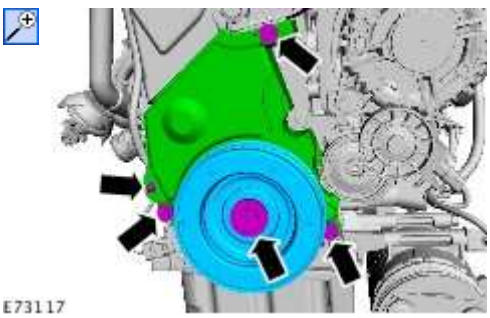

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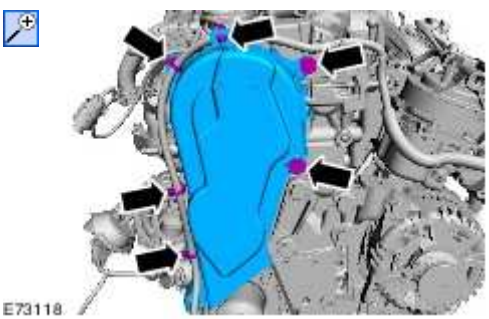

11.

12. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.

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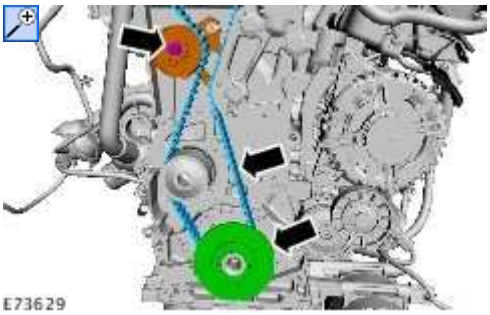

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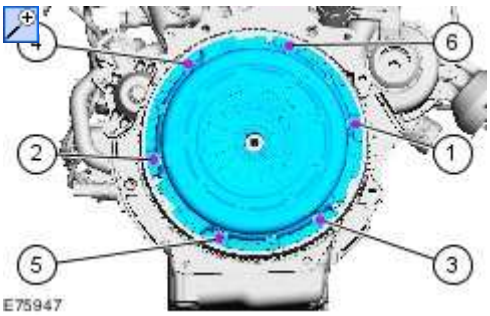
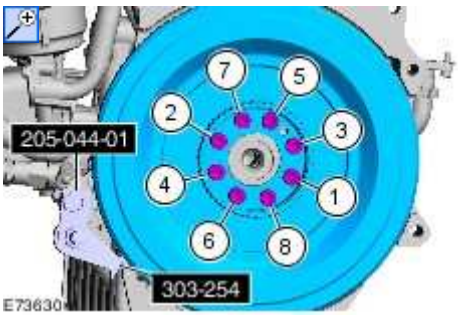


14. *Special Tool(s):* 205-044-01, 303-254



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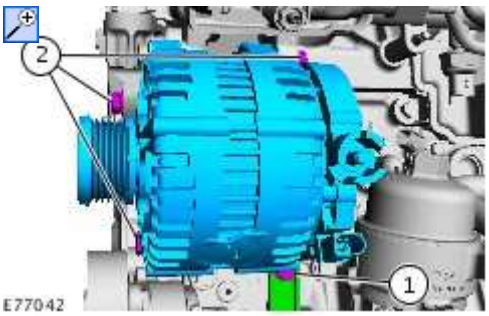

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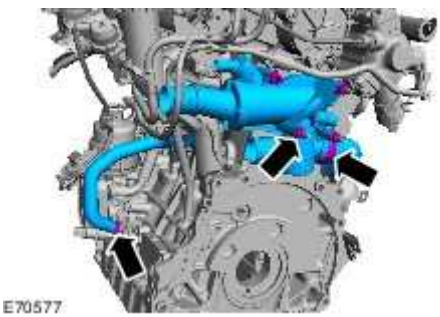

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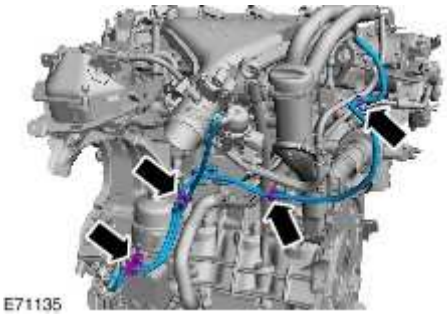

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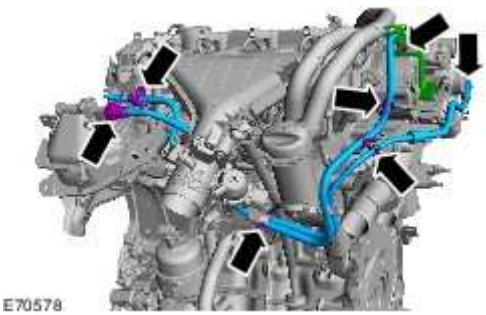

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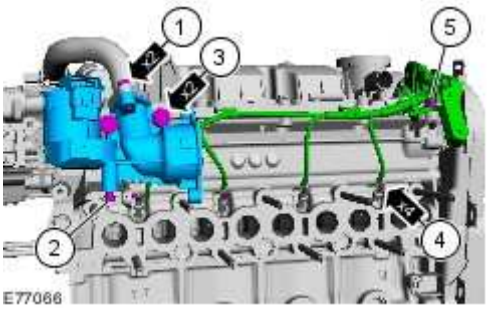

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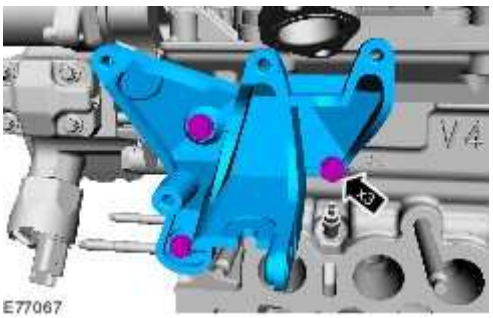

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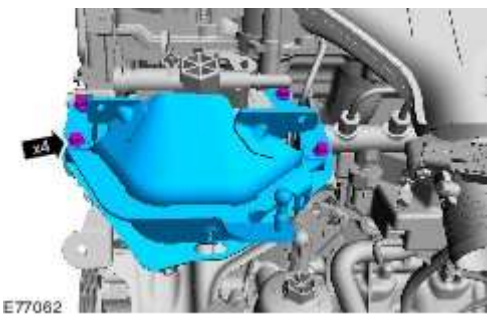

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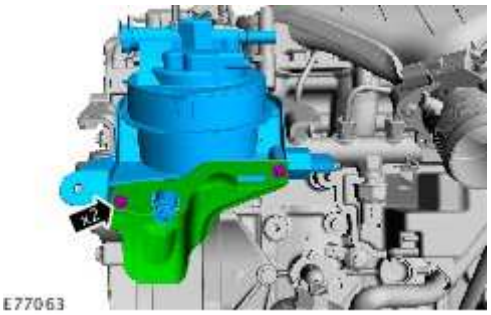

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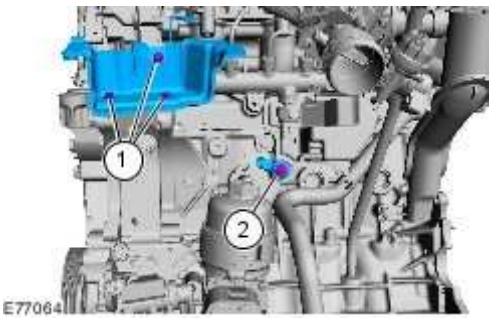

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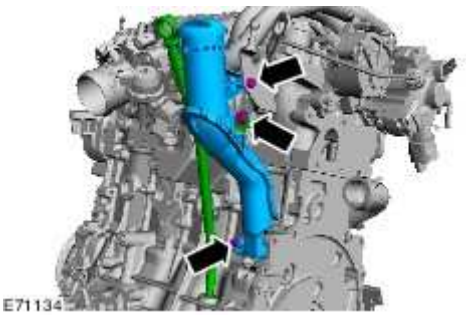

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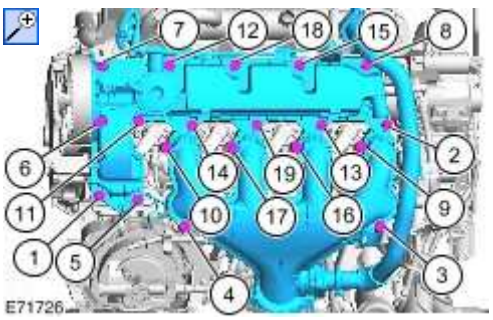

27.

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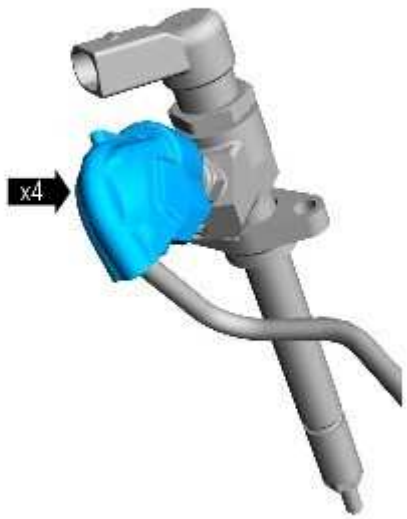
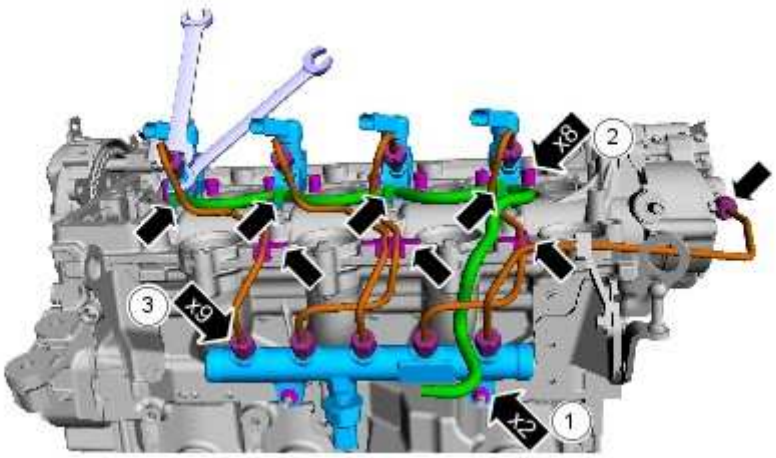


E112589



E77085

28. CAUTIOI

Use open-en wrench t prevent compone from turning.

Vac any fore material from the fuel pum and fuel unions before sealing t unions w blanking caps.

Mak sure tha the fuel remains contact a both enc until bot unions n have be unscrew and the area aro the joint

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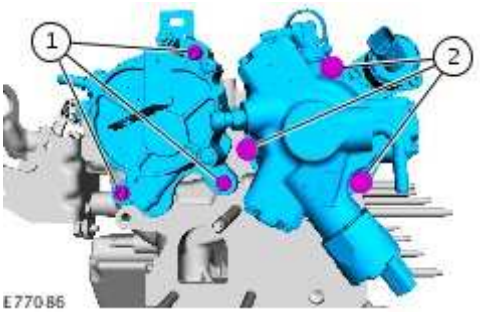
thoroughl
cleaned.

Mak
sure tha
opening
are seal
Use new
blanking
caps.
Discard t
high-pre
fuel supp
lines.

29.

30.

31.



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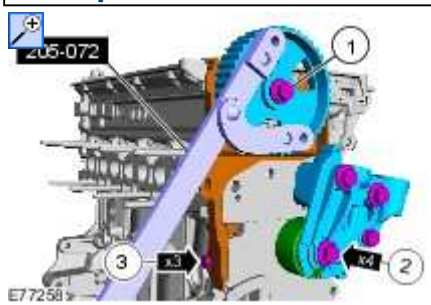
Disassembly

Special Tool(s)

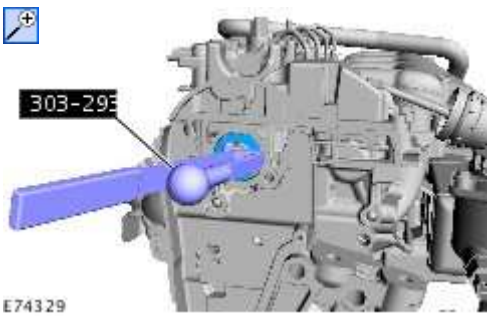
	205-072 Universal Flange Holding Wrench
	303-293 Remover, Crankshaft Seal

General Equipment

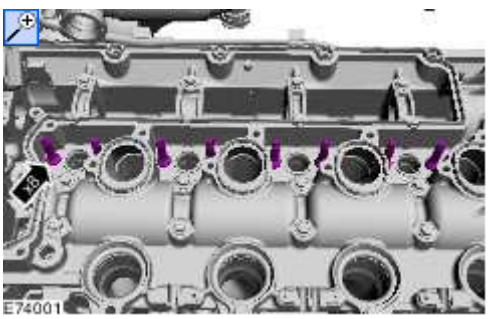
2 mm punch



1. *Special Tool(s):* 205-072



2. *Special Tool(s):* 303-293



3.

4. *General Equipment:* 2 mm punch

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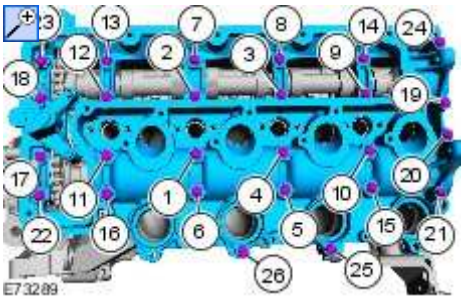

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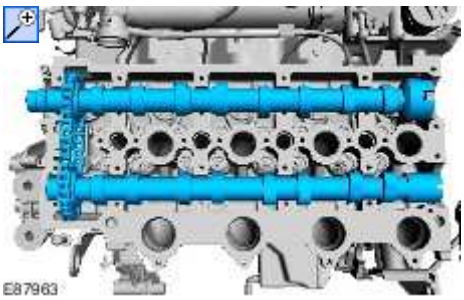

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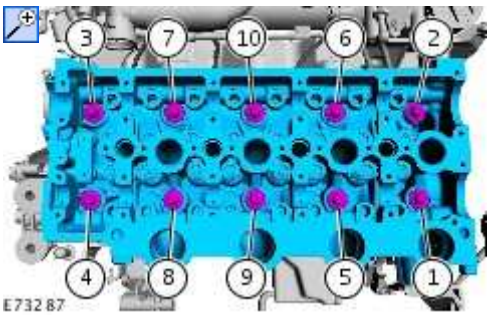

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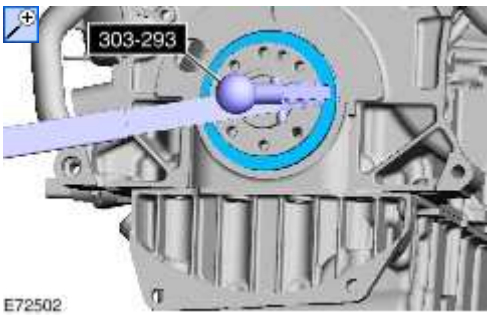
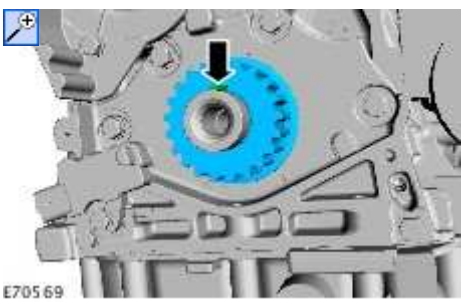


8. *Special Tool(s):* 303-293



9.

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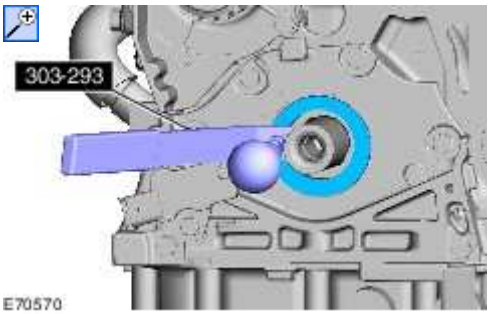
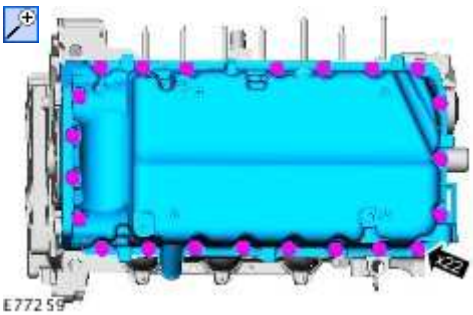


10. *Special Tool(s):* 303-293



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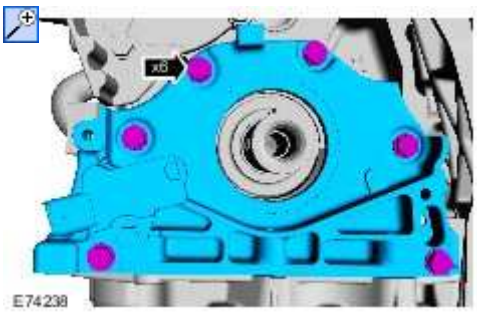

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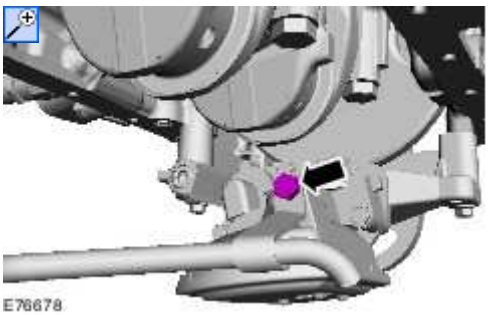

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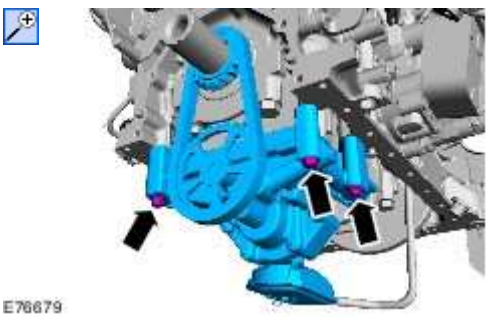

14.

15.

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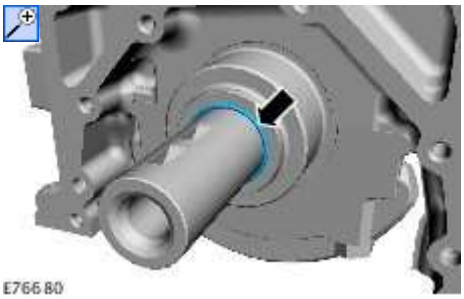
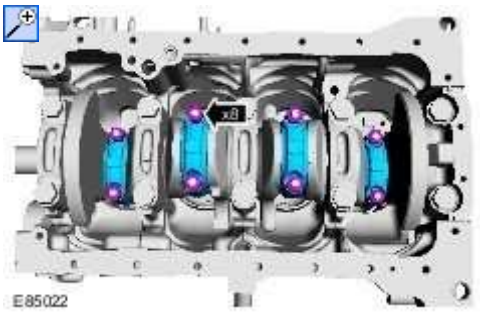
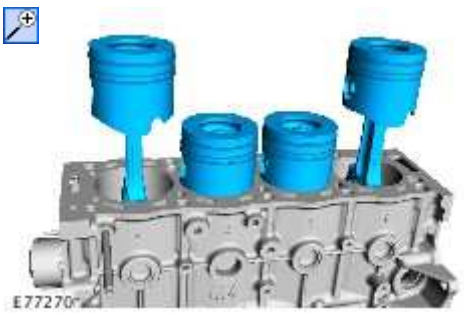

E76680


E85022

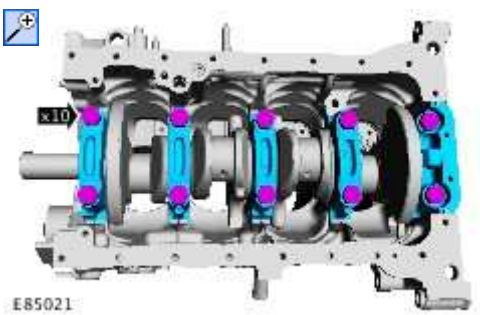
16. NOTE: Note the position of each component before removal.

E77286

17. NOTE: Note the position of each component before removal.


E77270

18. NOTE: Note the position of each component before removal.


E85021

19. NOTE: Note the position of each component before removal.

20. NOTE: Note the position of each component before removal.

http://vnx.su

E77266

E85018

21. NOTE: Note the position of each component before removal.

E77269

22. NOTE: Note the position of each component before removal.

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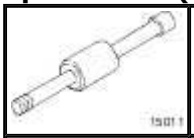
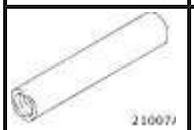
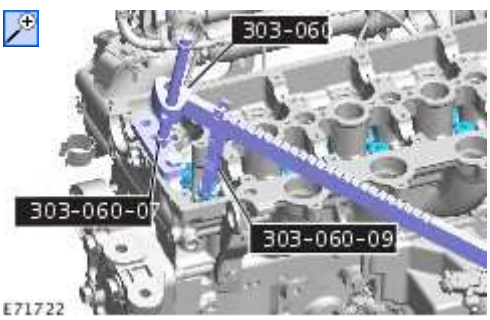
Print

Disassembly and Assembly of Subassemblies

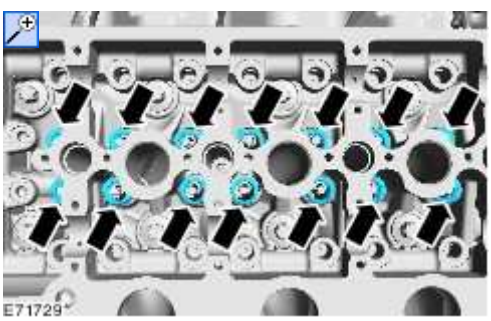
Special Tool(s)

	205-047 Slide Hammer
	303-037 Installer, Valve Stem Seal
	303-060 Compressor, Valve Spring
	303-060-07 Adapter for 303-060
	303-060-09A Adapter for 303-060
	303-292 Remover, Valve Stem Seal

Disassembly



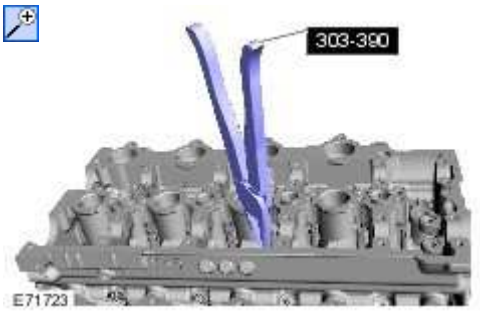
1. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A



2.

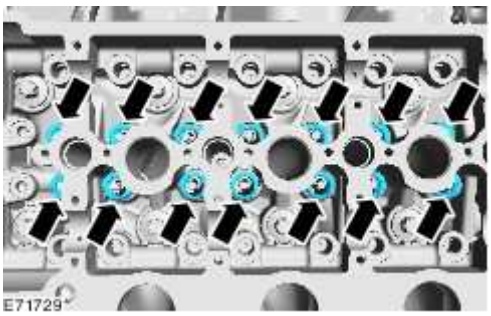
3. *Special Tool(s):* 205-047, 303-292

http://vnx.su



Assembly

4. *Special Tool(s):* 303-037



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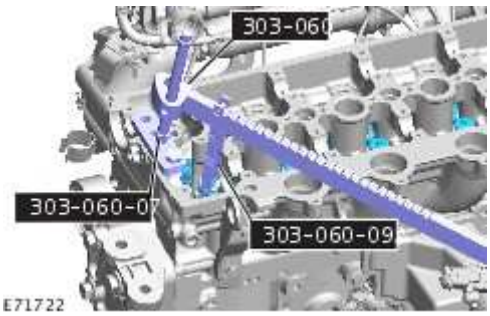
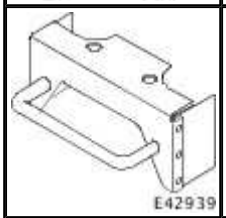
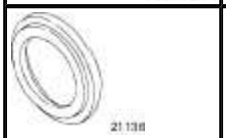
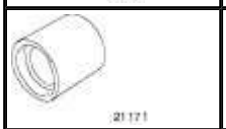
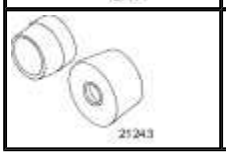


6. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

http://vnx.su

Assembly

Special Tool(s)

	205-307 Installer, Wheel Speed Sensor Ring
	303-1057 Installer, Main Bearing Cup
	303-255 Installer, Timing Cover Seal
	303-395 Installer, Crankshaft Seal
	303-684 Installer, Crankshaft Front Seal

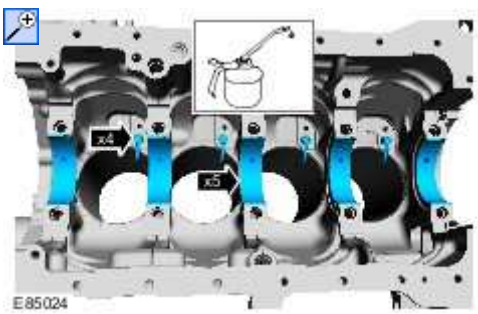
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

2 mm punch
Piston ring compressor

NOTE: Make sure that these components are installed to the noted removal position.



1. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

2.

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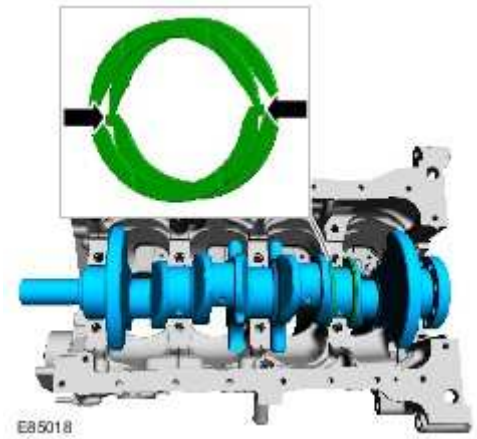
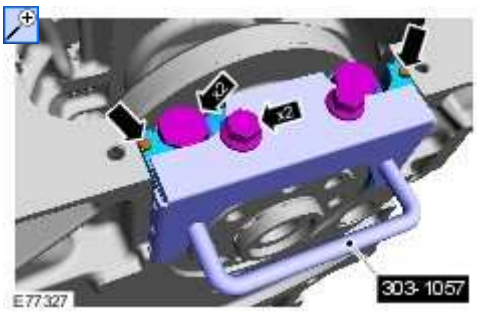
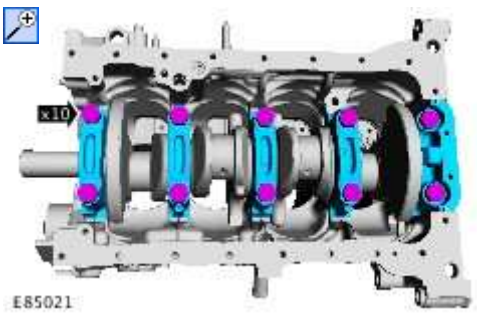


3. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

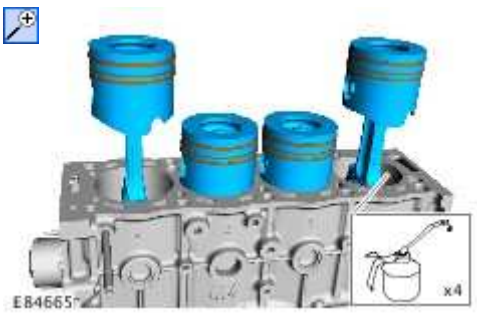


4. NOTE: Only tighten the bolts finger tight at this stage.
   Install the Special Tool(s): 303-1057

5. *Remove the Special Tool(s):* 303-1057



6. *Torque:*
   Stage 1: 30 Nm
   Stage 2: 63°



7. *General Equipment:* Piston ring compressor
   Material: Engine Oil - 5W-30 (WSS-M2C913-B)

8. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

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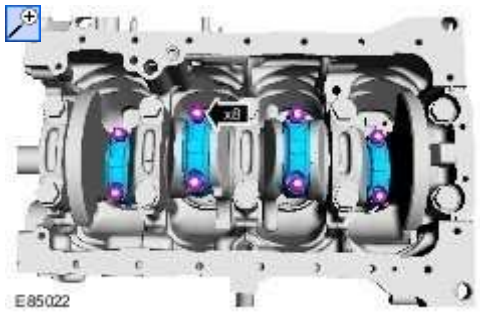
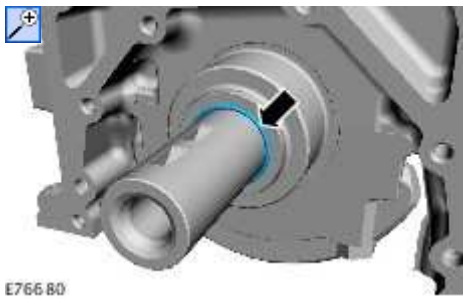
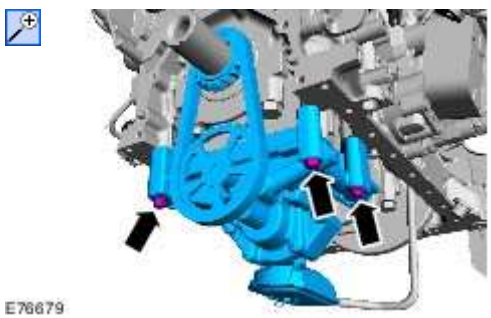


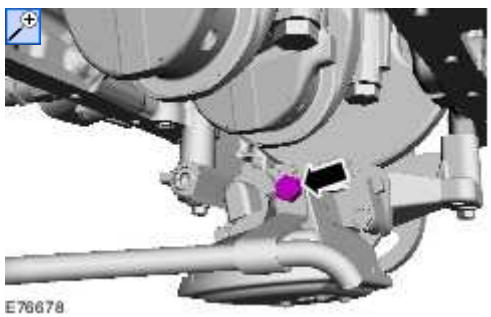
9. *Torque:*
   Stage 1: 20 Nm
   Stage 2: 70°



10.



11. *Torque:* 16 Nm



12. *Torque:* 12 Nm

13. NOTE: The component must be installed within 5 minutes of applying the sealant.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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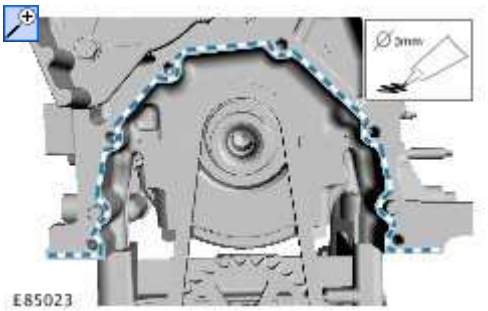
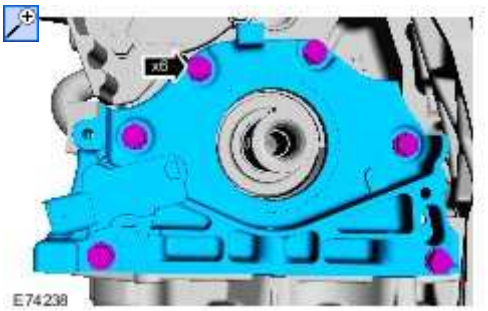
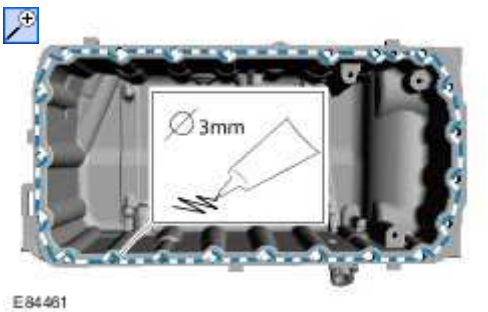
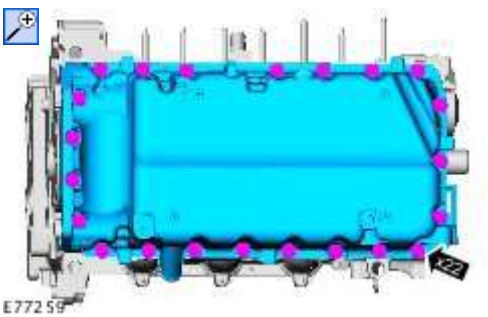




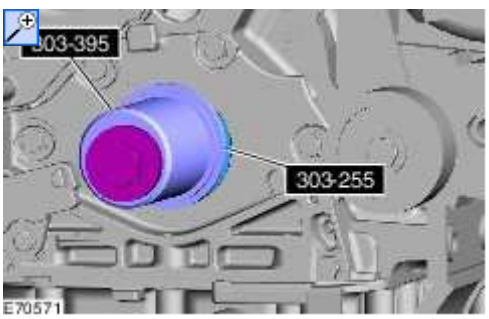
14. *Torque:* 14 Nm



15. NOTE: The component must be installed within 5 minutes of applying the sealant.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



16. *Torque:* 16 Nm



17. *Special Tool(s):* 303-255, 303-395

18.

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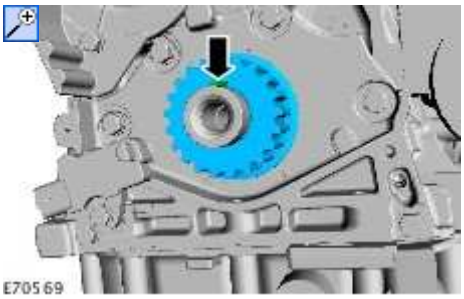
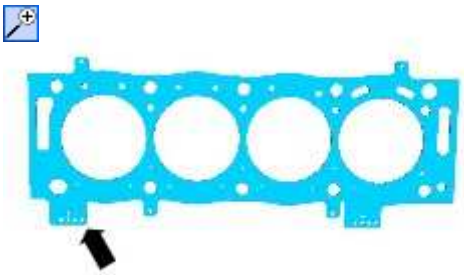
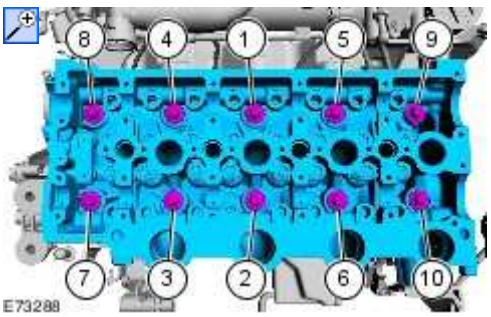

E70569


E73625

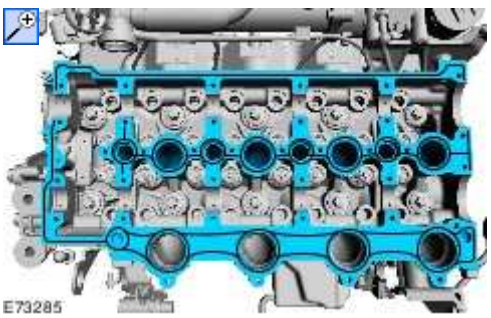
19. Make sure to use the right thickness of the cylinder head gasket.

Refer to: Specifications (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Specifications).



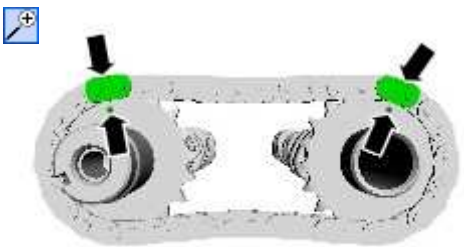
E73288

20. CAUTION: Make sure that new bolts are installed.
Torque:
Stage 1: 60 Nm
Stage 2: 220°


E73285

21. NOTE: The component must be installed within 5 minutes of applying the sealant.
Apply a 3 mm bead of sealant to the cylinder head.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)


E43476

22.

23. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

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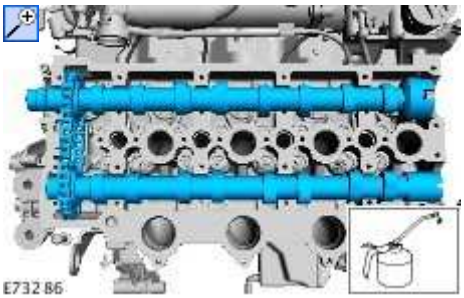
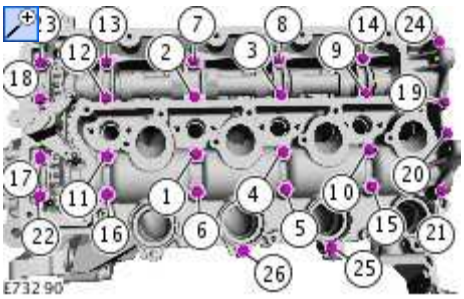
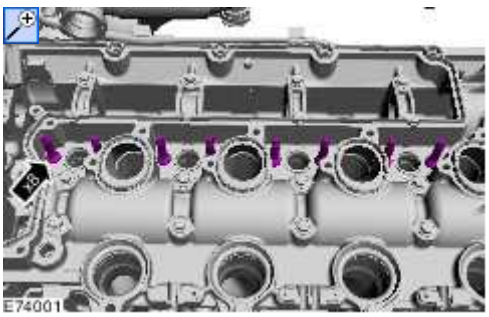


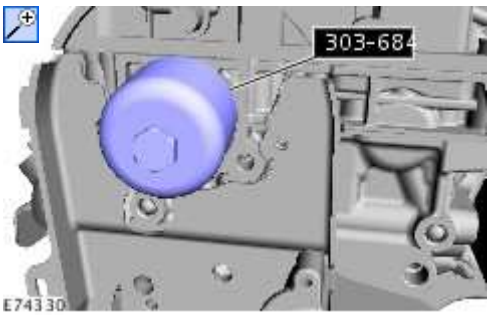


24. *Torque:*
    Stage 1: 5 Nm
    Stage 2: 10 Nm

25. *General Equipment:* 2 mm punch



26. *Torque:* 10 Nm



27. *Special Tool(s):* 303-684

28. *Special Tool(s):* 205-307

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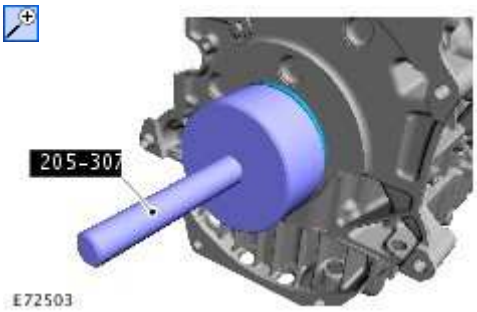

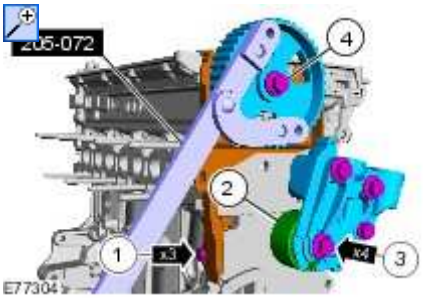

29.

1. *Torque:* 7 Nm
2. NOTE: Make sure that a new component is installed.
3. *Torque:* 56 Nm
4. *Torque:*
   Stage 1: 20 Nm
   Stage 2: 60°

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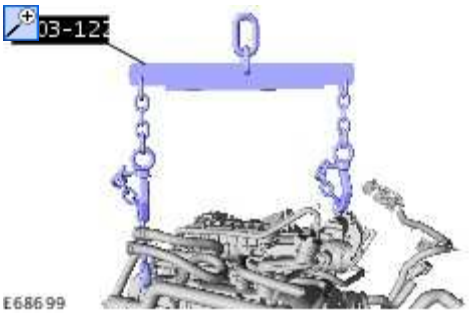
Installation

Special Tool(s)

	303-122 Lifting Bracket, Engine

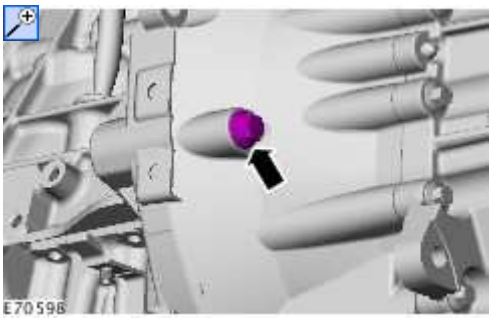
General Equipment

Hose clamp remover/installer
Hydraulic jib crane
Mounting table set

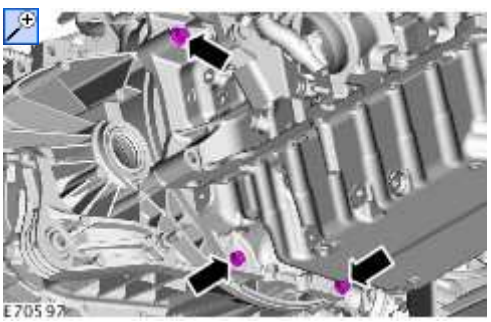


1. *Special Tool(s):* 303-122
   General Equipment: Hydraulic jib crane

2. *General Equipment:* Mounting table set



3. *Torque:* 48 Nm



4. *Torque:* 48 Nm

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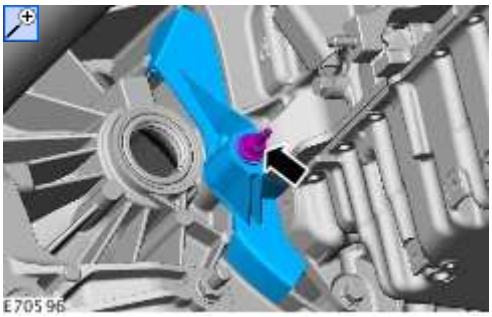
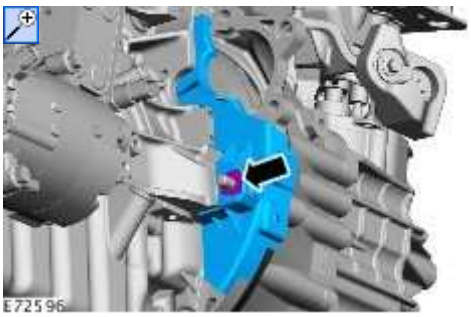


5. *Torque:* 48 Nm



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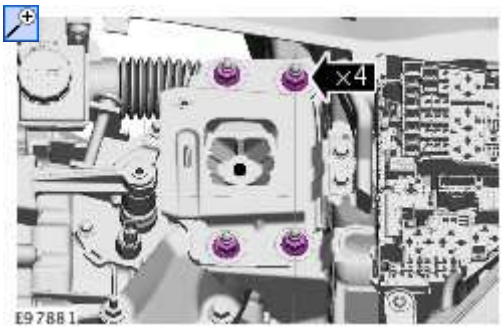
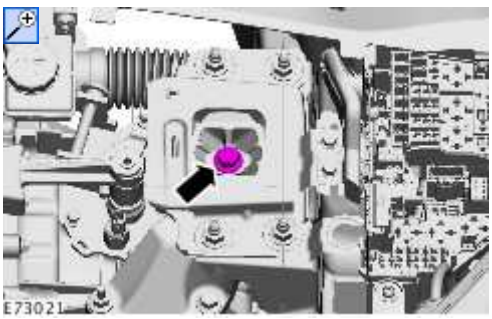
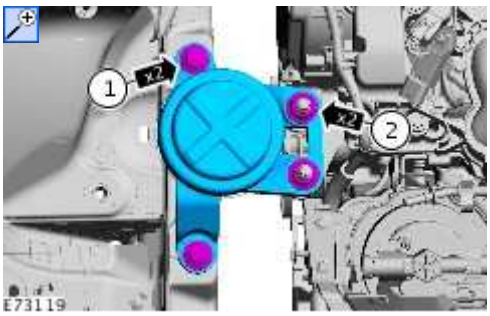


7. *Loosen:* 2 turn(s)



8. *Torque:* 133 Nm



9.
   1. NOTE: Only tighten the bolts finger tight at this stage.
   2. *Torque:* 133 Nm

10. Raise the vehicle and remove the Mounting table set.

    General Equipment: Mounting table set

11. *Torque:* 80 Nm

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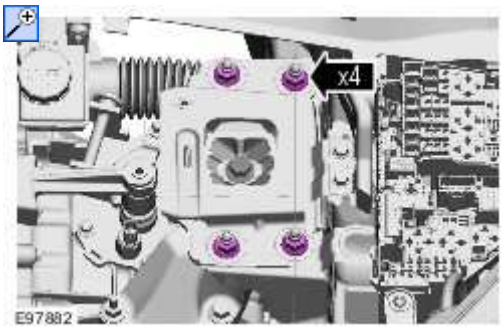
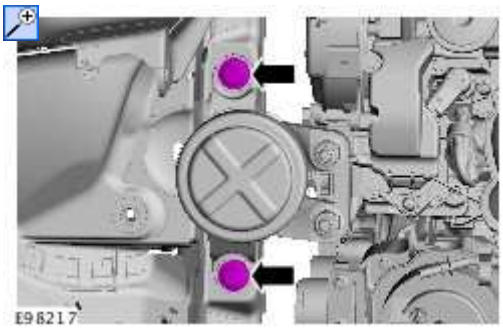
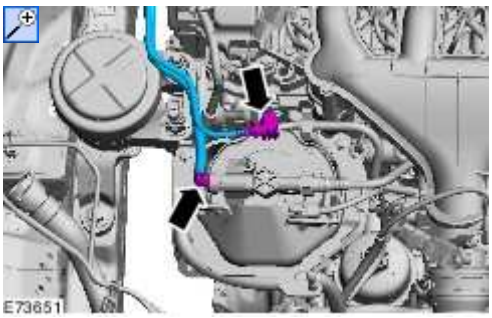
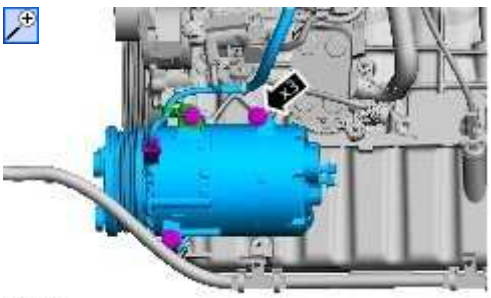




12. *Torque:* 90 Nm



13. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



14. *Torque:* 28 Nm

15. Install the following items:
    1. Front Drive Halfshafts

       Refer to: Front Drive Halfshafts (205-04 Front Drive Halfshafts, Description and Operation).
    2. Front Subframe.

       Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
    3. Catalytic Converter.

       Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi

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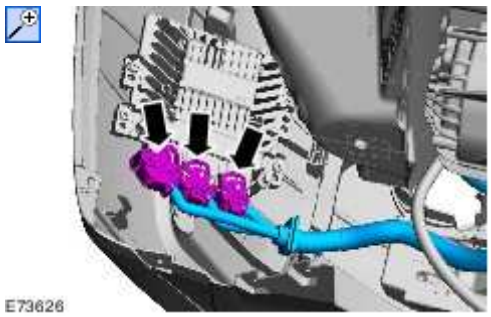
(103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



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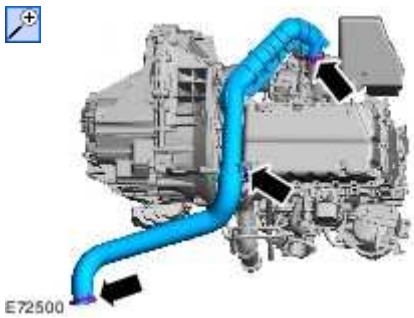
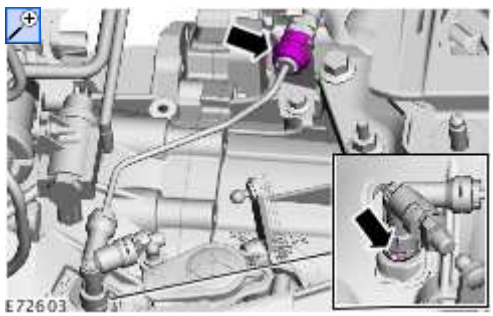
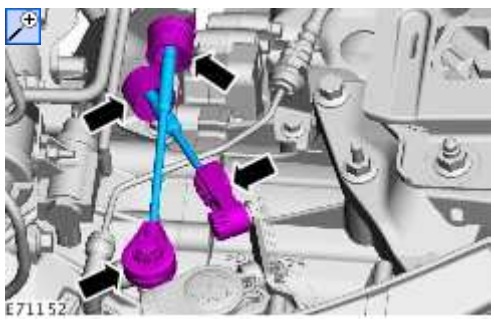


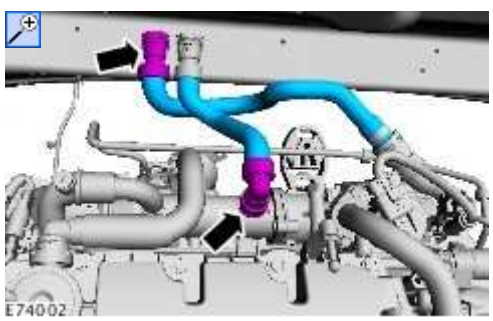
17. *General Equipment:* Hose clamp remover/installer
Torque: 10 Nm



18.



19.



20.

21.

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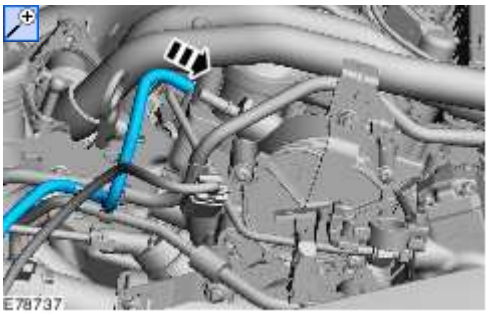
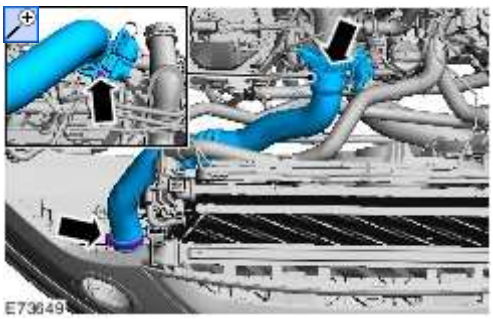
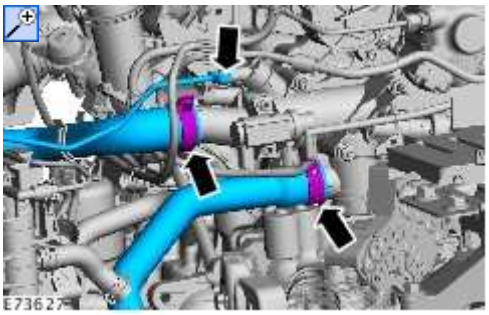
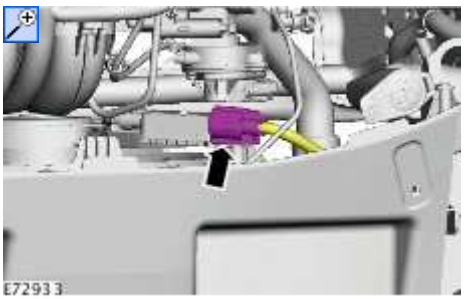




22. *Torque:* 10 Nm



23. *General Equipment:* Hose clamp remover/installer



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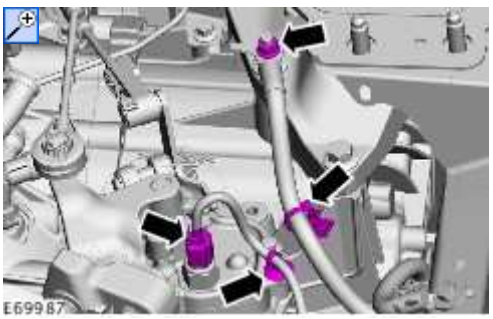

25. *Torque:* 10 Nm

26. *Torque:* 20 Nm

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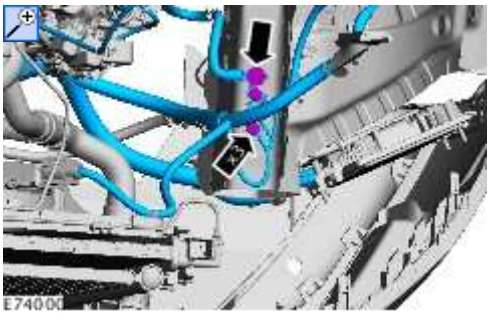

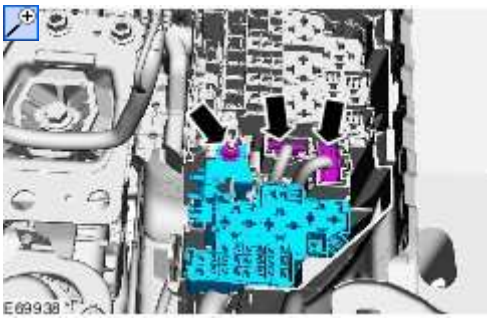

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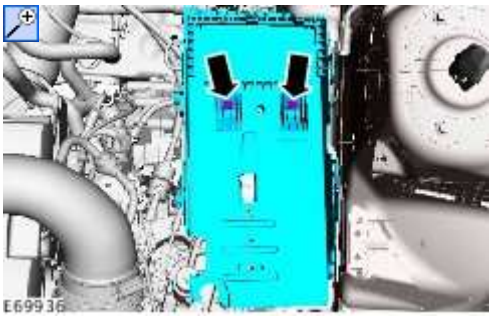

28. *Torque:* 10 Nm

29. *Torque:* 10 Nm

30. Install the following items:
    1. Air Cleaner

       Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
    2. Battery

       Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    3. Cowl Panel Grille

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Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

4. Charge Air Cooler

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
5. Radiator

   Refer to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

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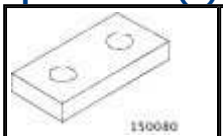
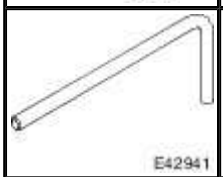
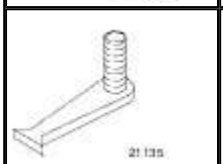
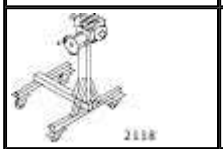
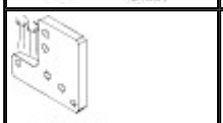
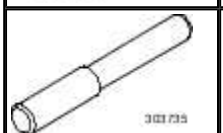
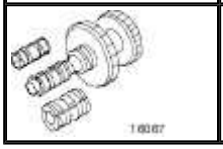
Installation

Special Tool(s)

	205-044-01 Adapter for 205-044
	303-1059 Alignment Peg, Crankshaft
	303-122 Lifting Bracket, Engine
	303-174 Gauge, Bolt Angle
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-04 Mounting Bracket for 303-435
	303-435-12A Mounting Plate for 303-435-04
	303-735 Alignment Peg, Camshaft
	308-204 Aligner, Clutch Disc

1. NOTE: The gaskets are to be reused unless damag
    1. *Torque:* 9 Nm
    2. *Torque:* 20 Nm

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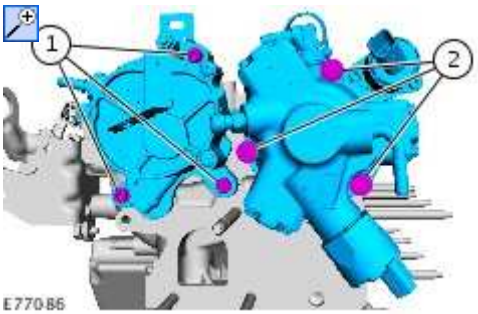
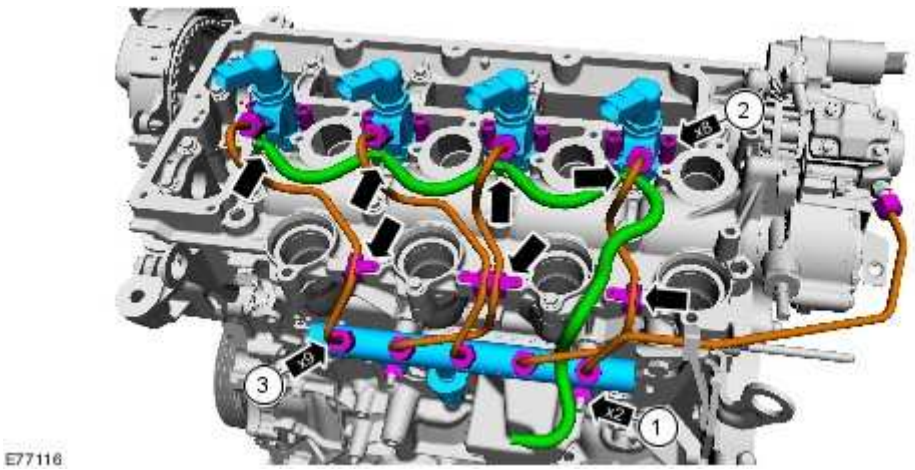


2. NOTE: Make sure that new components are install

3. CAUTION: Make sure that the seal is correctly located.



4.
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   2. NOT tigh nuts tigh stag
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5. CAU Use an c ended w to preve compon

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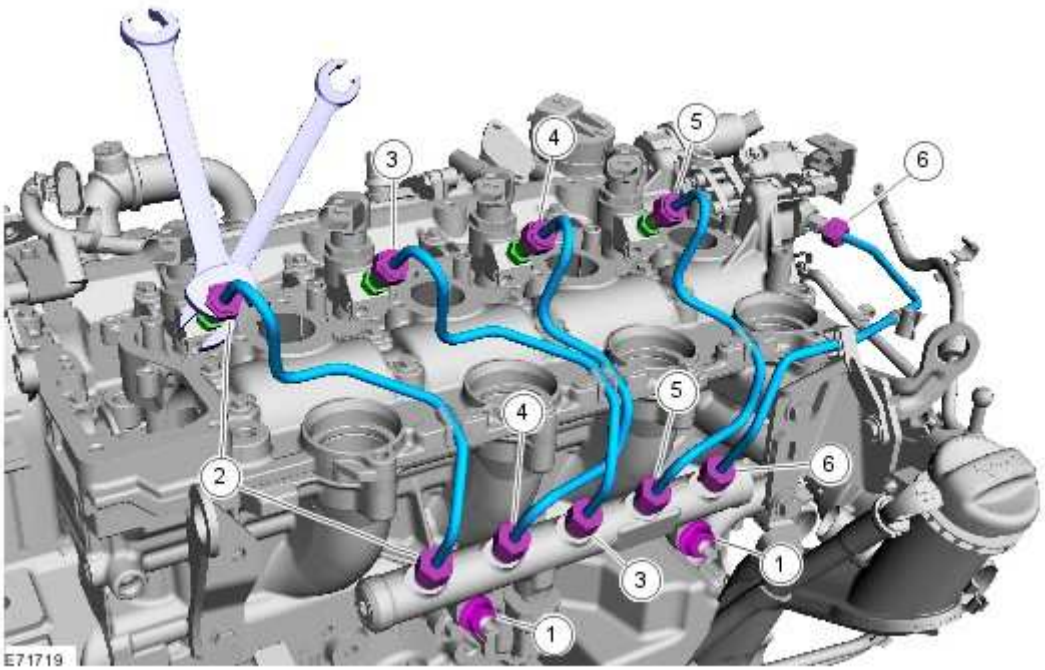

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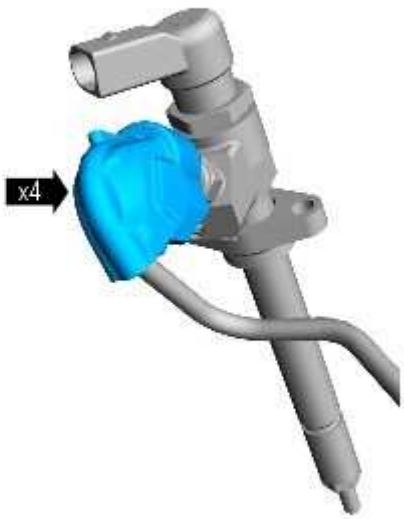

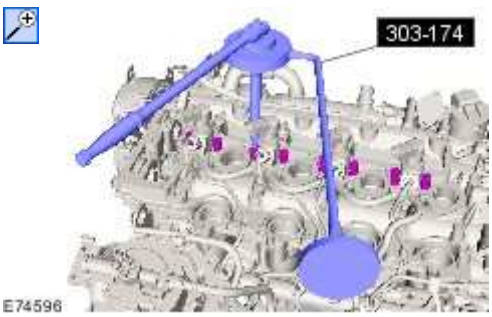

7. *Special Tool(s):* 303-174
Torque:
Stage 1: 4 Nm
Stage 2: 45°

8. *Torque:*
Stage 1: 5 Nm
Stage 2: 9 Nm

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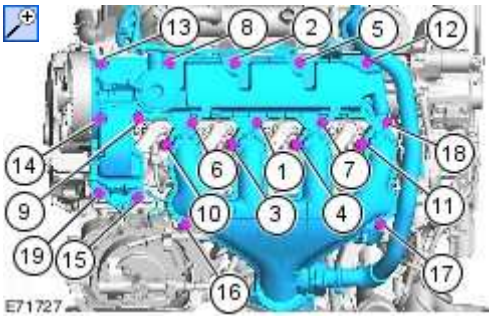
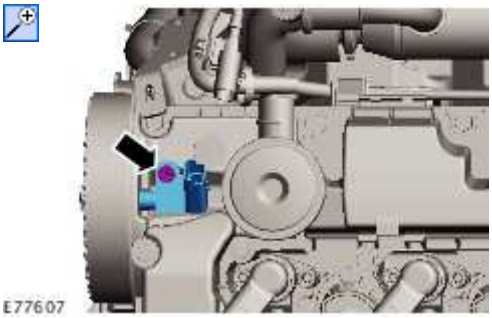
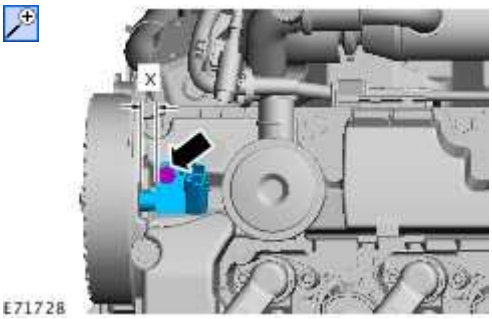




9. If installing a new camshaft position (CMP) sensor, p
the CMP sensor so that the tip of the sensor is in cor
the camshaft pulley and tighten the retaining bolt.

Torque: 2 Nm

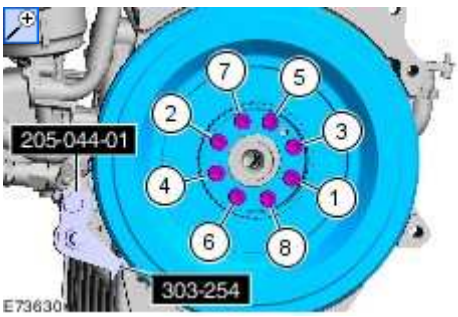


10.
- If installing the original CMP sensor, position t
sensor so that the tip of the sensor is in conta
the camshaft pulley.
- Measure the distance between the CMP sensor
intake manifold (X).
- Pull back the CMP sensor until the distance be
CMP sensor and the intake manifold = X + 1.2
tighten the retaining bolt.

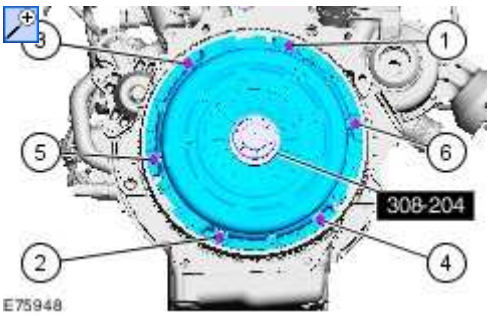
Torque: 2 Nm

11. Inspect the flywheel.

Refer to: Manual Transaxle and Clutch (308-00 Manu
Transmission/Transaxle and Clutch - General Inform
Diagnosis and Testing).



12. *Special Tool(s):* 205-044-01, 303-254
Torque: 48 Nm



13. *Special Tool(s):* 308-204
Torque: 29 Nm

14. *Special Tool(s):* 303-735

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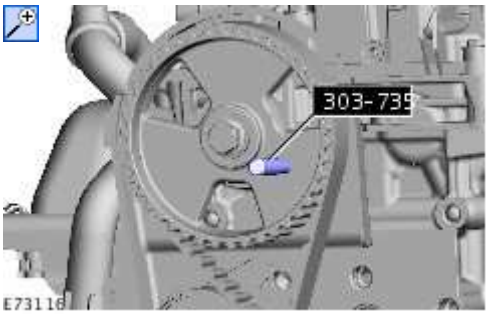
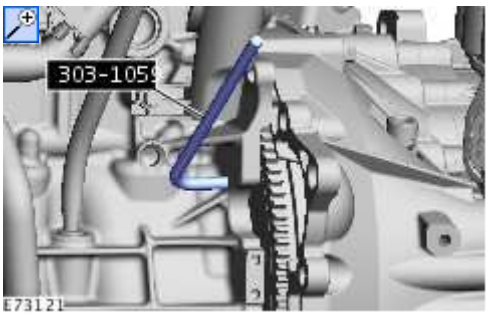
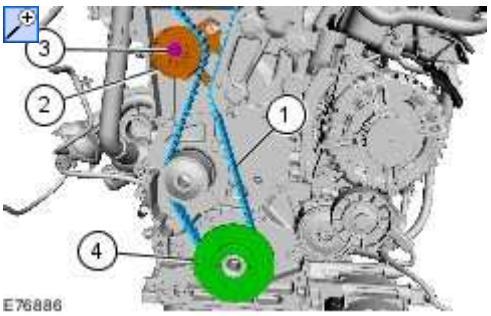
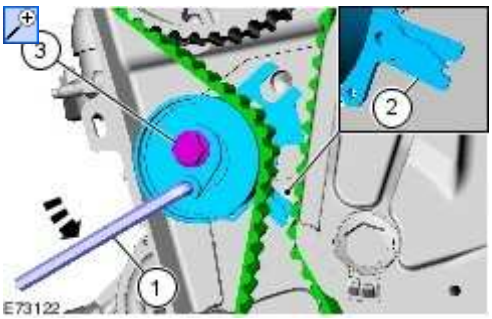




15. CAUTION: Make sure that the crankshaft is nc rotated while the special tool is installed.
Special Tool(s): 303-1059



16.
1. NOTE: Make sure that a new component is installed.
2. NOTE: Make sure that a new component is installed.
3. NOTE: Only tighten the bolt finger tight at th stage.
4. CAUTION: Take extra care when handlir crankshaft position (CKP) sensor ring.



17.
1. Allen key, 6mm
3. *Torque:* 21 Nm

18. *Torque:* 50 Nm

19. Remove the special tool.

Special Tool(s): 303-735

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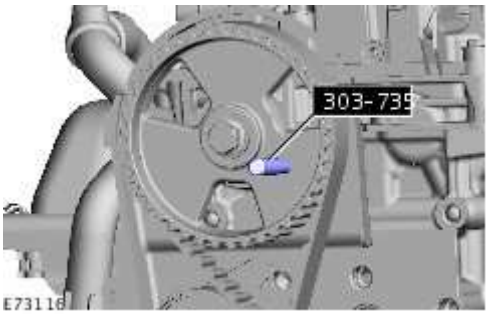
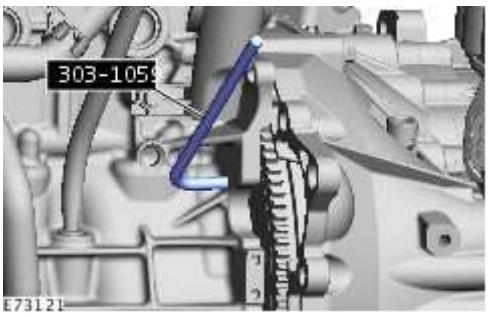
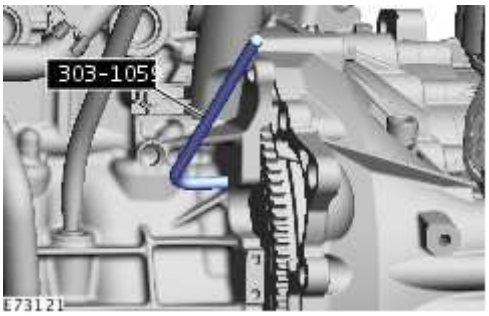




20. Remove the special tool.

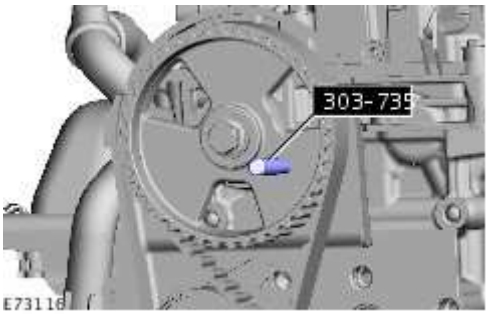
    Special Tool(s): 303-1059

21. CAUTION: Only rotate the crankshaft clockwis
    Rotate the crankshaft 4 revolutions.



22. Install the special tool.

    Special Tool(s): 303-1059



23. NOTE: The special tool can only be installed if the timing is correct.
    Install the special tool.

    Special Tool(s): 303-735

24.

25. Remove the special tool.

    Special Tool(s): 303-735

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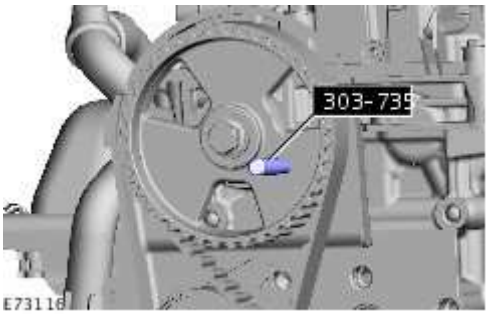
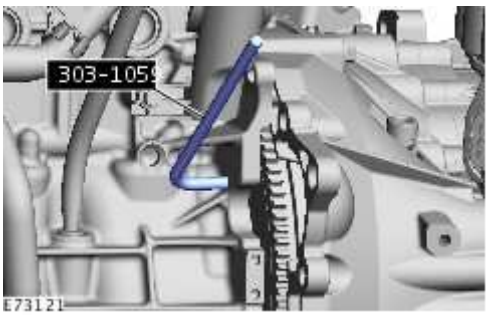
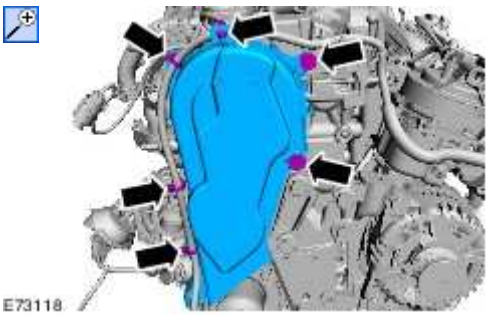


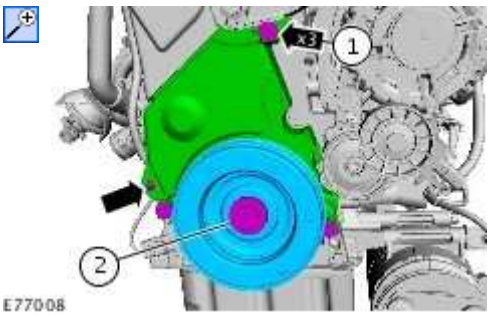


26. Remove the special tool.

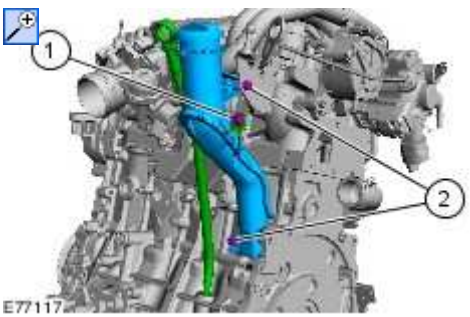
    Special Tool(s): 303-1059



27. *Torque:* 7 Nm



28.
    1. *Torque:* 7 Nm
    2. NOTE: Make sure that a new component is installed.
       Torque:
       Stage 1: 70 Nm
       Stage 2: 60°



29.
    1. *Torque:* 12 Nm
    2. *Torque:* 9 Nm

30. *Torque:* 20 Nm

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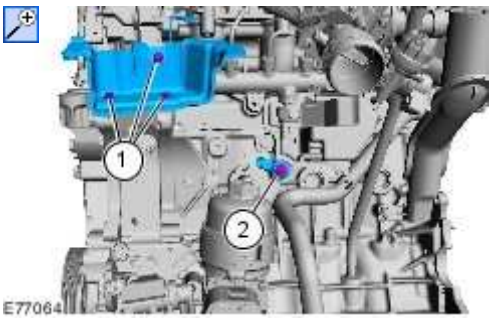
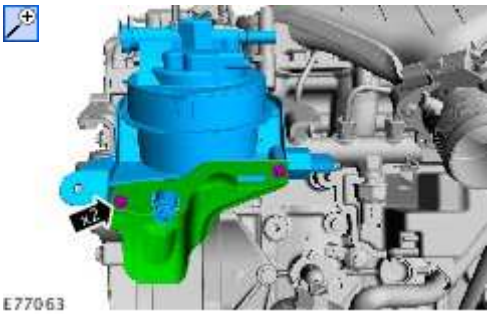
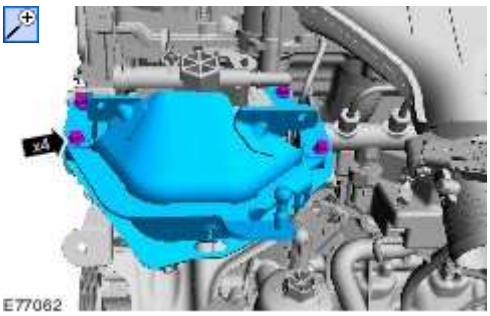


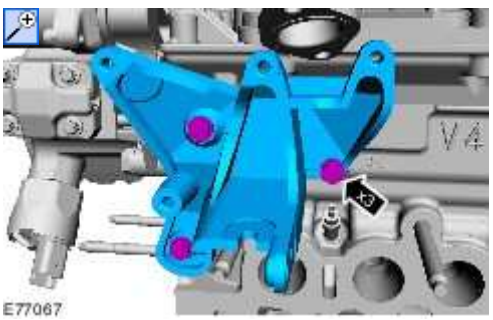
31.
1. *Torque:* 9 Nm
2. *Torque:* 20 Nm



32. *Torque:* 9 Nm



33. *Torque:* 9 Nm



34. *Torque:* 6 Nm

35.
1. *Torque:* 10 Nm
2. *Torque:* 2 Nm
3. *Torque:* 5 Nm
4. *Torque:* 8 Nm
5. *Torque:* 10 Nm

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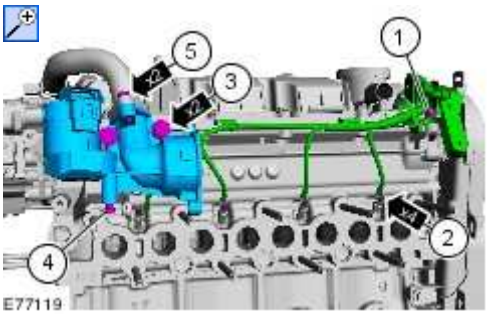

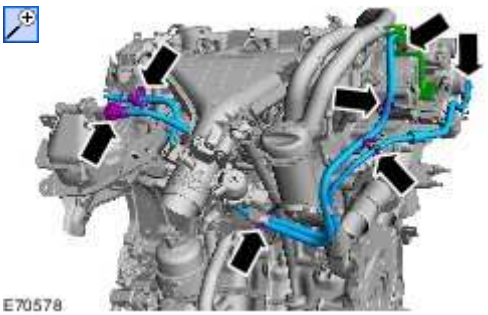

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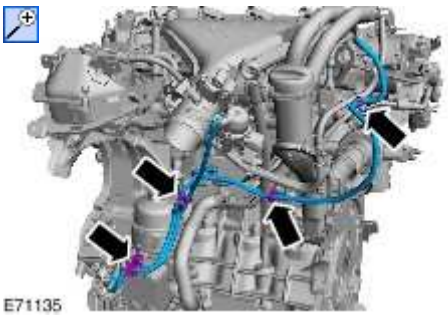

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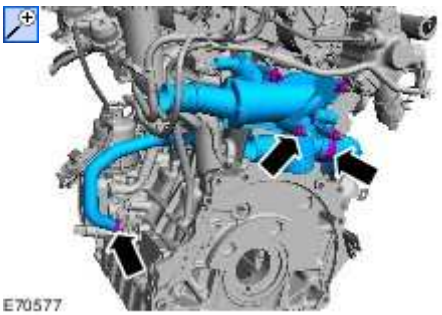
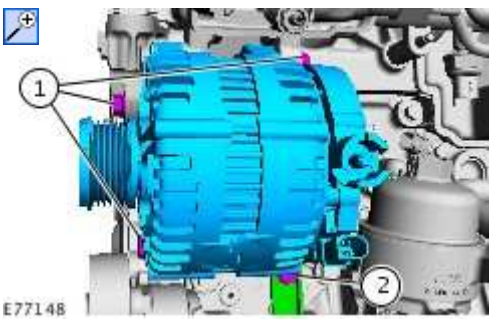


38. NOTE: The O-ring seal is to be reused unless dama
Torque: 10 Nm



39.

1. *Torque:* 48 Nm
2. *Torque:* 10 Nm

40. *Torque:* 18 Nm

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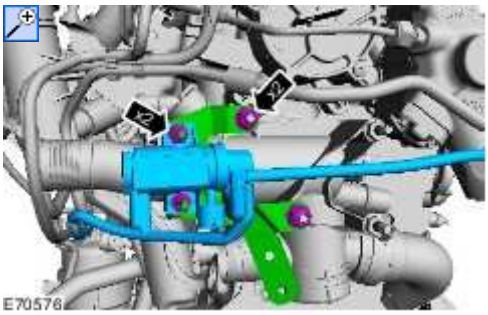
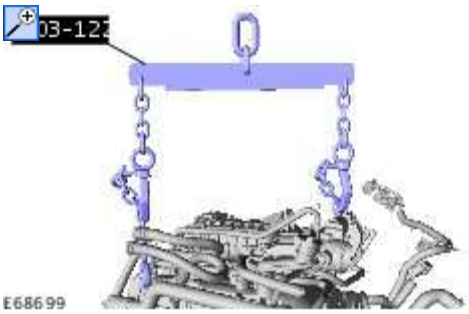
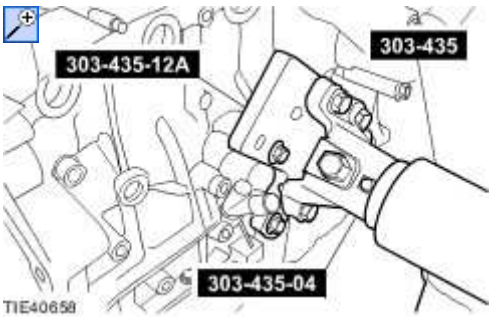


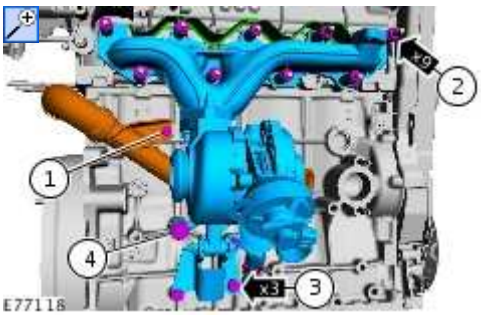


41. *Special Tool(s):* 303-122

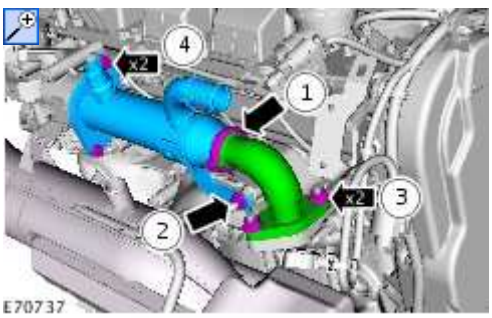


42. Remove the special tools.

Special Tool(s): 303-435, 303-435-04, 303-435-12A



43.
1. *Torque:* 9 Nm
2. *Torque:* 30 Nm
3. *Torque:* 15 Nm
4. *Torque:* 40 Nm



44. NOTE: Make sure that the clamp is installed to the orientation as when removed.
NOTE: Make sure that a new clamp is installed.
2. *Torque:* 30 Nm
3. *Torque:* 10 Nm
4. *Torque:* 10 Nm

45.
1. *Torque:* 30 Nm
2. *Torque:* 18 Nm

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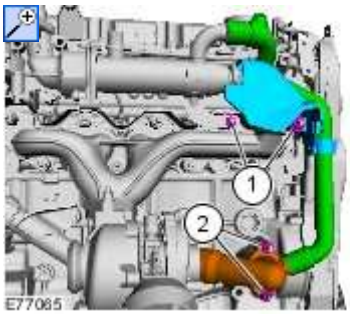
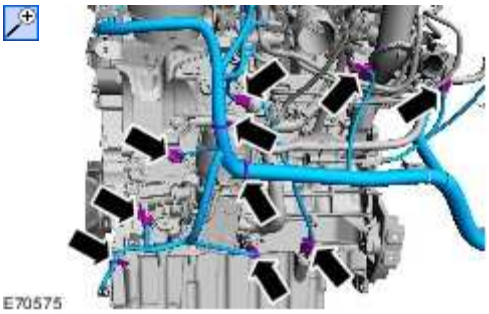
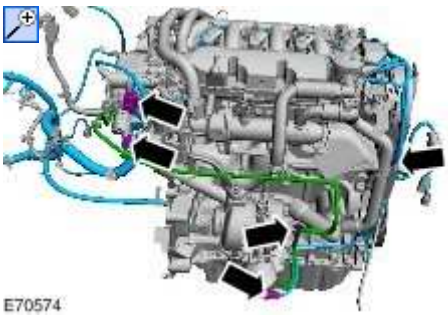


46.



47.



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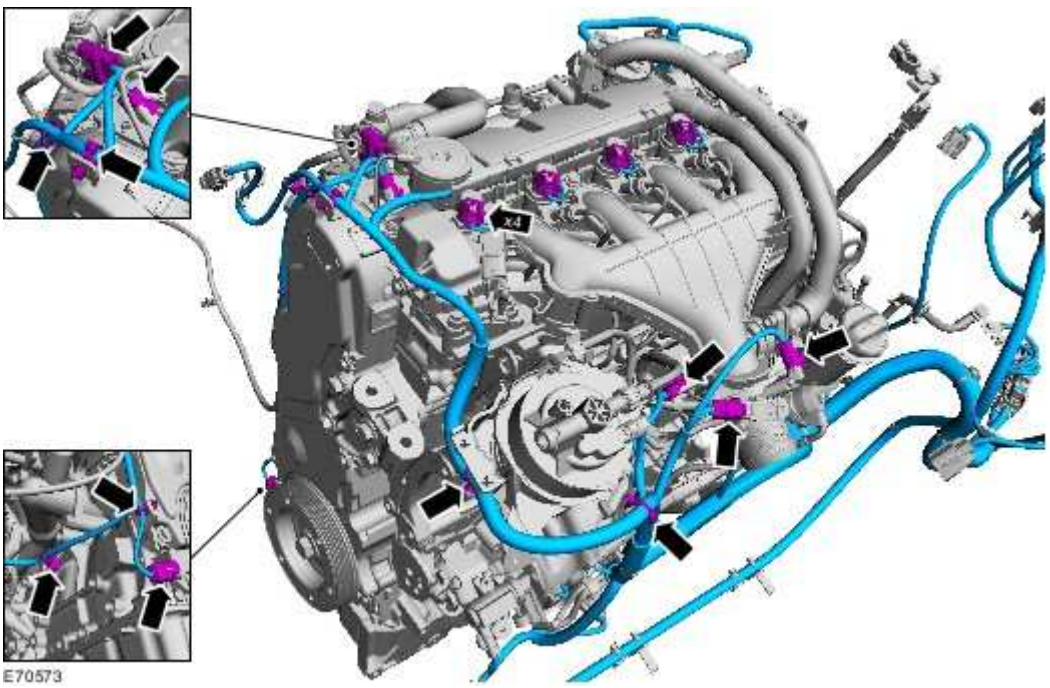

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Engine Data

Description	
Engine code	Q4BA
Firing order	1-3-4-2
Emission level	Stage IV
Bore	85.0 mm
Stroke	96.0 mm
Cubic capacity	2179 cm³
Compression ratio	16.6:1
Power output at 3500 rpm	129 kW (170 PS)
Torque at 1750 rpm	400 Nm
Idle speed	800 rpm
Oil consumption	0.1L / 1000 Km

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Engine oil	WSS-M2C913-B
Coolant	WSS-M97B44-D
Sealant	WSE-M4G323-A4

Engine Oil Capacity

Description	Liters
Initial fill including oil filter	6.5
Service fill with oil filter	5.9
Service fill without oil filter	5.3

Cylinder Head

Description	mm
Thickness of cylinder head gasket with piston protrusion of 0.55 to 0.60 mm	1.25 ± 0.04 (1 hole)
Thickness of cylinder head gasket with piston protrusion of 0.61 to 0.65 mm	1.30 ± 0.04 (2 holes)
Thickness of cylinder head gasket with piston protrusion of 0.66 to 0.70 mm	1.35 ± 0.04 (3 holes)
Thickness of cylinder head gasket with piston protrusion of 0.71 to 0.75 mm	1.40 ± 0.04 (4 holes)
Maximum distortion — measured longitudinally and diagonally	0.03

Oil Pressure Specifications

Description	bar
Oil pressure at 2000 rpm	2.0
Oil pressure at 4000 rpm	4.0

Balance Shaft Measurement Shims

Shim thickness mm	Shim marking
1.57	57

Balance Shaft Shims

Minimum clearance mm	Shim thickness mm	Shim marking
0.01 - 0.05	1.57	57
0.05	1.51	51

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0.06	1.49	49
0.07	1.47	47
0.09	1.45	45
0.1	1.43	43
0.11	1.41	41
0.12	1.41	41
0.13	1.39	39
0.14	1.37	37
0.15	1.35	35
0.16	1.35	35
0.17	1.33	33
0.18	1.31	31
0.19	1.29	29
0.2	1.29	29
0.21	1.27	27
0.22	1.25	25
0.23	1.23	23
0.24	1.23	23
0.25	1.21	21
0.26	1.19	19
>0.26	1.19	19

Item	Nm
Cylinder Block blanking plug	42

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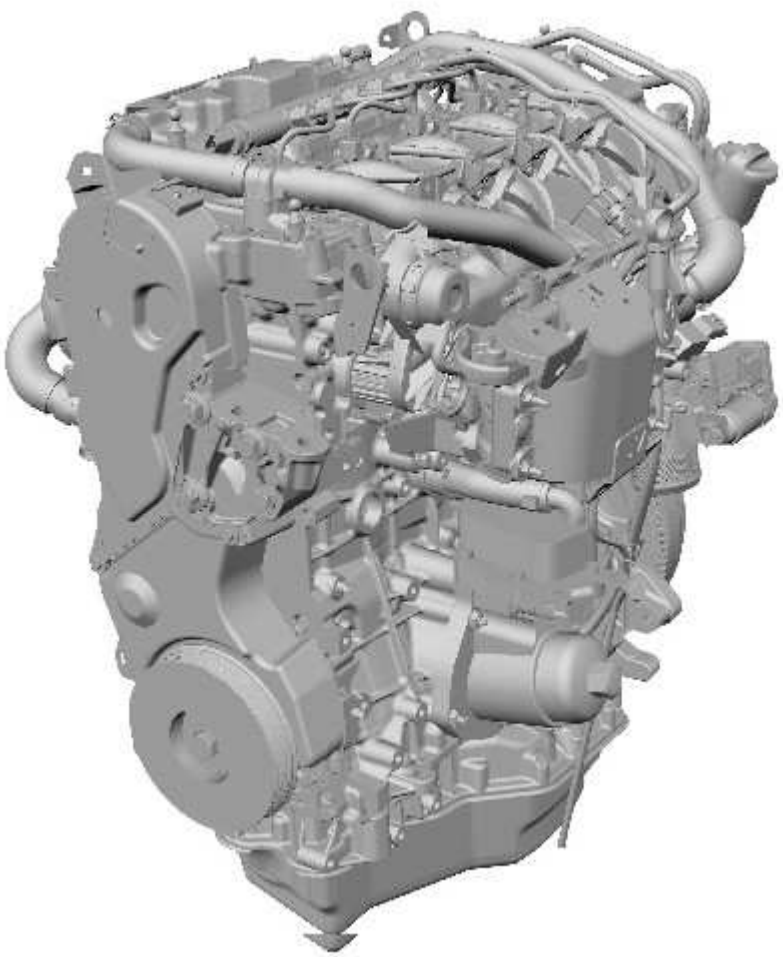
Description and Operation

2.2L Duratorq-TDCi (DW) diesel engine



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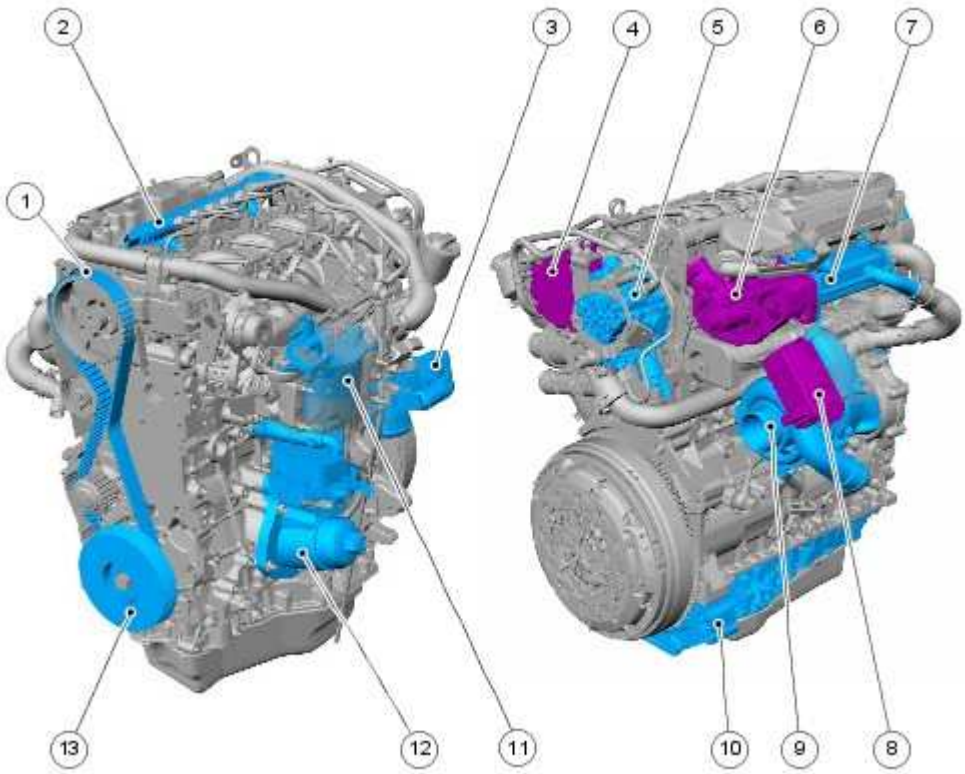

Item	Description
1	Timing belt
2	High-Pressure Fuel Rail
3	Electronically-controlled intake manifold flap
4	Vacuum pump
5	Fuel pump
6	Electrically controlled EGR (exhaust gas recirculation)
7	EGR radiator
8	Turbocharger variable vane electrical actuator
9	Variable-geometry turbocharger
10	Engine sump extension
11	Fuel filter
12	Oil filter/oil cooler unit
13	Crankshaft mass damper

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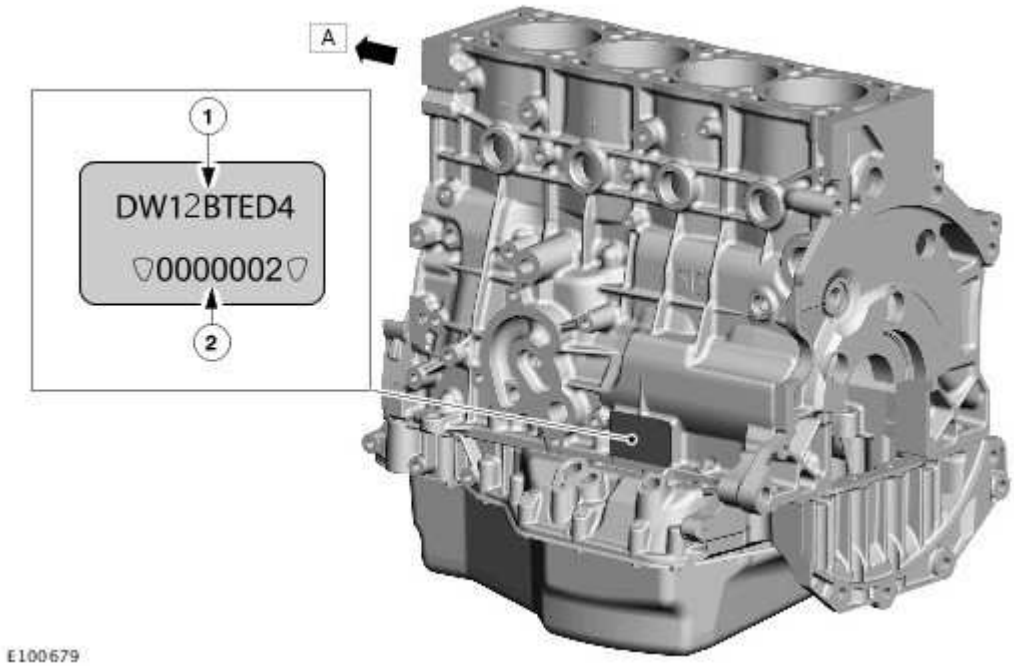

Item	Description
A	Front of the engine
1	Engine code
2	Engine serial number

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Description and Operation

The 2.2L Duratorq-TDCi (DW) diesel engine extends the range of TDCi 4-cylinder turbocharged diesel engines.

Features

- 4-cylinder turbodiesel in-line engine with two overhead camshafts and 16 valve technology
- Cast iron cylinder block with cast-in cylinder liners
- Ladder frame for extending the cylinder block
- Balance shaft unit for optimum running smoothness
- Two-part cylinder head made from aluminium
- Exhaust camshaft driven by a timing belt
- Intake camshaft driven via a timing chain (driven by the exhaust camshaft)
- Valves actuated by roller cam followers with hydraulic tappets
- Swirl and charge ducts for optimum combustion under all operating conditions
- Variable-geometry turbocharger for optimum cylinder charging

Fuel system

- Bosch common rail system with maximum fuel pump pressure of 1600 bar (also up to 1800 bar for a limited time)
- Fuel injectors with piezo technology
- Electric fuel pump for assisting with filling of the swirl pot in the fuel tank

Engine management

- Bosch PCM (powertrain control module) EDC16CP39
- Fuel metering valve, fuel pressure regulator and fuel pressure sensor for efficient regulation of the fuel pressure
- Turbocharger variable vane electrical actuator
- Actuator motor-controlled EGR (exhaust gas recirculation) valve
- Actuator motor-controlled intake manifold flap with position sensor
- generator control via LIN data bus system
- Oil temperature sensor as an input variable for calculating the oil quality

Engine-emission control

- Meets EURO IV
- Actuator motor-controlled EGR valve
- Intake manifold flap with position sensor
- Broadband Lambda probe for correcting the injection volume and for optimizing the EGR
- Coated DPF (diesel particulate filter) to minimize rust particle emissions

Diagnosis

- Via the DLC (data link connector)with IDS (Integrated Diagnostic System)

Specification

Torque and power output:

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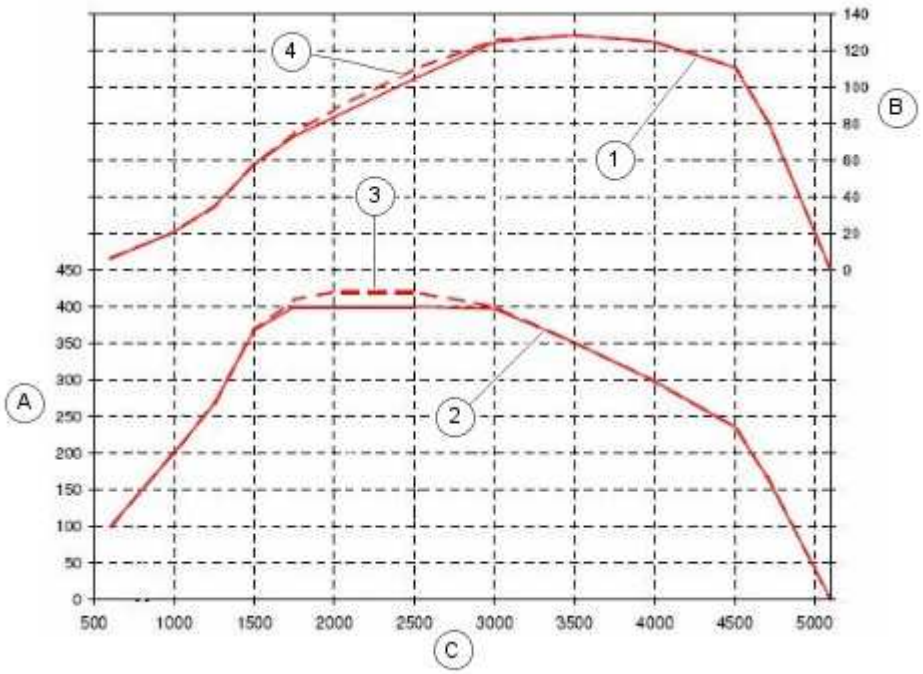

Item	Description
A	Torque (Nm)
B	Power output (kW)
C	Engine Speed
1	Power output curve
2	Engine speed curve
3	Torque during the overtorque function
4	Power output during the overtorque function

Designation	Dimensions
Engine code	Q4BA
Engine Type	4-cylinder in-line engine
Maximum power	130 kW (175 hp)
Maximum torque	400 Nm (420 Nm overtorque)
Engine Capacity	2,179 cm³
Lifting height	96 mm
Bore	85 mm
Compression ratio	16,6:1
Firing sequence	1 – 3 – 4 – 2
Idle speed	Approx. 800 rpm

Overview of the main engine components

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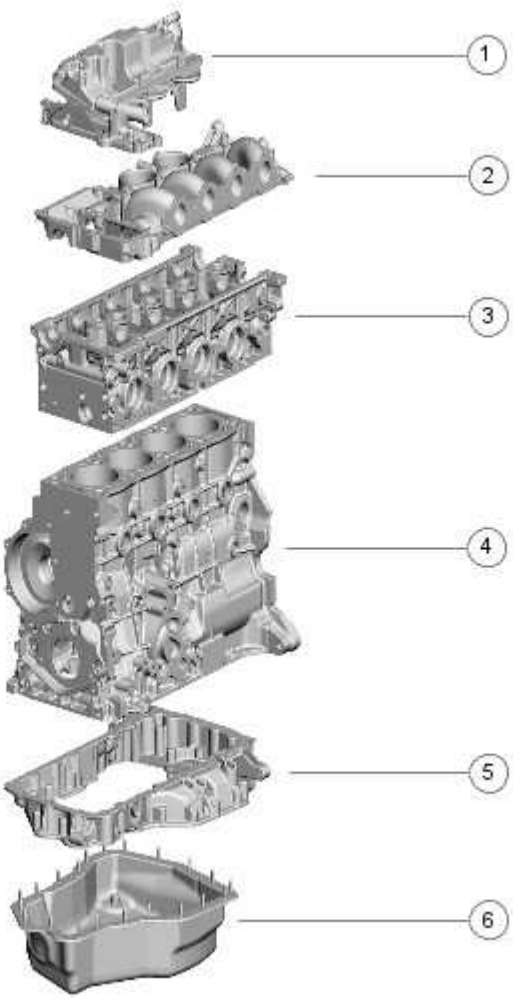

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Item	Description
1	Valve cover
2	Cylinder head - upper part
3	Cylinder head - lower part
4	Cylinder block
5	Oil pan extension
6	Oil sump

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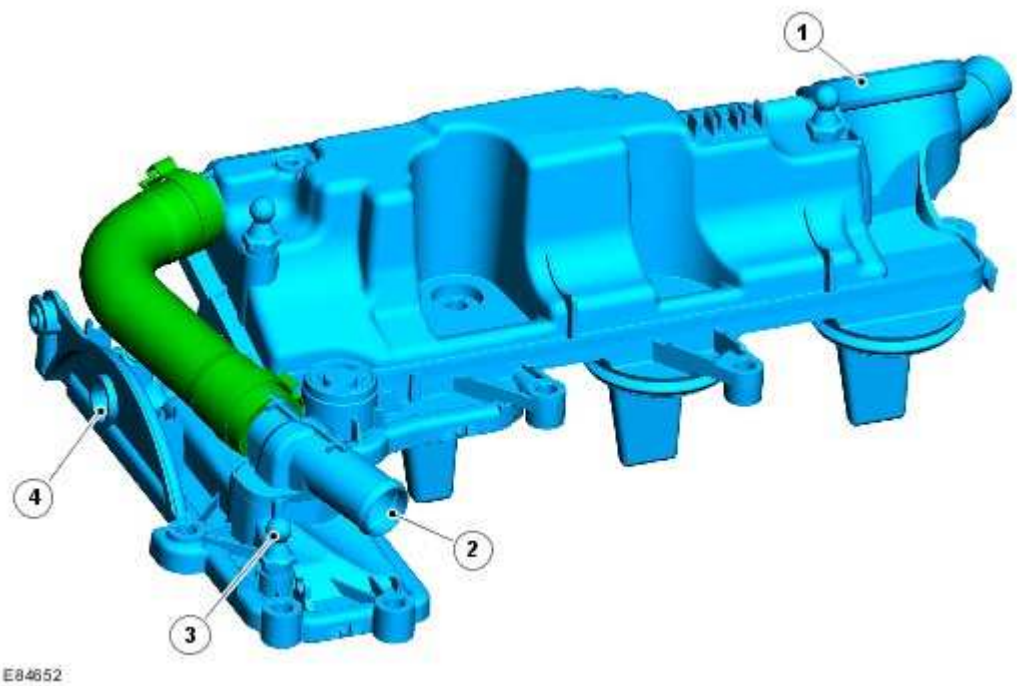
Description and Operation

System Operation

Valve cover and PCV (positive crankcase ventilation) valve

Valve cover



Item	Description
1	PCV valve
2	PCV hose connection
3	Engine cover fixing point
4	CMP (camshaft position) sensor installation location

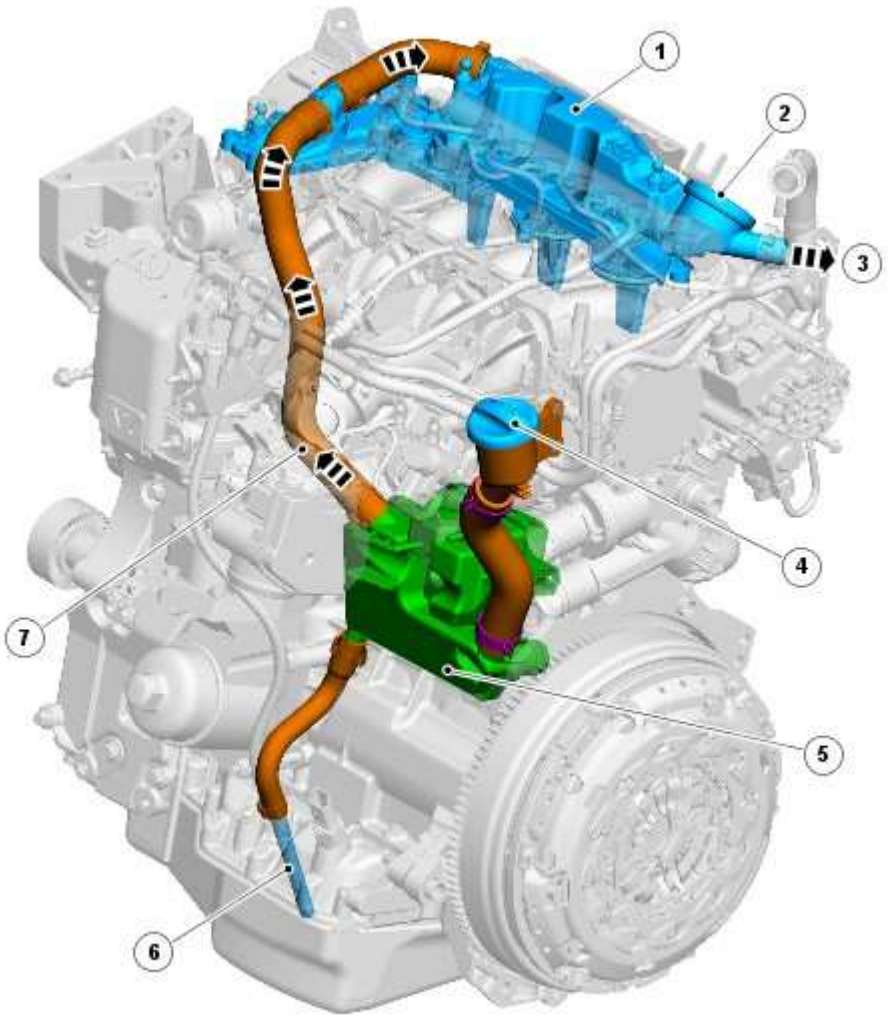
The L-shaped valve cover is made from composite material.

The PCV valve is integrated in the valve cover

A flat gasket is used to form a seal between the valve cover and the upper part of the cylinder are sealed by two O-rings in the upper part of the cylinder head.

PCV

http://vnx.su



E85244

Item	Description
1	Valve cover
2	PCV
3	Crankshaft gases to the intake tract
4	Oil filler cap
5	PCV oil separator
6	Oil drain pipe
7	Oil separator hose to PCV valve

Cylinder head

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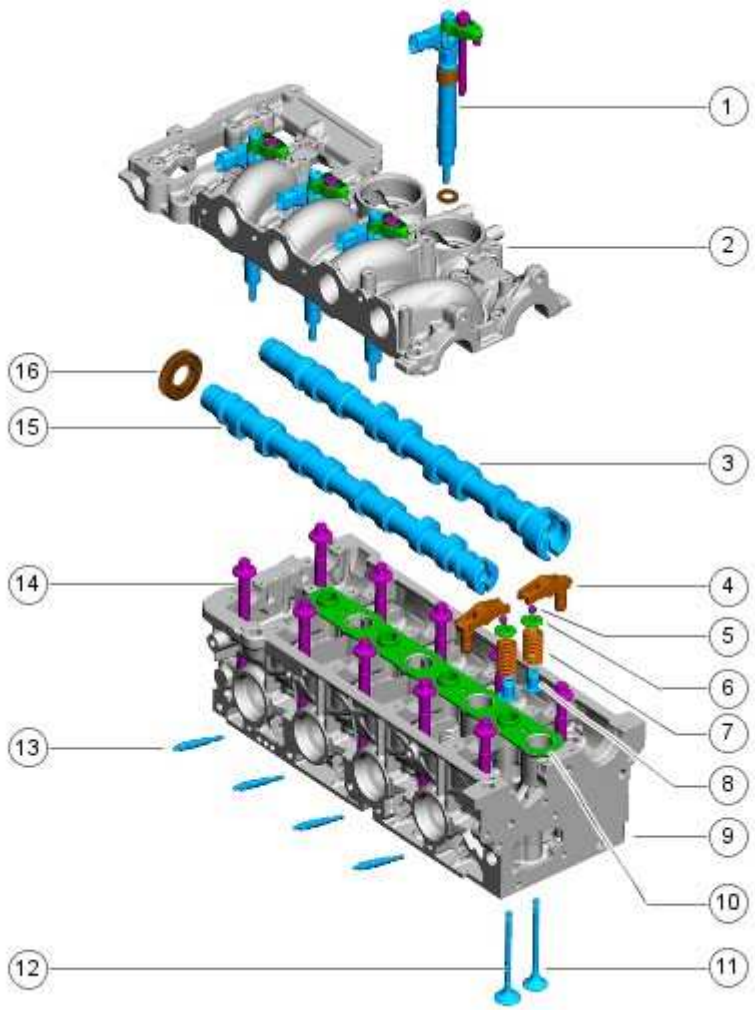

E96505

Item	Description
1	Fuel injector
2	Cylinder head upper part
3	Exhaust camshaft
4	Roller tappet
5	Valve collet
6	Upper valve guide
7	Valve spring
8	Lower valve guide
9	Cylinder head lower part
10	Gasket
11	Exhaust Valve
12	Intake Valve
13	Glow plug
14	Cylinder head bolt (10 in total)
15	intake camshaft
16	Radial shaft seal of the front exhaust camshaft

NOTE: The upper and lower parts of the cylinder head are matched to each other in terms of t

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renewed as individual parts.
NOTE: The parts of the cylinder head must not be reworked.
Both cylinder head parts have been matched to each other during production. Two guide sleev
parts exactly.

The upper part of the cylinder head is bolted to the lower part of the cylinder head and s

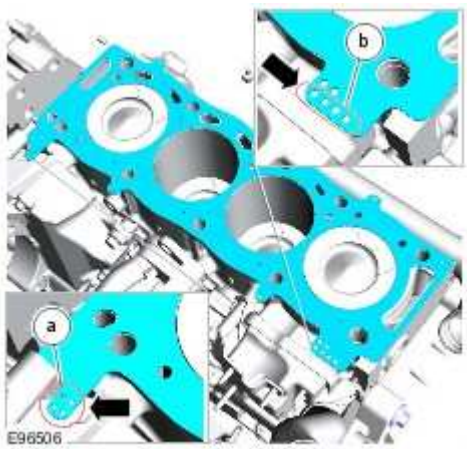
- using silicon sealer (seals the outer area),
- using a ready-made gasket (seals the swirl ducts and the guides for the fuel injectors).

The upper halves of the camshaft mountings are incorporated into the upper part of the cylind
directly in the aluminium.

The camshafts are made from cast iron. The intake camshaft drives the vacuum pump at the r
camshaft drives the fuel pump at the rearward end. An O-ring provides the seal in each case.

The lower part of the cylinder head is bolted to the cylinder block with a total of 10 bolts. The
be reused during servicing.

Cylinder head gasket



Item	Description
Connecting rod retaining bolts	Cylinder head gasket thickness
	b Cylinder head gasket thickness

The multi-layer steel cylinder head gasket is available in four thicknesses dependir

Number of cut-outs	Piston protrusion	Cylinder hea
1	0.55 - 0.60 mm	1.25 +
2	0.61 - 0.65 mm	1.30 +
3	0.66 - 0.70 mm	1.35 +
4	0.71 - 0.75 mm	1.40 +

Camshaft and camshaft drive

Overview of the components

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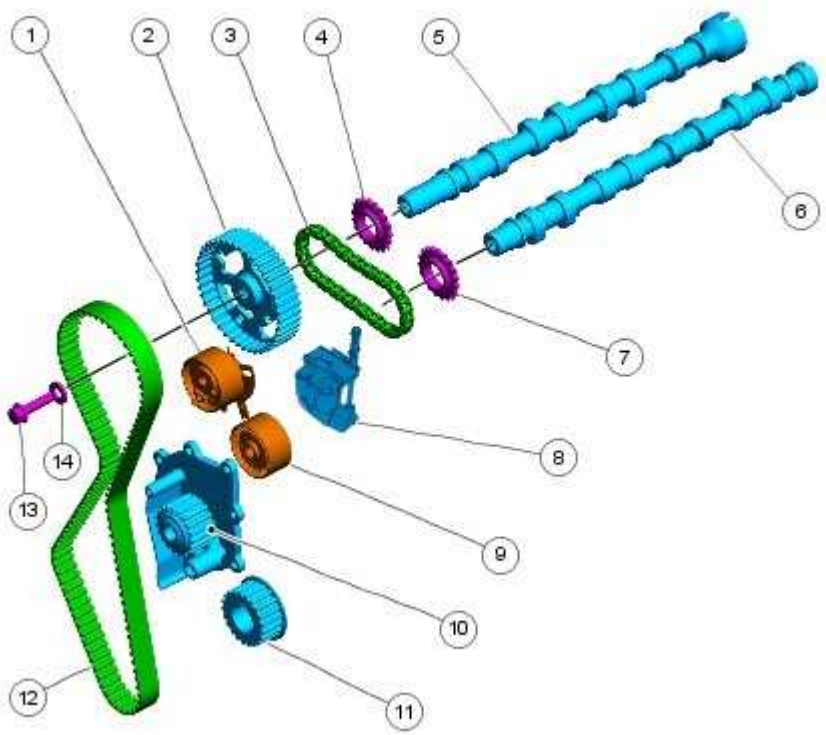

Item	Description
1	Automatic timing belt tensioner
2	Exhaust camshaft pulley
3	Camshaft timing chain
4	Exhaust camshaft sprocket
5	Exhaust camshaft
6	intake camshaft
7	Intake camshaft sprocket
8	Hydraulic timing chain tensioner
9	Idler pulley
10	Coolant pump drive gear
11	Crankshaft timing belt pulley
12	Timing belt
13	Retaining bolt of the camshaft sprocket
14	Washer

Timing Cover

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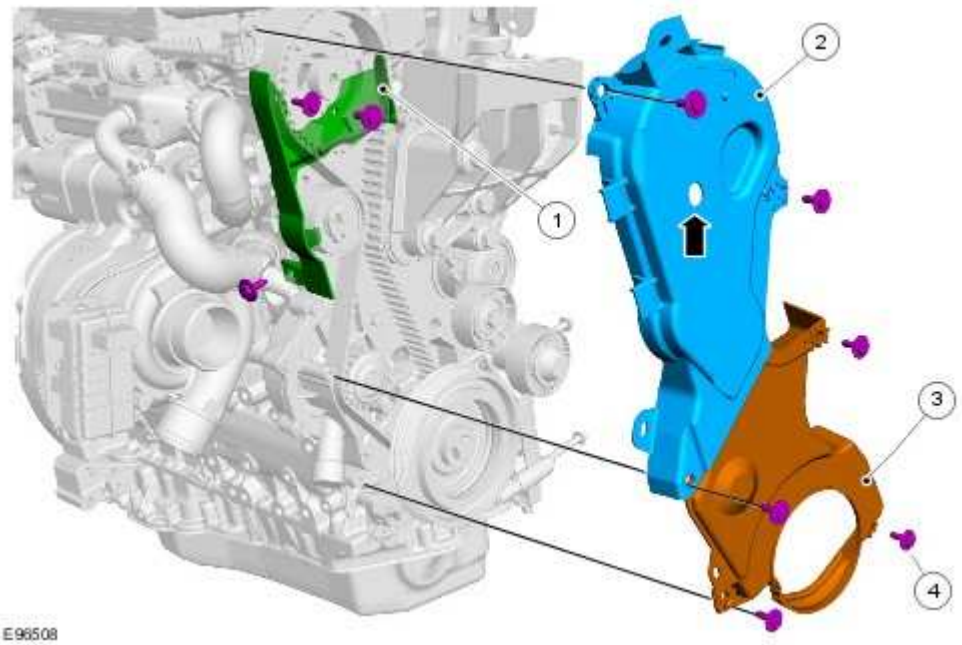
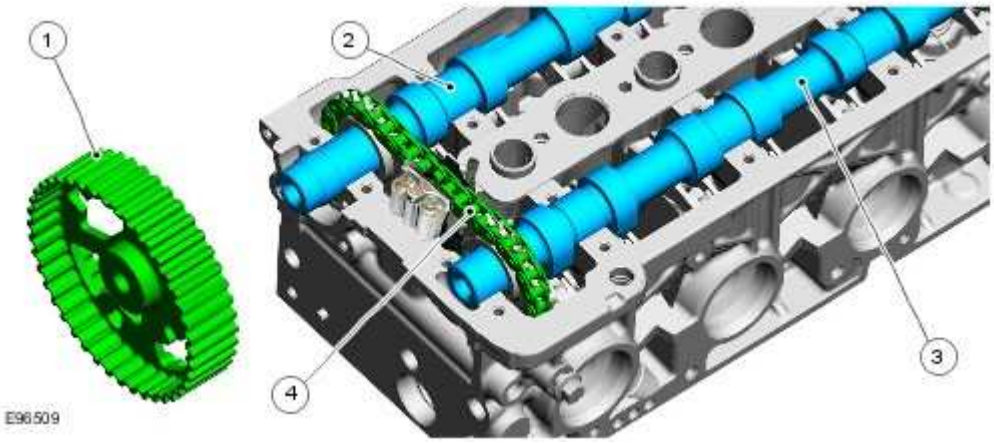


Item	Description
1	Rear timing cover
2	Upper timing cover
3	Lower timing cover
4	Mounting bolt

The plastic timing covers are secured to the engine using a total of nine bolts.

There is a hole (arrow) in the upper timing cover. This hole permits the insertion of the special camshaft pulley. This allows fast checking of the valve timing.

Camshaft Drive



Item	Description
1	Camshaft pulley
2	Exhaust camshaft
3	intake camshaft
4	Timing chain

The exhaust camshaft is driven by the crankshaft via a timing belt.

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The intake camshaft is driven by the exhaust camshaft via a timing chain.

Pretensioning of the timing chain is performed by a hydraulic timing chain tensioner.

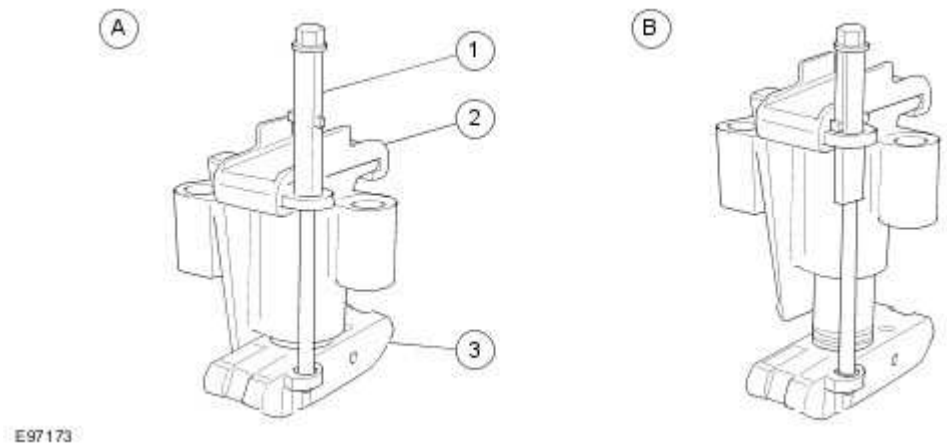
Hydraulic timing chain tensioner

The hydraulic timing chain tensioner is mounted between the camshaft sprockets on the upper

The hydraulic chain tensioner is supplied with the appropriate oil pressure via an oil bore. Also timing chain tensioner is a compression spring. This ensures the necessary pretensioning of th

There is a service pin at the chain tensioner for releasing the pretension during servicing.

Locking and disengaging the hydraulic timing chain tensioner



Item	Description
A	Chain tensioner locked
B	Chain tensioner disengaged
1	Service pin
2	Upper chain guide
3	Lower chain guide

NOTE: After installing the upper part of the cylinder head, make sure that the hydraulic chain t disengaged position.

The chain tensioner can be locked and disengaged again for servicing using the service pin.

To lock the chain tensioner, lift the service pin and then turn it 90 degrees.

To pretension the chain tensioner, turn the service pin once more by 90 degrees. The unlockin

Cylinder block

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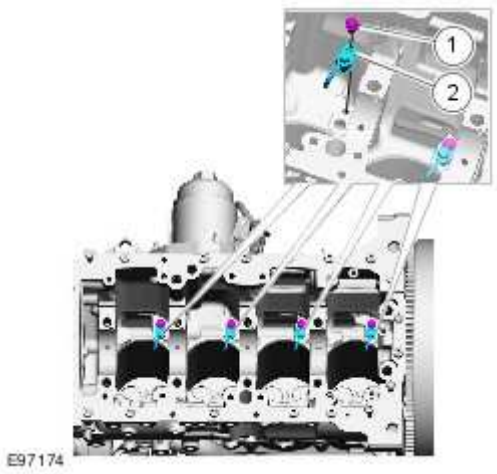
NOTE: Cylinder 1 is located on the transaxle side of the engine.
The cylinder block is made from grey cast iron and is double-walled. This helps to achieve high blanket of air that results in considerable sound insulation.

The serial number of the engine and the engine code are located on the intake side of the cylir second cylinder).

The running surfaces of the cylinders are worked directly into the cylinder block.

There are two holes on the cylinder block for the guide bushings for securing the cylinder head

Oil Spray Jets



Item	Description
1	Oil spray nozzle retaining bolt
2	Oil spray jet (4 off)

The efficient combustion provided by the direct-injection turbocharged diesel engine means th transmitted to the pistons.

There is an oil spray nozzle installed at the lower end of each cylinder liner for cooling the pist engine oil in a targeted manner under the piston crowns.

There are oil passages integrated in the piston crowns. The sprayed engine oil enters these oil necessary piston cooling. Piston cooling is not essential when the engine is cold. Lubrication of has a higher priority here. For this reason, the oil spray nozzles only open if an oil pressure of them.

Cylinder block extension

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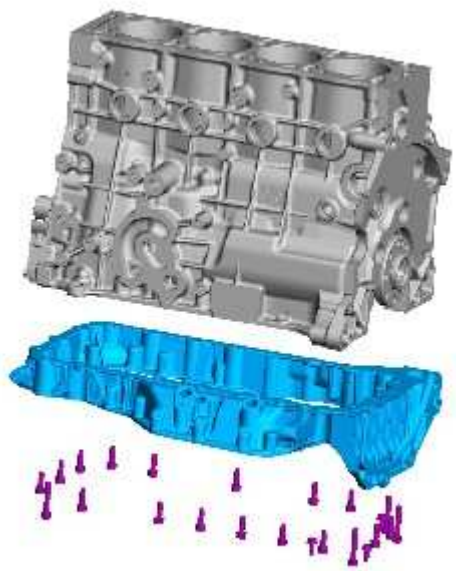
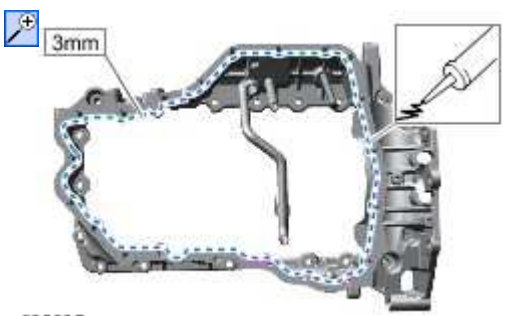


E96511

The oil pan extension is fitted between the cylinder block and the oil pan.

The use of balance shafts means that the oil pump has to be moved further in the direction of distance from the oil pump to the oil pan. The cylinder block extension at the cylinder block re between the oil pump and oil pan.



E85607

The seal with the cylinder block and the oil pan is formed using sealing compound.

Crankshaft and main bearings

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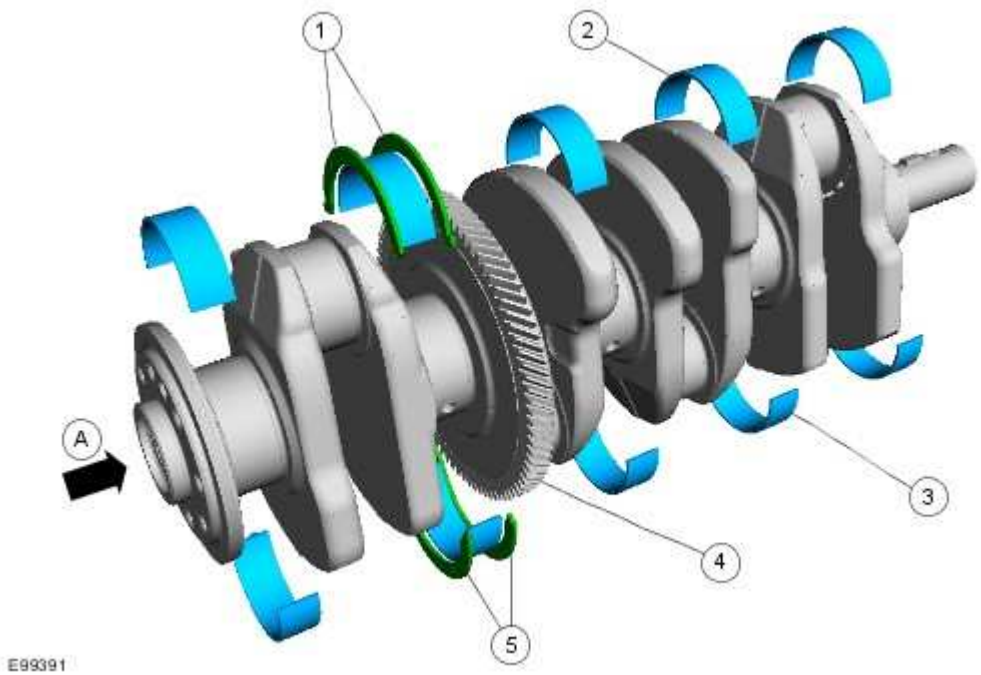

Item	Description
A	Flywheel side
1	Top thrust washers (2 pieces)
2	Top crankshaft bearing shells (5 pieces)
3	Bottom crankshaft bearing shells (5 pieces)
4	Balance shaft drive gear
5	Lower thrust washers (2 pieces)

The crankshaft runs on **five bearings** by means of five main bearing caps.

Each main bearing half cap is stamped with the corresponding cylinder number for identificatic

The crankshaft's radial play is restricted by **four semicircular thrust washers** that are arran bearing 2.

Lubrication grooves are formed on the thrust washers and must face toward the main bearing.

Each main bearing housing and half cap contains an upper and lower bearing half shell manufa upper half shells are formed with a drilling and annular groove to transfer pressurized oil from crankshaft drillings to the connecting rod big-end bearings.

For establishing the correct crankshaft main bearing play, the lower main bearing shells are av thicknesses.

The balance shaft drive gear is shrunk onto the third crankshaft web. The helical drive gear pr shafts.

Piston and Connecting Rod Assembly

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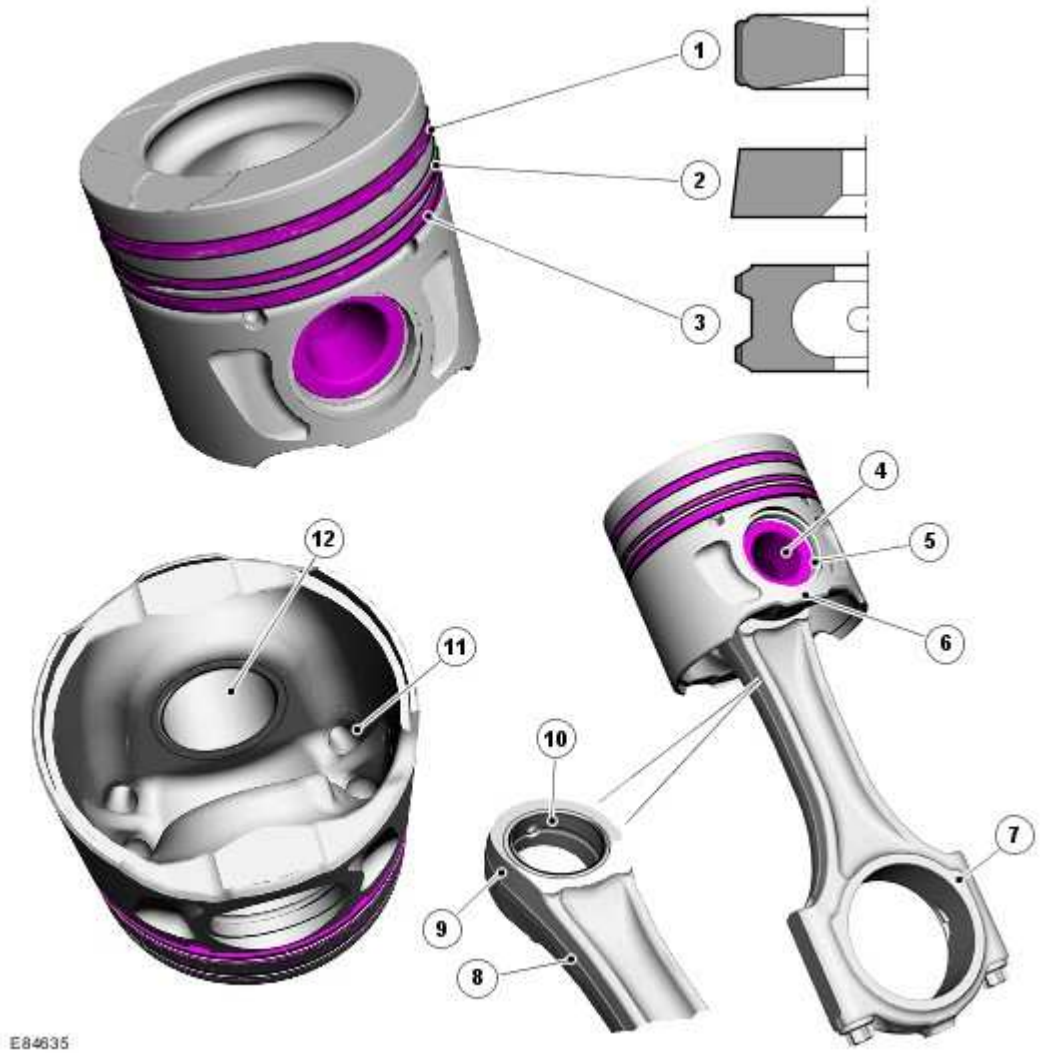

Item	Description
1	Upper compression ring
2	Lower compression ring
3	Oil control 'scraper' ring
4	Gudgeon pin
5	Gudgeon pin circlip (2 off)
6	Piston and connecting rod assembly
7	Connecting rod big-end
8	Connecting rod shaft
9	Connecting rod small-end
10	Small-end bushing
11	Piston crown cooling channel
12	Piston bush (2 off per piston)

Connecting rods

The connecting rods are made from forged steel.

The connecting rod small-end is narrowed on each side to form a tapered head. The taper imp between the piston and connecting rod during the combustion stroke.

A bronze bush is installed in the small-end, and formed with an internal groove to allow the flc

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bush.

Connecting rod big-end

The connecting rod large end is split as a bearing housing. The bearing cap is mounted using t

The connecting rod size is engraved both on the connecting rod large end and on the bearing c components belong together.

There is a bearing shell mounted in the connecting rod large end and in the bearing cap.

The connecting rod large end, the bearing cap and the bearing shells have a lug that aligns the prevents radial movement of the bearing shells. During installation the lugs must face toward the engine.

Pistons

The pistons are made from an aluminium alloy and have a total of three piston rings.

A steel insert is installed in the piston upper ring groove to provide reinforcement.

A piston recess of typical design for direct diesel injection is incorporated into the piston crown

Recesses are also formed in the piston crown to provide clearance for the 4 valve heads. This design produces optimum air/fuel mixture swirl.

The 3 piston rings must be installed with the ring gaps spaced at 120° (with permissible tolera other, around the piston.

The 2 upper compression rings are stamped with 'top' to aid installation.

The bearing surface of the piston is finished with a graphite substance for reducing friction in t

Two oil cooling channels on the underside of the piston crown ensure optimum piston cooling.

Balance shaft unit

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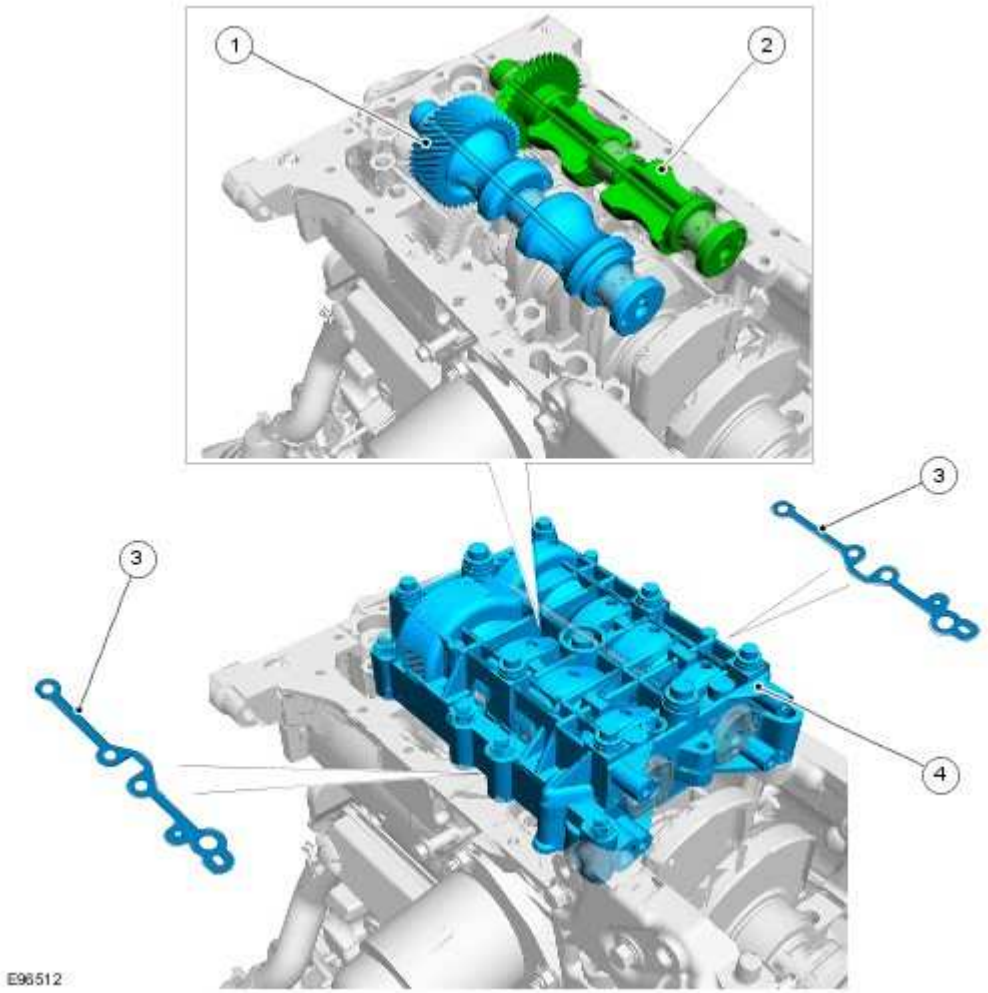

Item	Description
1	Propelled balance shaft (rotates counter to the crankshaft)
2	Driven balance shaft
3	Shims
4	Balance shaft unit

NOTE: The balance shaft unit must not be dismantled during servicing.
NOTE: Before installing the balance shaft unit, the backlash **between the two balance shaft crankshaft and the driven balance shaft** must be checked.
The balance shaft unit contains two balance shafts and is arranged beneath the crankshaft.

The assembly is attached with 8 bolts to the bottom of the cylinder block.

The oil pump is arranged on the underside of the balance shaft housing (not illustrated).

The balance shaft unit is attached to the cylinder block extension using two shims and eight bo

The backlash between the propelled balance shaft and the balance shaft drive gear at the cran shims.

The balance shafts should counteract the different forces of inertia (caused by the countermov the crankshaft.

Operation

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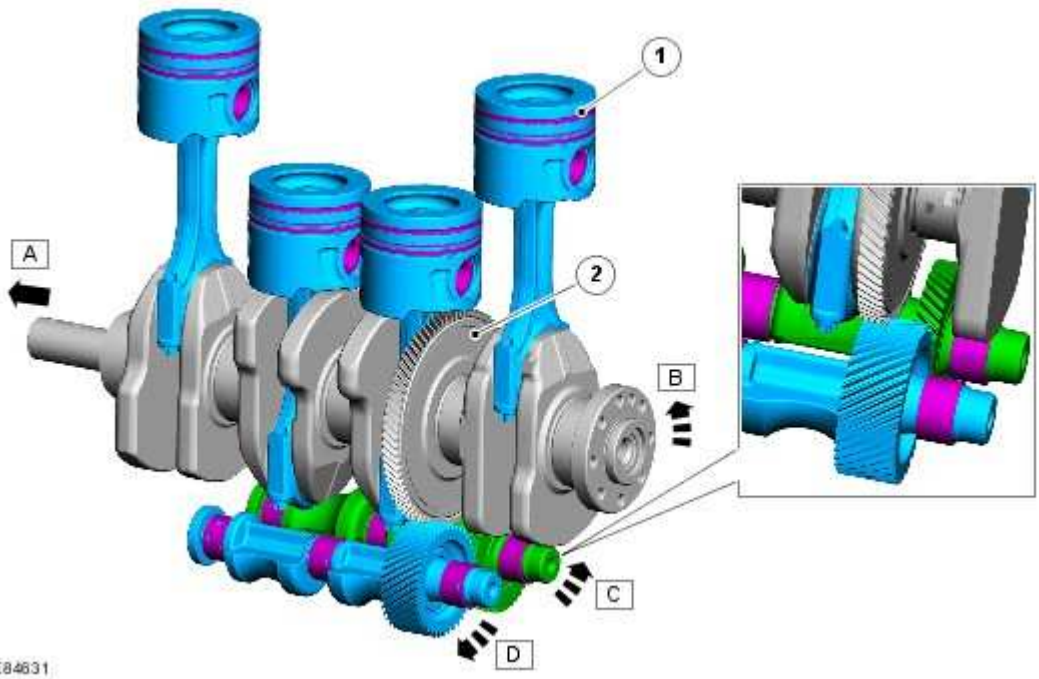

Item	Description
A	Front of the engine
B	Direction of crankshaft
C	Running direction of the driven balance shaft
Drive	Running direction of the balance shaft propelled by the crankshaft
1	Cylinder 1 piston
2	Balance shaft drive gear

The balance shaft drive gear at the crankshaft propels the propelled balance shaft in the oppos crankshaft.

The driven balance shaft is propelled by the propelled balance shaft and rotates in the same di

The balance shaft drive gear at the crankshaft has twice as many teeth as the mating gears or gear ratio is therefore 1:2.

Oil Pump Assembly

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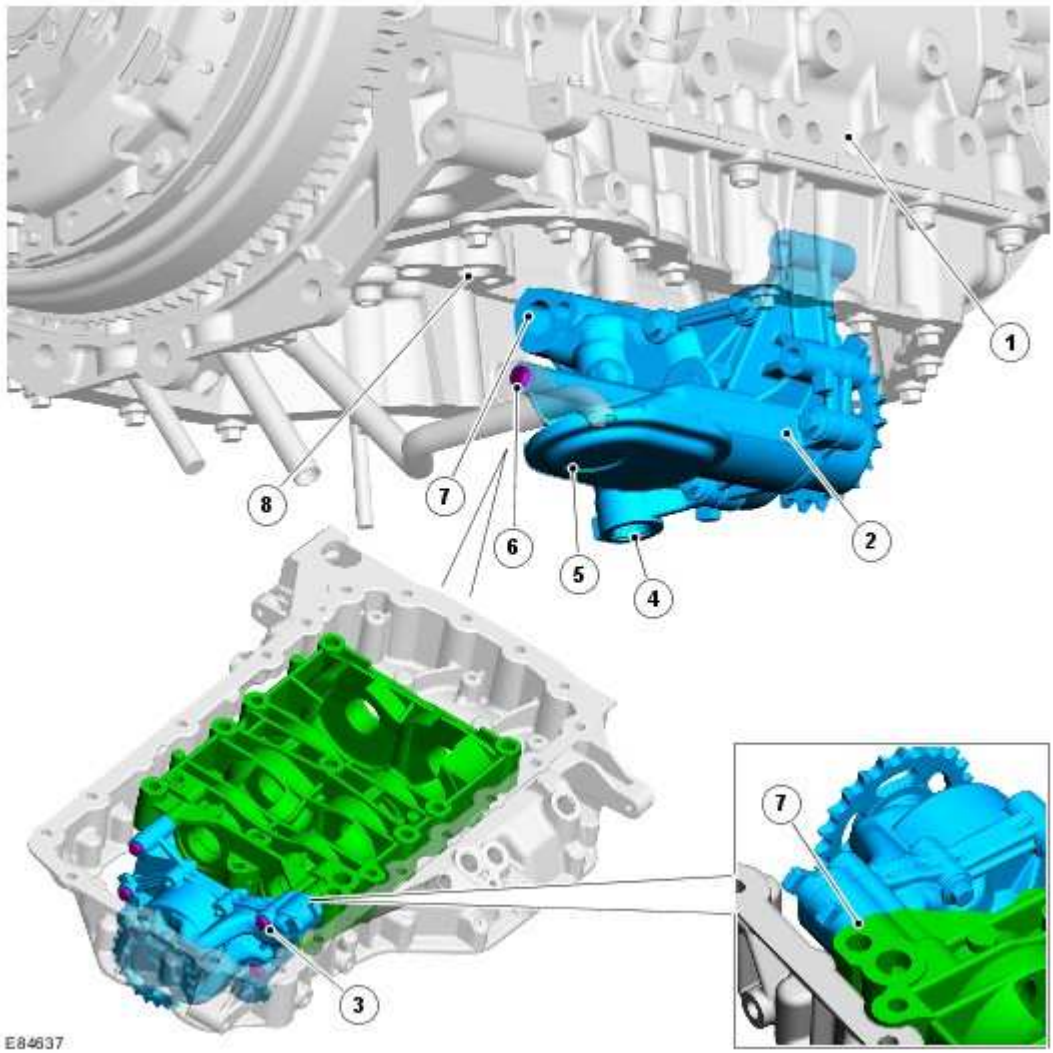

Item	Description
1	Cylinder block
2	Oil Pump Assembly
3	Retaining bolt (4 pieces)
4	Pressure relief valve housing
5	Oil pick up and strainer
6	Mounting bolt (1 off)
7	Oil pump outlet port
8	Oil pump supply to cylinder block

The oil pump is designed as a rotor pump and is bolted to the balance shaft unit using four ret
the oil strainer secures the oil pump with the oil dipstick tube.

The drive is provided by the crankshaft via a Simplex chain.

The oil pump generates a maximum permissible oil pressure of approx. 6.5 bar and a maximu

A pressure relief valve within the oil pump outlet protects the oil pump and lubrication system
pressure.

The pressure relief valve opens at approx. 8 bar. The excess oil runs directly back into the oil

Oil filter/oil cooler unit

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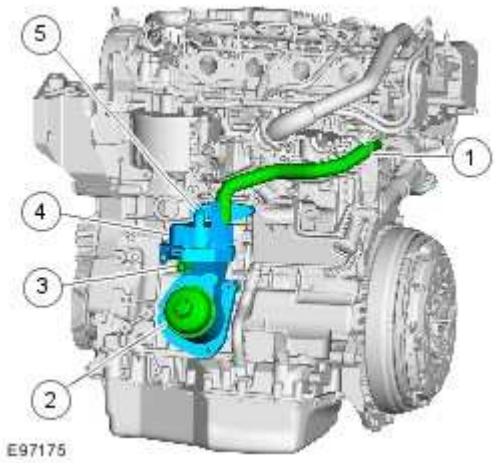


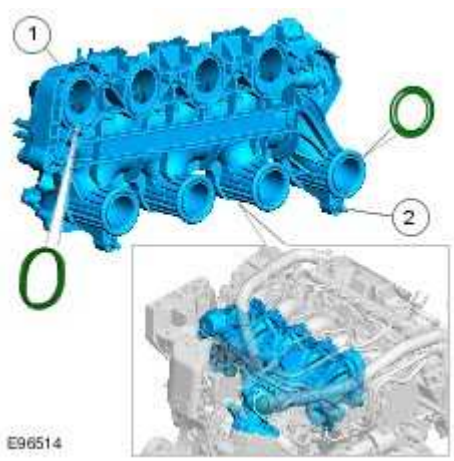
Item	Description
1	Coolant return
2	Oil filter housing
3	Oil pressure switch
4	Oil cooler
5	Coolant feed

The oil filter/oil cooler unit is located on the intake side of the engine, level with the third cylin

The oil filter element (paper filter element) is located in the oil filter housing.

The coolant is routed from the cylinder block into the oil cooler via the coolant feed. The coolar housing of the cooling system via the coolant return.

Intake manifold



The intake manifold is designed so that the charge air is routed to all eight intake ducts in a cc

Furthermore, the gas from the positive crankcase ventilation system and from the EGR (exhau returned to the intake manifold.

The seal with the intake ducts at the cylinder head is provided:

- by means of one O-ring for each of the four lower swirl ducts,
- by means of one rubber seal for each of the four upper charge ducts.

Note: When fitting the intake manifold, ensure that the O-rings/rubber seals are seated correc

The intake manifold is bolted to the cylinder head using a total of seven retaining bolts.

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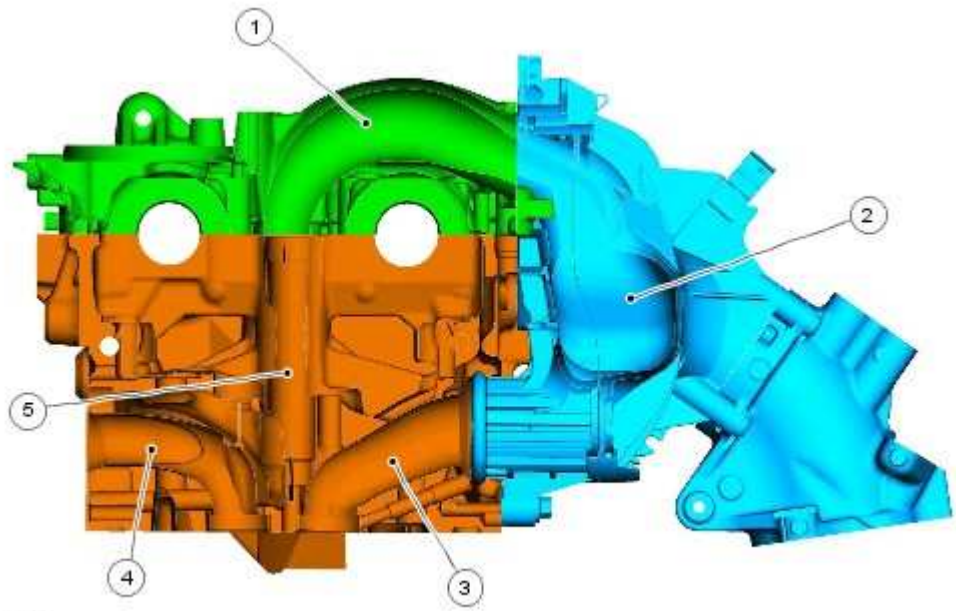
Intake ducts



E98515

Item	Description
1	Charge duct (in the upper part of the cylinder head)
2	Intake manifold
3	Swirl duct
4	Outlet Duct
5	Charge duct (in the lower part of the cylinder head)

The movement of the air flowing into the cylinder is crucial for optimum mixture formation.

Each cylinder is equipped with two intake valves. Leading to each intake valve is

- one swirl duct and
- one charge duct.

The **swirl duct** produces a specific rotational movement (swirl) in the charge air. This optimis
lower engine speed range and thus reduces fuel consumption.

The **charge duct** guarantees an optimum cylinder charge at all times. This has a positive effe
the **upper engine speed range**.

Exhaust Manifolds

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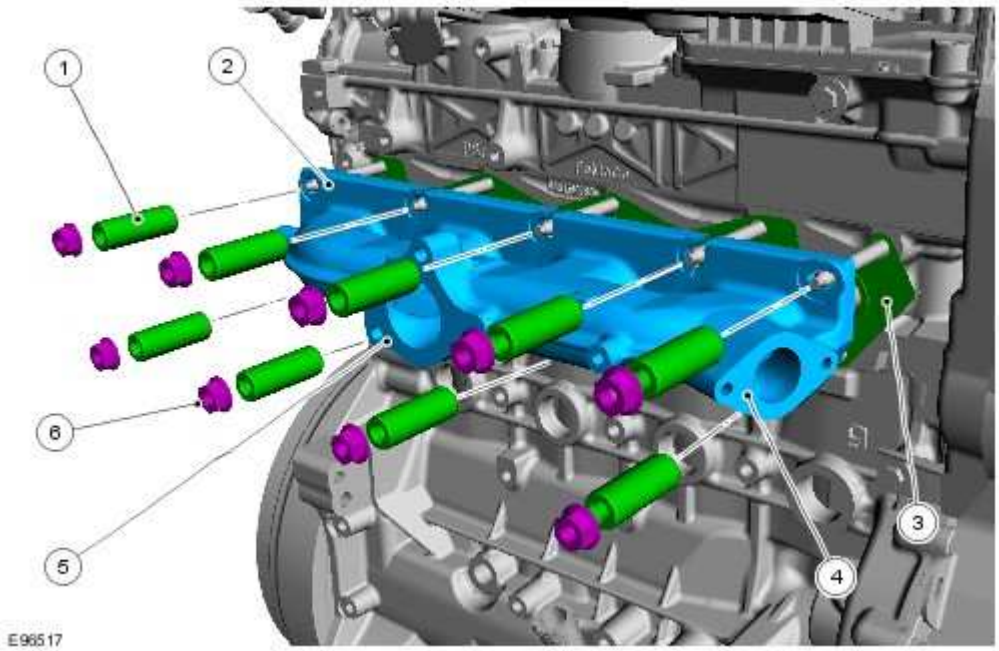


Item	Description
1	Spacer
2	Exhaust Manifolds
3	Gasket
4	EGR connection
5	TC (turbocharger) connecting flange
6	Self-locking retaining nut

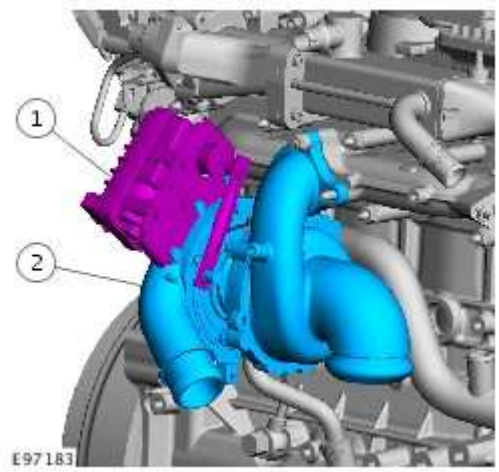
The exhaust manifold is bolted to the cylinder head using nine studs with self-locking nuts.

There is also a spacer mounted over each stud. The spacers compensate the expansion play w heats up or cools down.

One connecting flange each is incorporated in the exhaust manifold for the TC and the EGR.

There is an exhaust manifold heat shield mounted over the exhaust manifold (not illustrated). components in the vicinity of the exhaust manifold. It also prevents burns if someone accident

TC



Item	Description

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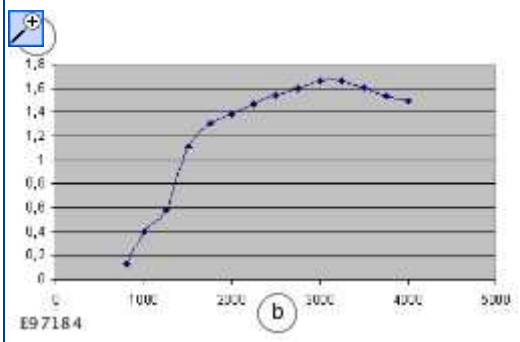
1	Turbocharger variable vane electrical actuator
2	TC

Charging of the engine takes place via the TC from Garrett with variable turbine geometry.

The turbocharger variable vanes are adjusted by a turbocharger variable vane electrical actuat

The shaft of the TC is lubricated and/or cooled with engine oil via a supply line.

The TC can reach a shaft speed of up to 200,000 rpm during operation.



Item	Description
Connecting rod retaining bolts	Charge pressure (in bar) b Engine Speed

A charge pressure of almost 1.7 bar is achieved depending on the engine speed **ar**

EGR system

Overview of the components

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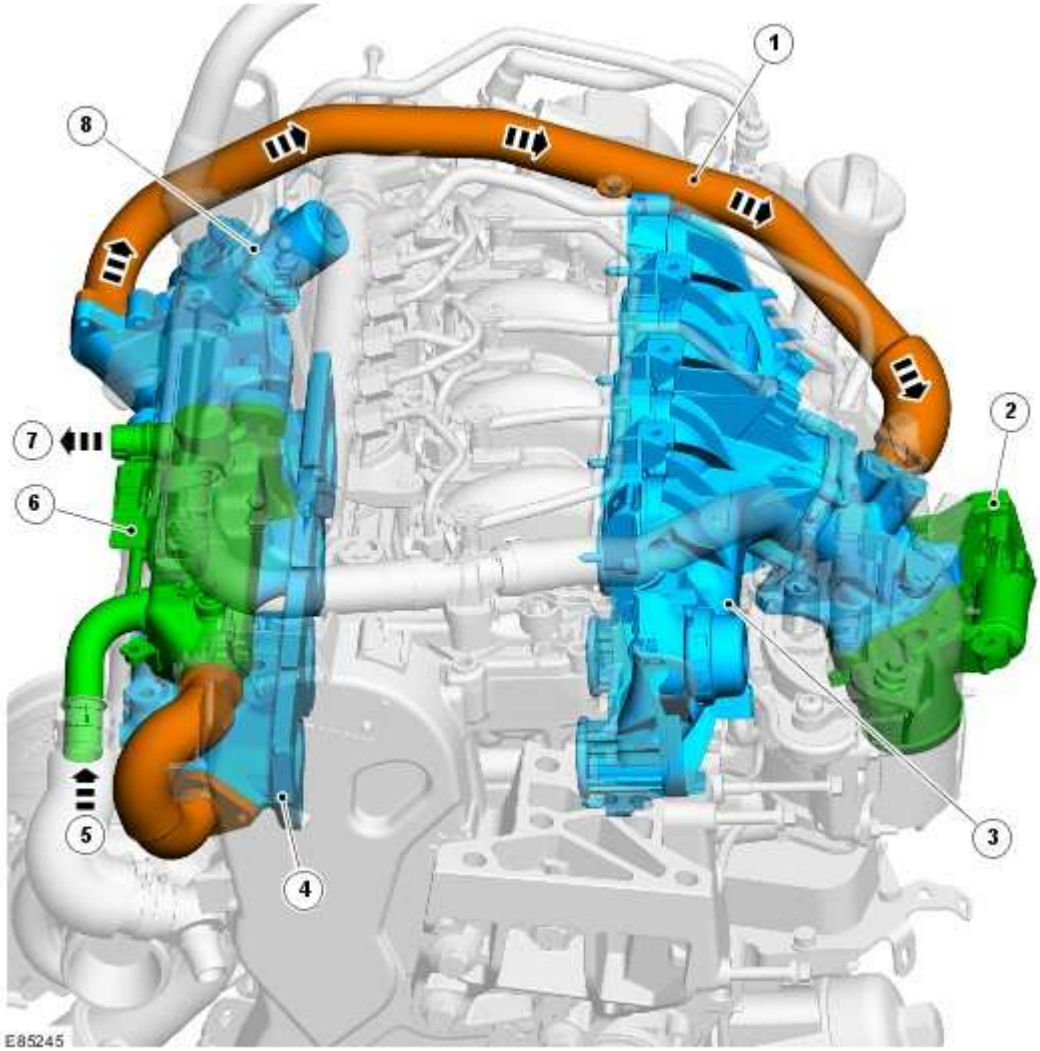

Item	Description
1	Connecting pipe leading from EGR valve to intake manifold
2	Throttle body
3	Intake manifold
4	Exhaust Manifolds
5	Coolant inlet port
6	EGR radiator
7	Coolant outlet connection
8	EGR valve

Diesel engines work with a large surplus of air. The high proportion of O2 (oxygen) produces a (oxides of nitrogen) during combustion.

Via the EGR system, part of the exhaust gas is routed back into the fresh air flow.

The proportion of recirculated exhaust gas no longer directly participates in the combustion. Tl proportion of NOX.

The exhaust gas recirculation rate depends to a large extent on the engine speed and engine l recirculated particularly efficiently in the lower partial load range. Recirculation rates of over 6 favourable conditions.

EGR valve and radiator

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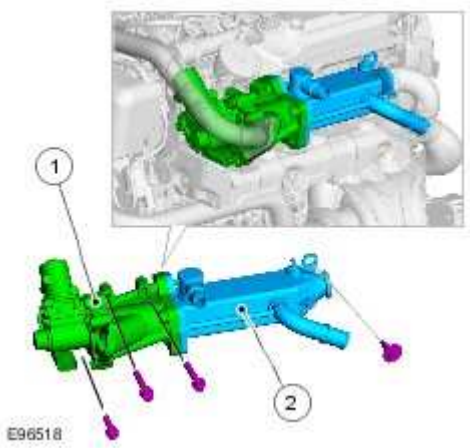


Item	Description
1	EGR valve
2	EGR radiator

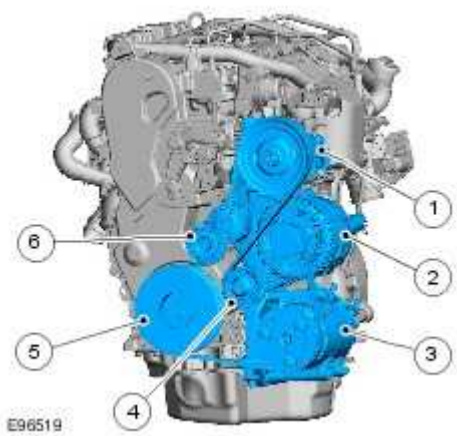
The EGR valve consists of a DC (direct current) motor and a position sensor.

The EGR valve and the EGR radiator are bolted together.

The EGR radiator is connected to the coolant circuit.

The EGR cooling reduces the NOX emission.

Accessory drive



Item	Description
1	Power steering pump
2	Generator.
3	Air conditioning compressor
4	Idler pulley
5	Mass damper
6	Automatic accessory drive belt tensioner

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Print

Diagnosis and Testing

Special Tool(s)

E42936	Compression Test Adapter 303-1414

General Equipment

Ford diagnostic equipment

Materials

Name	Specification
Adhesive - Loctite 243	WSK-M2G349-A7

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Oil leaks • Fuel system leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts	• Fuse(s) • Loose or corroded connector(s) • Control module • Damaged or worn switch(es)

Symptom Chart

Symptom	Possible Sources	Action
Loss of oil	* Oil leaks on components that are either coated in oil themselves or on components local to them.	* CHECK for evidence of oil leaks on components. Use an ultraviolet (UV) leak tester if an oil leak is not evident. INSTALL new gaskets or components as required.
	* Internal or external leak at the oil cooler.	* CHECK the coolant expansion tank for a film of oil on the coolant surface. INSTALL a new oil cooler or oil cooler gasket.
	* Leak at the crankshaft seal.	* INSTALL a new crankshaft seal.
	* Leaks from oil carrying components or basic engine.	* CHECK for cracks in oil-carrying components of the basic engine by means of a UV leak test. INSTALL new components or seals as necessary.
Oil consumption	* Use of the wrong type of engine oil.	* DETERMINE the last type of engine oil used and compare with the specification. Change the engine oil to the specification.

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		REFER to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).
	* Faulty positive crankcase ventilation (PCV) system. - Hoses or ventilation or breather valves are blocked. This causes excessive pressure in the crankcase which causes more oil to enter the combustion chamber. - PCV oil separator is faulty and engine oil can enter the combustion chamber through the intake manifold.	* CHECK if the PCV system is operating correctly and repair as necessary. REFER to: Engine Emission Control (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Turbocharger seals.	* INSTALL a new turbocharger. REFER to: Turbocharger (303-04K Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Damaged gaskets or mating surfaces. - Cylinder head gasket is damaged or mating face are warped. - Valve stem seals are worn and engine oil can enter the combustion chamber between the valve stem and the valve stem guide.	* CHECK the gaskets and mating surfaces for damage. - Remove the cylinder head. REFER to: Cylinder Head (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).CHECK the mating faces, cylinder head gasket and the evenness of the cylinder head and engine block mating faces. - INSTALL new valve seals. REFER to: Valve Stem Seals (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Piston ring or cylinder liner wear.	* INSTALL new components as necessary.
	* Damaged cylinder liners or excessive clearance of engine components. - Pistons. - Piston rings (clearance in groove and end gap). - Cylinder liners.	* CHECK the running surfaces and clearances of the individual engine components. INSTALL new components as necessary. INSTALL a new cylinder block if necessary. * Check the pistons and piston rings.
Coolant consumption	* Cooling system components.	* Check the cooling system components. REFER to: Engine Cooling (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Oil cooler.	* INSTALL a new oil cooler.
	* Damaged gaskets or warped mating faces.	* CHECK the cylinder head gasket for damage. CHECK the cylinder head for distortion.
	* Cracks or fractures in engine components surrounded by coolant, such as cylinder liners and cylinder head combustion chamber.	* DETERMINE the damaged engine component(s) and install new component (s) as necessary.
Engine will not	* Battery or cables.	* CHECK the battery, bracket and cables.

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crank	* Starter motor or cables.	* CHECK the starting system. REFER to: Starting System (303-06E Starting System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
Engine cranks but will not start	* Fuel tank is empty.	* CHECK the fuel level.
	* Water in fuel.	* Drain the water from the fuel system.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01D Fuel Tank and Lines - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Engine intake air system.	* CHECK the intake air system.
	* Glow plug faulty.	* CHECK the glow plugs. INSTALL new glow plugs as necessary. REFER to: Glow Plug (303-07E Glow Plug System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Engine management system.	* CHECK the engine management system.
	* Incorrect valve timing.	* CHECK and adjust the valve timing. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Broken or damaged timing belt/timing chain or pulley/sprocket.	* CHECK the timing belt/timing chain and sprockets/pulleys. INSTALL new components as necessary. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Very poor power output or fuel consumption too high or engine running rough.	* Fuel charging system.	* CHECK the fuel charging system. REFER to: Fuel Charging and Controls (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Engine intake air system.	* CHECK the intake air system. REFER to: Intake Air Distribution and Filtering (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Exhaust system blocked.	* CHECK the exhaust system. REFER to: Exhaust System (309-00F Exhaust System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Description and Operation).
	* Engine management system.	* CHECK the engine management system.
	* Turbocharger.	* CHECK the turbocharger. REFER to: Turbocharger (303-04K Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Incorrect valve timing. Timing belt/timing sprocket or pulley/sprocket damaged.	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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Noisy running	* Engine auxiliary components loose or damaged.	* CHECK engine auxiliary components for damage or looseness. CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Noisy running, misfiring or knocking	* Water in fuel or fuel contaminated.	* CHECK the fuel system for water or other contamination.
	* Valve timing incorrect, timing belt/chain or pulley/sprocket damaged.	* CHECK and adjust valve timing. INSTALL new components as necessary. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Noisy running or valve train noise	* Valve clearance too large due to faulty valve tappets or worn valve train components.	* INSTALL new hydraulic lash adjusters. REFER to: Camshafts (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Timing belt or timing chain damaged.	* INSTALL a new timing belt or timing chain. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Timing belt or timing chain incorrectly tensioned.	* CHECK the timing belt tension. INSTALL a new timing belt or timing chain as necessary. REFER to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Noisy running or engine noise	* Engine components - Pistons. - Piston rings. - Connecting rod big end, main bearing or thrust bearing journals. - Connecting rods bent or damaged.	* CHECK the engine components for wear or damage. Make sure all components are within specification. INSTALL new components as necessary. REFER to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).

Engine - Oil Leaks

NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.
If the oil leak cannot be identified clearly by a visual inspection, carry out an ultraviolet (UV) test:

Ultraviolet (UV) Testing

1. **1.** Clean the engine and transmission with a suitable cleaning fluid.
2. **2.** Pour the UV-test fluid in accordance with the quantity specified by the manufacturer through the oil filler neck into the engine and install the oil filler cap.
3. **3.** Start the engine and let it run for about five minutes.
4. **4.** Switch off the engine.

NOTE: If no leak can be found, road test the vehicle under various loads and check the engine for leaks again.

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5. **5.** Check the engine for oil leaks using a suitable UV lamp.

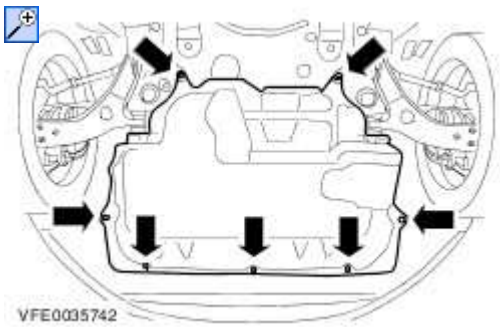
6. **6.** Rectify any leaks found and check the engine for oil leaks.

Measure the compression pressure

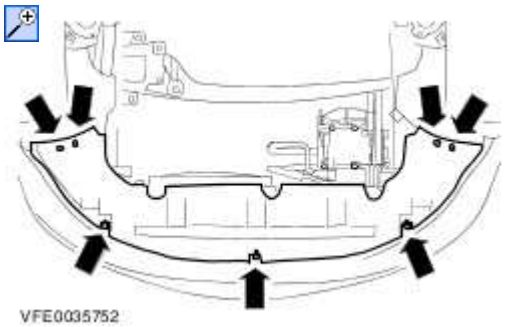
WARNING: Do not carry out any repairs to the fuel injection system without checking that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater. Failure to follow these instructions may result in personal injury.
NOTE: The powertrain control module (PCM) receives an error message when the fuel pump relay is removed or electrical components are disconnected. This error message must be deleted from the fault memory using the Ford diagnostic equipment after completing the compression test.
NOTE: Valve clearance must be set correctly before performing a compression test. Make sure the engine is at the normal operating temperature.
NOTE: The varying design of compression checking devices and fluctuating starter motor speeds normally only allows for a comparison to be made of the compression pressures in all cylinders.

1. **1.** Using datalogger in the Ford diagnostic equipment, check that the fuel pressure has dropped to zero and that the fuel temperature has either reached ambient temperature or is below 30°C, whichever is the greater.

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



3. **3.** Remove the engine undershield.



4. **4.** Remove the radiator undershield.

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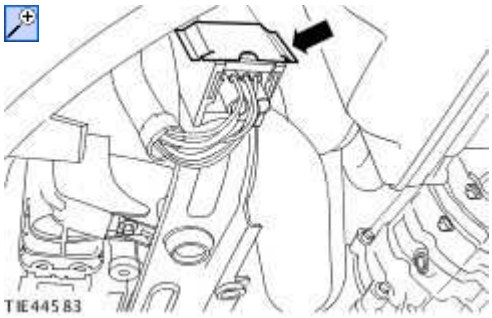
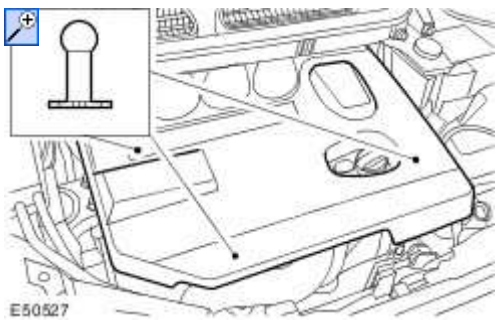


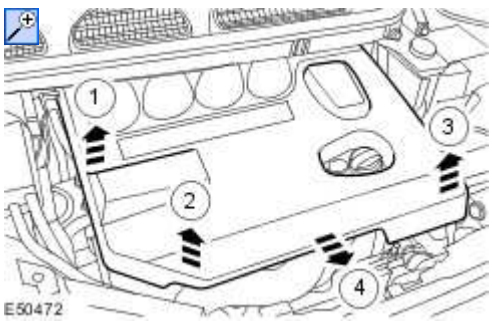
5. **5.** Remove the glow plug relay.

6. **6.** Lower the vehicle.

7. **7.** Remove the cowl panel grille.
   REFER to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).



8. NOTE: The engine upper cover is held in place by 3 ball clips. The ball clips are not vertical, but are angled backwards by approximately 20 degrees.
   8. Location of the engine upper cover ball clips.



9. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. If the ambient temperature is below 0°C, detach the engine upper cover with extreme caution. Failure to follow this instruction may cause the engine upper cover to be damaged.
   NOTE: Only remove and install the engine upper cover in the sequence shown.
   9. Remove the engine upper cover.
   - Detach the engine upper cover ball clips in the sequence shown.

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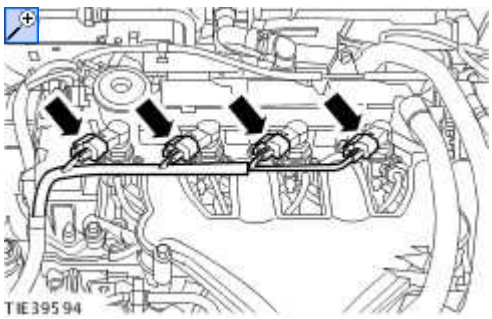
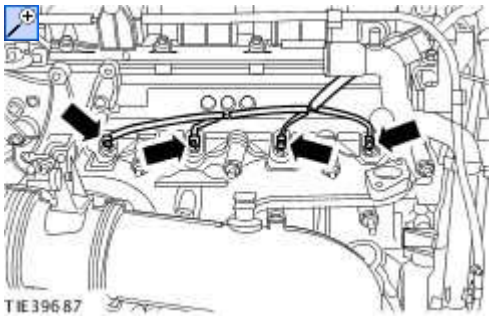


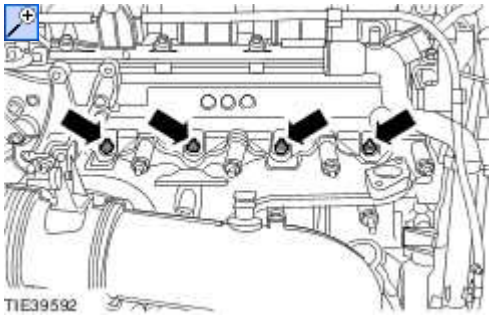
10. CAUTION: Do not disconnect the fuel injection pump electrical connectors and crank the engine.
    10. Disconnect the fuel injector electrical connectors.

11. **11.** Remove the exhaust gas recirculation (EGR) cooler. REFER to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

12. **12.** Remove the EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



13. **13.** Remove the glow plug power supply.



14. **14.** Remove the glow plugs.

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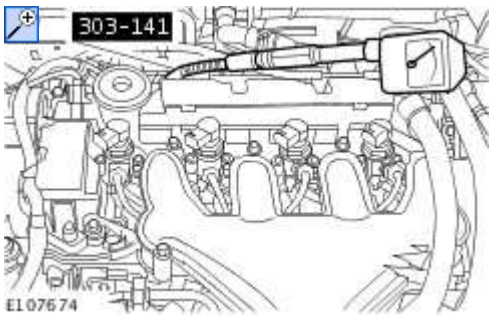
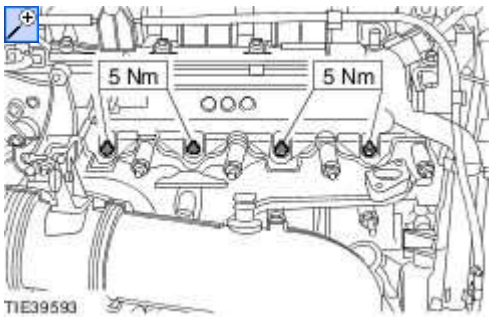


15. **15.** Install the special tool and a suitable compression tester into the glow plug bore.

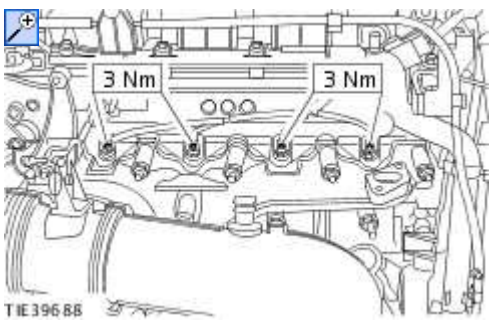
NOTE: Crank the engine with the starter motor until the pointer on the compression tester stops rising.

16. **16.** Carry out the measurement on all cylinders, following the measuring equipment manufacturer's instructions.

17. **17.** Detach the compression tester and the special tool.



18. **18.** Install the glow plugs.



19. **19.** Install the glow plug power supply.

20. **20.** Install the EGR valve.
REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

21. **21.** Install the EGR cooler.
REFER to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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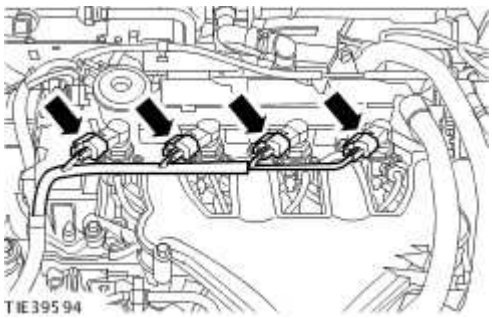
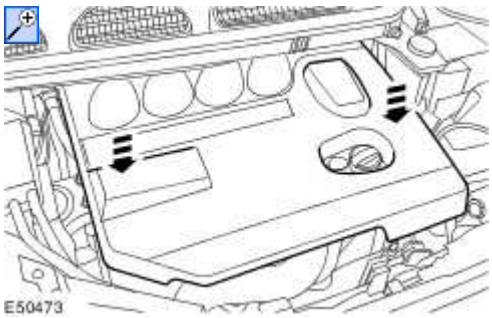


22. **22.** Connect the fuel injector electrical connectors.

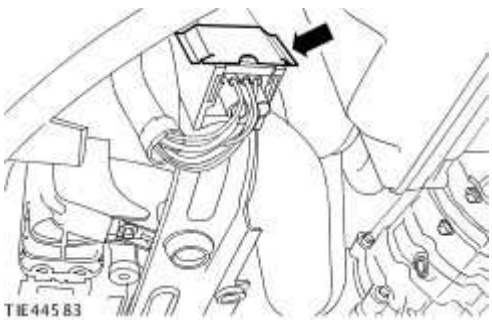
23. **23.** Apply soap solution to the ball clip mountings in the engine upper cover.
    - Soap solution (maximum concentration of soap in water 1:200).



24. CAUTION: Contact of the engine upper cover with the cowl panel may cause damage (scratches) on the engine upper cover. Failure to follow this instruction may cause the engine upper cover to be damaged.
    24. Put the engine cover into installation position and clip it in place by pressing at the places shown.
    - Make sure that the engine upper cover is fully engaged in the area of the fuel filter, if necessary apply more pressure in the areas shown.

25. **25.** Install the cowl panel grille.
    REFER to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

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



27. **27.** Install the glow plug relay.

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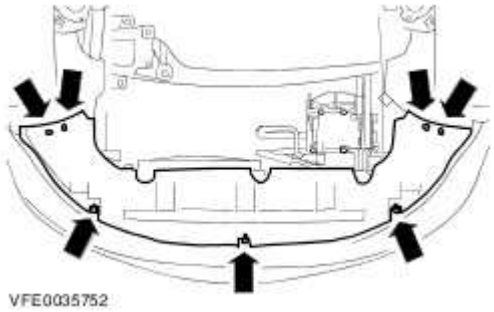
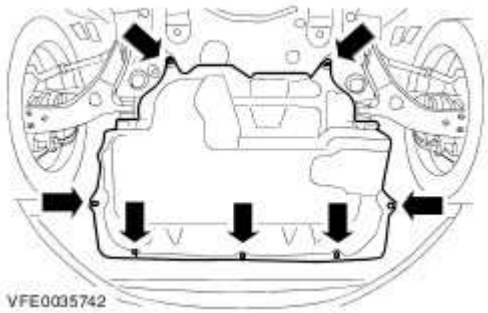


28. **28.** Install the radiator undershield.



29. **29.** Install the engine undershield.

30. **30.** Lower the vehicle.

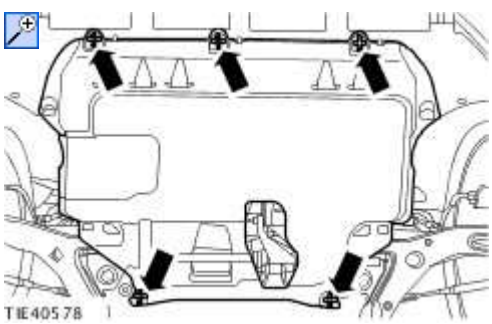
31. **31.** Reset the PCM fault memory.

Measure the oil pressure (21 113 0)

The oil pressure depends on various factors (engine speed, oil temperature, oil viscosity, amount of oil filter contamination etc.).

Measure the oil pressure

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



2. **2.** Remove the engine under shield.

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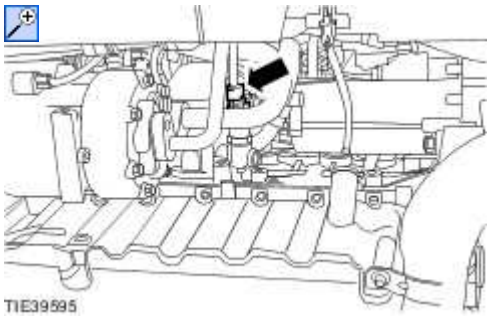
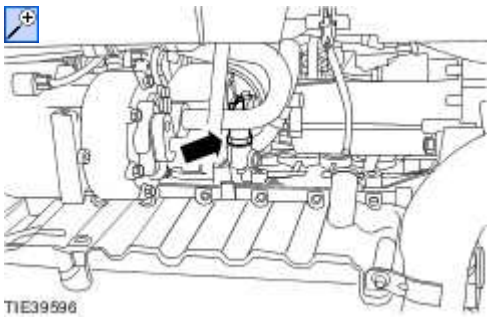
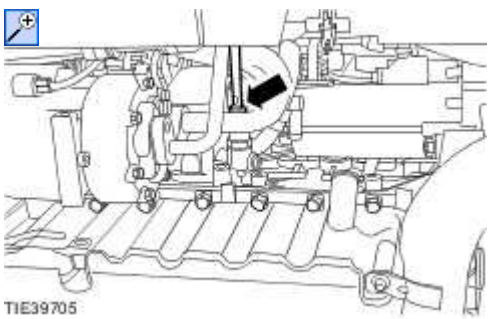


3. **3.** Disconnect the oil pressure switch electrical connector.

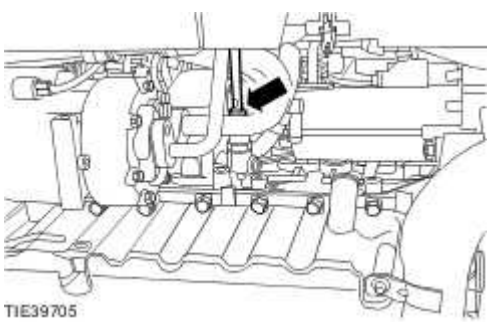


4. **4.** Remove the oil pressure switch.



5. **5.** Attach the oil pressure gauge with the oil pressure gauge connector.

6. NOTE: Measure the oil pressure at the specified engine speed. Measure the oil pressure at an oil temperature of 80° C.
   NOTE: Measure the oil pressure at 2000 rpm and at 4000 rpm.
   NOTE: Oil pressure at 2000 rpm: 2.0 bar.
   NOTE: Oil pressure at 4000 rpm: 4.0 bar.
   6. Check the oil pressure.



7. **7.** Detach the oil pressure gauge and the oil pressure gauge connector.

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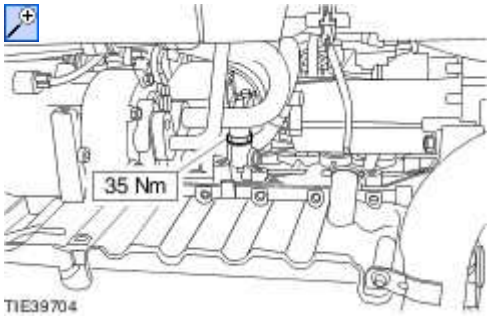
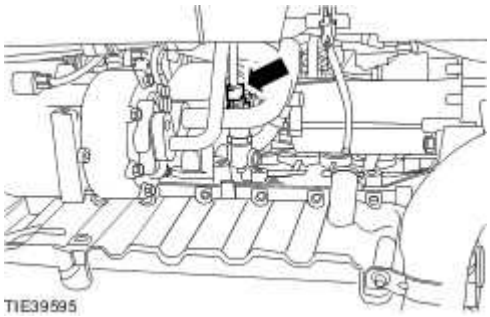
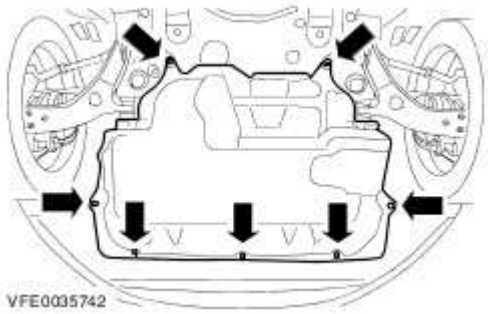
8. **8.** Coat the oil pressure switch with adhesive.



9. **9.** Install the oil pressure switch.



10. **10.** Connect the oil pressure switch electrical connector.



11. **11.** Install the engine under shield.

12. **12.** Lower the vehicle.

Valve train analysis - static (engine off)

Remove the valve cover.

Check all valve train components for damage and wear. Ensure that only original components are installed and that all bolts and nuts have been tightened to the correct tightening torque. REFER to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).

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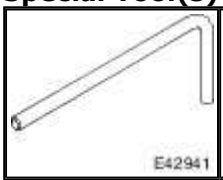
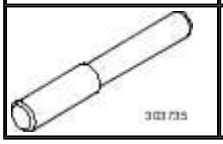
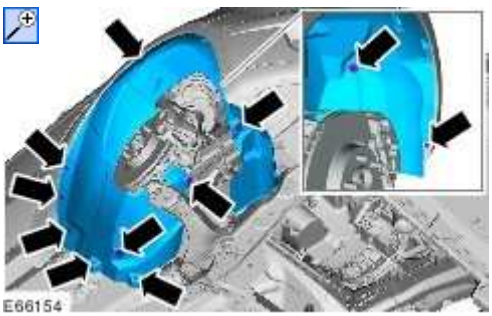
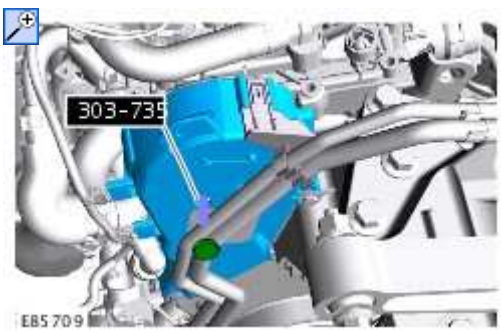
General Procedures

Special Tool(s)

 E42941	303-1059 Alignment Peg, Crankshaft
 303-735	303-735 Alignment Peg, Camshaft

1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
2. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
3.  E66154
4.  E85709

   CAUTION: Only rotate the crankshaft clockwise.
   Special Tool(s): 303-735
5. E84831

   Special Tool(s): 303-1059
6. If the camshaft timing is found to be incorrect, proceed with the adjustment.

   Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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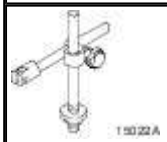
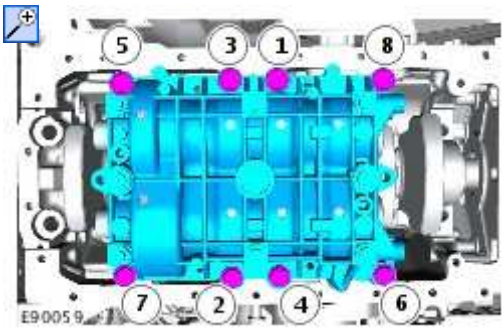
General Procedures

Special Tool(s)

	205-069 Dial Indicator Gauge (Metric)
	205-070 Holding Fixture, Dial Indicator Gauge
	303-1330 Backlash Lever, Balance Shafts



1. Refer to: Balance Shaft Assembly (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2.
   - Measure the backlash between the balance shaft and crankshaft.
   - Install the measuring shims (57).
   - Install the new balance shaft assembly, tighten the bolts evenly in 2 stages to the sequence shown.

   Torque:
   Stage 1: 5 Nm
   Stage 2: 22 Nm
3. *Install the Special Tool(s):* 303-1330, 205-069, 205-070

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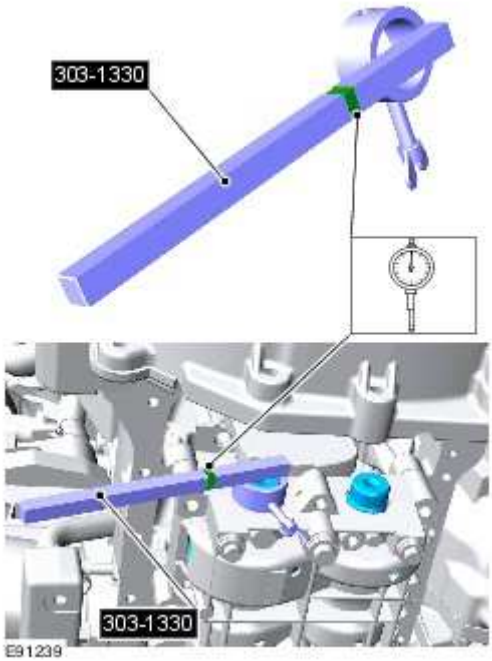
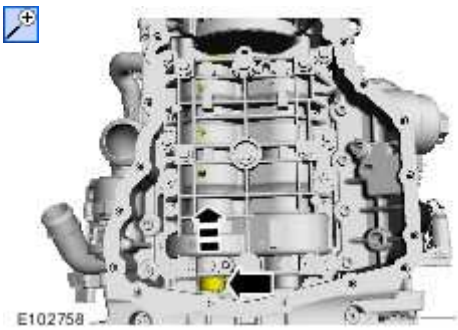
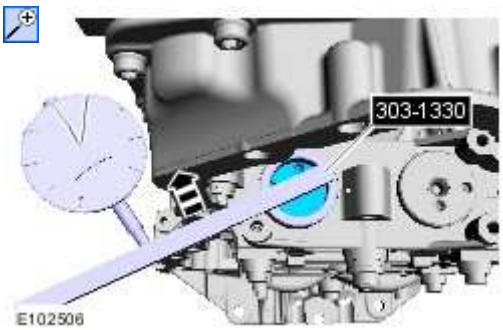




4. Push the ballance shaft until it stops.



5.

6. *Remove the Special Tool(s):* 303-1330
7.
   - Turn the crankshaft in the normal direction of rotation, measure and record the backlash on every quarter rotation of the balance shafts, until 8 readings are taken and the crankshaft has completed 1 revolution.

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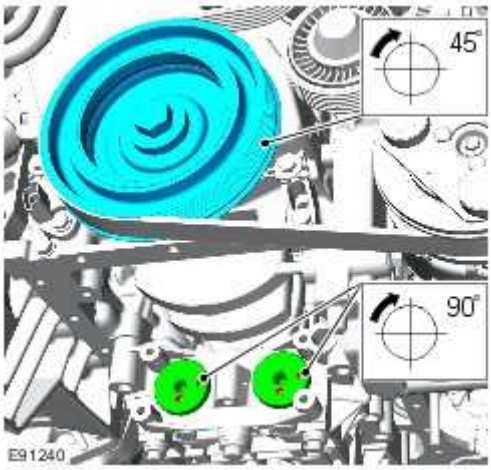
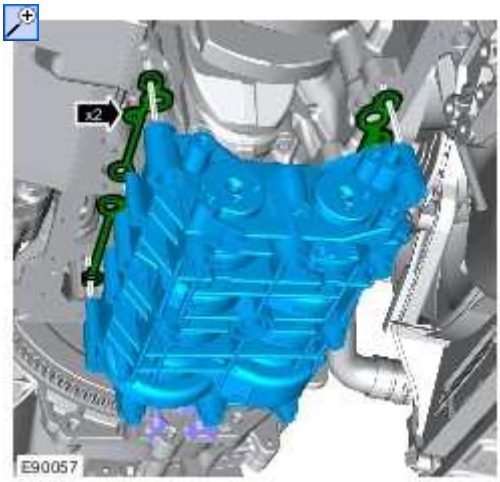


8.
- Take the minimum clearance values, to select the required shims.
- For example minimum clearance value 0.2mm = shim thickness 1.29mm = shim marking 29
- Refer to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).



9. CAUTIONS:

Note the position of each component before removal.

Extreme cleanliness must be exercised when handling these components.
Remove the measuring shims.

10. Refer to: Balance Shaft Assembly (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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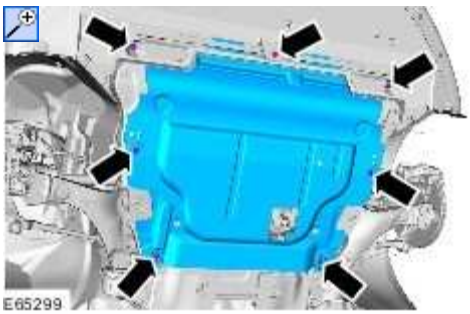
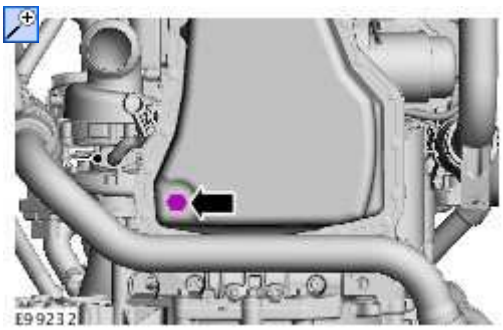
General Procedures

General Equipment

Fluid container

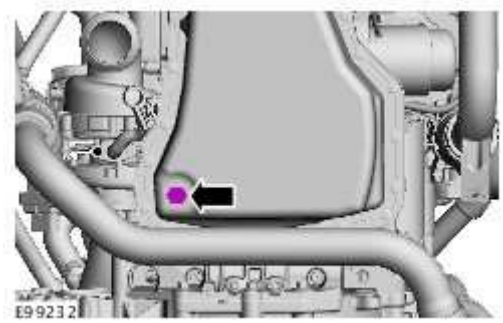


1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2.

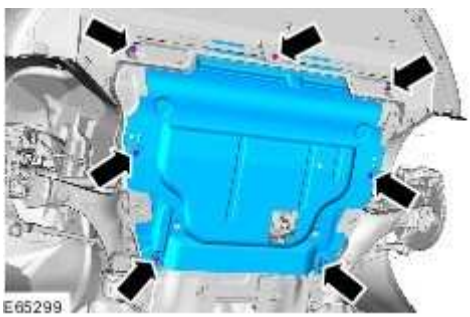


3. NOTE: Be prepared to collect escaping fluid
   Discard the sealing washer.

   General Equipment: Fluid container



4. NOTE: Make sure that a new component is installed.
   Torque: 20 Nm



5. *Torque:* 9 Nm

6. Fill the engine with oil.

   Refer to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).

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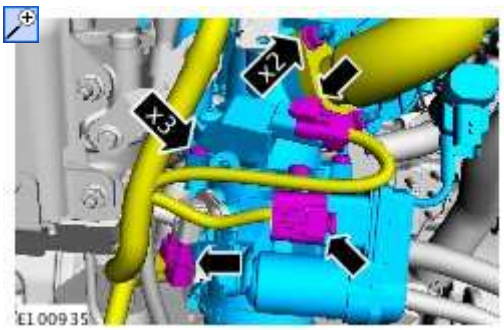
Removal and Installation

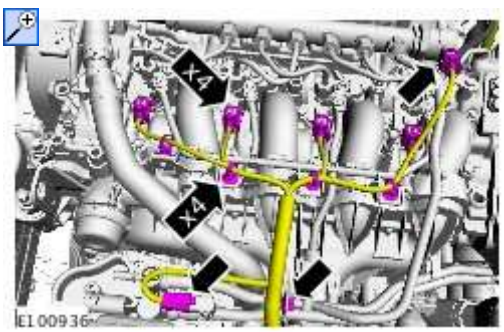
Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

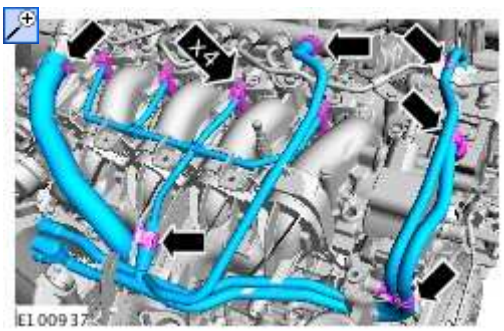


2. NOTE: Clean and inspect the gasket. The gasket is to be reused unless damaged.
   Torque: 10 Nm

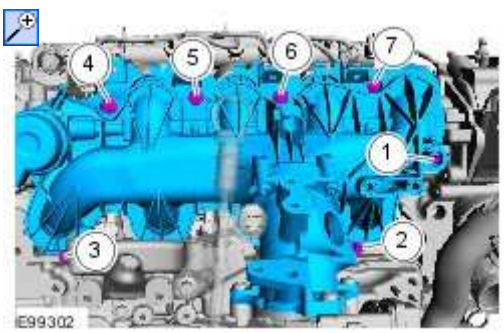


3.

4. Refer to: Fuel Filter (310-01D Fuel Tank and Lines - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



5.



6. NOTE: Clean and inspect the gasket. The gasket is to be reused unless damaged.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 9 Nm

7. *Torque:* 6 Nm

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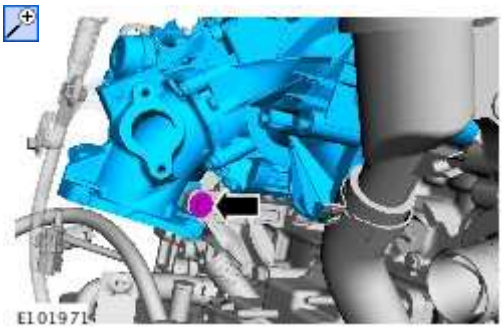

Installation

1. To install, reverse the removal procedure.

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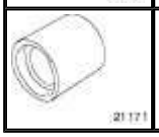
Removal and Installation

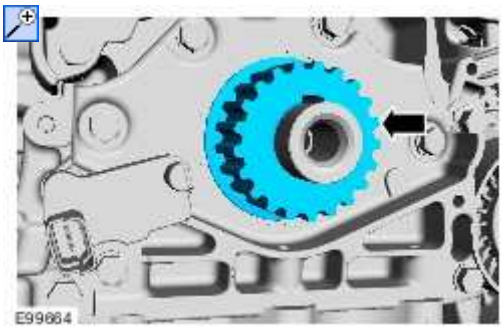
Special Tool(s)

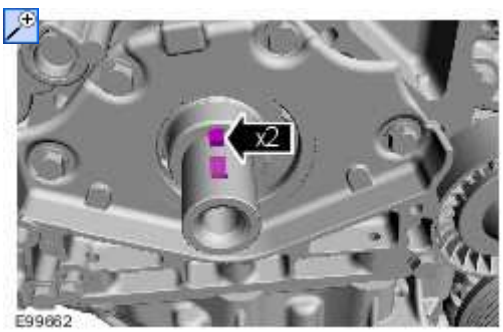
	303-255 Installer, Timing Cover Seal
	303-395 Installer, Crankshaft Seal

Removal

1. Remove the timing belt.

   Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

2. 

3. 

4.

Installation

1. *Special Tool(s):* 303-255, 303-395

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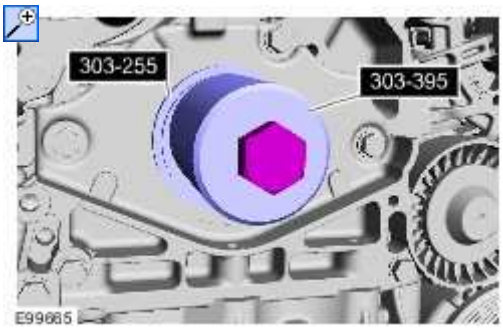
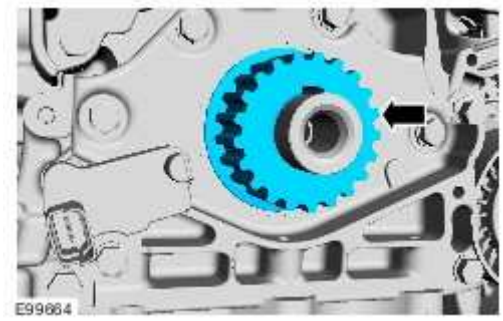


2.

3.



4. Install the timing belt.

   Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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Removal and Installation

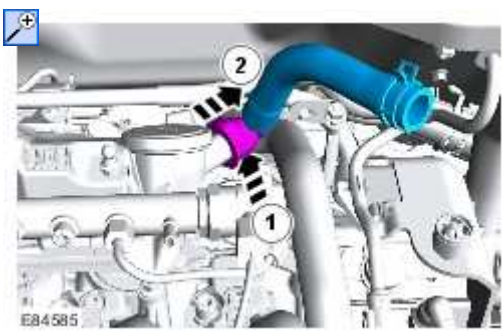
Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

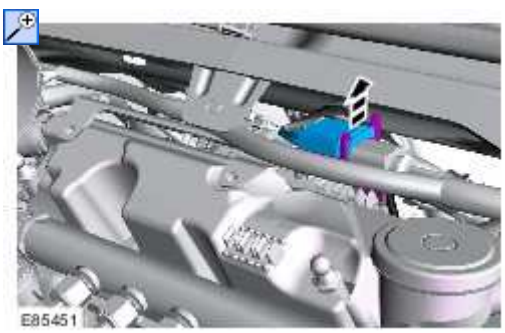
Removal

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

1. Refer to: Air Cleaner (303-12F Intake Air Distributio and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - Removal and Installation).
   Refer to: Camshaft Seal (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Fuel Rail (303-04F Fuel Charging and Cont 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal Installation).
   Refer to: Fuel Injectors (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW Removal and Installation).
   Refer to: Intake Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



2.



3.

4. NOTE: Make sure that a new clamp is installed.

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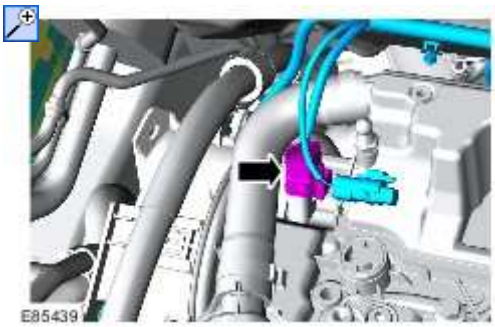
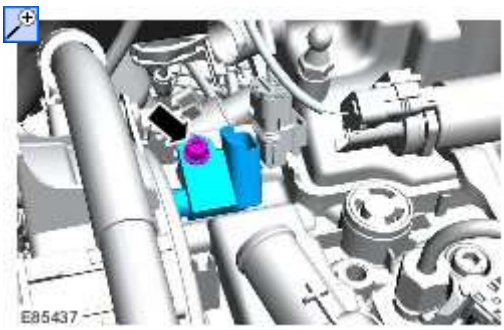
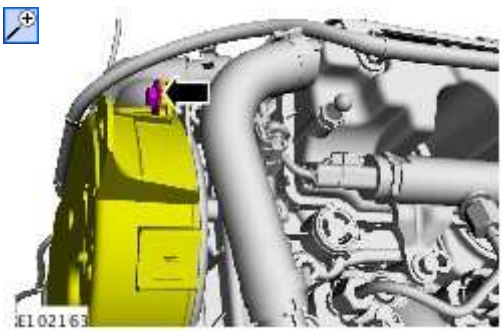


5.

6. NOTE: Make sure that a new clamp is installed.



7.



8. *Torque:* 5 Nm

9. CAUTION: Make sure that new bolts are installed.
NOTE: Only tighten the bolts finger tight at this stage.

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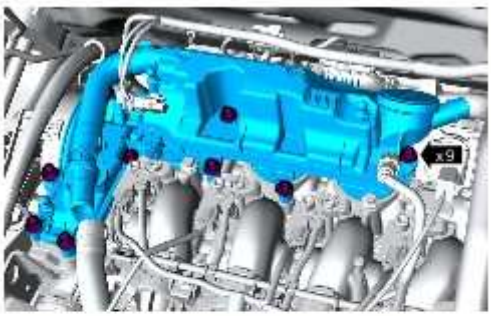
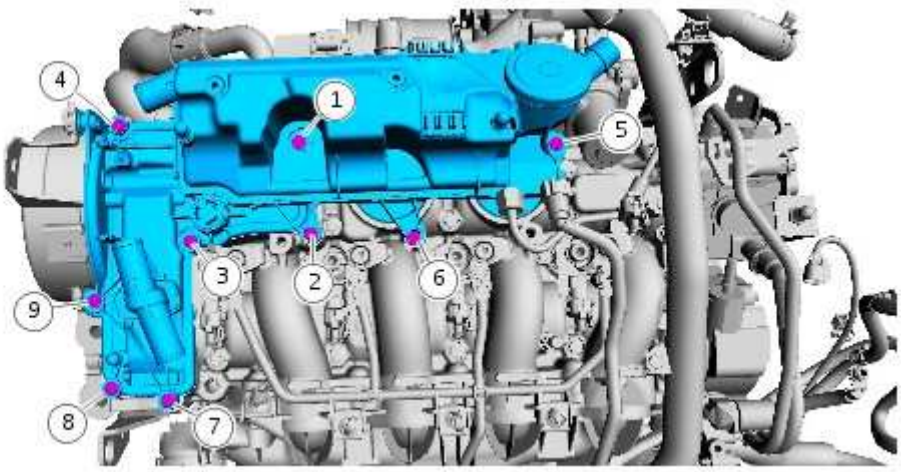
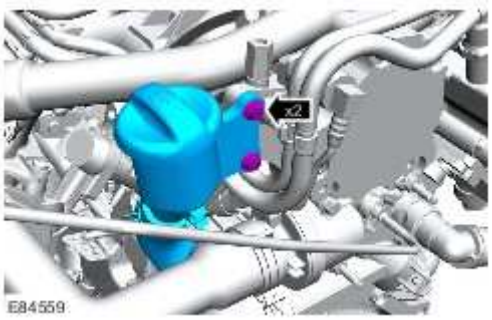


E85814



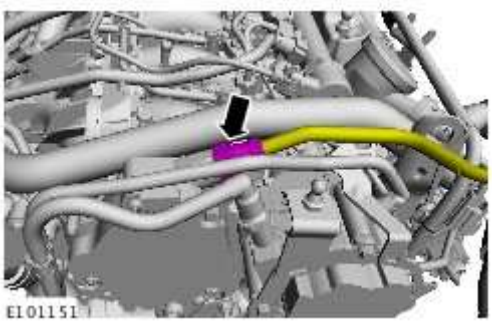
E101813

10. *Torque:*
    5 Nm
    9 Nm



E84559

11. *Torque:* 9 Nm



E101151

12. CAUTIONS:

⚠ Extreme cleanliness must be exercised when handling this component.

⚠ Make sure that all openings are sealed. Use new blanking caps.

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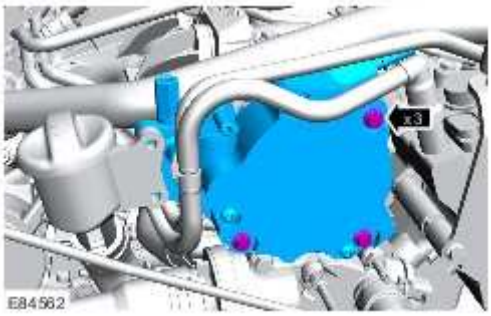
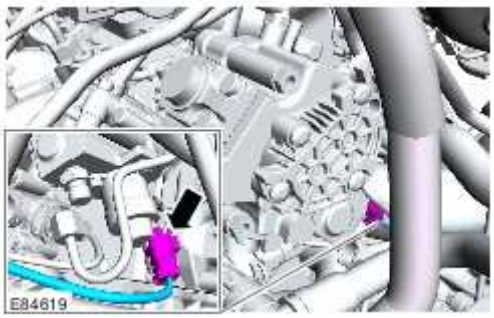
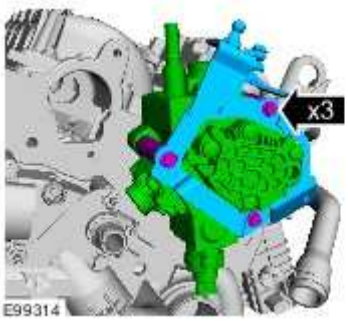


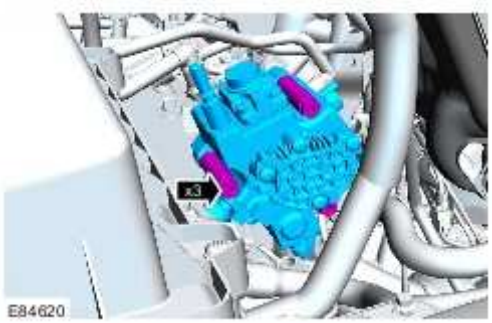
13. *Torque:* 9 Nm



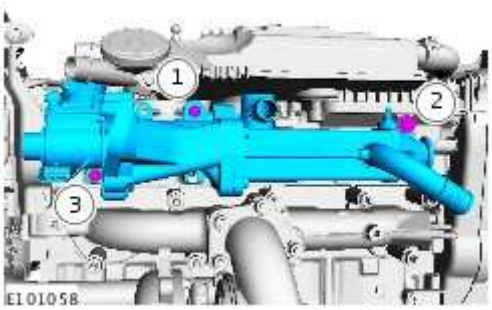
14.



15. *Torque:* 8 Nm



16. *Torque:* 22 Nm



17. *Torque:*
    1 10 Nm
    2 8 Nm
    3 10 Nm

18.

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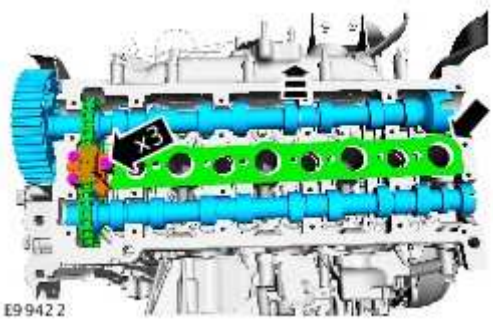
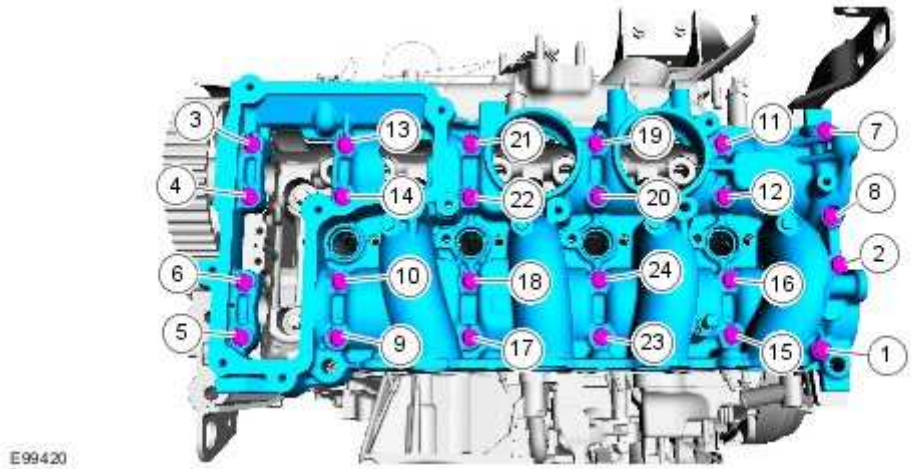


19. Install a new gasket.

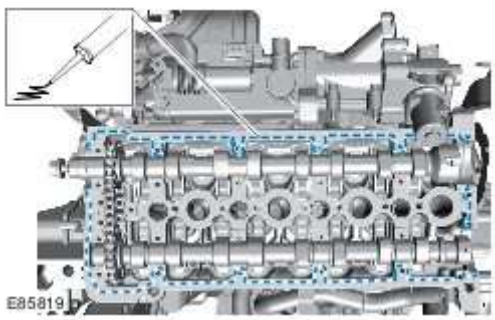
    Torque: 6 Nm



20.

Installation

1. To install, reverse the removal procedure.
2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U M4G323-AA)



3. Tighten t bolts in t sequence illustrate

   Torque: Nm

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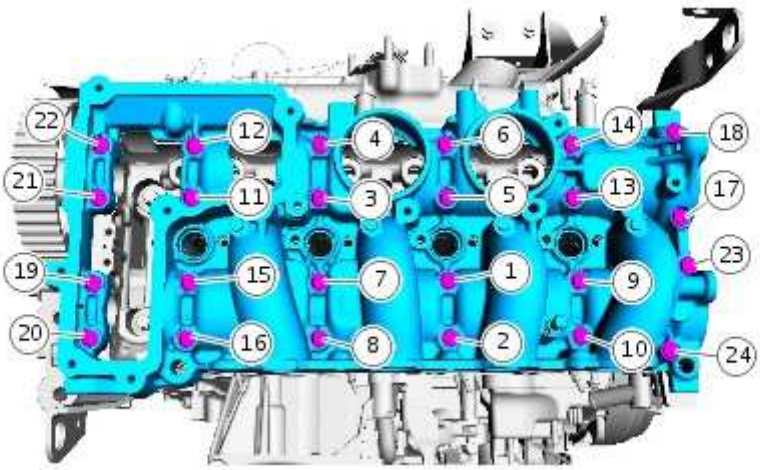

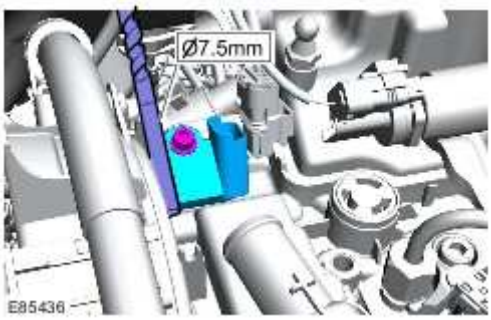

4. When installing the old sensor.

   Torque: 4 Nm

5.
   - When installiung a new sensor.
   - Install the CMP sensor until the tip of the sens touches the back of the camshaft pulley.

     Torque: 4 Nm

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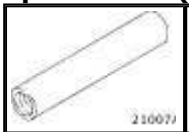
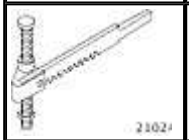
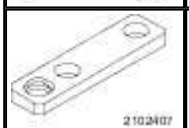
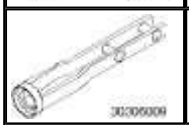
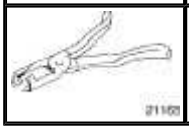
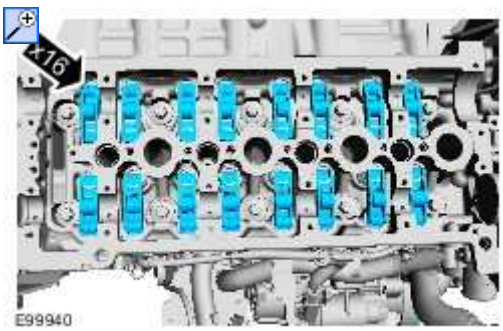
Removal and Installation

Special Tool(s)

	303-037 Installer, Valve Stem Seal
	303-060 Compressor, Valve Spring
	303-060-07 Adapter for 303-060
	303-060-09A Adapter for 303-060
	303-390 Pliers, Valve Stem Seal

Removal



1. Refer to: Camshafts (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2.
3. Position the appropriate piston at top dead center (TDC).
4. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

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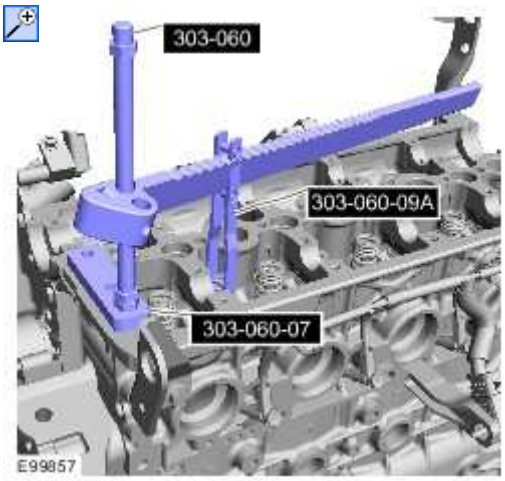
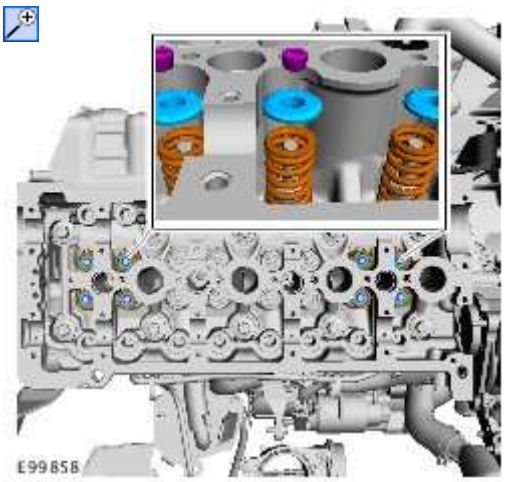
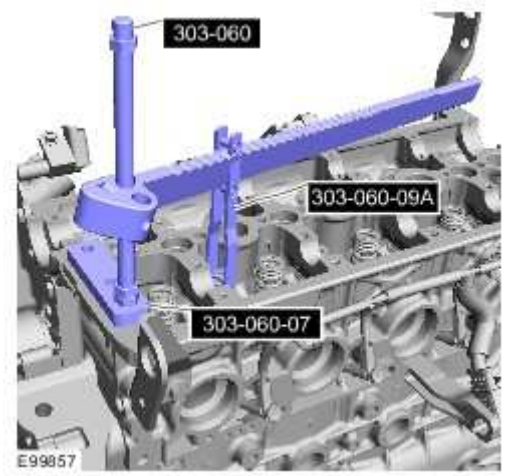




5.

6. Position the appropriate piston at top dead center (TDC).



7. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

8.

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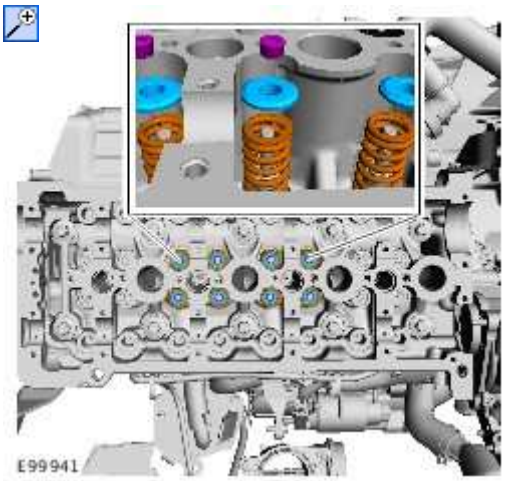
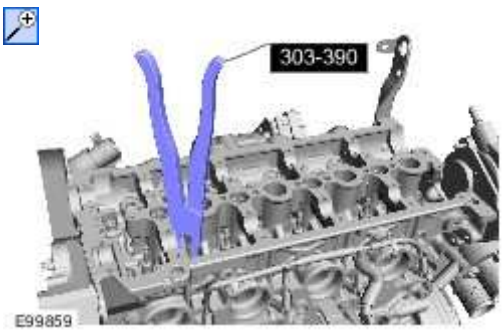
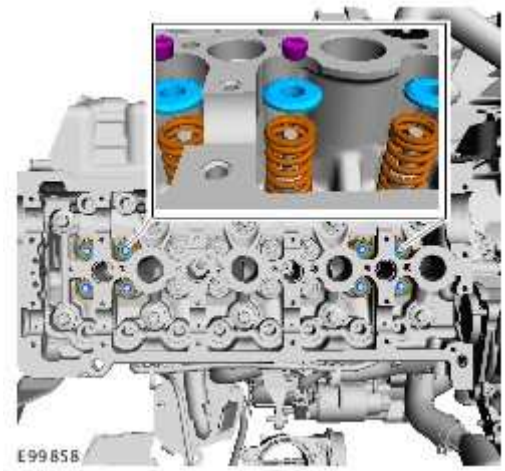




9. *Special Tool(s):* 303-390

Installation

1. *Special Tool(s):* 303-037



2.

3. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

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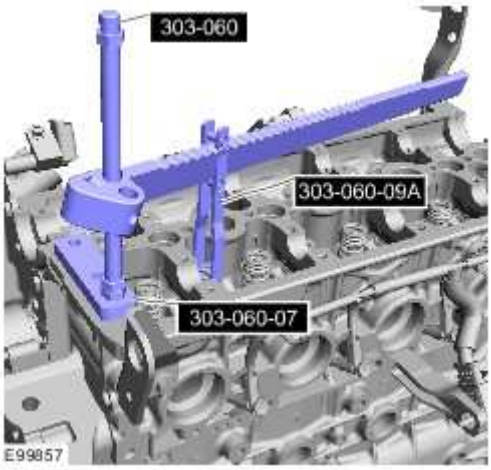

4. Refer to: Camshafts (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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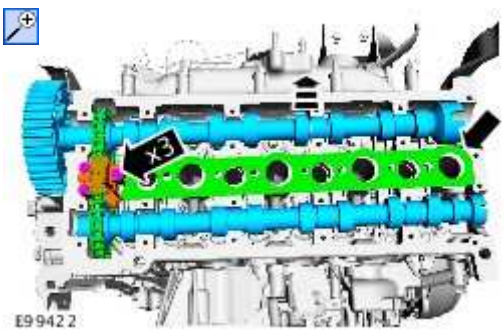
Removal and Installation

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the following items:
   1. Refer to: Intake Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   2. Refer to: Valve Cover (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   3. Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

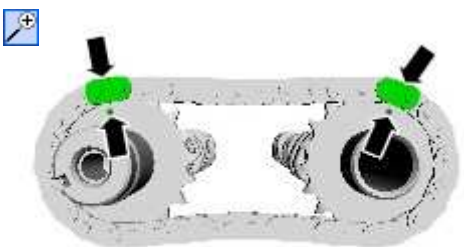
3.



4. *Torque:* 6 Nm

Installation

1. To install, reverse the removal procedure.
2.



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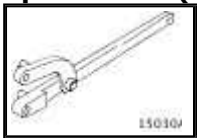
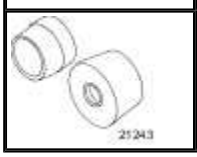
Removal and Installation

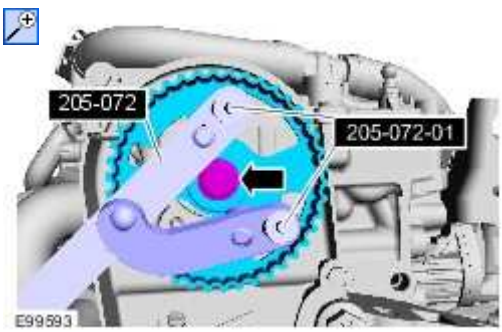
Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-174 Gauge, Bolt Angle
	303-293 Remover, Crankshaft Seal
	303-684 Installer, Crankshaft Front Seal

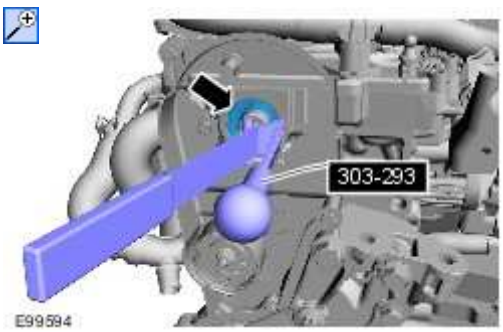
Removal

1. Remove the timing belt.

   Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



2. *Special Tool(s):* 205-072



3. *Special Tool(s):* 303-293

Installation

1. *Special Tool(s):* 303-684

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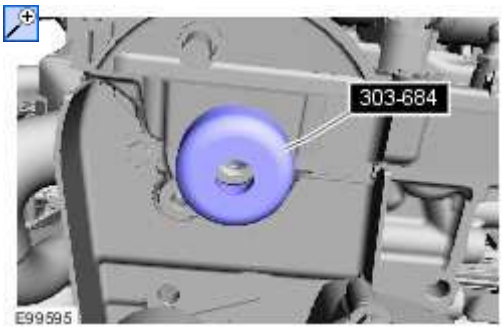

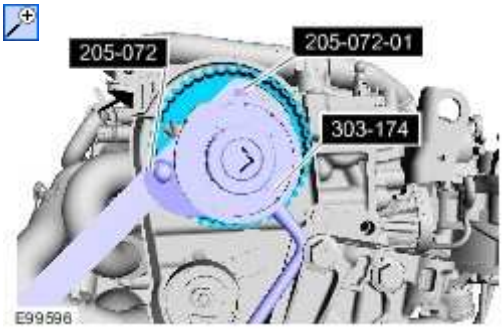

2. *Special Tool(s):* 303-174, 205-072
   Torque:
   Stage 1: 20 Nm
   Stage 2: 60°

3. Install the timing belt.

   Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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Removal and Installation

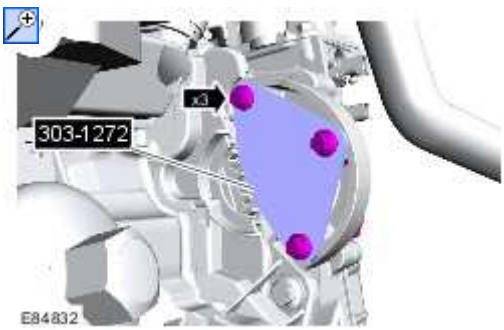
Special Tool(s)

	303-1272 Locking Tool, Flywheel

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
   Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



2. *Install the Special Tool(s):* 303-1272

3. CAUTION: Make sure that a new bolt is installed.
   Torque:
   Stage 1: 70 Nm
   Stage 2: 82°

4.

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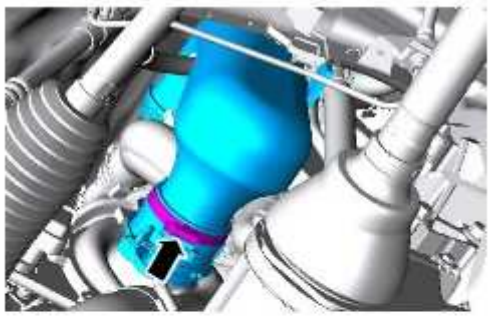
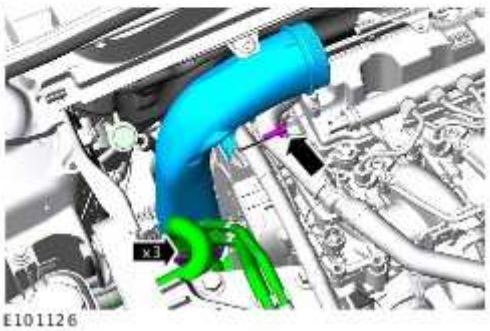
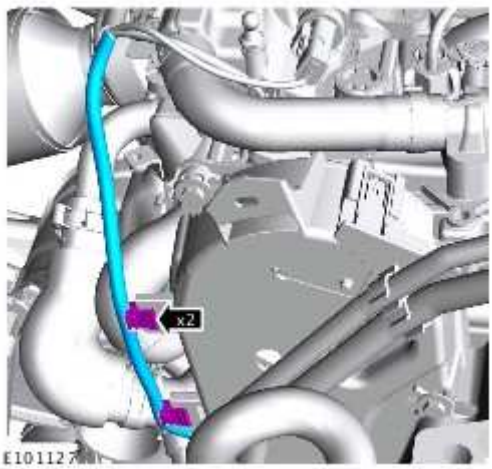
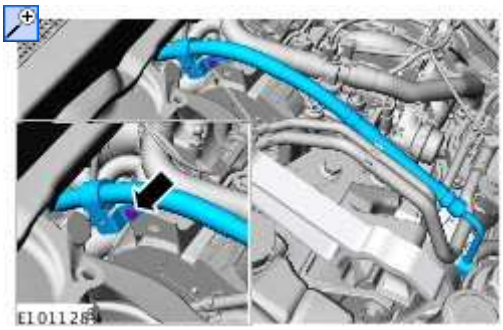




5.



6. *Torque:* 5 Nm



7. *Torque:* 5 Nm

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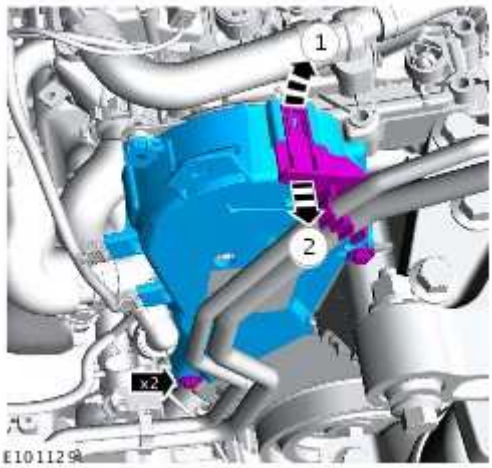
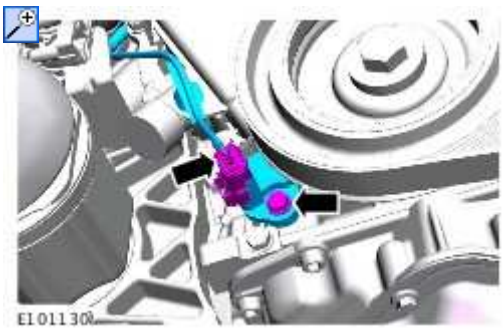
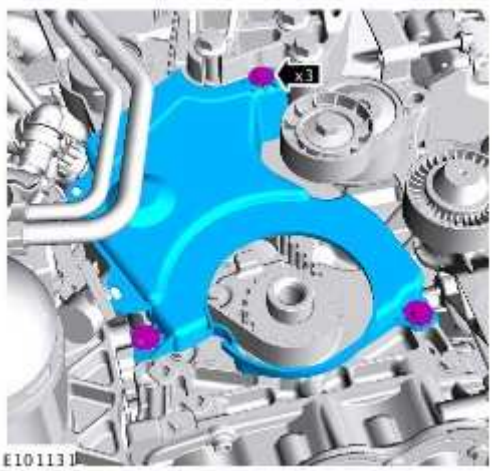
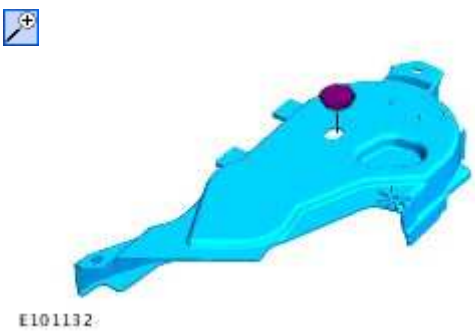




8. WARNING: Make sure that the wiring harnesses are correctly located.
Torque: 8 Nm



9. *Torque:* 5 Nm



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

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

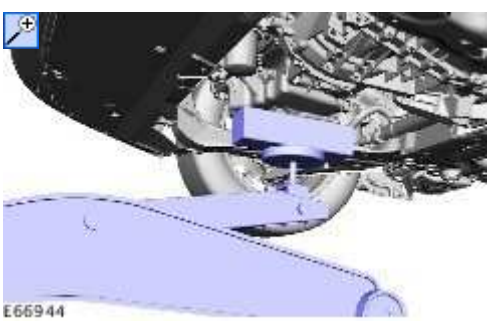
Special Tool(s)

	303-1059 Alignment Peg, Crankshaft
	303-735 Alignment Peg, Camshaft

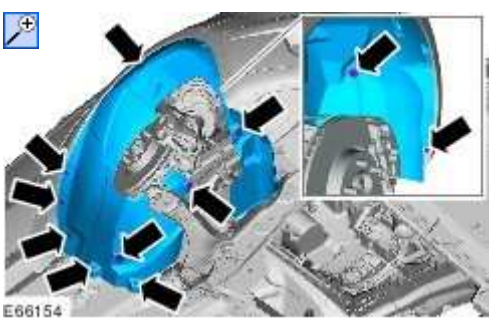
General Equipment

Trolley jack

Removal


E66944

1. *General Equipment:* Trolley jack


E66154

2.

3.

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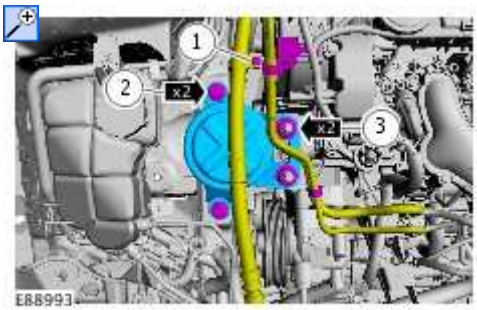
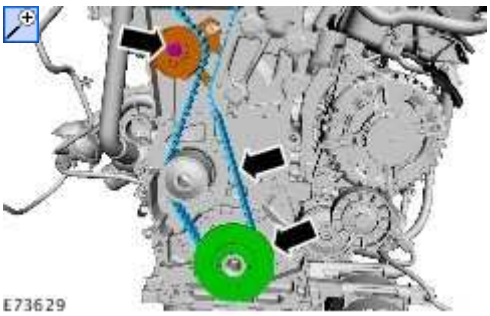


4. Refer to: Timing Cover (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
5. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. CAUTION: Make sure that the crankshaft is not rotated while the special tool is installed.
Install the Special Tool(s): 303-1059

7. *Install the Special Tool(s):* 303-735



8. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.

9.

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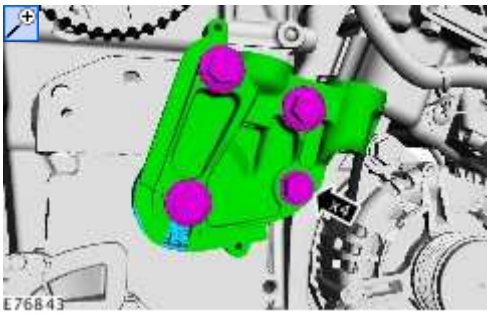
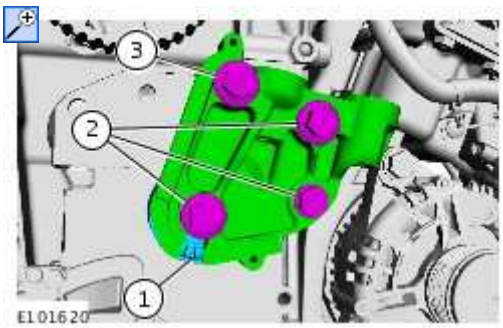
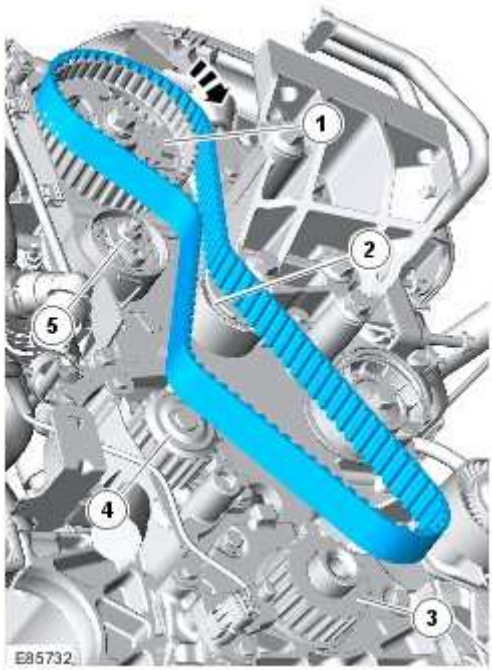


Installation



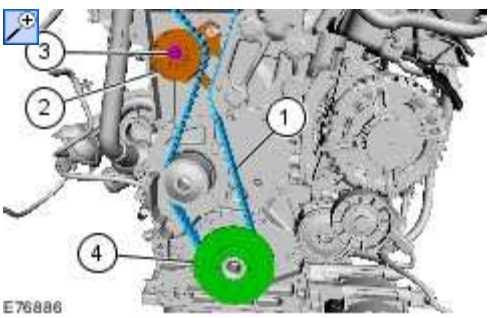
1.
    1. NOTE: Make sure that a new component is installed.
    2. *Torque:* 60 Nm
    3. *Torque:* 80 Nm



2. CAUTIONS:

    The crankshaft or camshafts must not be rotated while the timing belt is removed.

    Make sure that the timing belt is not folded to produce a loop with a diameter less than 35 mm.



3.
    1. NOTE: Make sure that a new component is installed.
    2. NOTE: Make sure that a new component is installed.
    3. NOTE: Only tighten the bolt finger tight at this stage.
    4. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.

4. Allen key, 6mm

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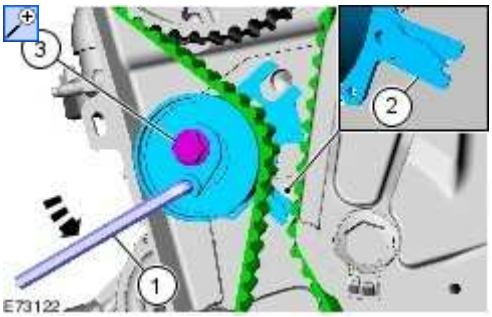
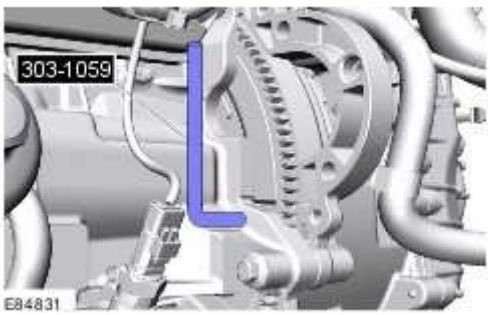
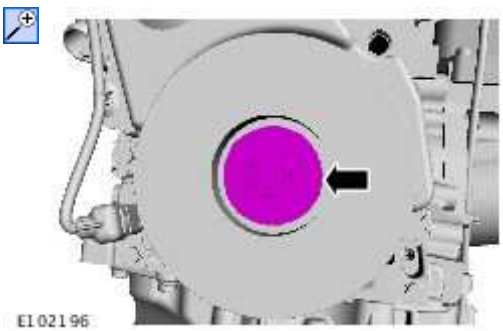


Torque: 25 Nm



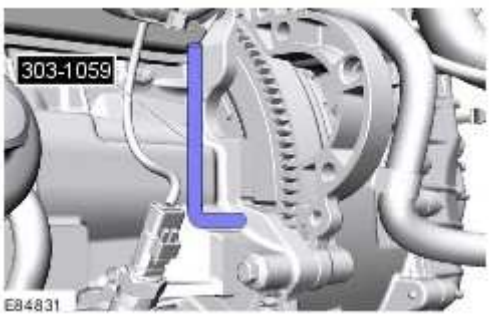
5. *Remove the Special Tool(s):* 303-1059

6. *Remove the Special Tool(s):* 303-735



7. NOTE: Only tighten the bolt finger tight at this stage.

8. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft 4 revolutions.



9. CAUTION: Make sure that the crankshaft is not rotated while the special tool is installed.
Install the Special Tool(s): 303-1059

10. NOTE: The special tool can only be installed

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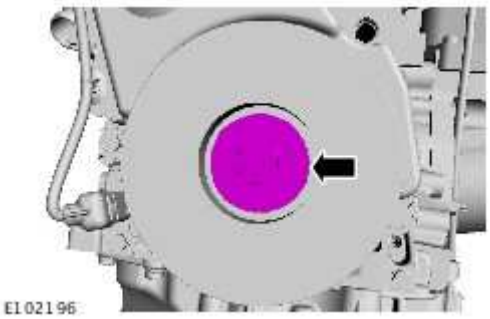
if the valve timing is correct.
Install the Special Tool(s): 303-735



11. NOTE: Make sure a new component is installed.
Torque:
Stage 1: 70 Nm
Stage 2: 82°

12. *Remove the Special Tool(s):* 303-735

13. *Remove the Special Tool(s):* 303-1059

14. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
15. Refer to: Timing Cover (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
16.
    1. NOTE: Only tighten the bolts finger tight at this stage.
    2. *Torque:* 133 Nm

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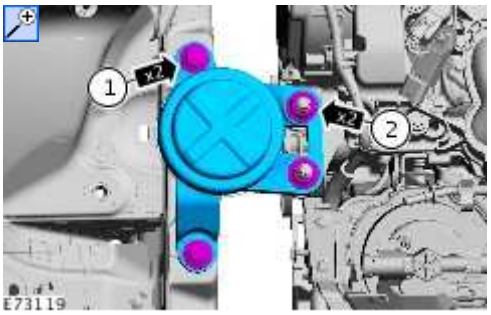
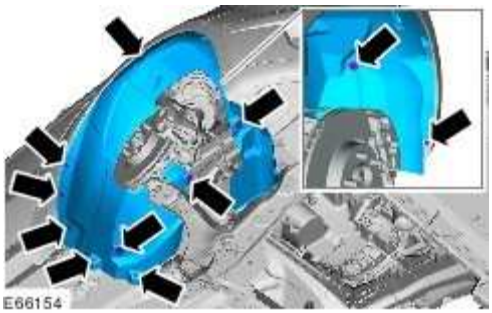
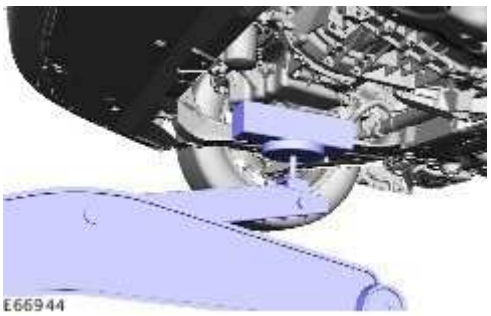


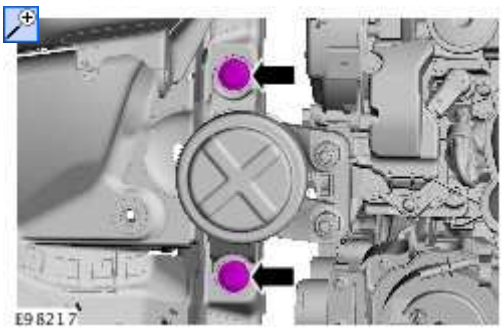
17.



18. *General Equipment:* Trolley jack



19. *Torque:* 90 Nm



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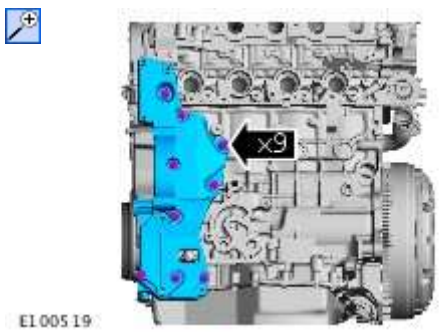
Removal and Installation

Removal

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).
2. Remove the following items:
    1. Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    2. Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    3. Refer to: Fuel Filter (310-01D Fuel Tank and Lines - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Refer to: Exhaust Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Refer to: Thermostat (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    6. Refer to: Fuel Rail (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    7. Refer to: Fuel Injectors (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    8. Refer to: Fuel Pump (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    9. Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
3. 

4. *Torque:*
    1. 20 Nm

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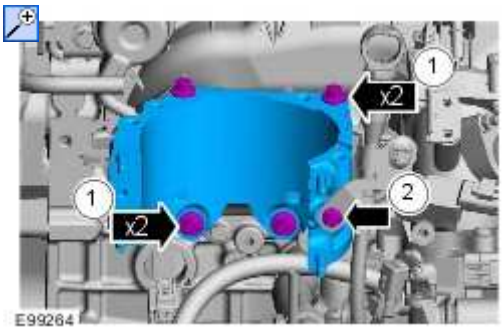
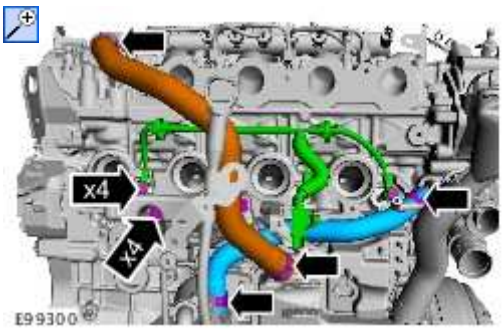
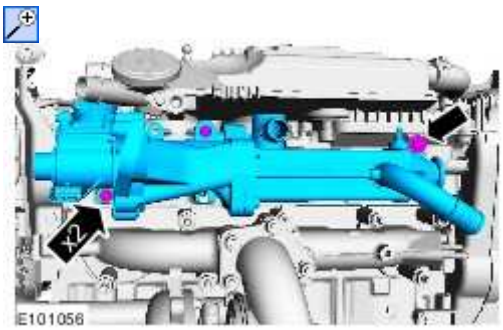


2. 10 Nm

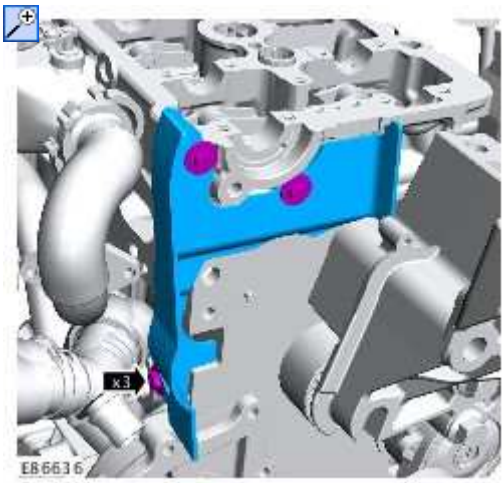


5. NOTE: Make sure that a new clamp is installed.
Torque: 20 Nm



6.

7. Refer to: Valve Cover (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



8.

9.

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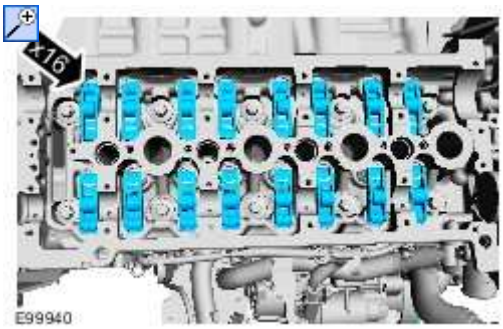

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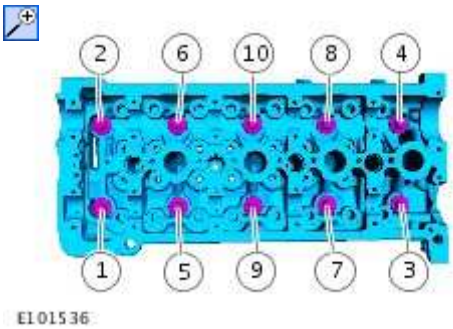

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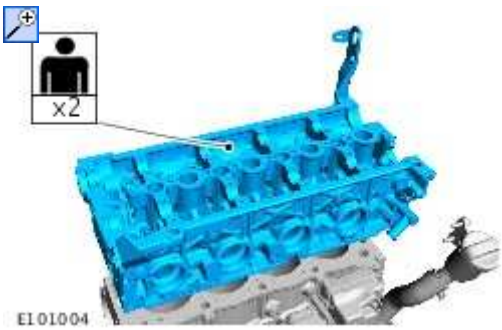
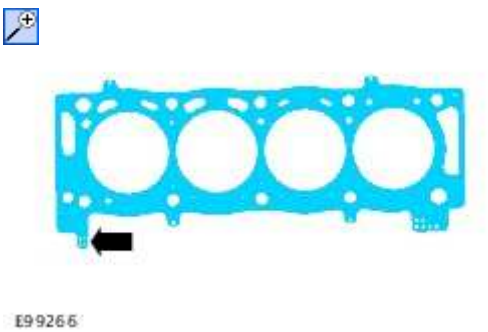


Installation

1.



2. CAUTION: Note the thickness of the gasket.
NOTE: Make sure that a new component is installed.

3.

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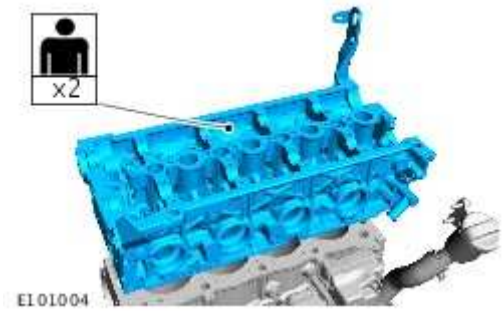
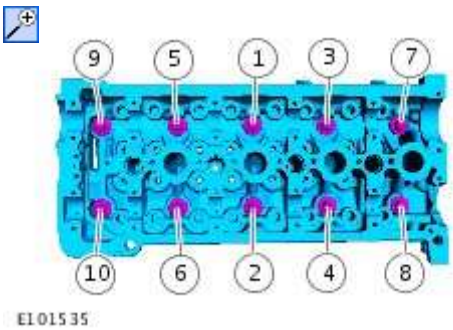
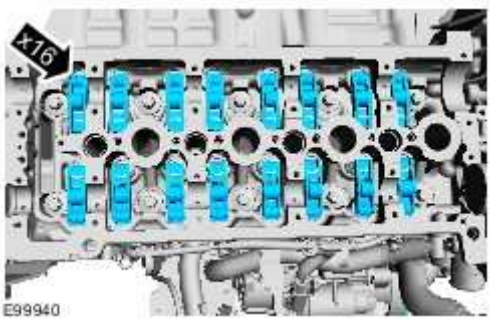


4.



5. CAUTION: Make sure that new cylinder head bolts are installed.
Tighten the cylinder head bolts in three stages in the sequence indicated.

Torque:
Stage 1: 20 Nm
Stage 2: 60 Nm
Stage 3: 220°



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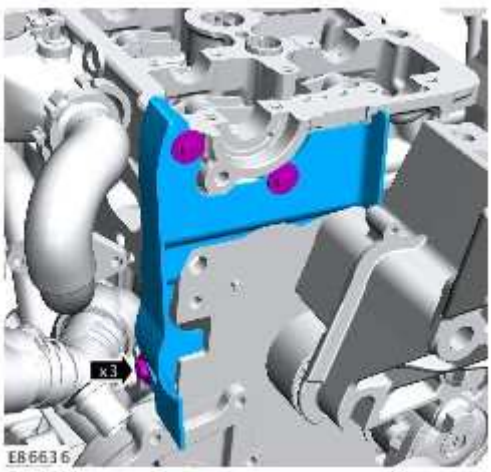

7. *Torque:* 5 Nm

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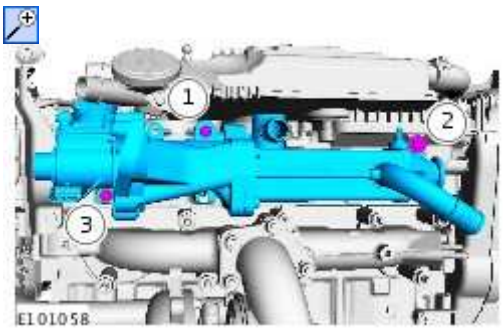
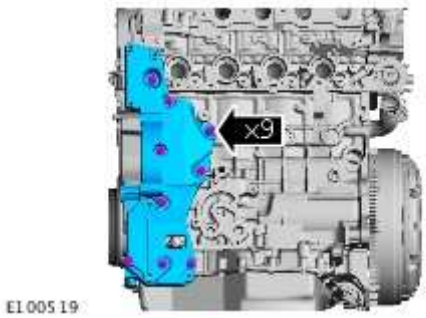
8. Refer to: Valve Cover (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



9. *Torque:*
   1 10 Nm
   2 8 Nm
   3 10 Nm



10. *Torque:* 28 Nm

11. Install the following items:
    1. Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    2. Refer to: Fuel Pump (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    3. Refer to: Fuel Injectors (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Refer to: Fuel Rail (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Refer to: Thermostat (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    6. Refer to: Exhaust Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    7. Refer to: Fuel Filter (310-01D Fuel Tank and Lines - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    8. Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    9. Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and

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Installation).

12. Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).

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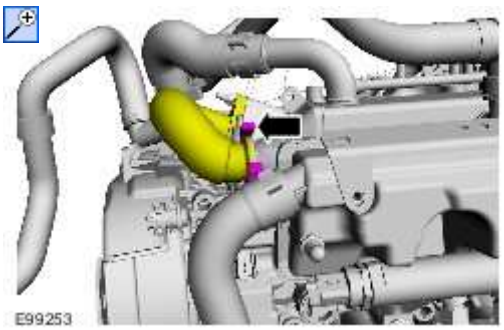
Removal and Installation

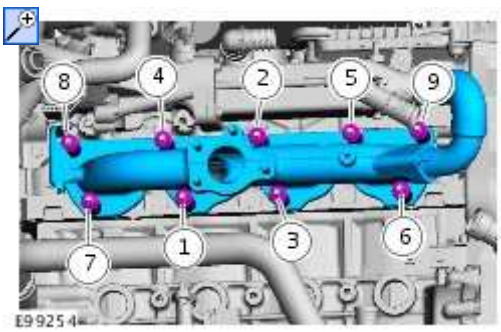
Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the following items:
    1. Refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
    Refer to: Turbocharger (303-04K Fuel Charging and Controls - Turbocharger - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



3. NOTE: Make sure that a new component is installed.
Torque: 10 Nm



4. NOTE: Install new nuts and a new gasket.
Torque:
Stage 1: 12 Nm
Stage 2: 25 Nm
Stage 3: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

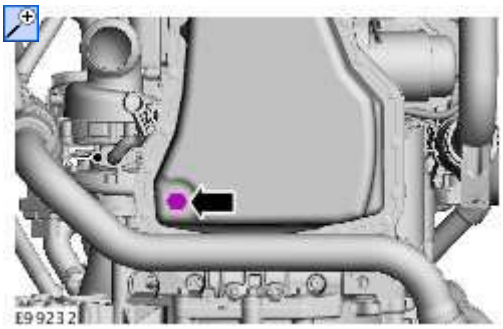
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

Fluid container

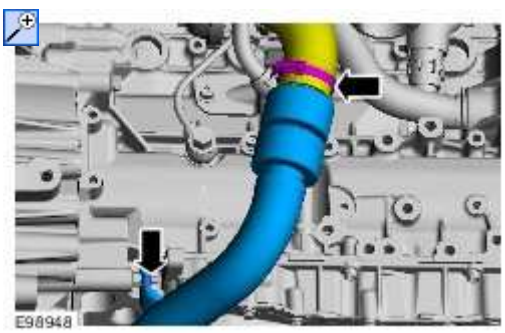
Removal

1. NOTE: Removal steps in this procedure may contain installation details.
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. NOTE: Be prepared to collect escaping fluid.
   General Equipment: Fluid container
   Torque: 20 Nm

3. *Torque:* 10 Nm



4. *Torque:* 10 Nm

5. *Torque:* 9 Nm

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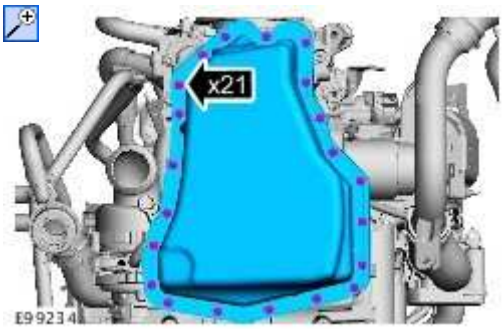
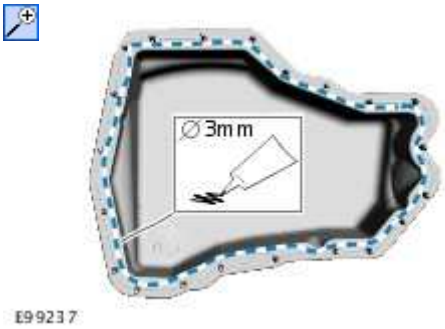


Installation



1. To install, reverse the removal procedure.
2. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)
3. Fill the engine with engine oil.

   Refer to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).
   Material: Engine Oil - 5W-30 (WSS-M2C913-B)

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Removal and Installation

Special Tool(s)

	303-397 Remover/Installer, Hose Clamp

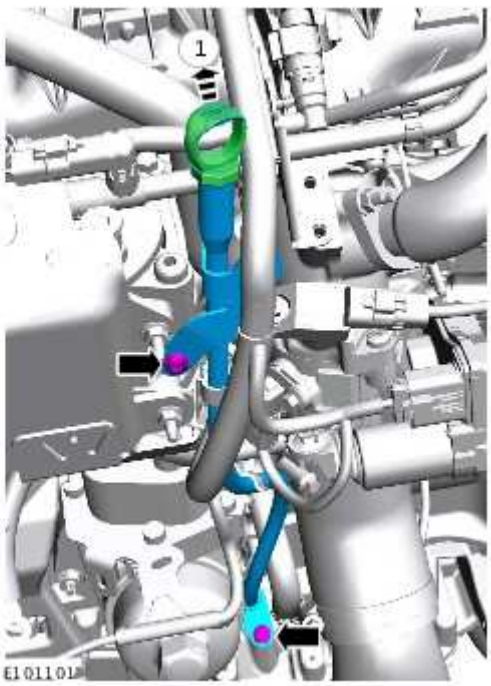
Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

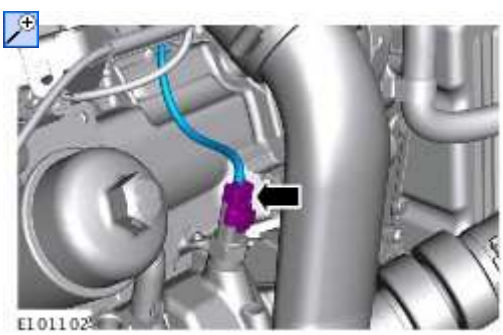
Removal

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

1. Refer to: Oil Pan (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2. *Torque:* 10 Nm



3.



4. *Special Tool(s):* 303-397

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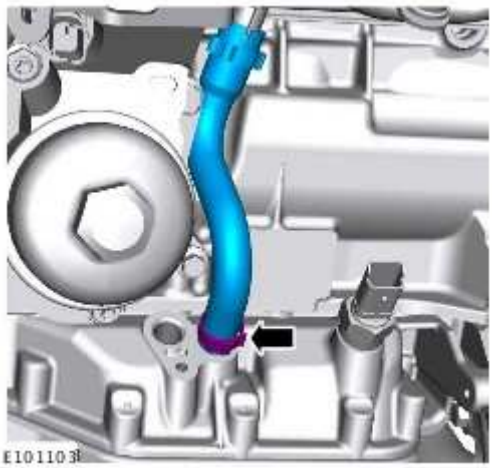
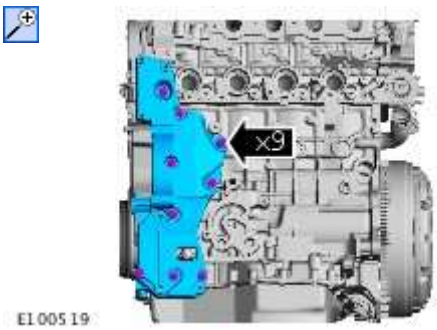
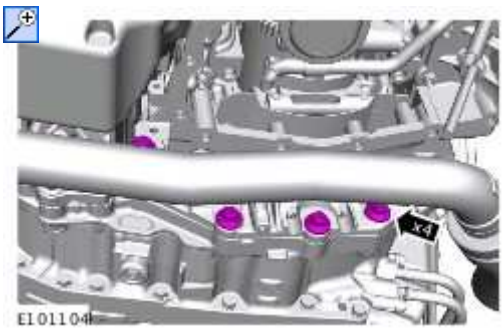
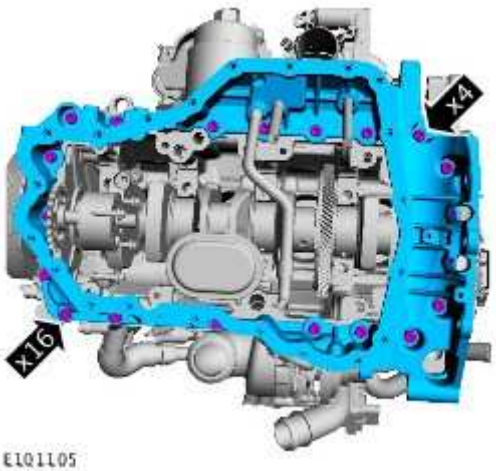




5. *Torque:* 28 Nm



6. *Torque:* 47 Nm



7. WARNING: Make sure that these components are installed to the noted removal position.
Torque:
Stage 1: 10 Nm
Stage 2: 16 Nm

8. NOTE: The gasket is to be reused unless damaged.
Torque: 27 Nm

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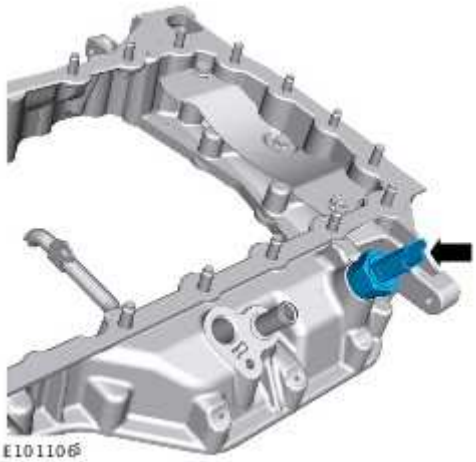
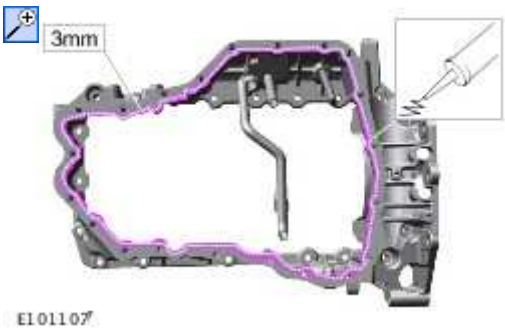


Installation



1. WARNING: Extreme cleanliness must be exercised when handling these components. To install, reverse the removal procedure.

   Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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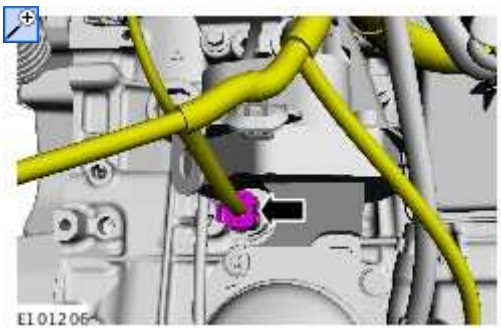
Removal and Installation

Removal

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

1. Refer to: Fuel Filter (310-01D Fuel Tank and Lines - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Throttle Body (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2. Remove the air conditioning compressor and position to one side.



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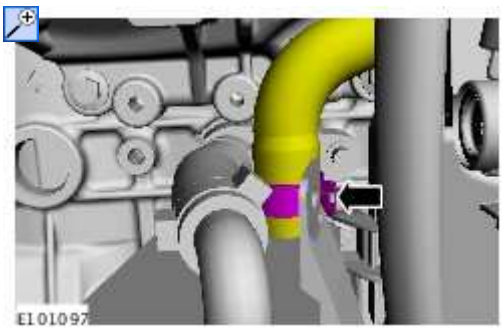
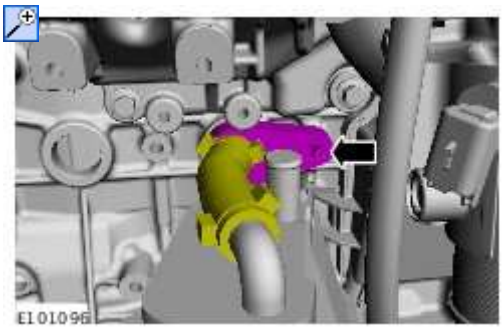


4. NOTE: Make sure that a new clamp is installed.



5. NOTE: Make sure that a new component is installed.
   Torque: 9 Nm

6. NOTE: Make sure that the component is clean and free of foreign material.
   NOTE: Make sure that a new component is installed.
   Torque:
   Stage 1: 10 Nm
   Stage 2: 20 Nm

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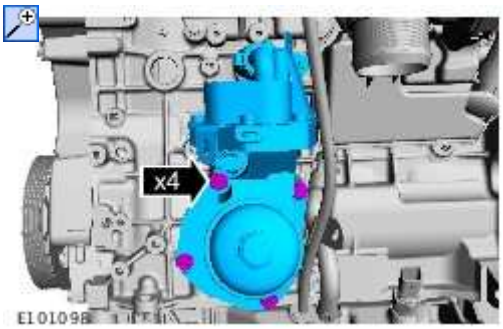

Installation

1. To install, reverse the removal procedure.

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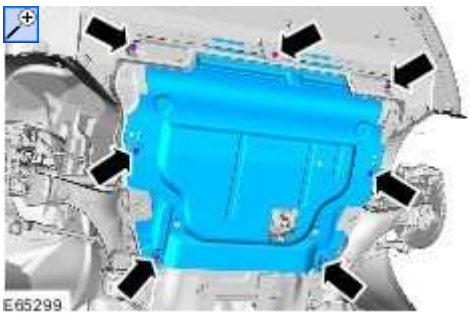
Removal and Installation

Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. 

3.

WARNING: Be prepared to collect escaping fluid.
NOTE: The seal is to be reused unless damaged.
Torque: 16 Nm

Installation

1. To install, reverse the removal procedure.
2. Fill the engine with oil.

   Refer to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications).

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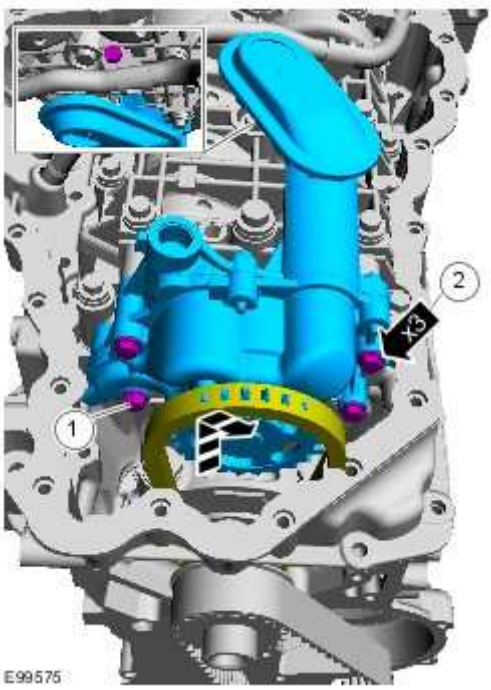
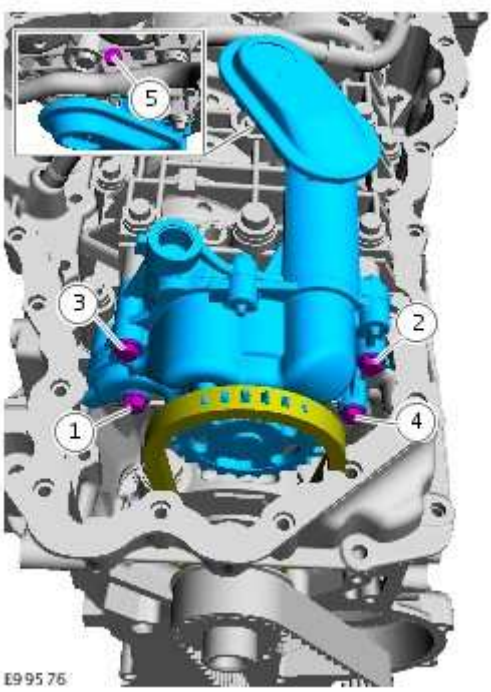
Removal and Installation

Removal



1. Refer to: Oil Pan (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2. CAUTION: Note the position of each component before removal.

Installation



1. CAUTIONS:

   Make sure that the mating faces are clean and free of foreign material.

   Make sure that these components are installed to the noted removal position.
   Tighten the bolts evenly in 2 stages in the sequence shown.

   Torque:
   Stage 1: 7 Nm
   Stage 2: 9 Nm

2. Refer to: Oil Pan (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal

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and Installation).

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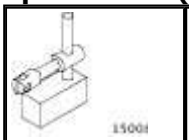
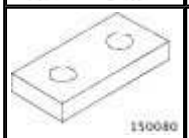
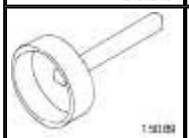
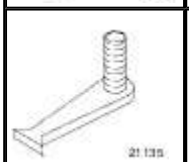
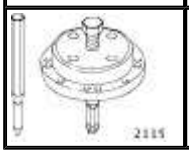
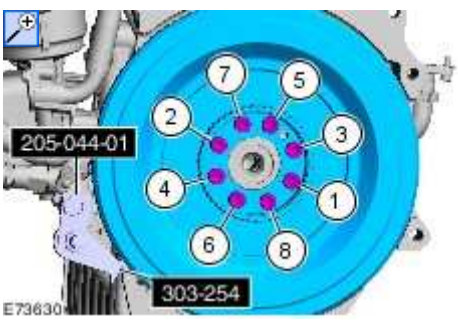
Removal and Installation

Special Tool(s)

	205-044 Holding Fixture, Dial Indicator Gauge
	205-044-01 Adapter for 205-044
	205-307 Installer, Wheel Speed Sensor Ring
	303-254 Locking Tool, Flywheel
	303-336 Remover, Crankshaft Rear Seal

Removal

1. Refer to: Clutch Disc and Pressure Plate (308-01C Clutch - Vehicles With: 6-Speed Manual Transaxle - M66, Removal and Installation).
2. *Special Tool(s):* 205-044, 205-044-01, 303-254



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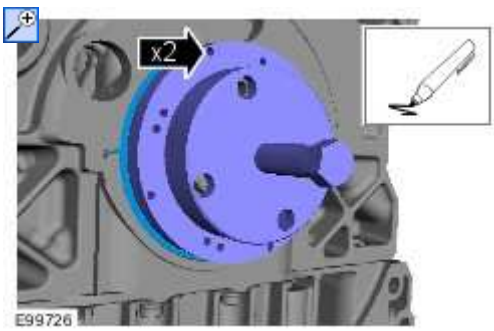

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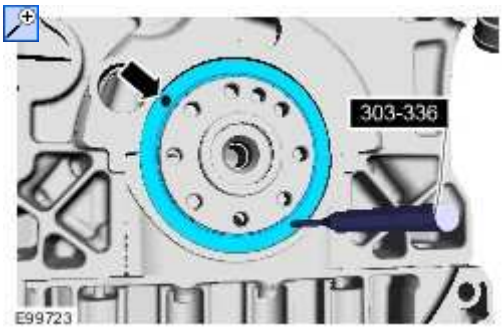
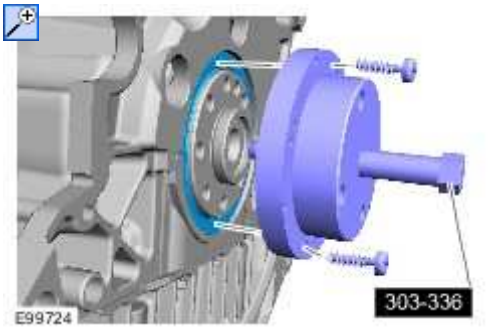
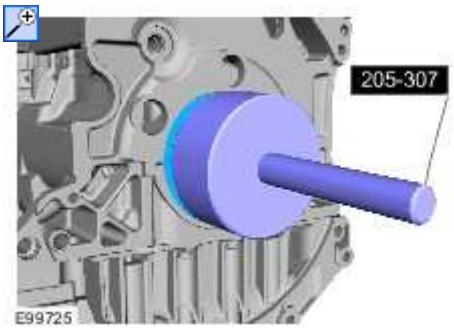


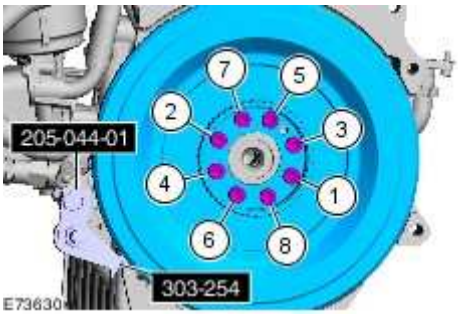


5. *Special Tool(s):* 303-336

Installation



1. *Special Tool(s):* 205-307



2. *Special Tool(s):* 205-044, 205-044-01, 303-254
   Torque:
   Stage 1: 33 Nm
   Stage 2: 34°

3. Refer to: Clutch Disc and Pressure Plate (308-01C Clutch - Vehicles With: 6-Speed Manual Transaxle - M66, Removal and Installation).

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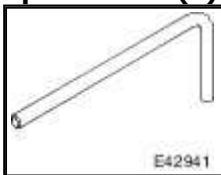
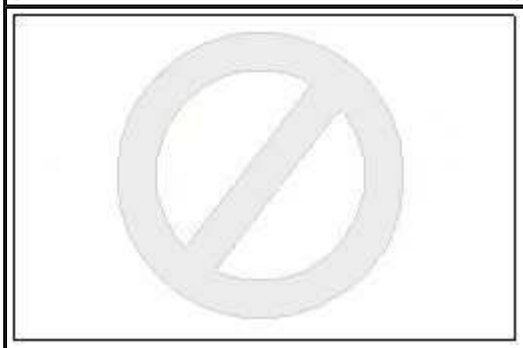
Removal and Installation

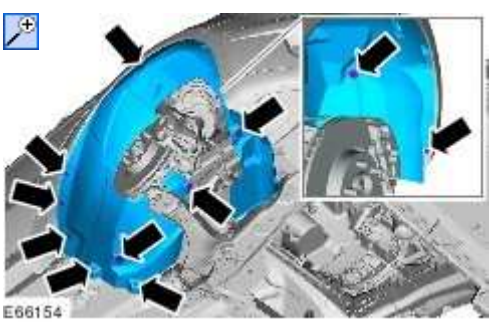
Special Tool(s)

 E42941	303-1059 Alignment Peg, Crankshaft
	303-1270 Timing Pin, Crankshaft
	303-1329 Locking Tool, Balance Shafts

Removal

CAUTION: Extreme cleanliness must be exercised when handling these components.

1. Remove the following items:
   1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
   2. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   3. Refer to: Oil Pan Extension (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).


E66154

2.

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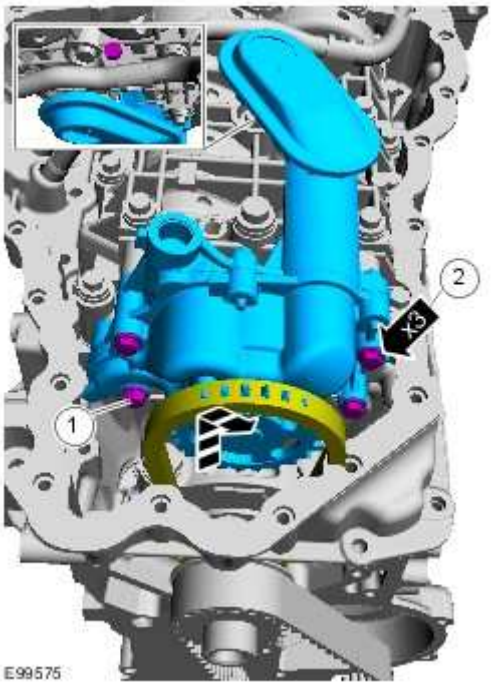
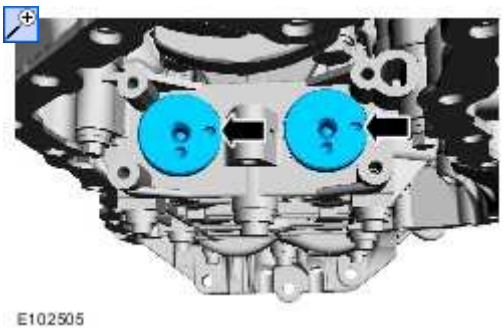
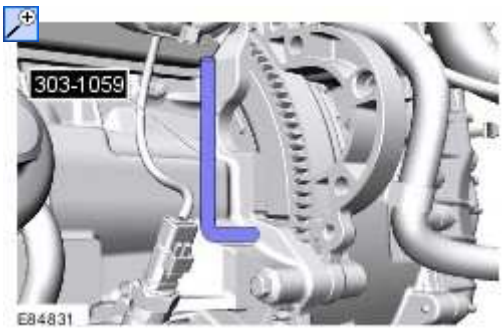


3. CAUTION: Note the position of each component before removal.



4.



5. *Special Tool(s):* 303-1059

6. *Special Tool(s):* 303-1329

7. CAUTION: Note the position of each component before removal.

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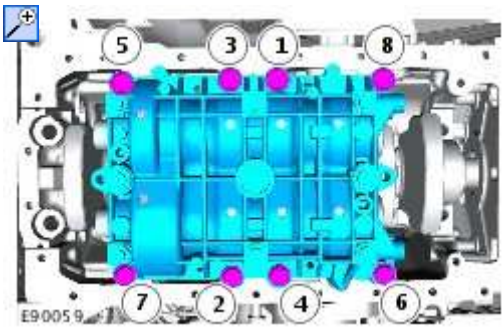
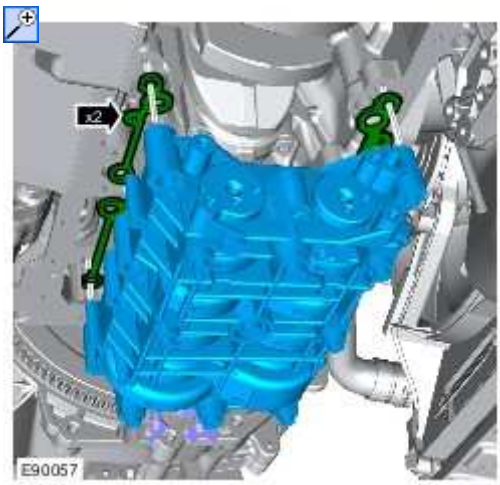


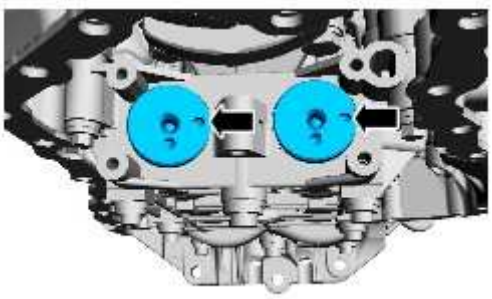


8. CAUTIONS:

   Note the position of each component before removal.

   Extreme cleanliness must be exercised when handling these components.

Installation



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

2. NOTE: This step is only necessary when installing a new component.
   Special Tool(s): 303-1270

3. NOTE: This step is only necessary when installing a new component.
   Refer to: Balance Shaft Backlash (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).

4.

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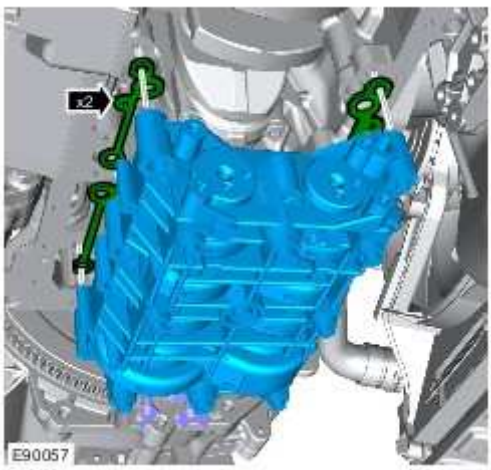
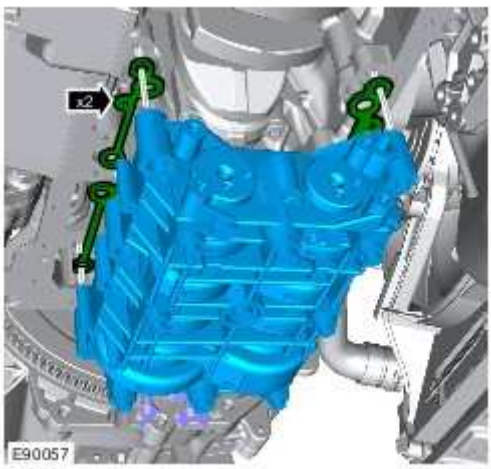
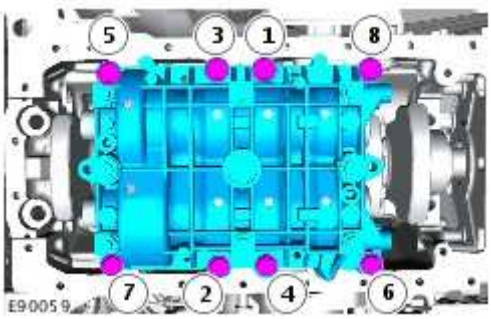


5. CAUTION: Extreme cleanliness must be exercised when handling these components.
NOTE: Make sure that this component is installed to the noted removal position.
Install the removed shims.



6. CAUTION: Extreme cleanliness must be exercised when handling these components.
NOTE: Make sure that this component is installed to the noted removal position.
NOTE: This step is only necessary when installing a new component.
Install the selected shims.



7. NOTE: Make sure that this component is installed to the noted removal position.
Torque:
Stage 1: 5 Nm
Stage 2: 22 Nm

8. *Remove the Special Tool(s):* 303-1270, 303-1329

9. CAUTIONS:

Make sure that the mating faces are

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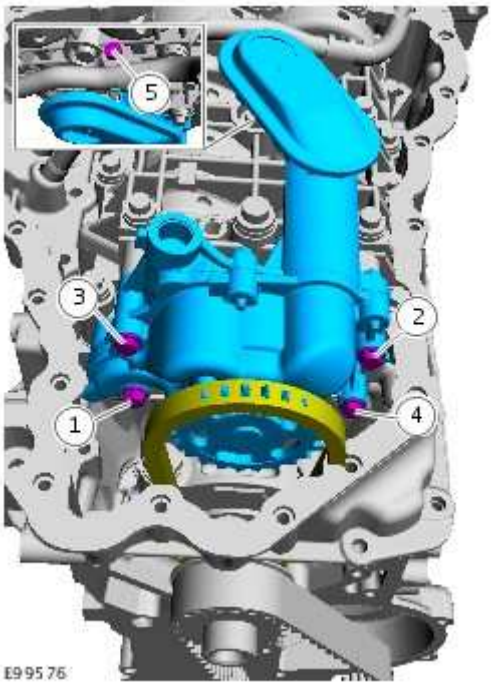
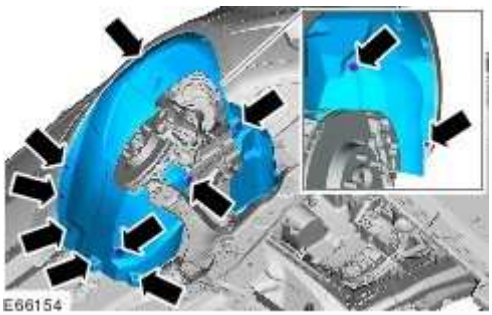


clean and free of foreign material.

Make sure that these components are installed to the noted removal position.
Tighten the bolts evenly in 2 stages in the sequence shown.

Torque:
Stage 1: 7 Nm
Stage 2: 9 Nm



10.

11. Install the following items:
    1. Refer to: Oil Pan Extension (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    2. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    3. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

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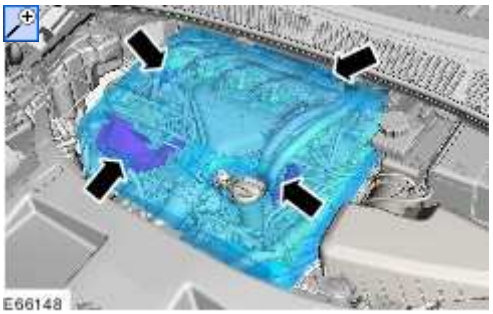
Removal

Special Tool(s)

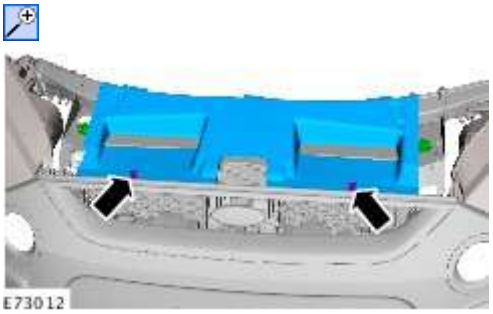
	303-122 Lifting Bracket, Engine

General Equipment

Hose clamp remover/installer
Hydraulic jib crane
Mounting table set

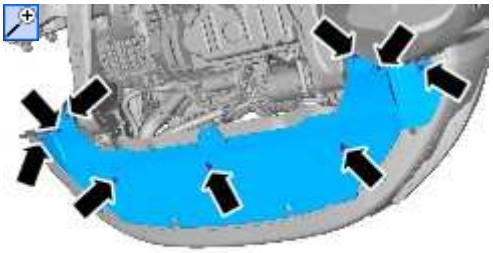


1.



2.

3. Remove the following items:
   1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
   2. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4. Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).



5.

6.

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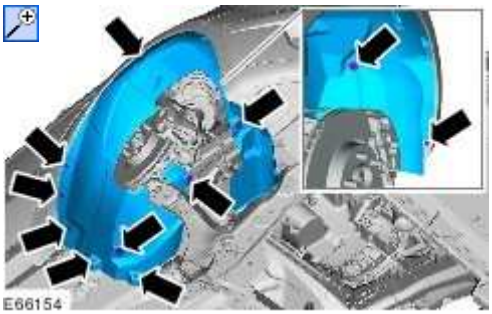

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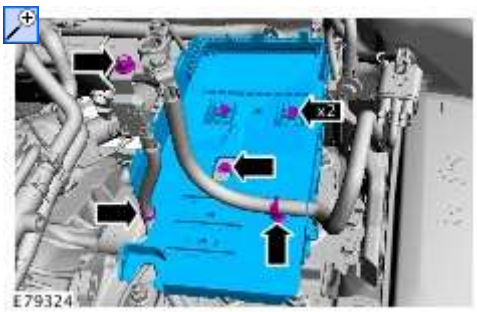
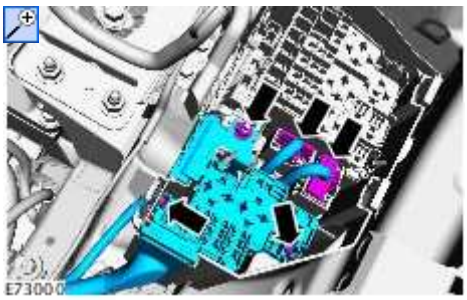


8.

9.



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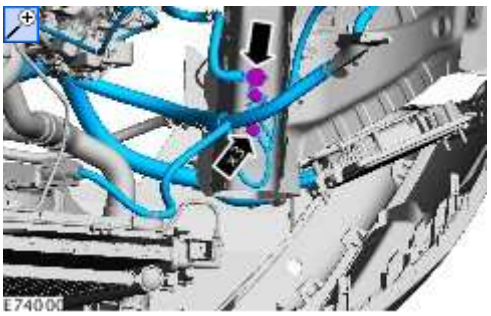

11.

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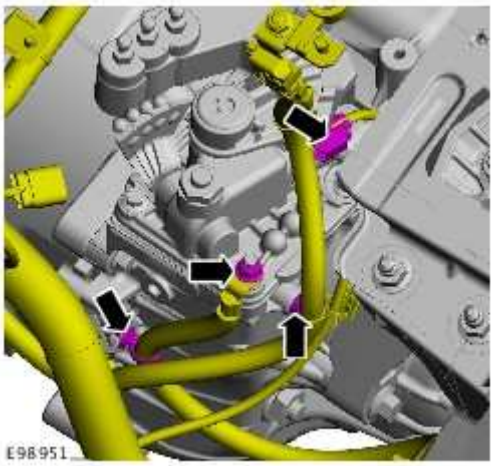

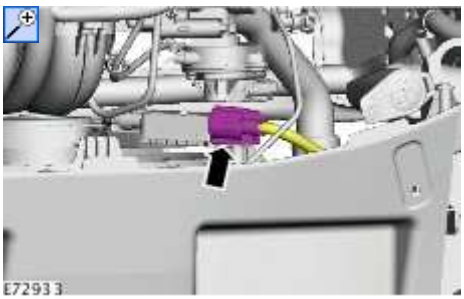

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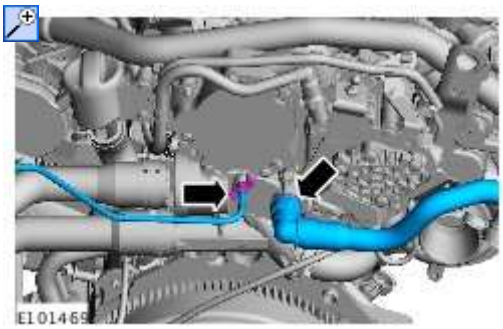
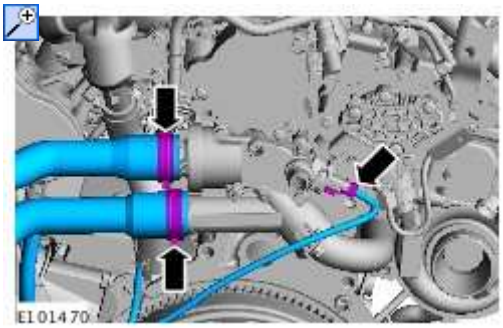


13. *General Equipment:* Hose clamp remover/installer



14.

15.

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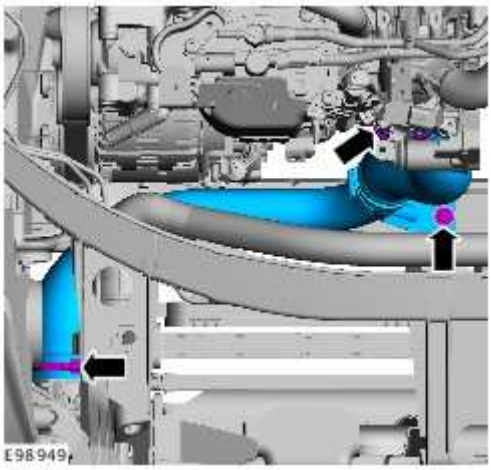
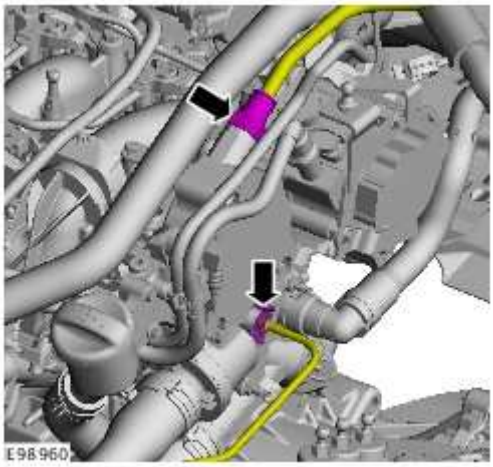
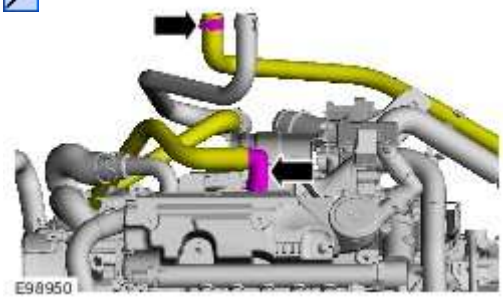


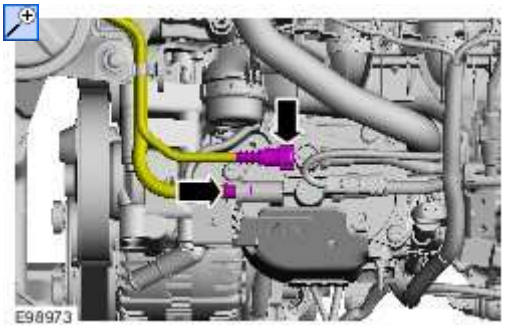
16.



17. *General Equipment:* Hose clamp remover/installer



18. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



19. Secure the power steering pump to one side.

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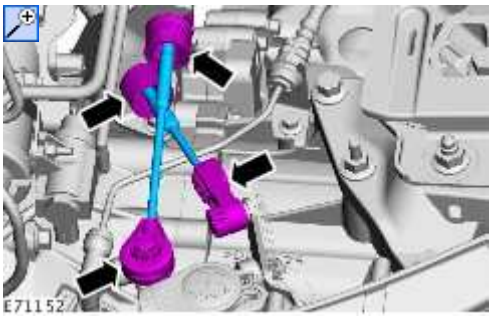
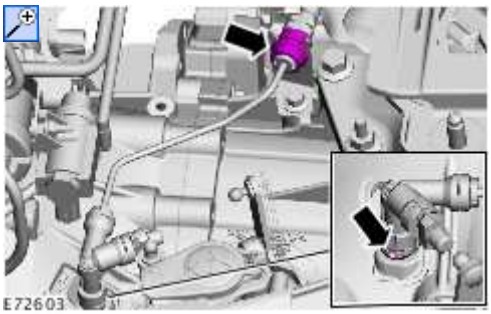
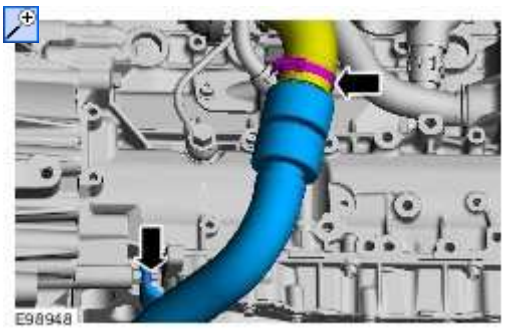


20. CAUTION: Gearshift cables must not be kinked or bent.



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

22.



23.

24.

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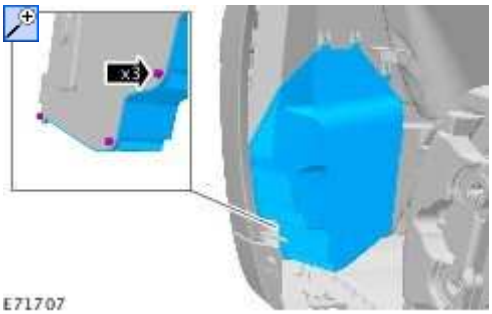
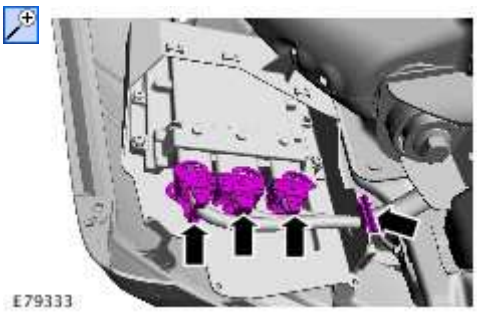
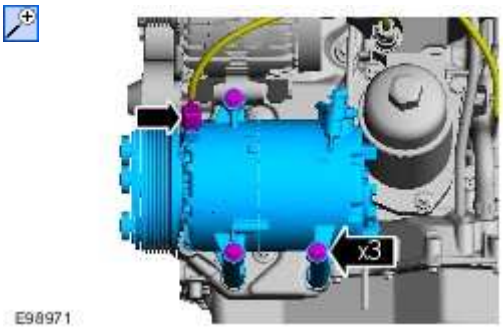




25.

26. Remove the following items:
    1. Refer to: Catalytic Converter (309-00F Exhaust System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    2. Refer to: Front Drive Halfshafts (205-04 Front Drive Halfshafts, Description and Operation).
    3. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



27. Secure the (A/C) compressor to one side.

28. WARNING: Make sure that the engine and transmission assembly is on wooden blocks and secured with suitable retaining straps.
General Equipment: Mounting table set

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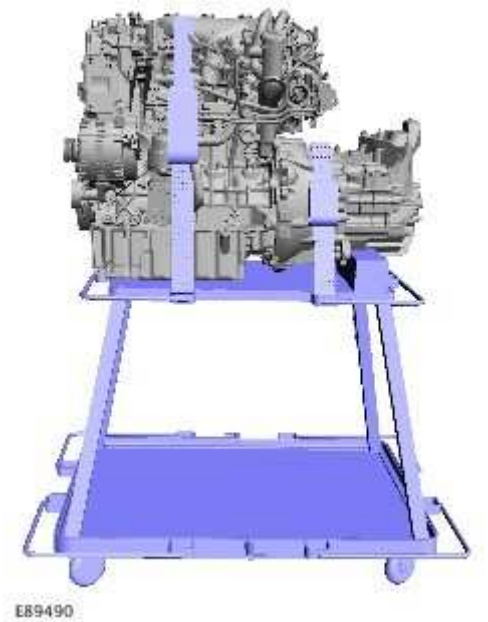
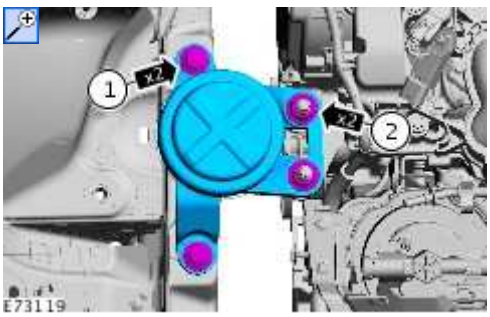
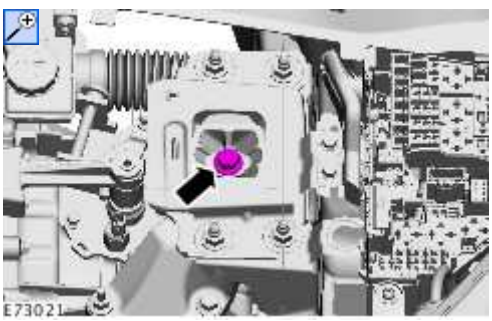


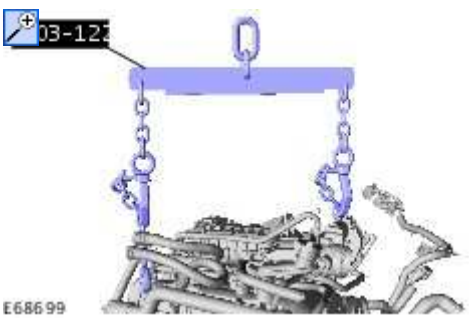


29.



30.

31. CAUTION: Make sure that no components catch when lowering the engine. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



32. *Special Tool(s):* 303-122
General Equipment: Hydraulic jib crane

33. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) -

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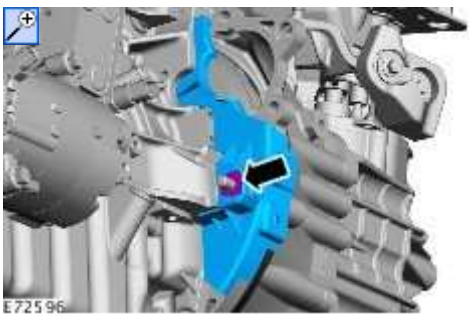
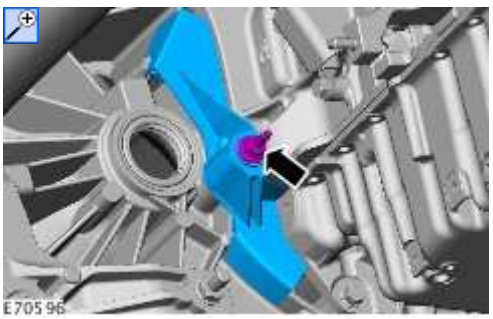
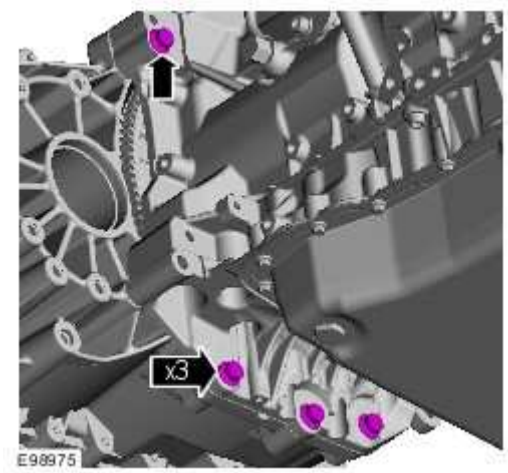
DW, Removal and Installation).
Refer to: Generator - 2.2L Duratorq-TDCi (129kW/175PS) - DW (414-02 Generator and Regulator, Removal and Installation).



34.



35.



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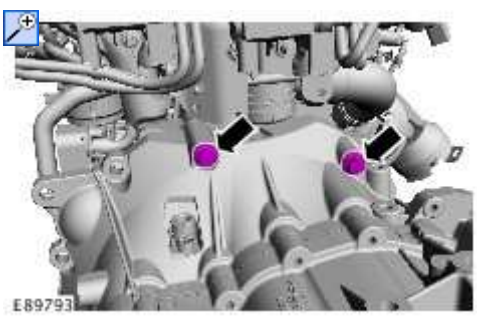

37.

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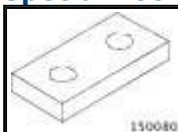
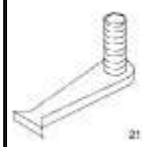
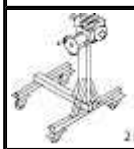
Print

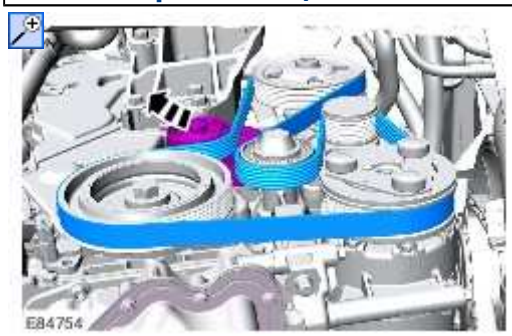
Removal

Special Tool(s)

	205-044-01 Adapter for 205-044
	303-122 Lifting Bracket, Engine
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11B Mounting Plate for 303-435-06

General Equipment

Hose clamp remover/installer



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2.

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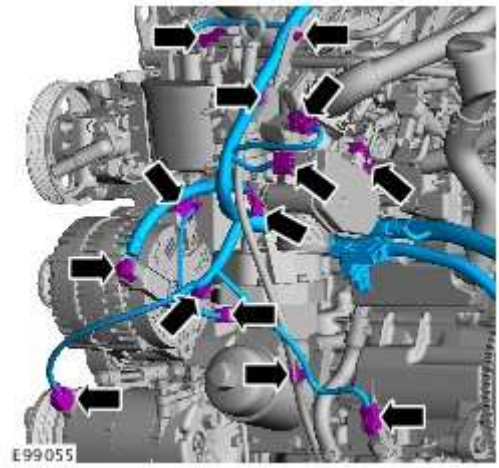

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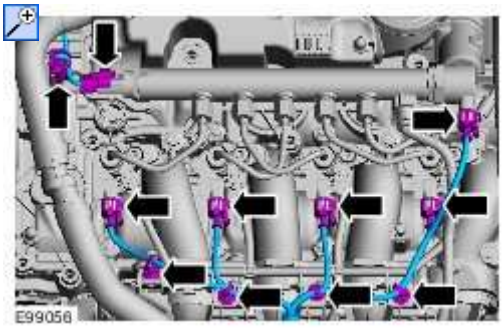

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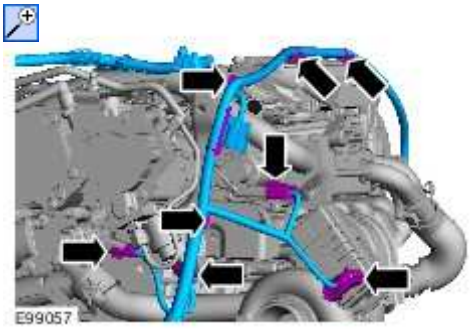

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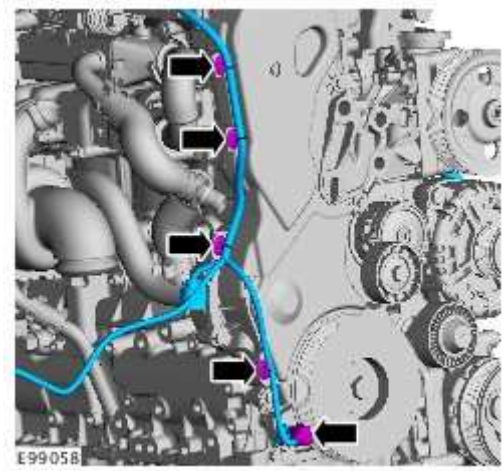

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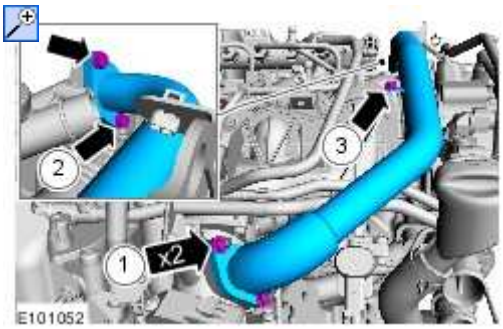

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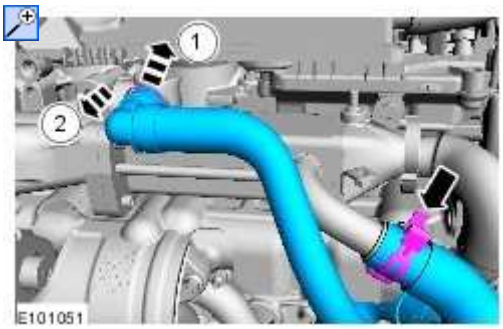

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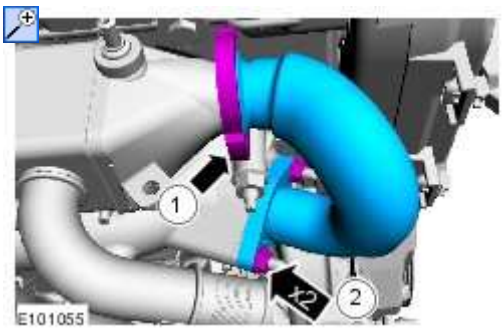

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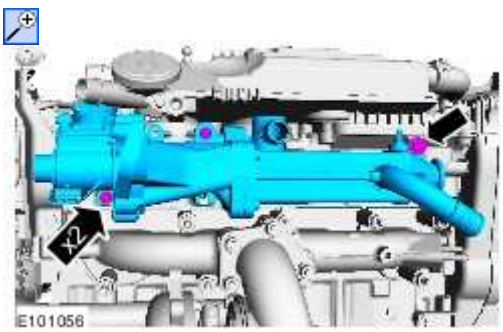

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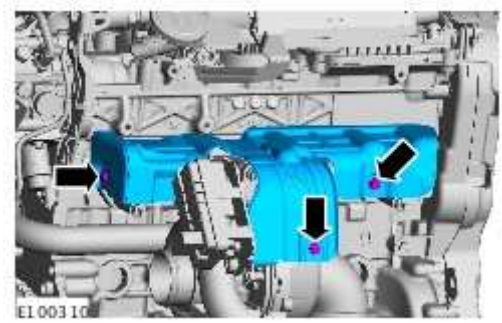
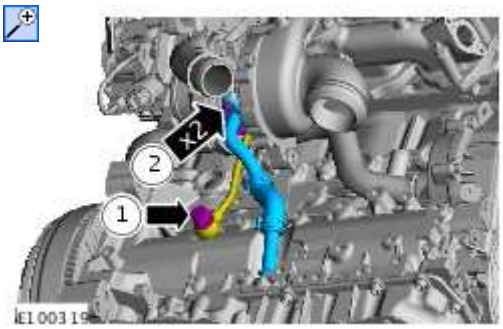


11.

http://vnx.su



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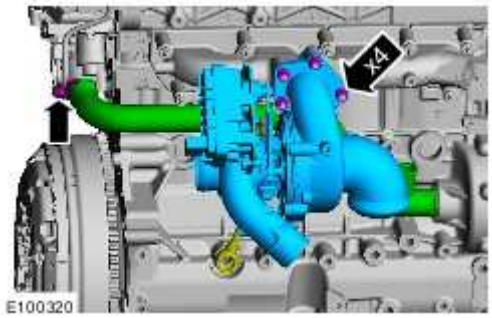

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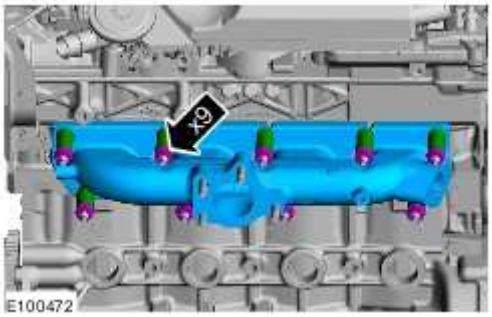
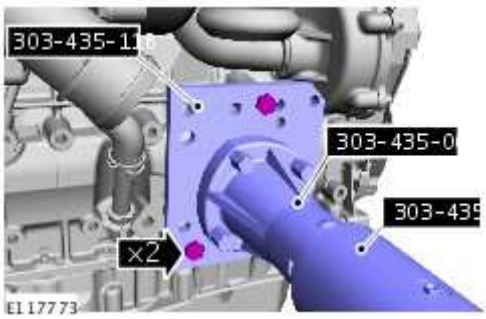
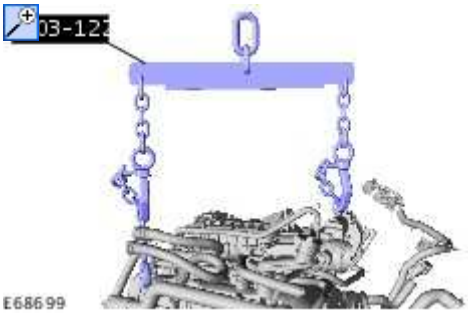


14. *Install the Special Tool(s):* 303-435, 303-435-11B, 303-435-06

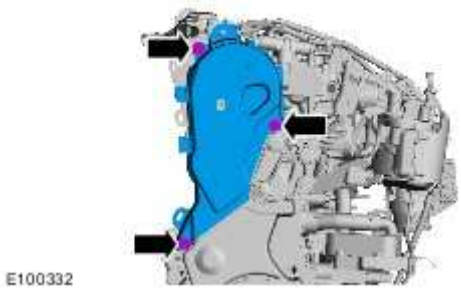


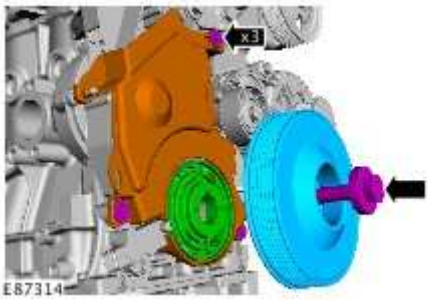
15. *Remove the Special Tool(s):* 303-122



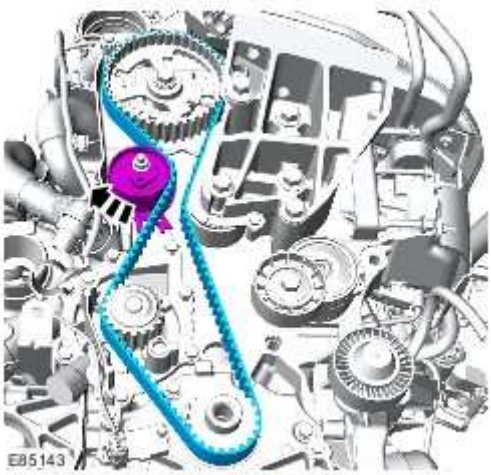
16.

http://vnx.su





17. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.



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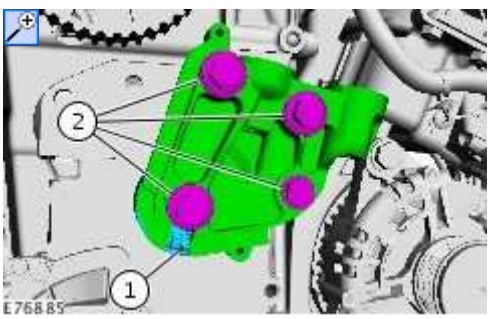

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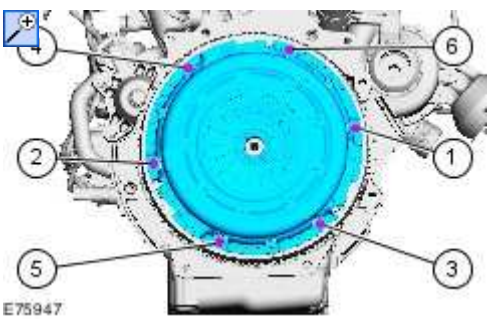

20.

21. *Special Tool(s):* 205-044-01, 303-254

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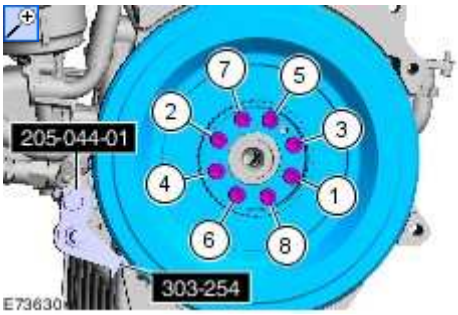

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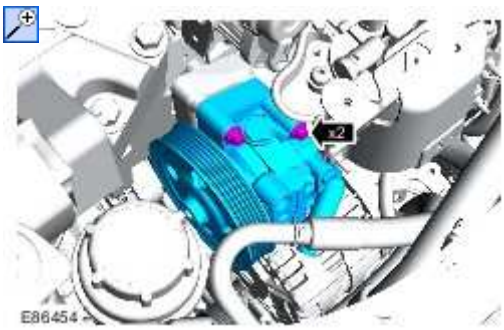

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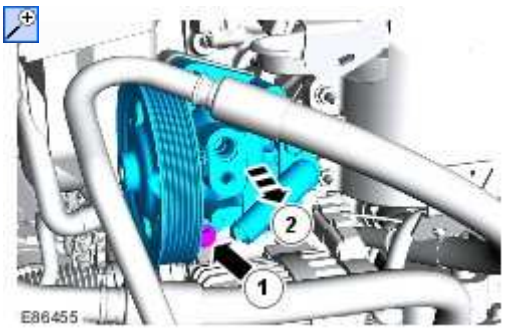

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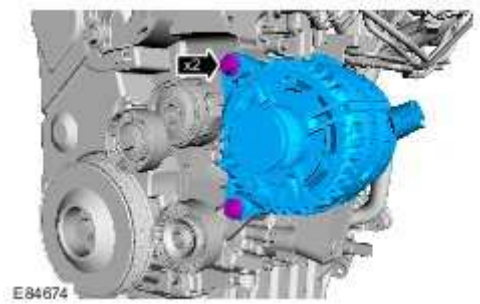

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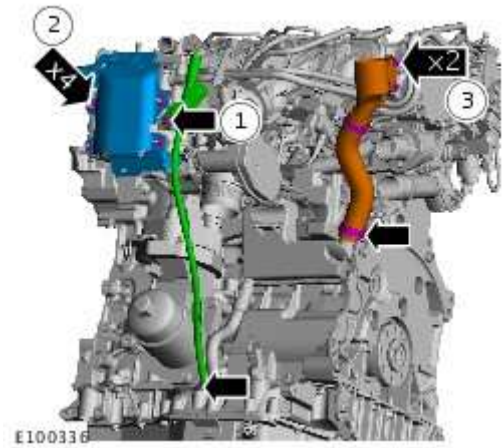

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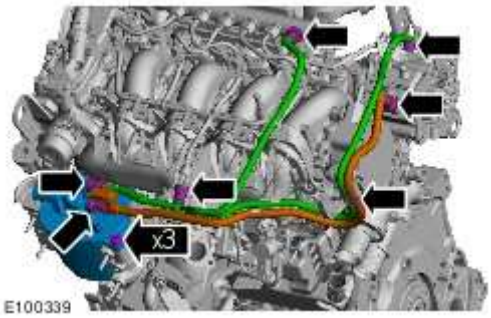

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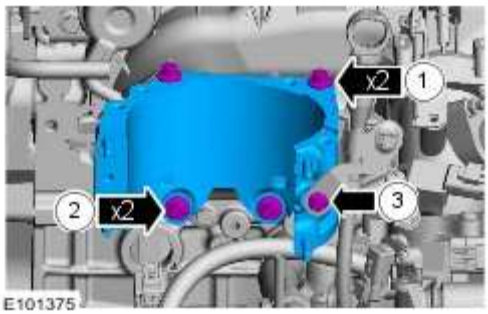

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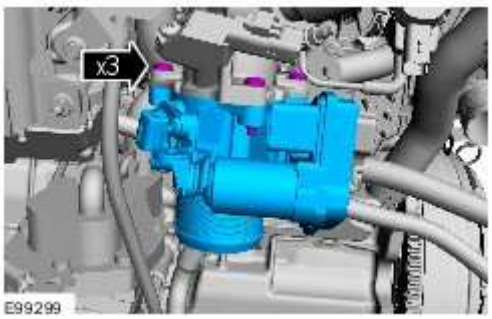

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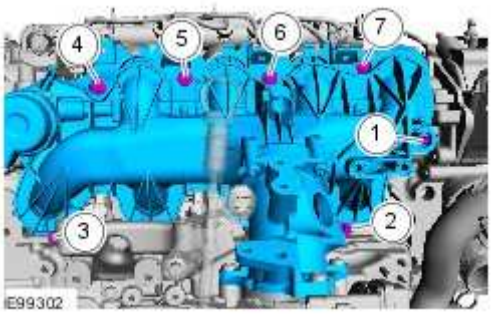

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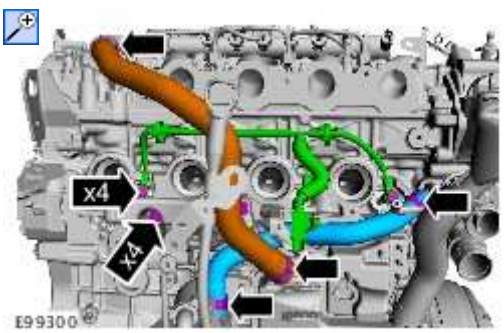
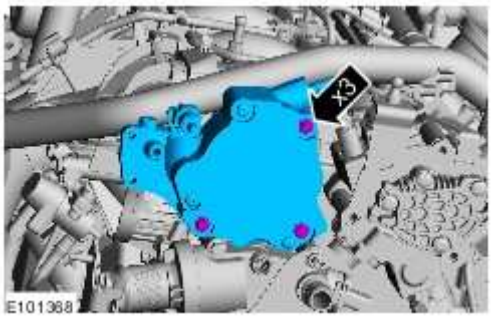
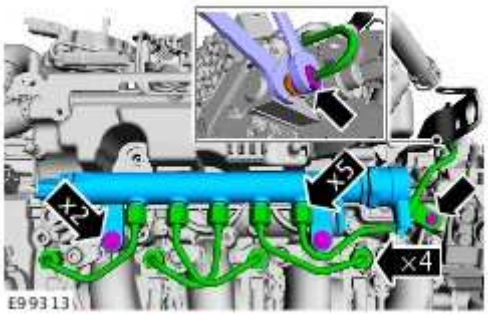


31.

http://vnx.su





32. CAUTIONS:

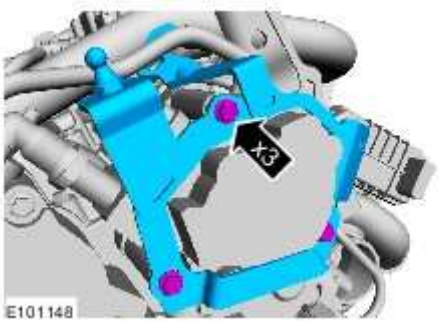
⚠ Use an open-ended wrench to prevent the component from turning.

⚠ Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.

⚠ Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

⚠ Make sure that all openings are sealed. Use new blanking caps.
Refer to: Fuel Injection Component Cleaning (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).

33.



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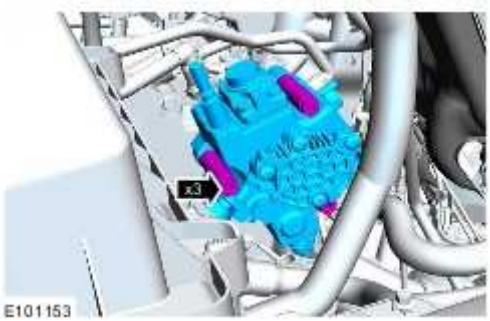

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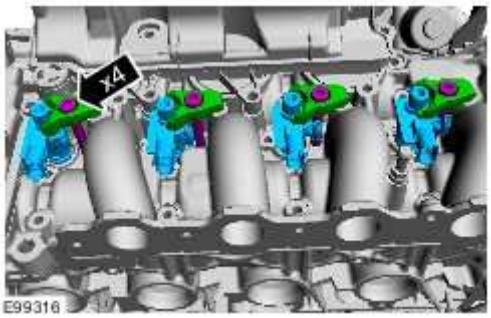
http://vnx.su



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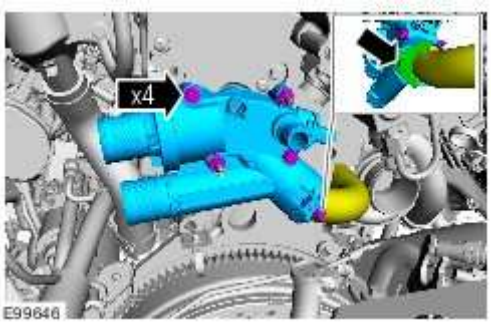
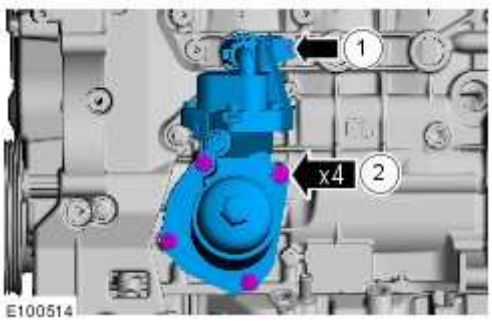


37. *General Equipment:* Hose clamp remover/installer



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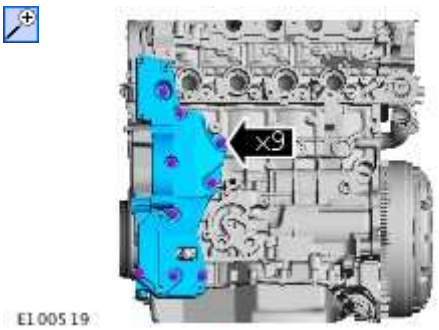
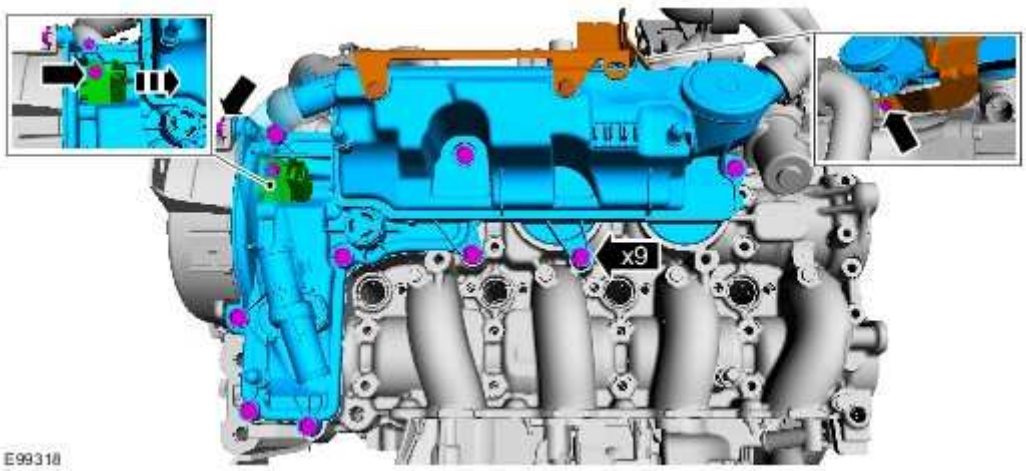


39.

40.

http://vnx.su



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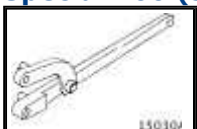
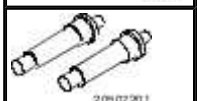
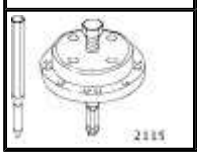
Print

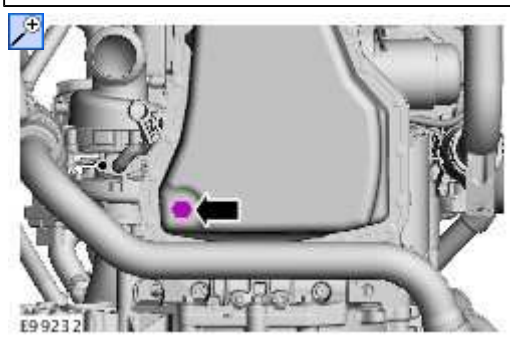
Disassembly

Special Tool(s)

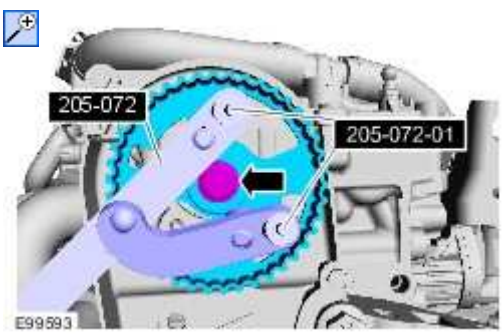
	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	303-293 Remover, Crankshaft Seal
	303-336 Remover, Crankshaft Rear Seal

General Equipment

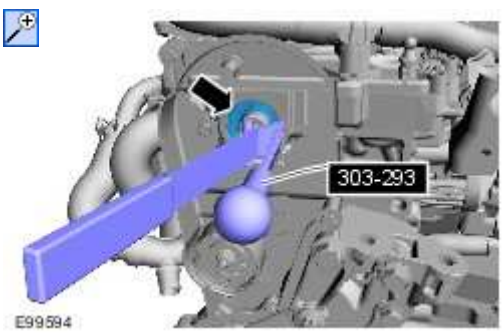
Fluid container



1. NOTE: Use suitable paper to absorb any escaping fluid.
   General Equipment: Fluid container



2. *Special Tool(s):* 205-072, 205-072-01



3. *Special Tool(s):* 303-293

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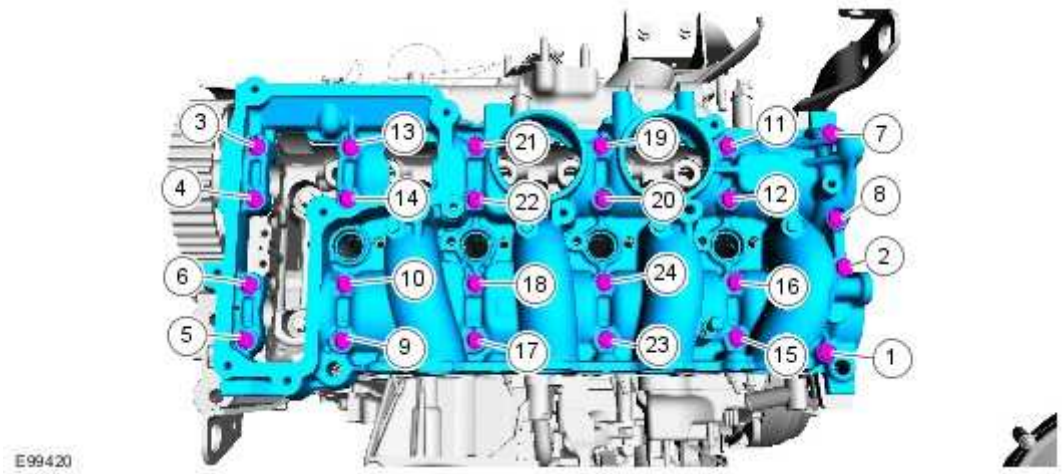
4.

5.



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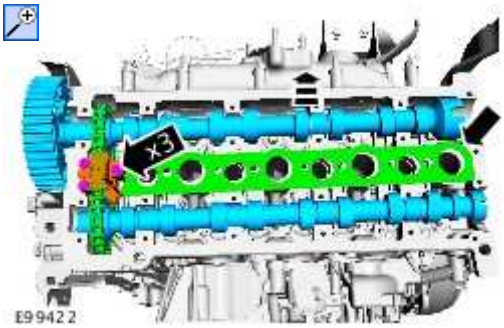

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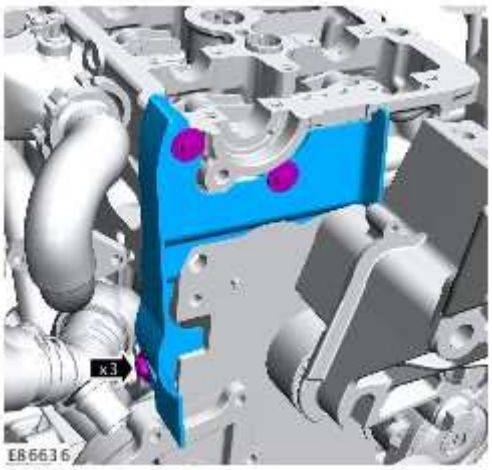

8.

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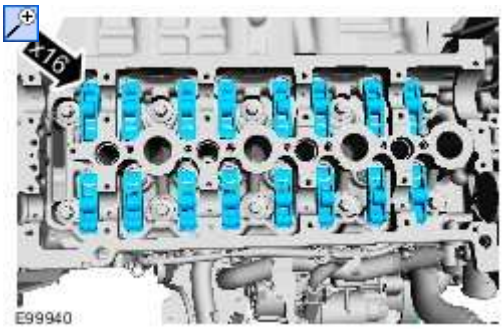
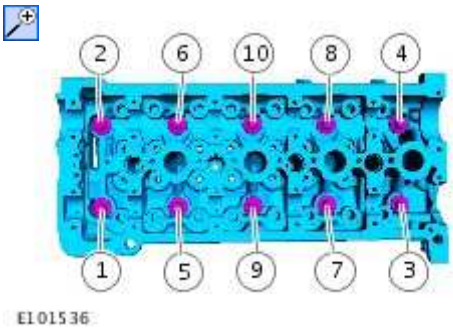


9.



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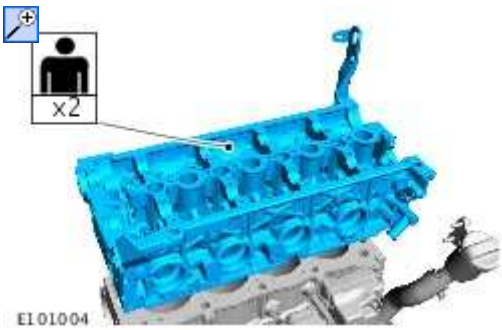

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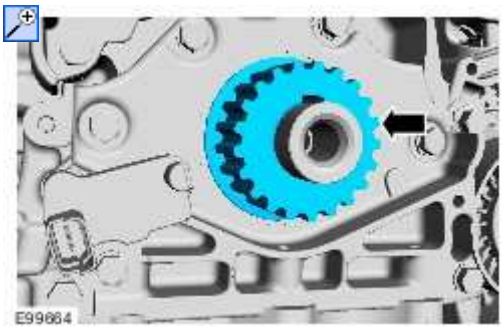

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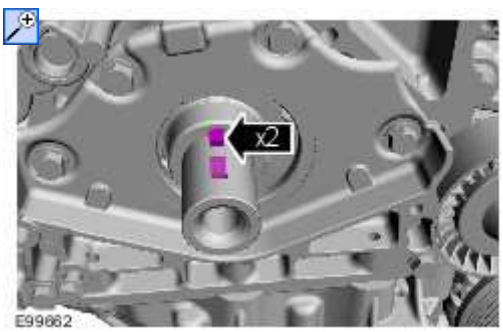

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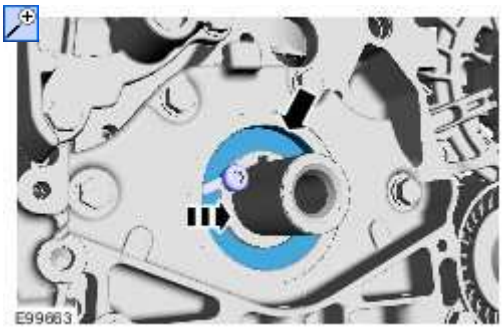
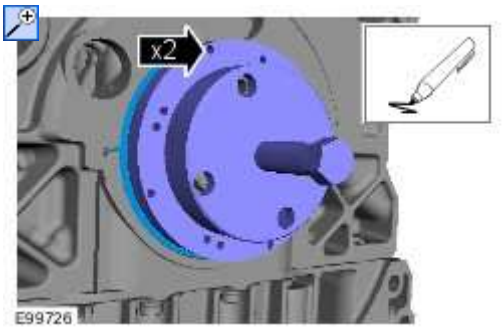
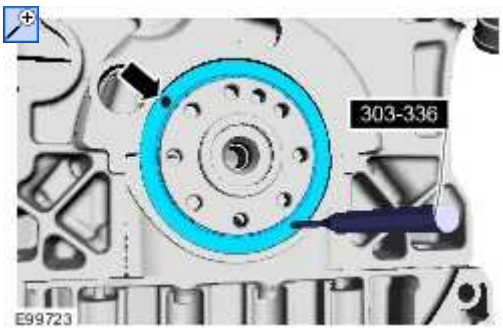
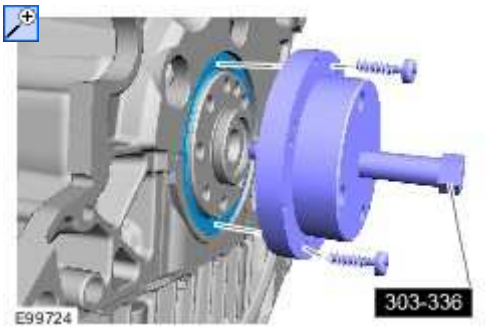




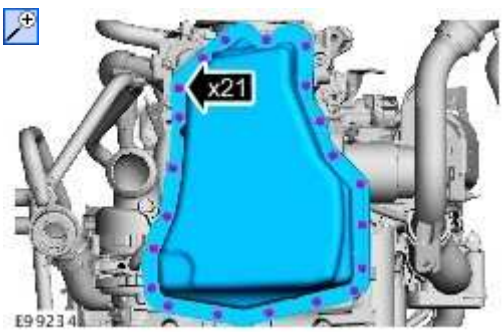
14. *Special Tool(s):* 303-336



15. *Special Tool(s):* 303-336



16. *Special Tool(s):* 303-336



17.

18. NOTE: Note the position of the components before removal.

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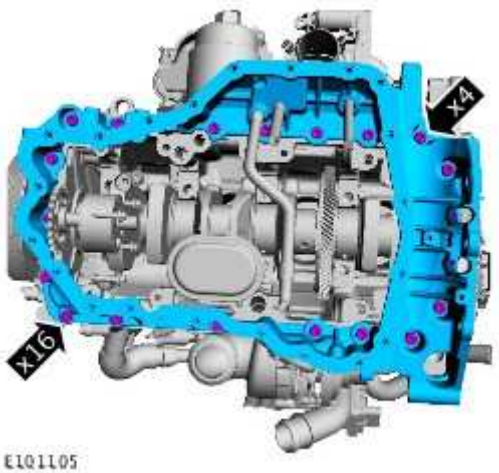
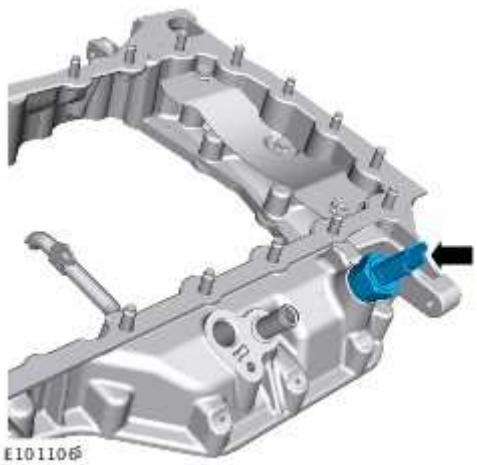
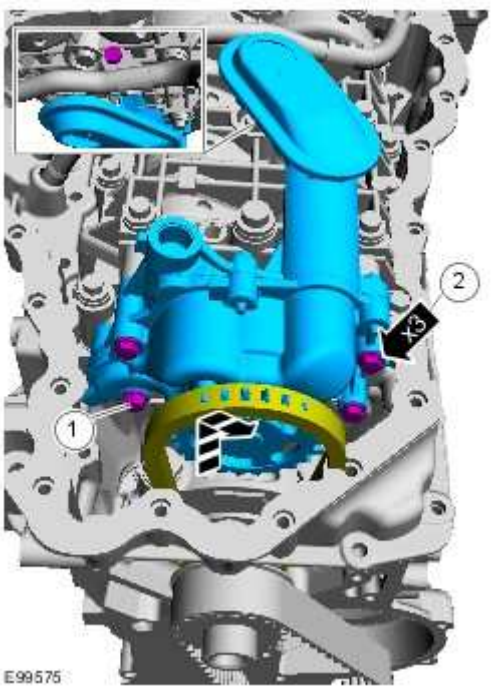


19. NOTE: The gasket is to be reused unless damaged.





20. CAUTION: Note the position of each component before removal.

21. CAUTION: Note the position of each component before removal.

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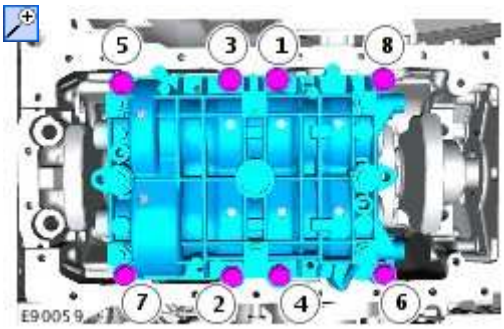
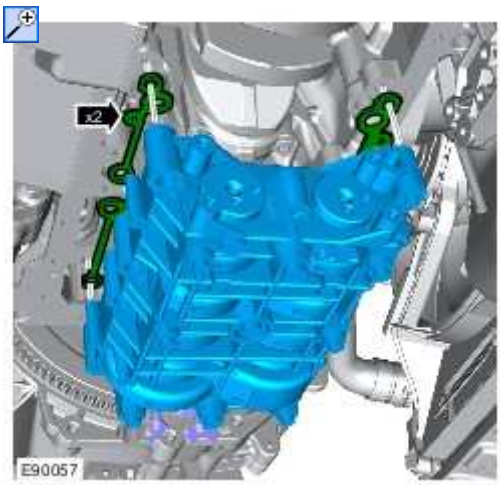
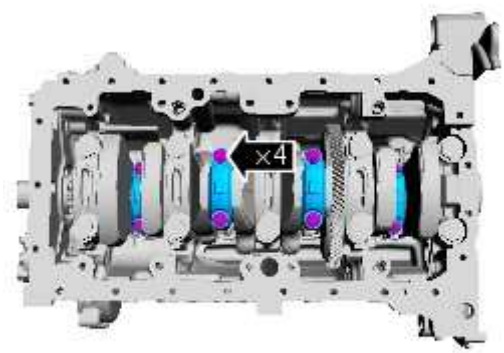




22. CAUTIONS:

Note the position of the components before removal.

Extreme cleanliness must be exercised when handling the component.



23. NOTE: Note the position of each component before removal.

24. NOTE: Note the position of each component before removal.

25. NOTE: Note the position of each component before removal.

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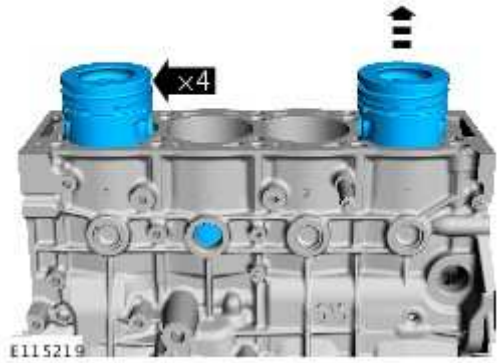
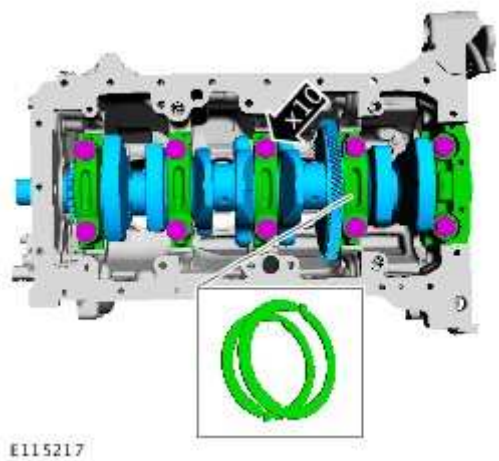


26. NOTE: Note the position of each component before removal.



27.

28. NOTE: Note the position of each component before removal.

29. NOTE: Note the position of each component before removal.

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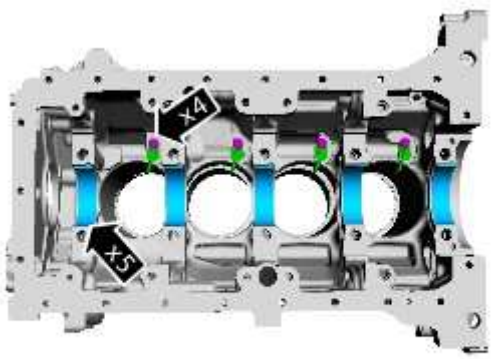

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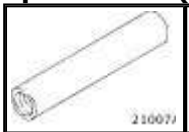
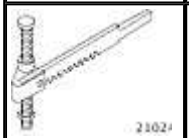
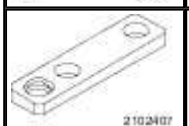
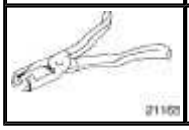
Print

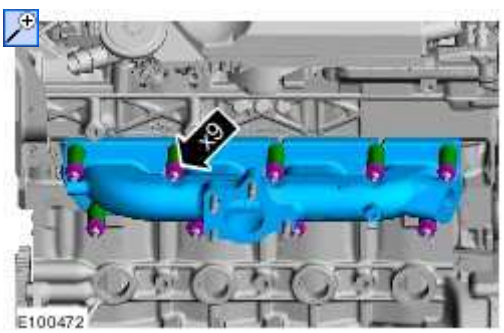
Disassembly and Assembly of Subassemblies

Special Tool(s)

	303-037 Installer, Valve Stem Seal
	303-060 Compressor, Valve Spring
	303-060-07 Adapter for 303-060
	303-060-09A Adapter for 303-060
	303-390 Pliers, Valve Stem Seal

Disassembly

1.



2.

3.

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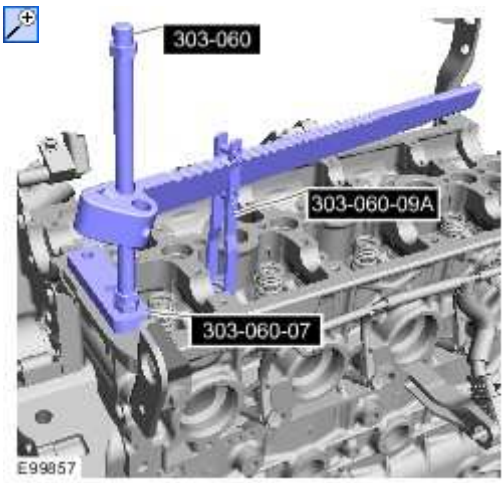
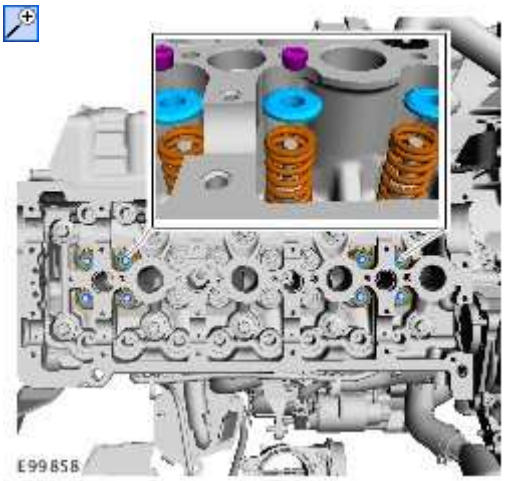
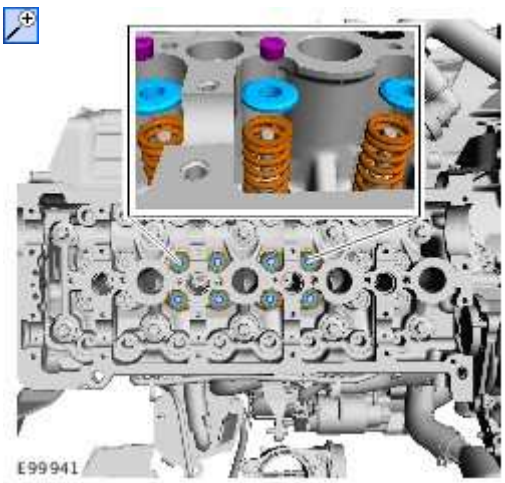


4. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A



5.



6.

7. *Special Tool(s):* 303-390

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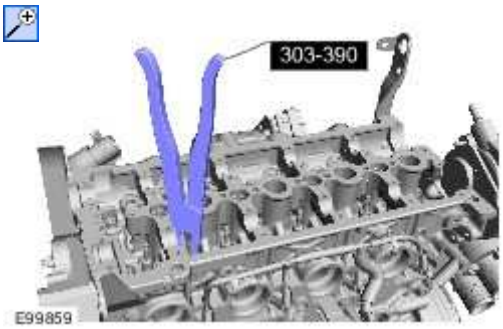
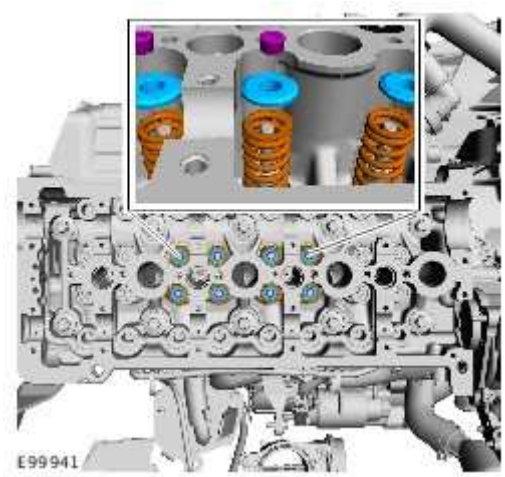
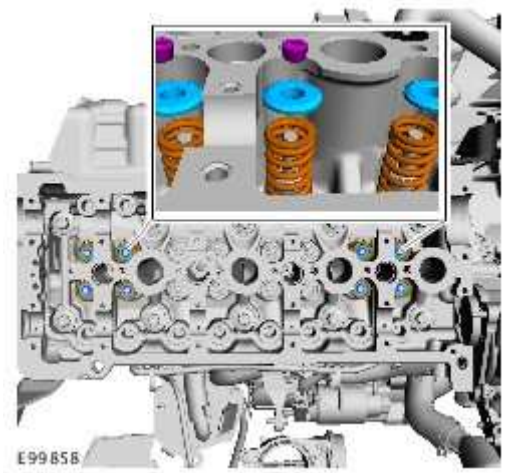


Assembly

8. *Special Tool(s):* 303-037



9.



10.

11. *Special Tool(s):* 303-060, 303-060-07, 303-060-09A

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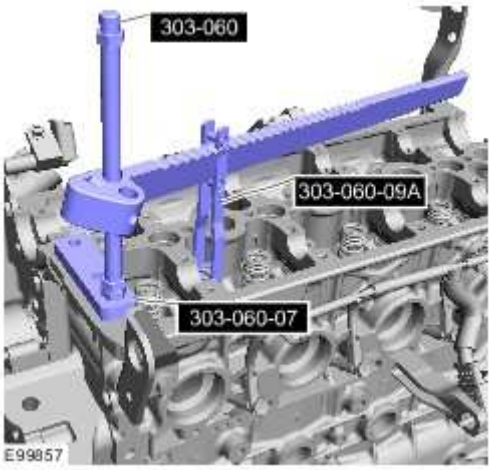
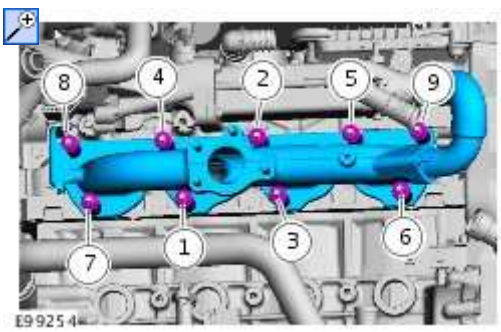
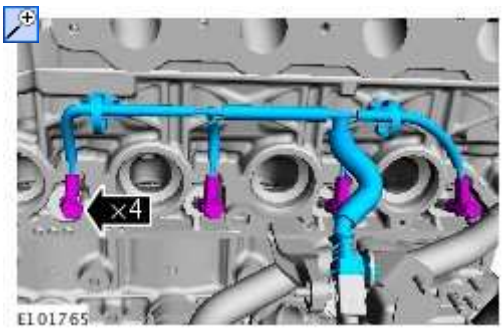


12. *Torque:* 12 Nm

13. *Torque:* 19 Nm



14. NOTE: Install new nuts and a new gasket.
Torque:
Stage 1: 12 Nm
Stage 2: 25 Nm
Stage 3: 25 Nm



15.

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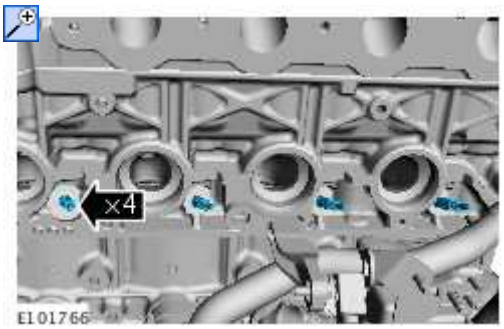

16. *Torque:* 8 Nm

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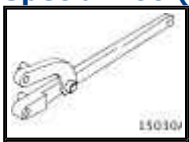
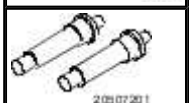
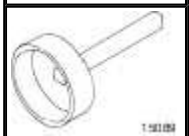
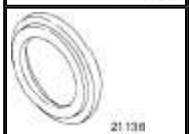
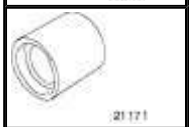
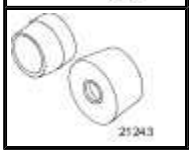
Assembly

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	205-072-01 Adapter for 205-072
	205-307 Installer, Wheel Speed Sensor Ring
	303-174 Gauge, Bolt Angle
	303-255 Installer, Timing Cover Seal
	303-395 Installer, Crankshaft Seal
	303-684 Installer, Crankshaft Front Seal

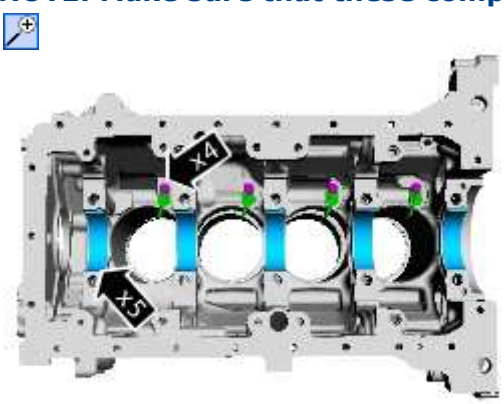
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

General Equipment

Piston ring compressor

NOTE: Make sure that these components are installed to the noted removal position.



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1. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)
   Torque: 10 Nm

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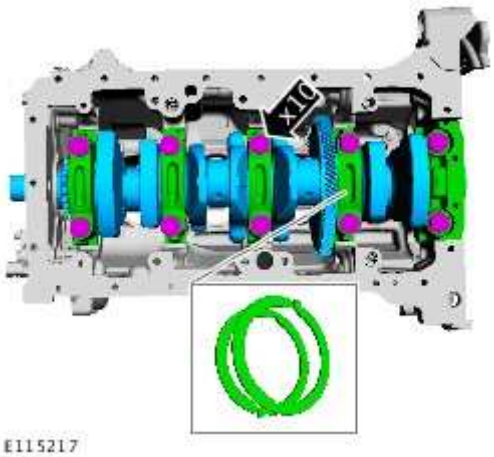
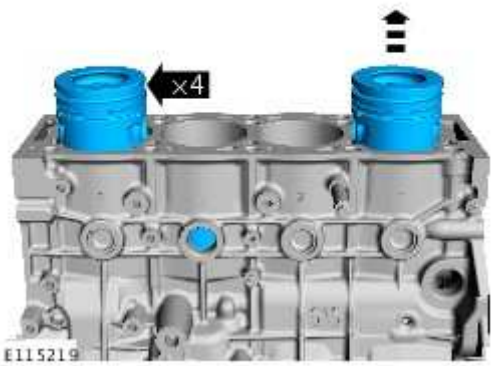
2. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)

3.



4. NOTE: Make sure that these components are installed to the noted removal position.
Torque:
Stage 1: 30 Nm
Stage 2: 82°



5. NOTE: Make sure that these components are installed to the noted removal position.
General Equipment: Piston ring compressor
Material: Engine Oil - 5W-30 (WSS-M2C913-B)

6. NOTE: Make sure that these components are installed to the noted removal position.
Material: Engine Oil - 5W-30 (WSS-M2C913-B)

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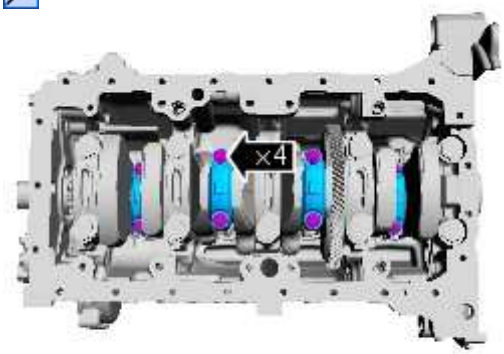
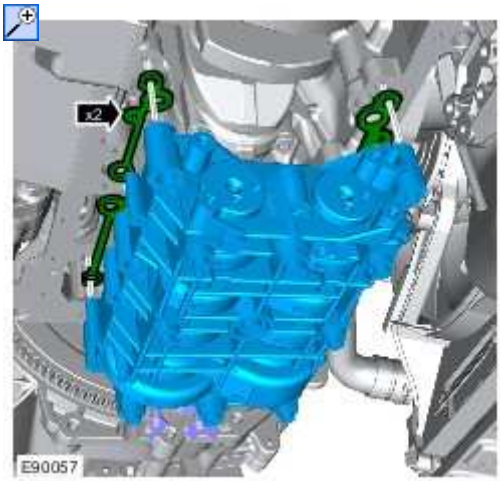
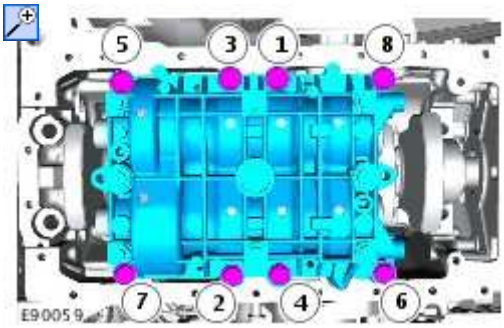


7. NOTE: Make sure that these components are installed to the noted removal position.
Torque:
Stage 1: 20 Nm
Stage 2: 70°



8. CAUTION: Extreme cleanliness must be exercised when handling the component.
NOTE: Make sure that these components are installed to the noted removal position.



9. NOTE: Make sure that these components are installed to the noted removal position.
Torque:
Stage 1: 5 Nm
Stage 2: 22 Nm

10. CAUTION: Make sure that the mating faces a clean and free of foreign material.
NOTE: Make sure that these components are installed to the noted removal position.
Torque:
Stage 1: 7 Nm

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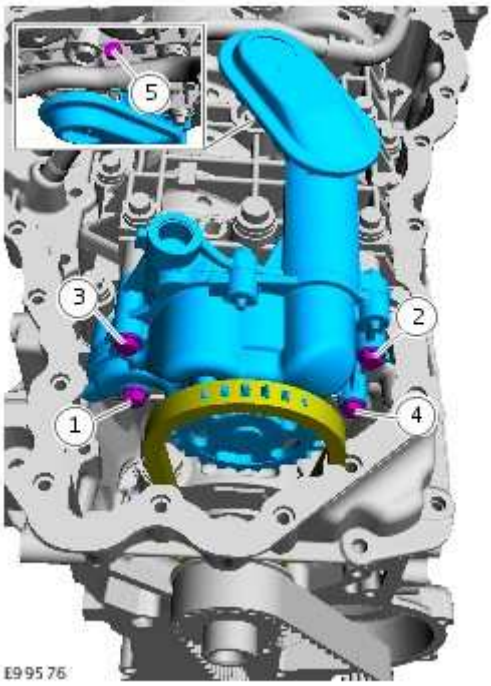
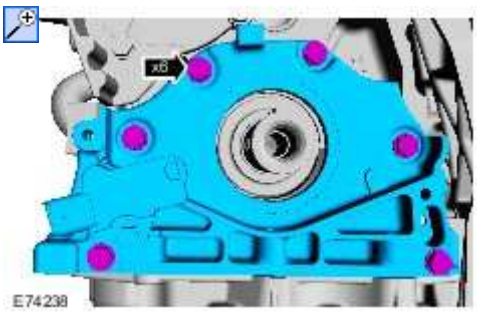
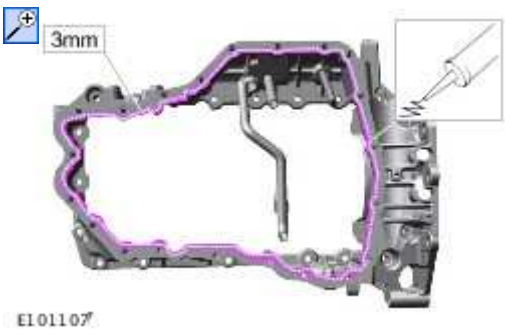


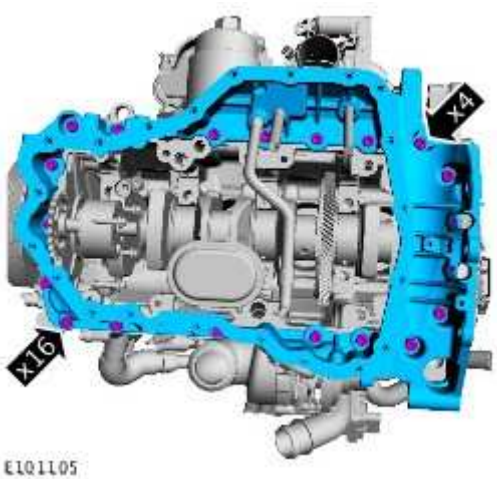
Stage 2: 9 Nm



11. *Torque:* 14 Nm



12. WARNING: Extreme cleanliness must be exercised when handling these components.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2L M4G323-AA)



13. NOTE: Make sure that these components are installed to the noted removal position.
NOTE: The component must be installed within 5 minutes of applying the sealant.
Torque:
Stage 1: 10 Nm
Stage 2: 16 Nm

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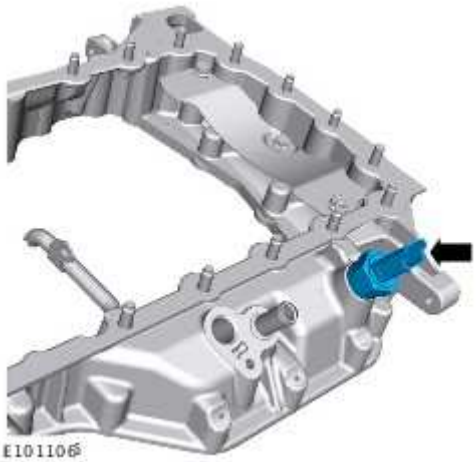
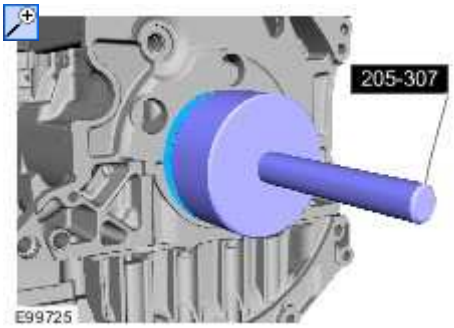
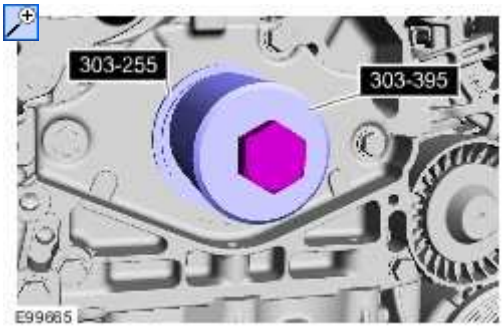


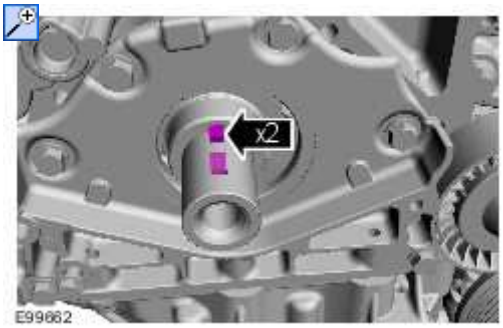
14. NOTE: The gasket is to be reused unless damage
Torque: 27 Nm



15. *Special Tool(s):* 205-307



16. *Special Tool(s):* 303-255, 303-395



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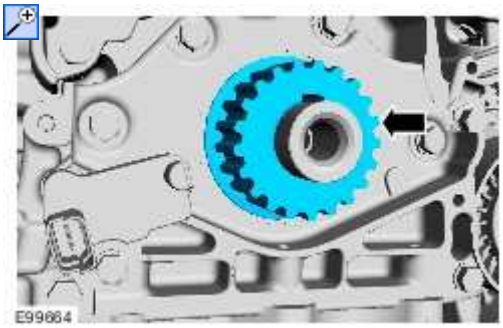

18.

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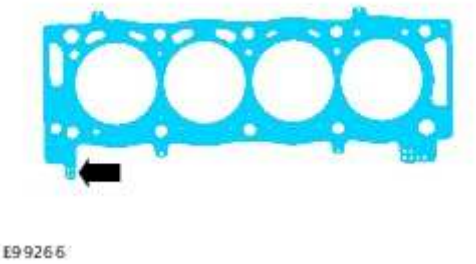
19.

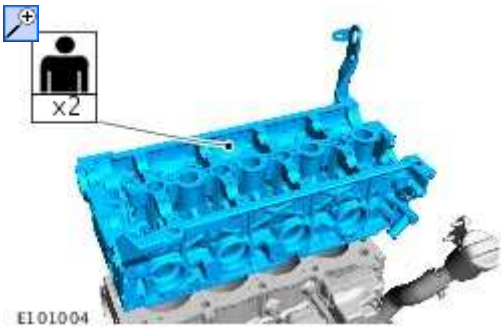
20. Make sure to use the right thickness of the cylinder gasket.

Refer to: Specifications (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Specifications



21.

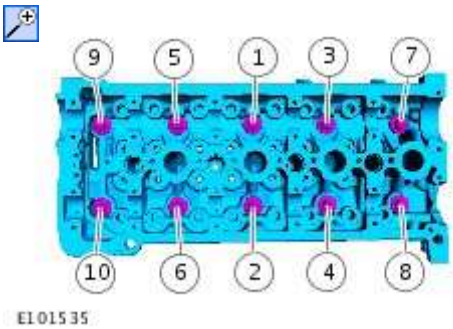
22.



23. CAUTION: Make sure that new bolts are installed.

Torque:

Stage 1: 20 Nm
Stage 2: 60 Nm
Stage 3: 220°



24.

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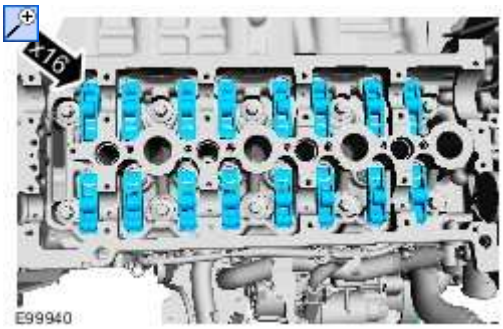
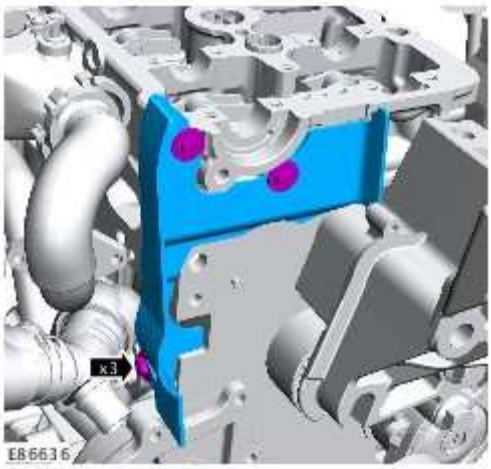


25. *Torque:* 20 Nm



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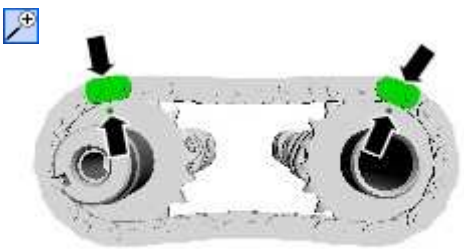
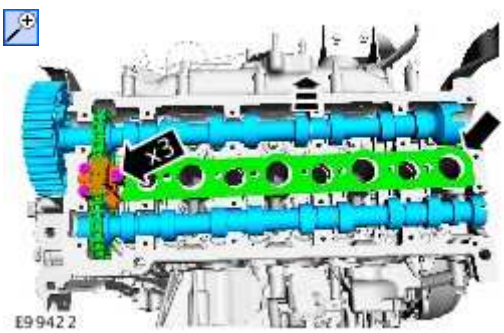


27. *Material:* Engine Oil - 5W-30 (WSS-M2C913-B)
Torque: 6 Nm



28.

29. NOTE: The component must be installed within 5

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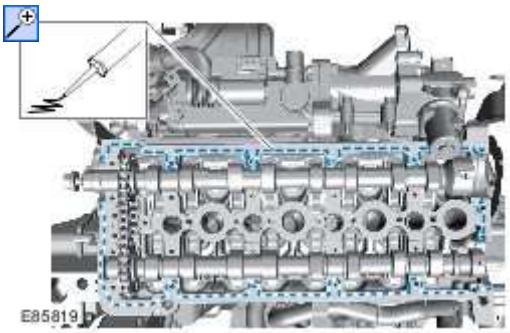
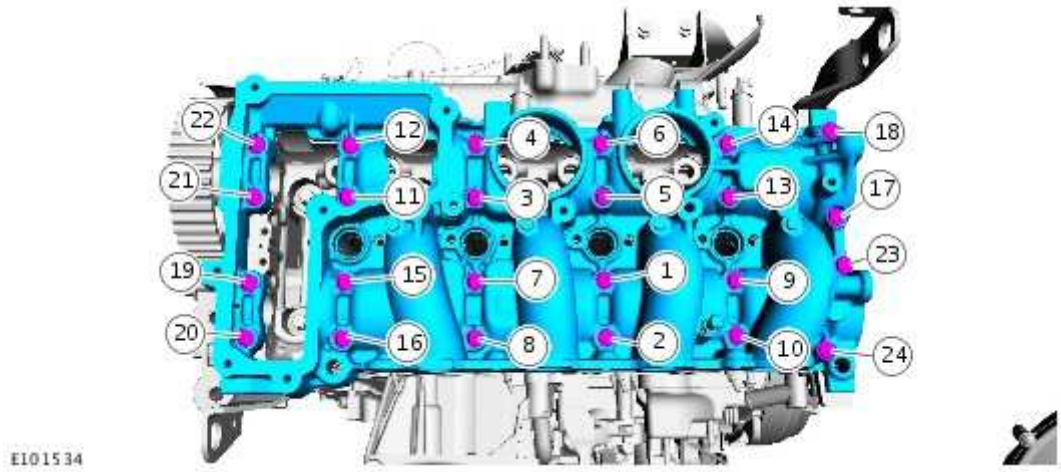
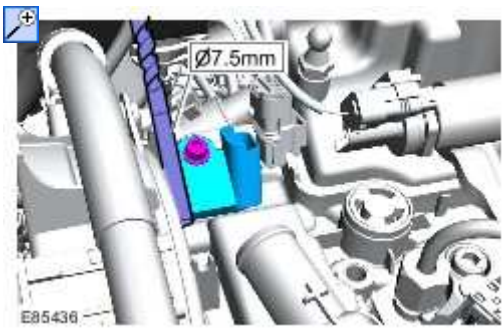


minutes of applying the sealant.
Apply a 3 mm bead of sealant to the cylinder head.

Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U M4G323-AA)



30. *Torque:*
    S
    8 Nm
    S
    11 Nm

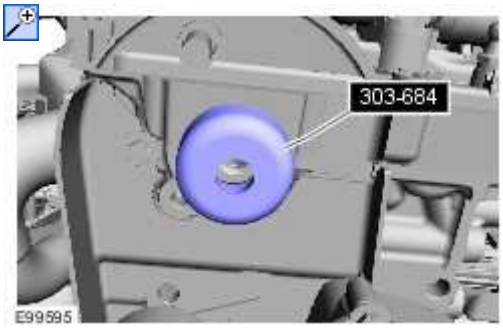


31. When installing the old sensor.

    Torque: 4 Nm

32.
- When installiung a new sensor.
- Install the CMP sensor until the tip of the sens touches the back of the camshaft pulley.

    Torque: 4 Nm



33. *Special Tool(s):* 303-684

34. *Special Tool(s):* 205-072, 205-072-01, 303-174

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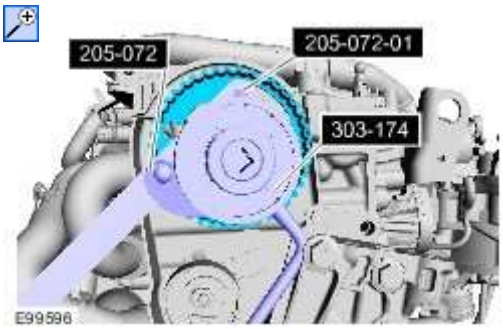
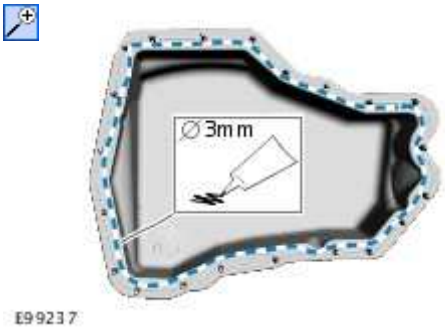
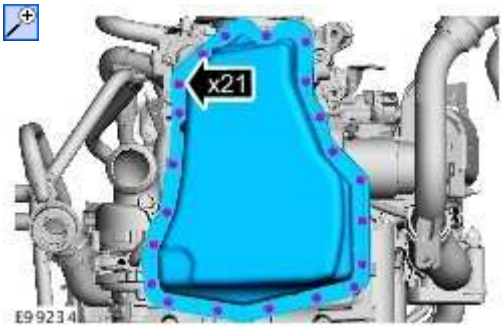
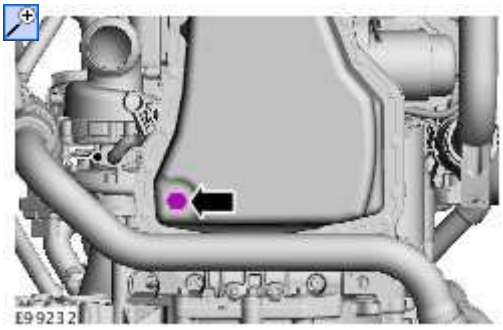




35. NOTE: The component must be installed within 5 minutes of applying the sealant.
Material: Silicone Sealant LB (WSE-M4G323-A4 / 2L M4G323-AA)



36. *Torque:* 9 Nm



37. NOTE: Use a new seal.
Torque: 20 Nm

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Print

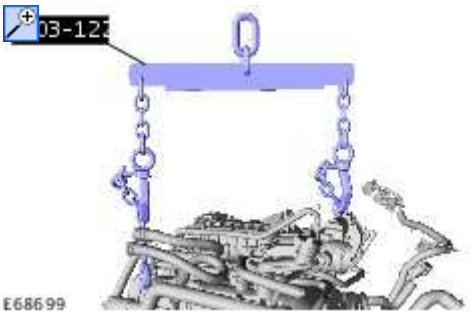
Installation

Special Tool(s)

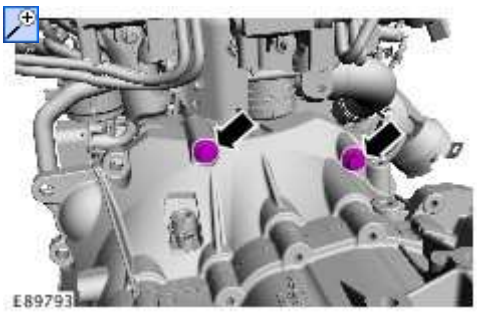
	303-122 Lifting Bracket, Engine

General Equipment

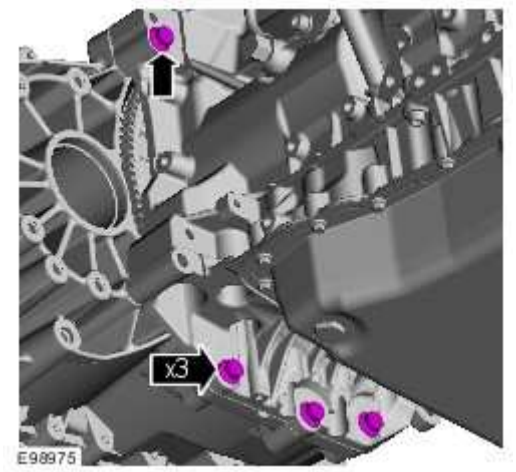
Hose clamp remover/installer
Hydraulic jib crane
Mounting table set



1. *Special Tool(s):* 303-122
   General Equipment: Hydraulic jib crane



2. *Torque:* 48 Nm



3. *Torque:* 48 Nm

4. *Torque:* 48 Nm

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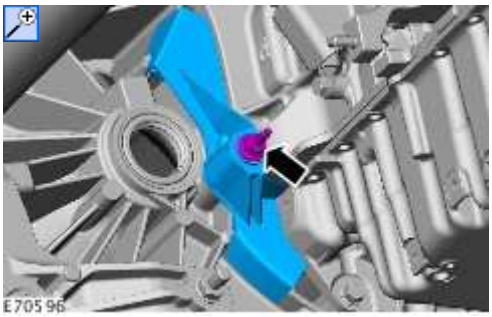
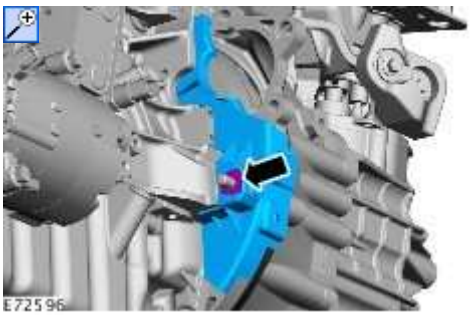
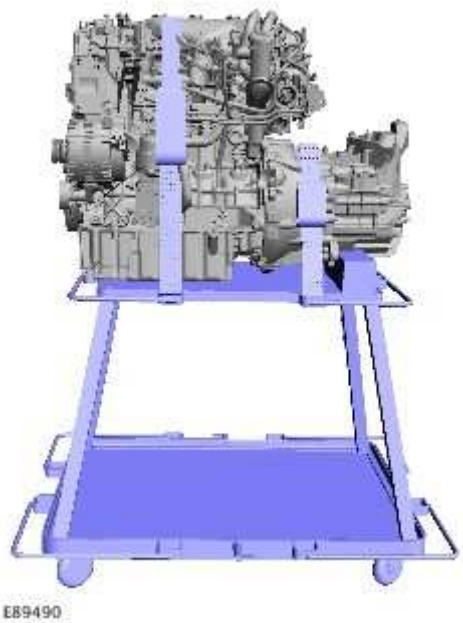




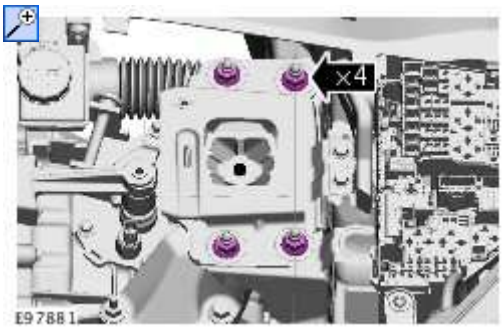
5. *Torque:* 48 Nm

6. Refer to: Starter Motor (303-06F Starting System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Refer to: Generator - 2.2L Duratorq-TDCi (129kW/175PS) - DW (414-02 Generator and Regulator, Removal and Installation).



7. WARNING: Make sure that the engine and transmission assembly is on wooden blocks and secured with suitable retaining straps.
General Equipment: Mounting table set

8. Lower the vehicle.



9. *Loosen:* 2 turn(s)

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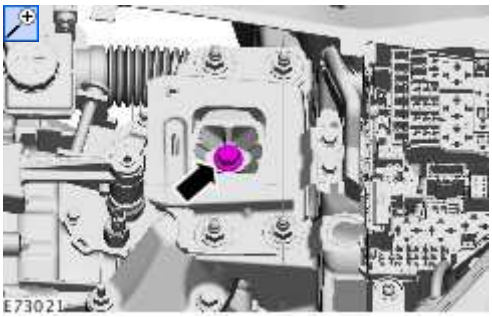
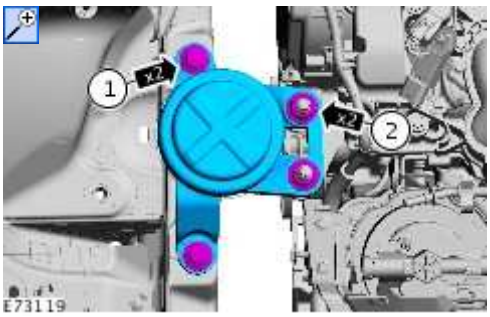


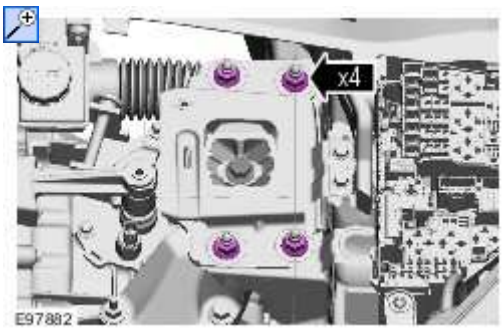
10. *Torque:* 133 Nm



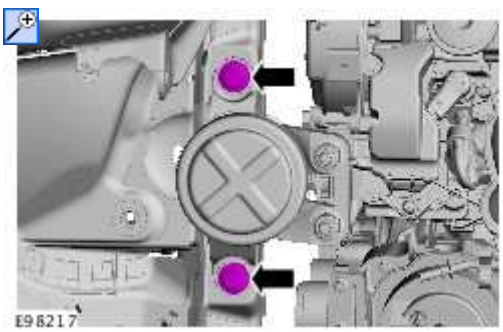
11.
    1. NOTE: Only tighten the bolts finger tight at this stage.
    2. *Torque:* 133 Nm

12. Raise the vehicle and remove the Mounting table set.

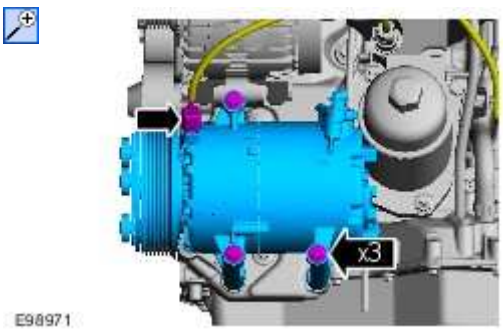
    General Equipment: Mounting table set



13. *Torque:* 80 Nm



14. *Torque:* 90 Nm



15. *Torque:* 24 Nm

16. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and

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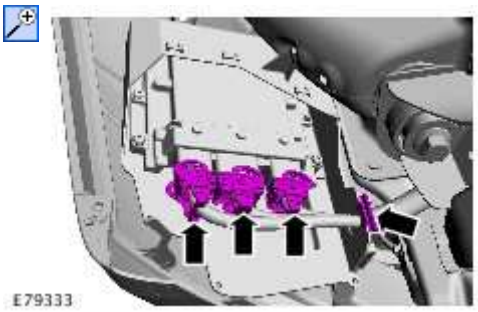
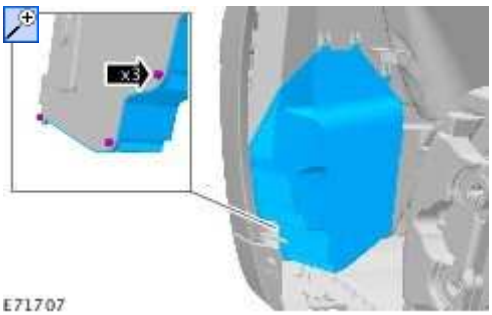
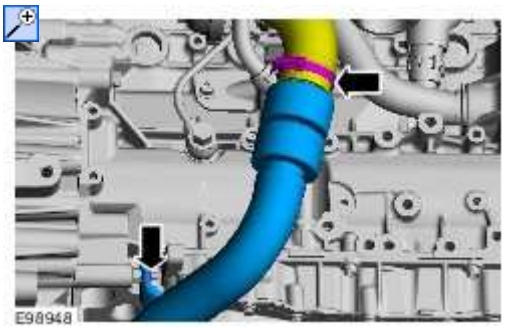
Installation).
Refer to: Front Drive Halfshafts (205-04 Front Drive Halfshafts, Description and Operation).
Refer to: Catalytic Converter (309-00F Exhaust System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



17.

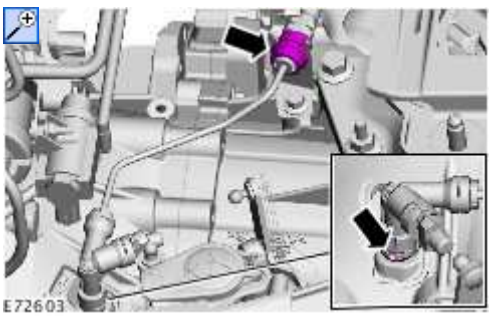


18.



19. *Torque:* 10 Nm

20. *Torque:* 10 Nm



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

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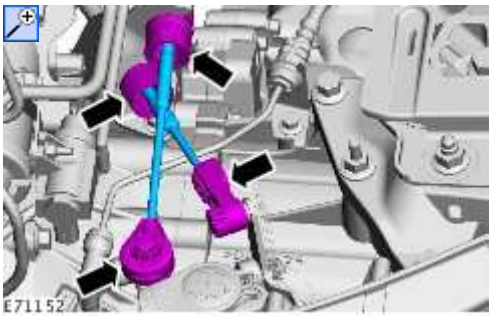
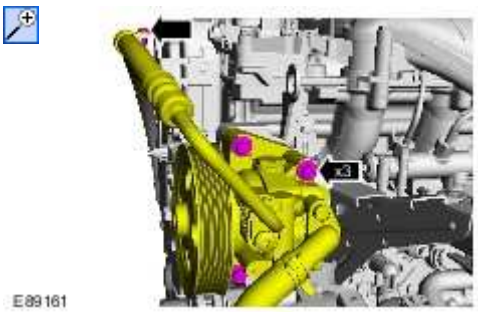
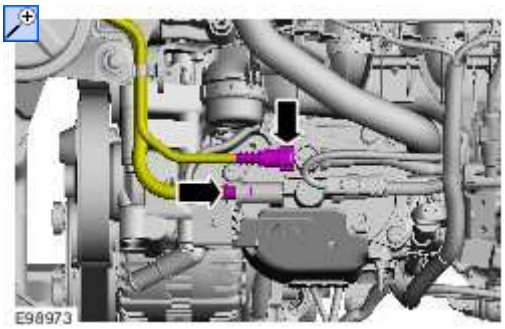


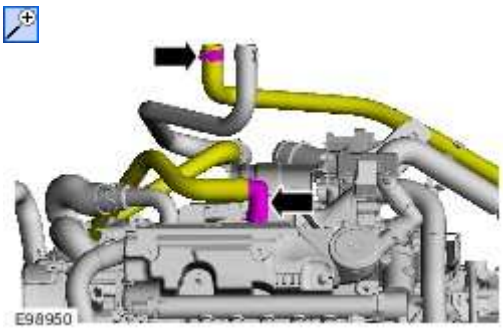
22. CAUTION: Gearshift cables must not be kinked or bent.



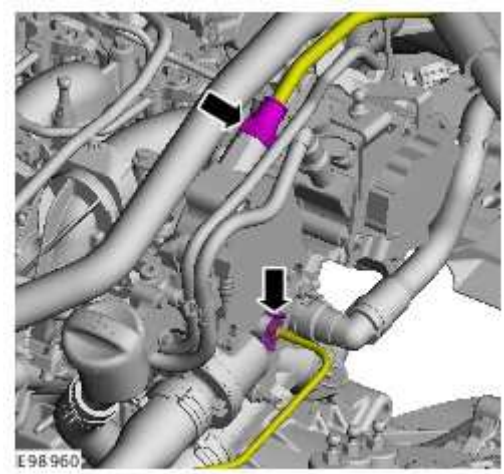
23. *Torque:* 24 Nm



24. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



25. *General Equipment:* Hose clamp remover/installer



26.

27. *Torque:* 10 Nm

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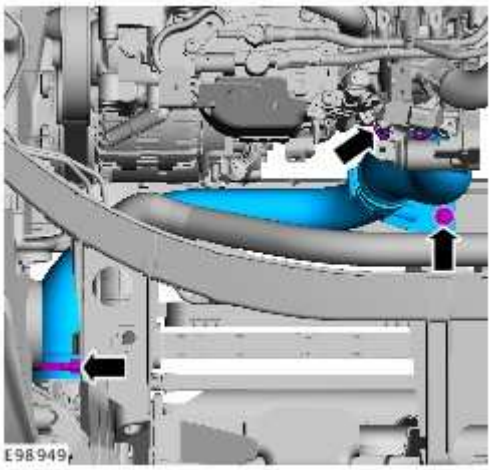
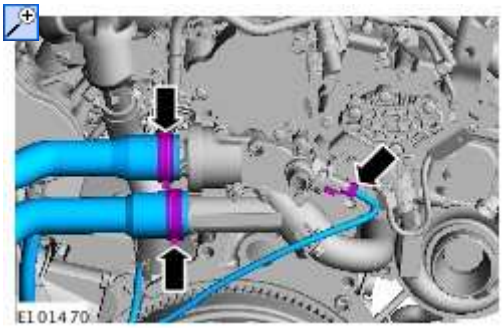
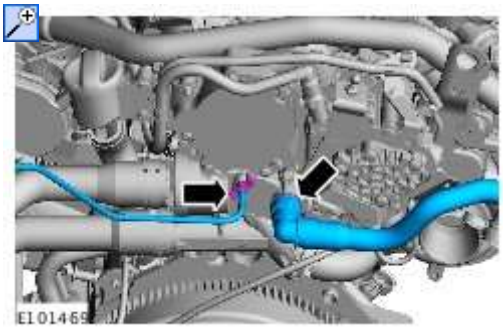


28.



29. *General Equipment:* Hose clamp remover/installer



30.

31.

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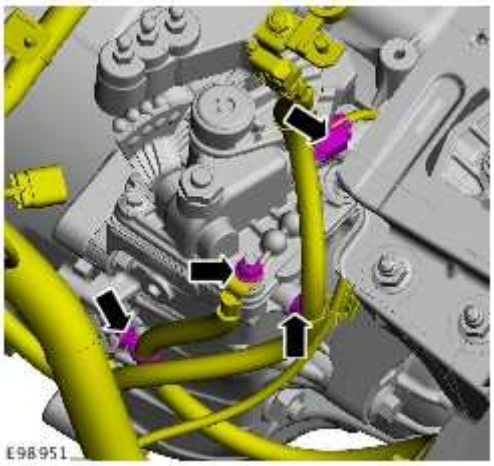
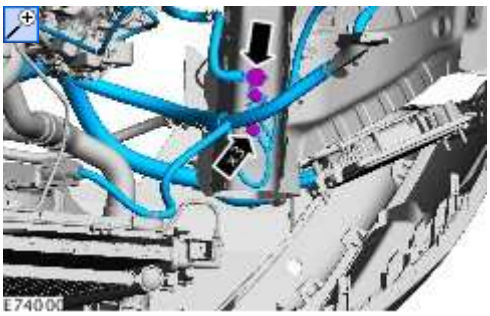
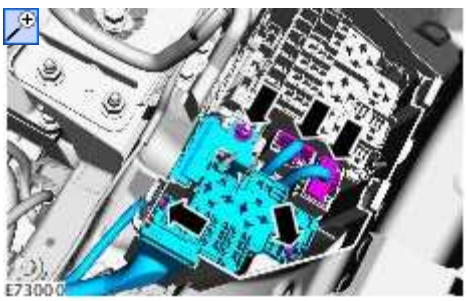
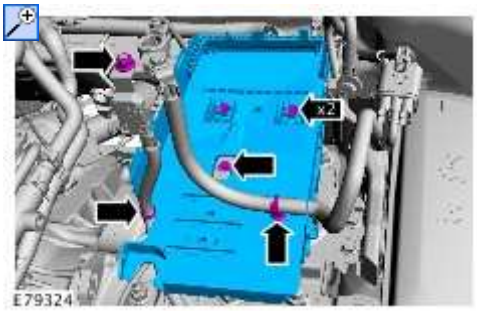


32. 

33. 

34.

35. *Torque:* 10 Nm



36.

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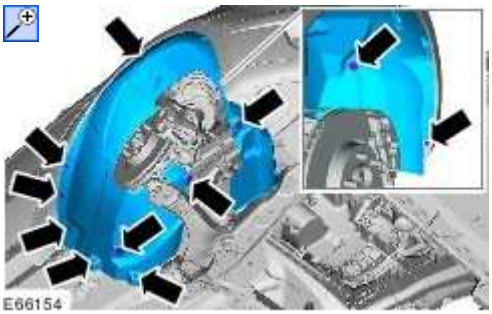
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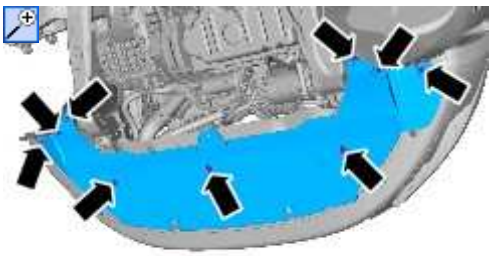
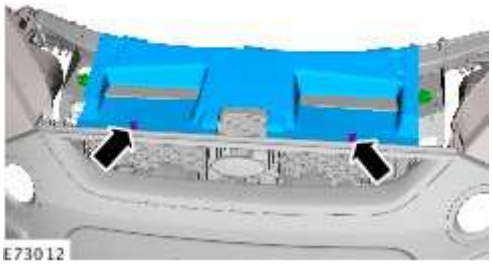

E68962

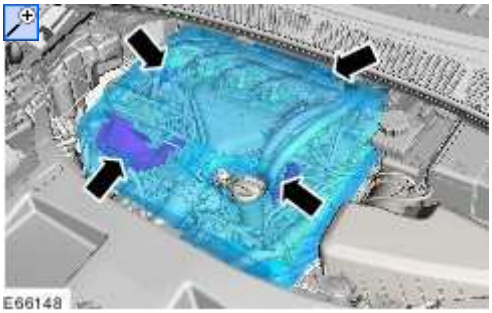
37.

38. Refer to: Clutch System Bleeding (308-00, General Procedures).

39. Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).

40.


E73012


E66148

41.

42. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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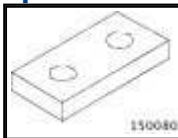
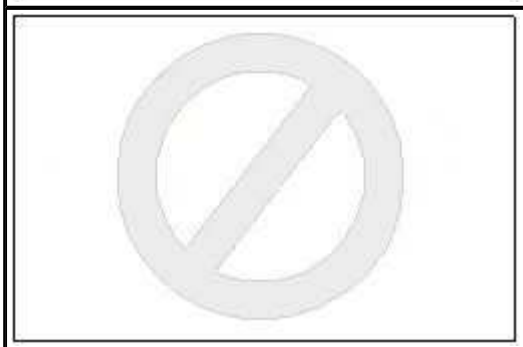
Installation

Special Tool(s)

	205-044-01 Adapter for 205-044
	303-122 Lifting Bracket, Engine
	303-1270 Timing Pin, Crankshaft
	303-1277 Timing Pin, Camshaft
	303-254 Locking Tool, Flywheel
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	303-435-11B Mounting Plate for 303-435-06

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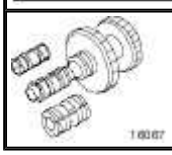
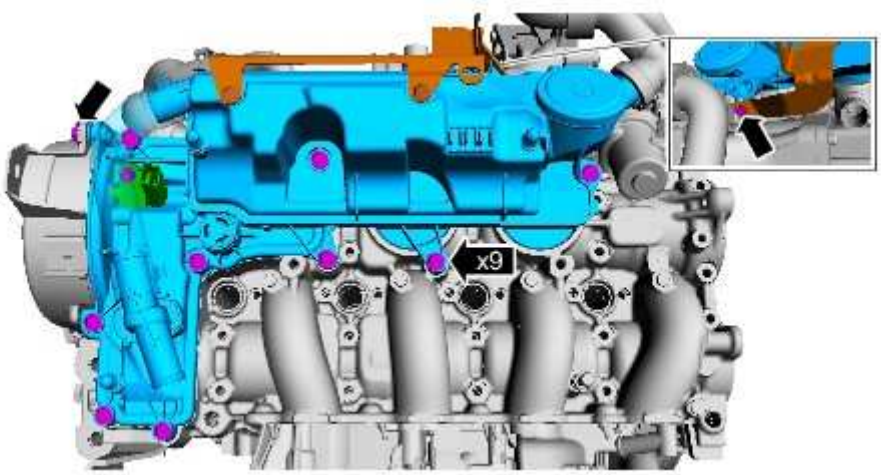
	308-204 Aligner, Clutch Disc

Materials

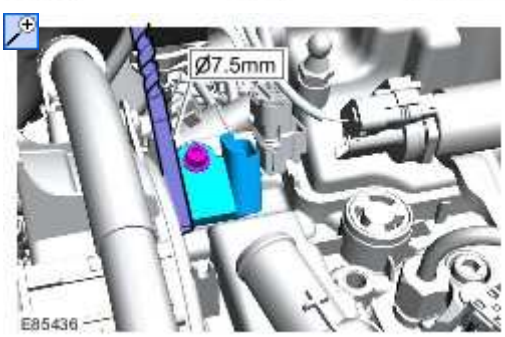
Name	Specification
Brake Cleaner	3U7J-2C410-AA

General Equipment

Dowel with a diameter of 4 mm
Hose clamp remover/installer



1. *Torque:* Nm



2. *Torque:* 4 Nm

3. *Torque:* 28 Nm

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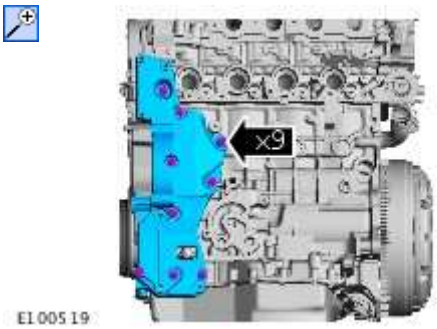
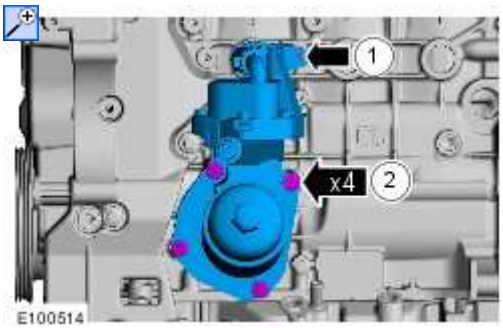
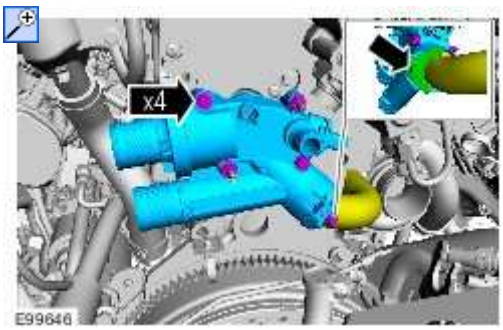


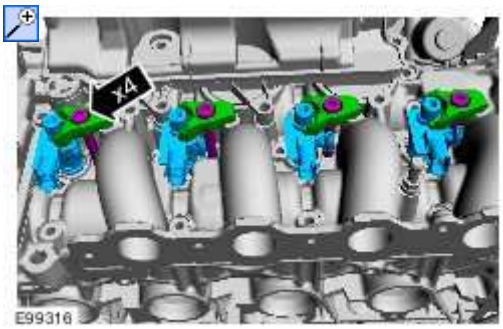


4. *Torque:*
   1: 9 Nm
   2: 20 Nm



5. *General Equipment:* Hose clamp remover/installer
   Torque: 8 Nm

6. NOTE: Make sure that the seal is correctly located
   NOTE: Make sure that new components are installed.
   Refer to: Fuel Injection Component Cleaning (303-0
   Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).



7. NOTE: Install all the bolts finger tight before final tightening.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 130°

8. *Torque:* 22 Nm

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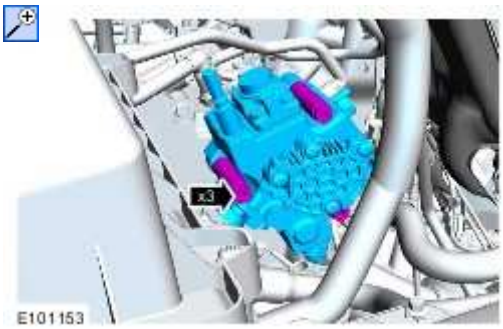
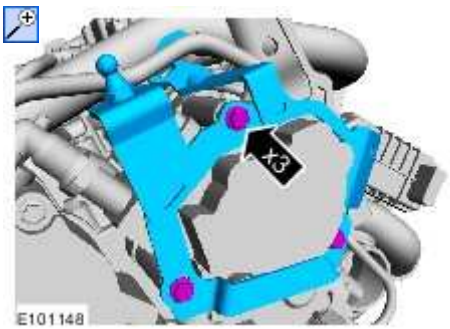
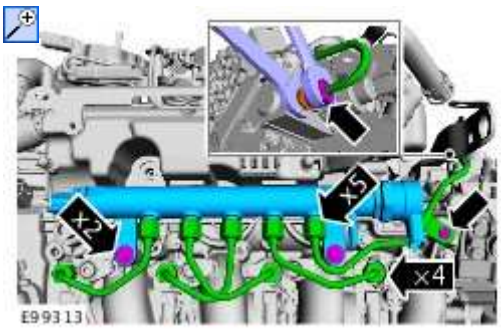
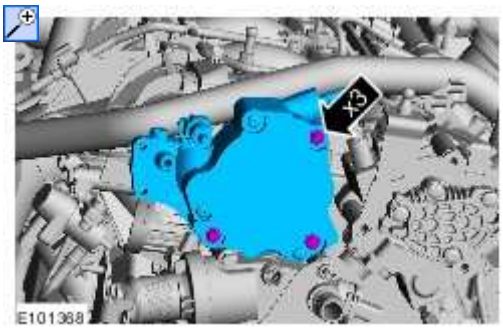




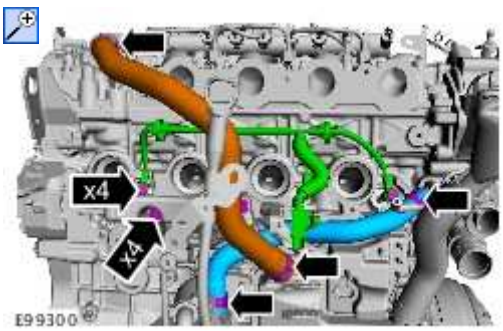
9. *Torque:* 8 Nm



10. NOTE: Make sure that new components are installed.
Refer to: Fuel Injection Component Cleaning (303-0
Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).
Torque:
Stage 1: 22 Nm
Stage 2: 25 Nm



11. *Torque:* 9 Nm



12. *Torque:* 20 Nm

13. *Torque:*
1: 9 Nm
2: 10 Nm

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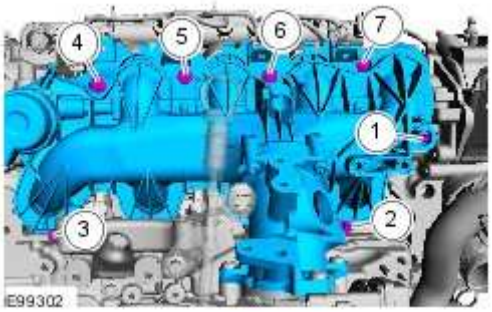
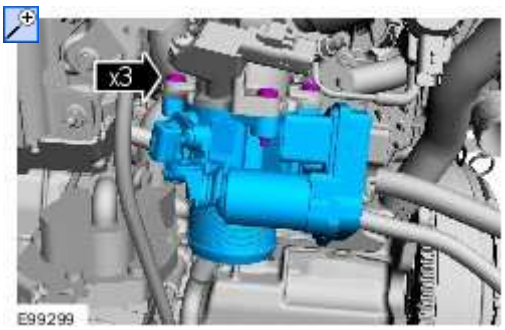
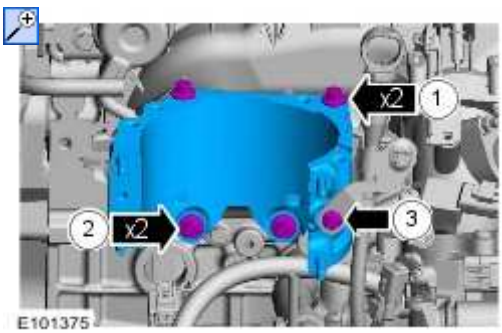
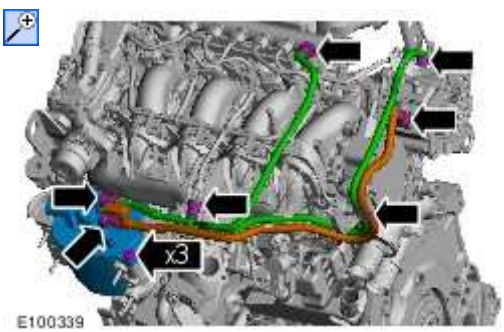




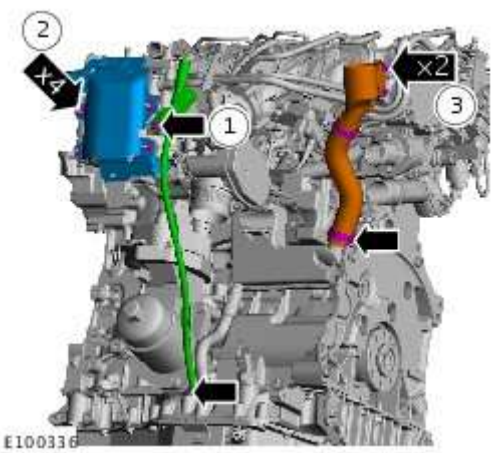
14. *Torque:* 10 Nm



15. *Torque:*
    1: 20 Nm
    2: 20 Nm
    3: 10 Nm



16. *Torque:* 9 Nm



17. *Torque:*
    1: 10 Nm
    2: 10 Nm
    3: 9 Nm

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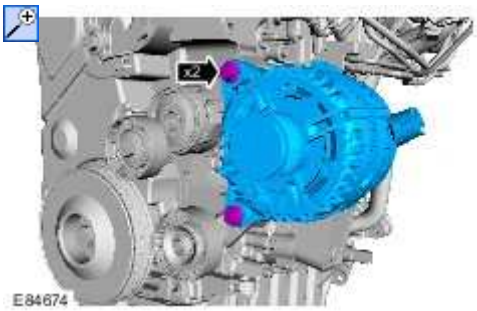
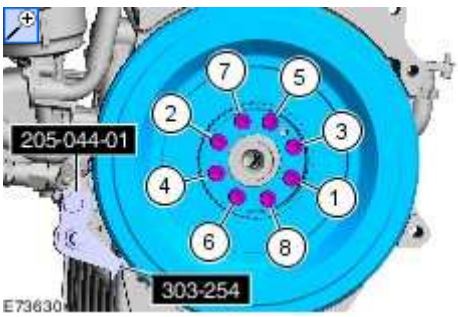
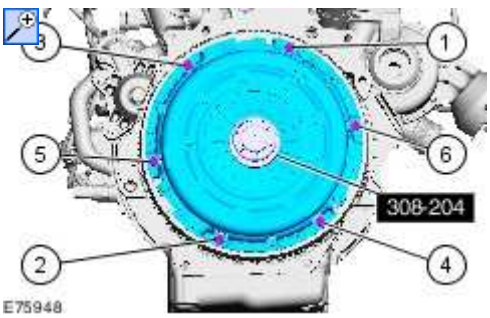


18. *Torque:* 48 Nm

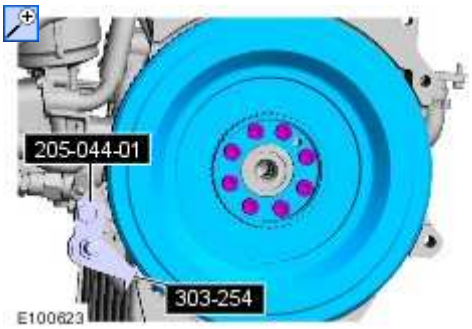
19. *Torque:* 24 Nm



20. *Special Tool(s):* 205-044-01, 303-254
Torque:
Stage 1: 33 Nm
Stage 2: 34°



21. *Special Tool(s):* 308-204
Torque: 20 Nm



22. *Remove the Special Tool(s):* 205-044-01, 303-254

23. CAUTION: Make sure that the crankshaft is not rotated while the special tool is installed.
Install the Special Tool(s): 303-1270

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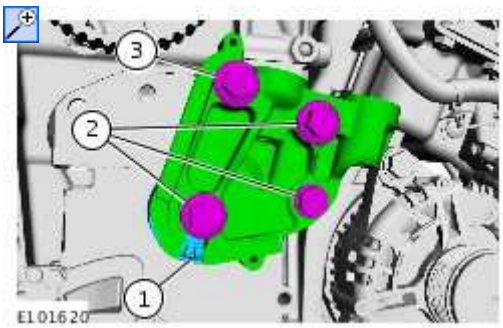
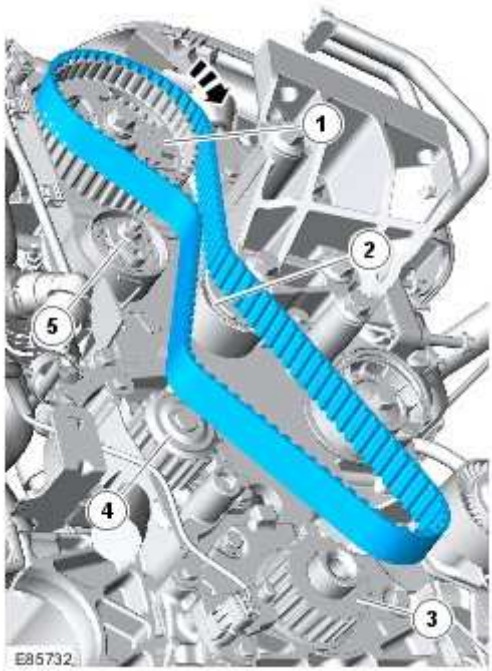
24. *Install the Special Tool(s):* 303-1277



25.
1. NOTE: Make sure that a new component is installed.
2. *Torque:* 60 Nm
3. *Torque:* 80 Nm



26. CAUTION: Make sure that the timing belt is not folded to produce a loop with a diameter less than 35 mm.

27.
1. NOTE: Make sure that a new component is installed.
2. NOTE: Make sure that a new component is

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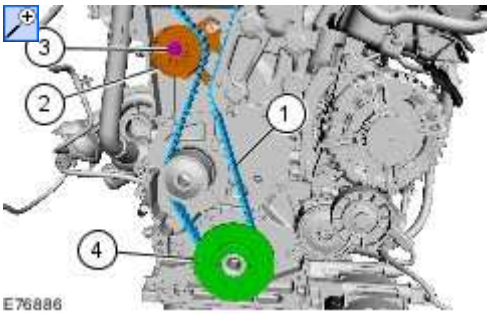
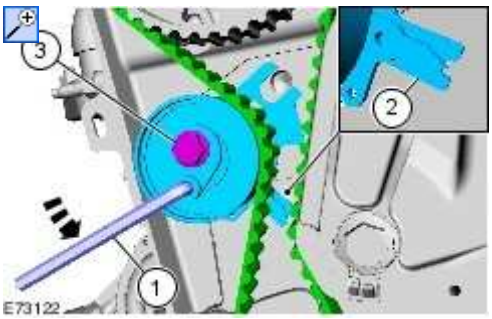


installed.

3. NOTE: Only tighten the bolt finger tight at this stage.

4. CAUTION: Take extra care when handling the crankshaft position (CKP) sensor ring.

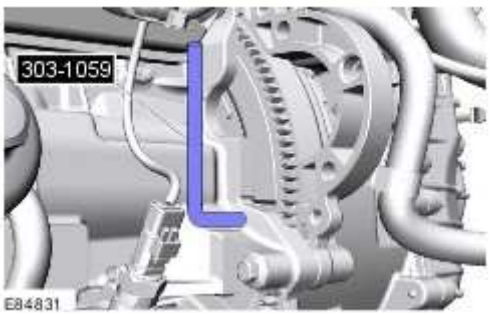


28. Allen key, 6mm

Torque: 25 Nm

29. NOTE: Only tighten the bolt finger tight at this stage.

30. *Remove the Special Tool(s):* 303-1277



31. *Remove the Special Tool(s):* 303-1270

32. CAUTION: Only rotate the crankshaft clockwise.
Rotate the crankshaft 4 revolutions.

33. CAUTION: Make sure that the crankshaft is

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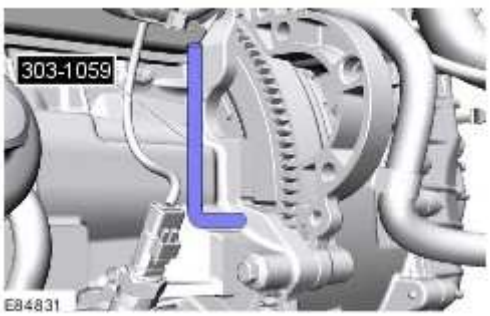
not rotated while the special tool is installed.
Install the Special Tool(s): 303-1270

34. NOTE: The special tool can only be installed if the valve timing is correct.
Install the Special Tool(s): 303-1277

35.

36. *Remove the Special Tool(s):* 303-1277



37. *Remove the Special Tool(s):* 303-1270

38. *Torque:* 5 Nm

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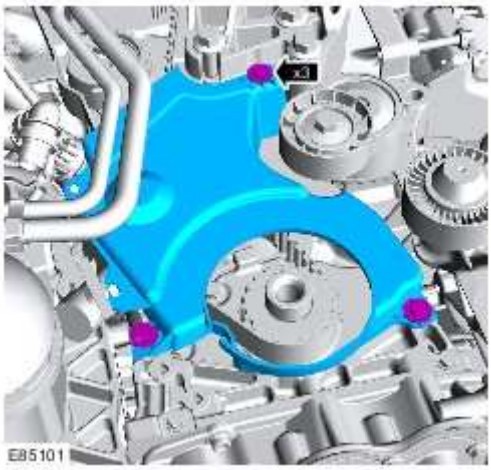
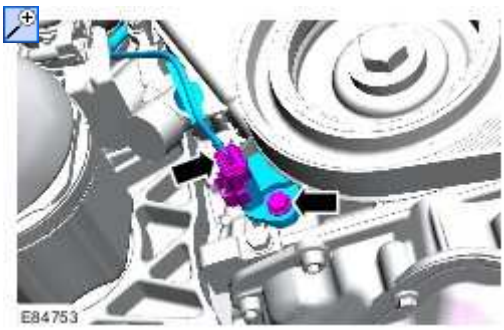
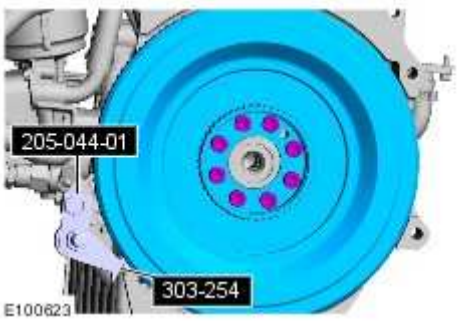


39. *Torque:* 8 Nm

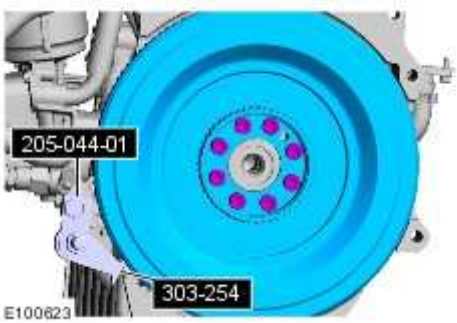


40. *Install the Special Tool(s):* 205-044-01, 303-254



41. *Torque:*
Stage 1: 70 Nm
Stage 2: 82°

42. *Remove the Special Tool(s):* 205-044-01, 303-254



43. *Torque:* 5 Nm

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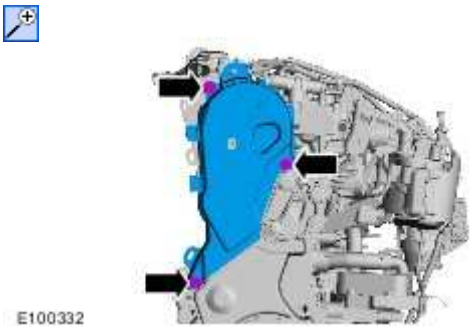
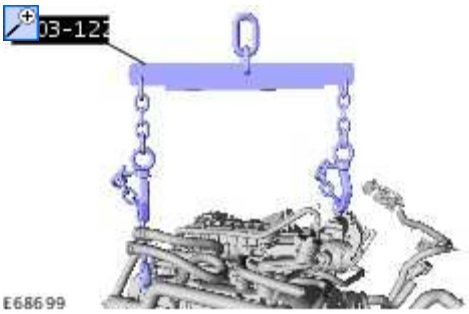
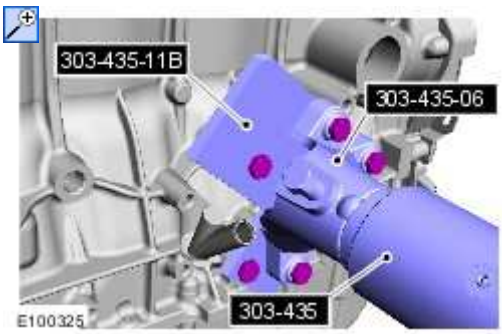
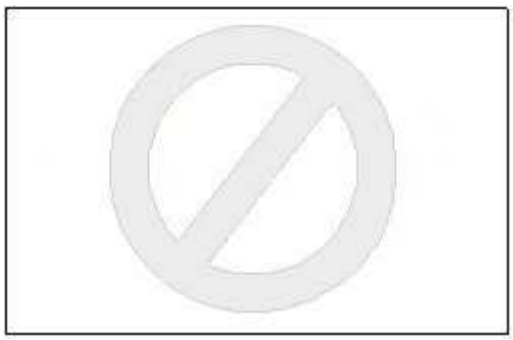




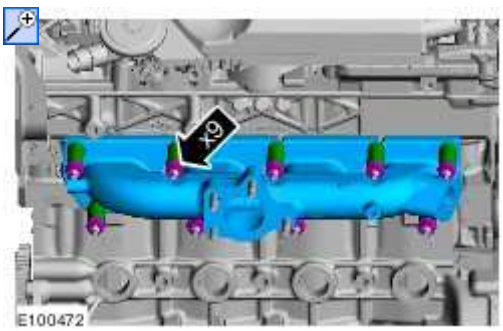
44. *Install the Special Tool(s):* 303-122



45. *Remove the Special Tool(s):* 303-435, 303-435-06, 303-435-11B



46. If BA level, install latest level.



47. *Torque:* 26 Nm

48. *Torque:* 26 Nm

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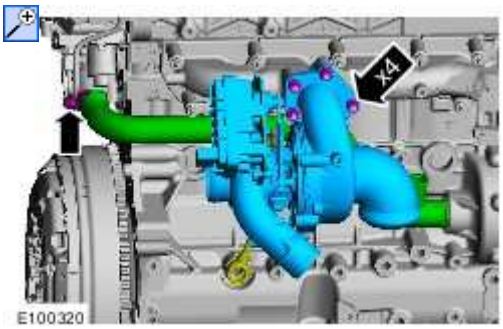
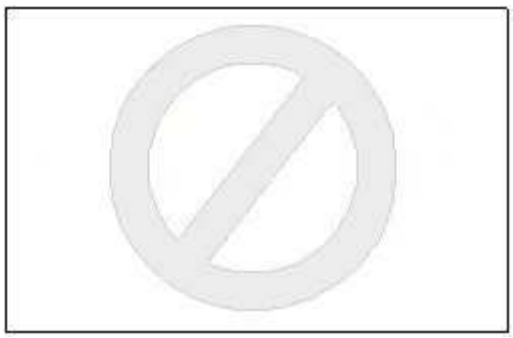
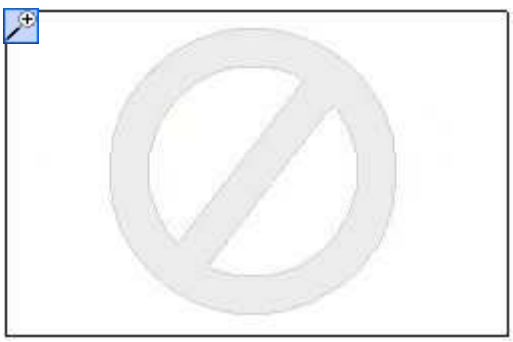


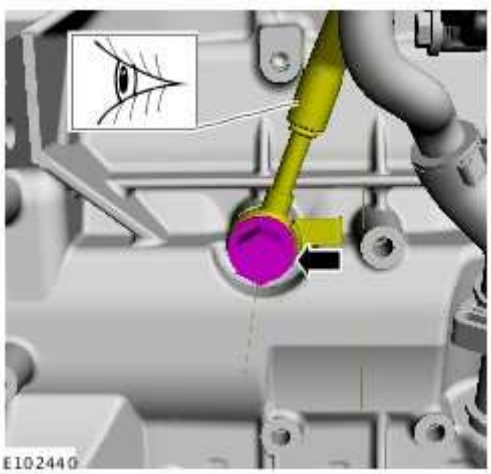


49. NOTE: Make sure that a new component is installed.



50. Clean the filter.

Material: Brake Cleaner (3U7J-2C410-AA)



51. CAUTION: Make sure that the component is not bent.
NOTE: Make sure that a new component is installed.
NOTE: Use new seals.
NOTE: Only tighten the bolt finger tight at this stage.

52. CAUTION: Make sure that the component is not bent.
NOTE: Make sure that a new component is installed.
NOTE: Only tighten the bolt finger tight at this stage.

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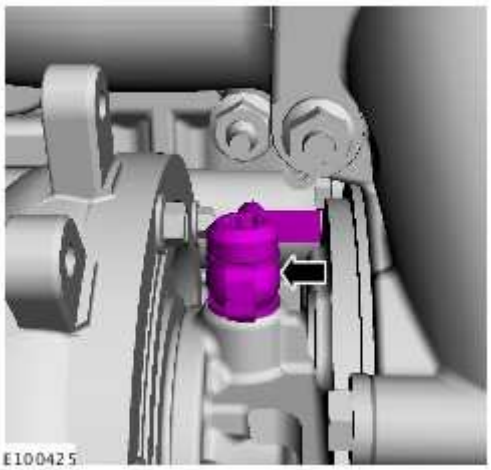
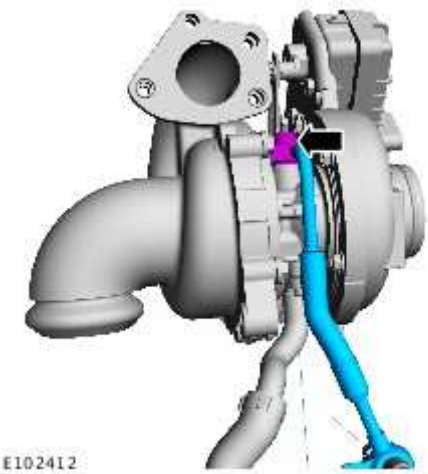
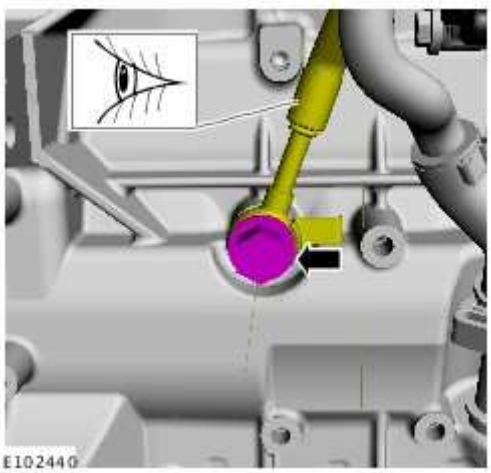




53. CAUTION: Make sure that the component is not bent.
Torque: 5 Nm



54. CAUTION: Make sure that the component is not bent.
Torque: 40 Nm

55. *Torque:* 17 Nm

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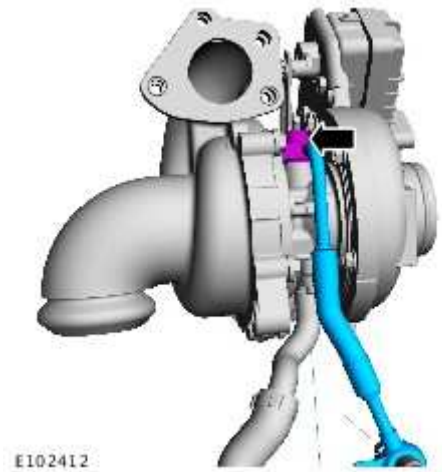
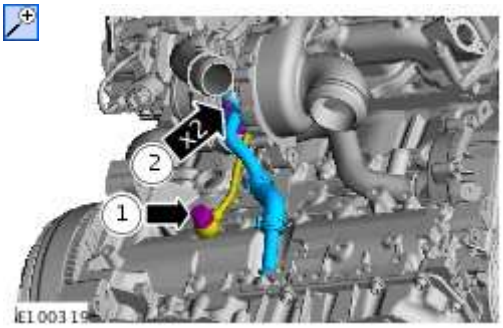
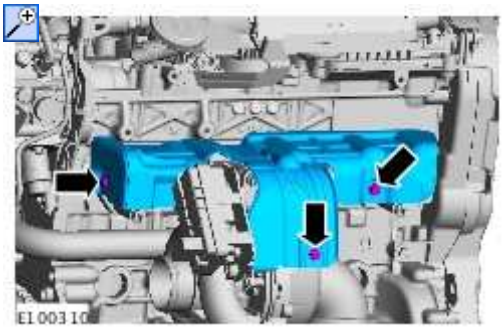
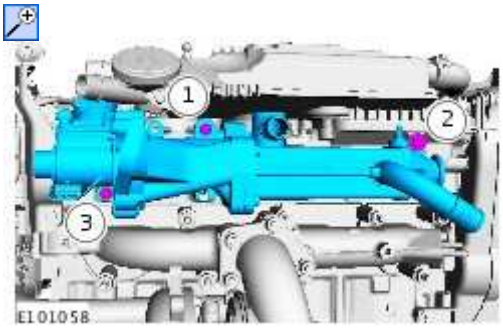




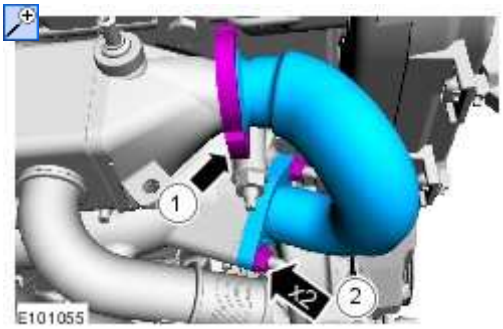
56. *Torque:*
    1: 40 Nm
    2: 24 Nm



57. *Torque:* 10 Nm



58. *Torque:*
    1: 10 Nm
    2: 8 Nm
    3: 10 Nm



59. *Torque:* 10 Nm

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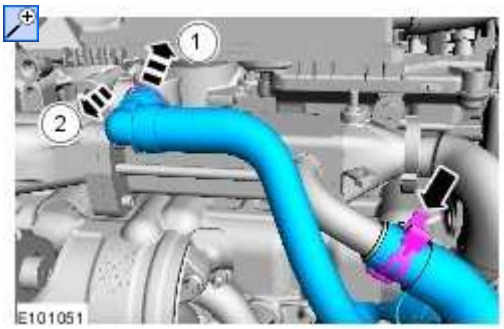
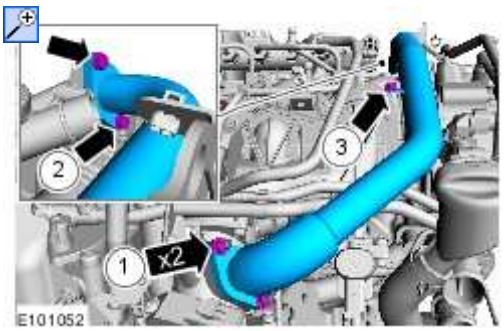
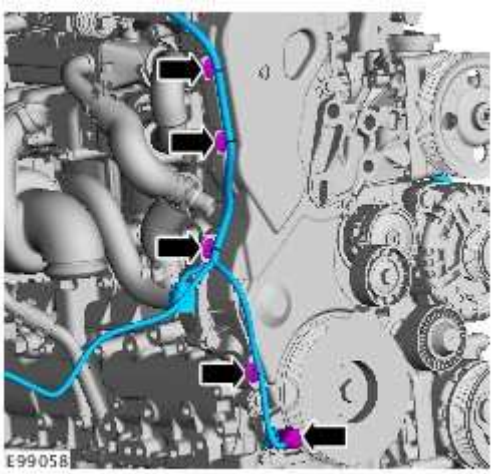


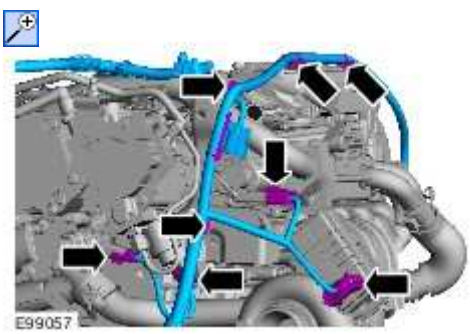
60.



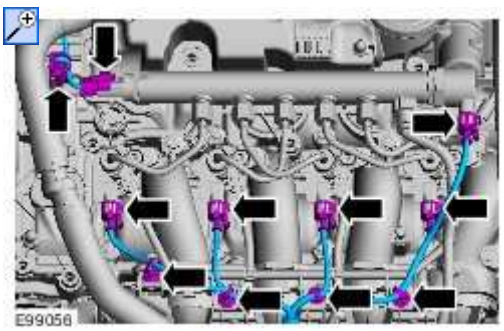
61. *Torque:*
    1: 10 Nm
    2: 8 Nm
    3: 10 Nm



62.



63.



64.

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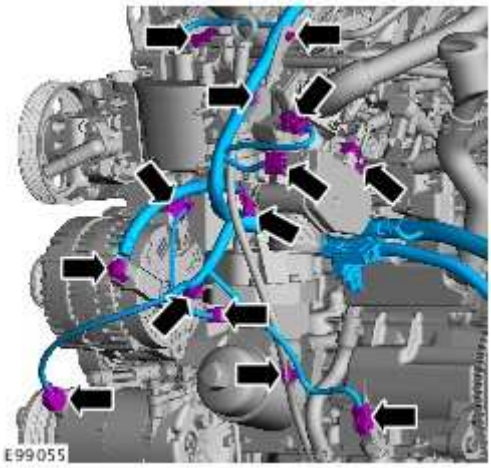
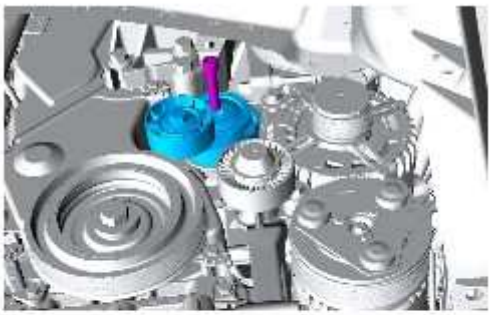
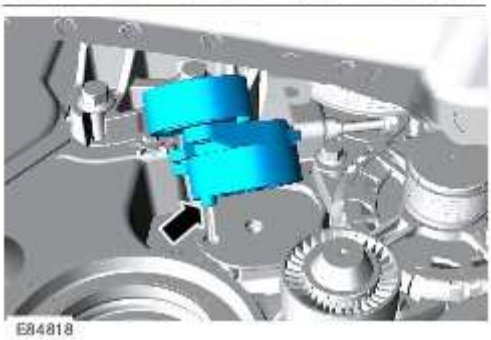


65.

66. *Torque:* 48 Nm





67. *General Equipme*
Dowel wi
a diamet
of 4 mm

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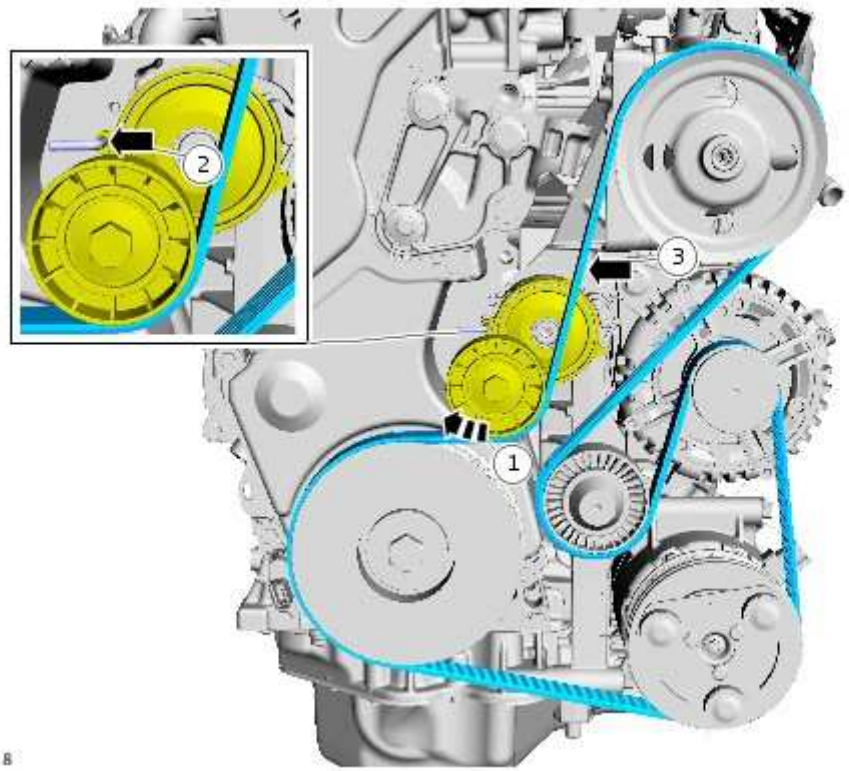

E100318

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Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13°F)	–37°C (–35°F)

Cooling System Refill Capacity - Vehicles with 2.0L Duratec-HE (MI4) engine

Description	Liters
Cooling system and heater	6.2

Cooling System Refill Capacity - Vehicles with 2.3L Duratec-HE (MI4) engine

Description	Liters
Cooling system and heater	6.9

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19.6 to 22.5)

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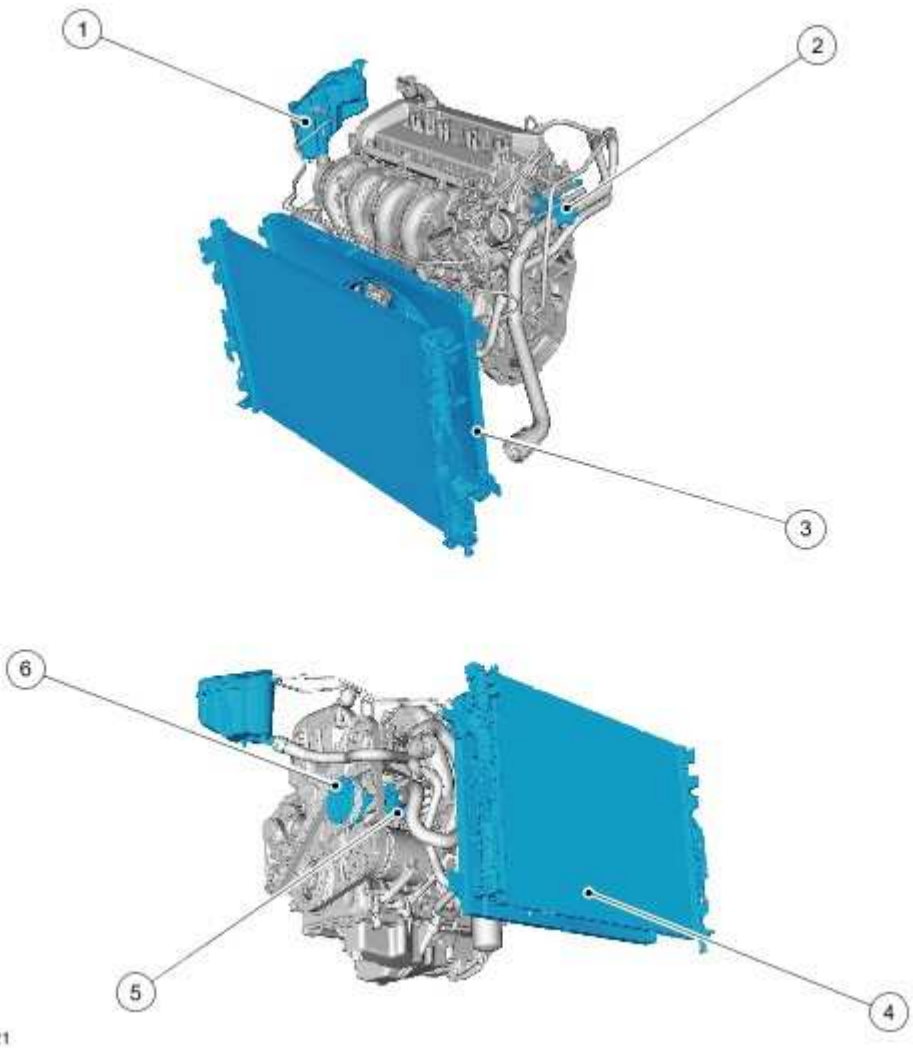
Print

Description and Operation



E64721

Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Coolant outlet connector
3	-	Cooling fan motor and shroud
4	-	Radiator
5	-	Thermostat housing
6	-	Coolant pump

CAUTION: If the coolant concentration is insufficient, low temperature protection and corrosion resistance will be impaired.
NOTE: Providing the coolant has not been contaminated with other fluids or foreign material, the robust corrosion resistance properties of this coolant means that it can be reused after changing an aluminum cooling system component. The concentration should always be checked and maintained within the specification.
Coolant concentration should be checked through the neck of the coolant expansion tank

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with a hydrometer. The acceptable range of specific gravity (sg) must be maintained.

The coolant used is an orange colored Motorcraft Super Plus 2000 engine coolant. This is a non silicated organic acid technology (OAT) coolant that must not be mixed with other coolant types. For cooling system top up, only use coolant which meets the correct specification.

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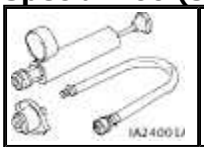
Diagnosis and Testing

Special Tool(s)

	Pressure Tester, Cooling System 303-396 (24-001 A)
	Adaptor for 303-396 303-396-09

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leak(s) • Gasket(s) or seal(s) • Hose(s) or hose joints • Coolant expansion tank cap and seal • Coolant expansion tank • Radiator • Coolant pump • Thermostat housing • Heater core • Accessory drive belt • Coolant outlet connector	• Fuse(s) • Wiring harness • Electrical connector(s) • Engine coolant temperature (ECT) sensor • Cooling fan • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Loss of coolant	* Hose(s) or hose joint(s).	* INSPECT the hoses and hose joints. INSTALL a new hose(s) as necessary.
	* Radiator.	* INSPECT the radiator for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary.

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		REFER to: Radiator (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Coolant pump.	* INSPECT the coolant pump for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Thermostat housing.	* INSPECT the thermostat housing for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Coolant expansion tank cap or seal(s).	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as necessary.
	* Coolant expansion tank.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Heater core.	* CHECK the heater core for leaks.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation), Cylinder Head (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
The engine overheats (signs of coolant boiling)	* Cooling system does not hold pressure.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary. * INSPECT the coolant pump or coolant pump gasket for damage. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation). * INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation), Cylinder Head (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Air in cooling system.	* BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
	* Coolant expansion tank	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as

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	cap or seal(s).	necessary.
	* Coolant expansion tank.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Coolant level or condition.	* CHECK the coolant level. REFILL the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures). * CHECK the coolant condition. If the coolant is in poor condition drain and refill with new coolant. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
	* Coolant concentration.	* REFER to: Specifications (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Specifications).
	* Radiator grille.	* INSPECT the radiator grille for air restrictions or damage. REPAIR or INSTALL new parts as necessary.
	* Coolant pump.	* CARRY OUT the Pressure Test Component Test in this section. INSPECT the coolant pump for leaks. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
	* Accessory drive belt.	* CHECK the condition of the accessory drive belt. REFER to: Accessory Drive (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing), Accessory Drive (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing).
	* Cooling fan.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation), Cylinder Head (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
The engine does	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in

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not reach normal operating temperature.		this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

Component Tests

Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.
NOTE: If the coolant expansion tank cap is rotated counterclockwise by ½ a full turn, the pressurized coolant will be vented to the underside of the coolant expansion tank cap.

1. **1.** Slowly remove the coolant expansion tank cap to release the cooling system pressure.
2. **2.** Install the coolant expansion tank cap.
3. **3.** Install the special tools 303-396 and 303-396-09 to the coolant expansion tank.
4. **4.** Pressurize the cooling system to the coolant expansion tank cap release pressure. REFER to: Specifications (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Specifications).
5. **5.** Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the cooling system holds pressure, proceed to Step 7. If the cooling system does not hold pressure, check it thoroughly for coolant leaks.
6. **6.** Check the engine for coolant leaks. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
7. **7.** Recheck the cooling system by repeating Steps 3 and 4 at least twice.

Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.
Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

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WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of coolant scalding, Failure to follow this instruction may result in personal injury.

1. **1.** Remove the coolant expansion tank cap.

2. **2.** Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. **3.** Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing, and note the highest pressure reading obtained.

4. **4.** Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. **5.** If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

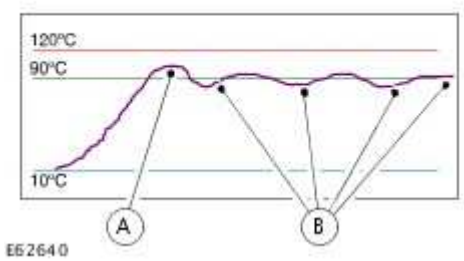
1. **1.** Connect the Ford approved diagnostic tool to the data link connector (DLC).

2. **2.** Using the Ford approved diagnostic tool datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- CHT - cylinder head temperature (CHT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor or CHT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Part Number

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Item		Description
	A -	Thermostat opens
B	-	Thermostat settles into a cyclic open and closure pattern

CAUTION: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
If the Ford approved diagnostic tool only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The CHT sensor output is useful to examine the cylinder head temperature rise during the warm-up cycle and later during the normal light throttle cruise test. This sensor output may vary between vehicles with manual transmission and vehicles with automatic transmission and should be used for reference only.

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford approved diagnostic tool in datalogger mode, the signals recorded should remain within the DEFAULT values set by the Ford approved diagnostic tool.

3. WARNING: Make sure that the Ford approved diagnostic tool is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford approved diagnostic tool in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.
   NOTE: The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford approved diagnostic tool can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.
   NOTE: The results from the test are more conclusive if the engine is cold when the test is started.
   3. Carry out a road test.
   REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

4. **4.** Drive the vehicle at a constant throttle opening and set speed until the ECT value

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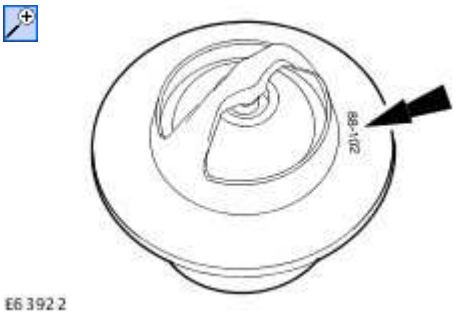
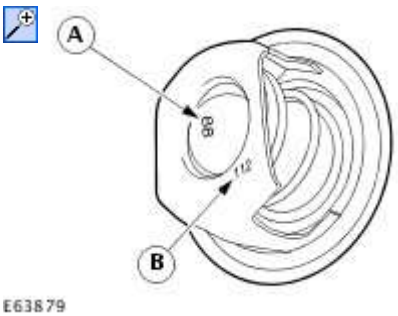
settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.
The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	-	Opening temperature
B	-	Fully open temperature

NOTE: Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.
The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. **5.** INSTALL a new thermostat.
   REFER to: Thermostat - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

6. **6.** Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. **7.** Using the Ford approved diagnostic tool, clear the PCM keep alive memory (KAM)

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or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

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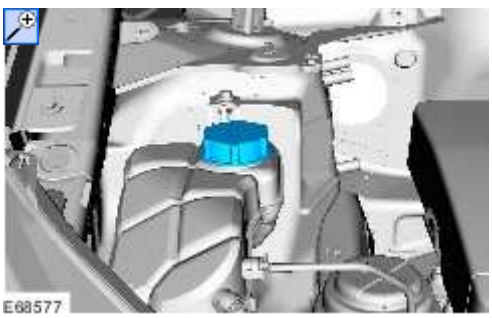
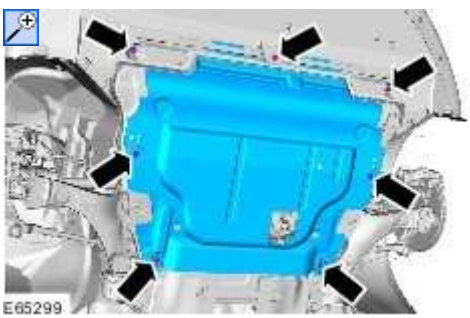
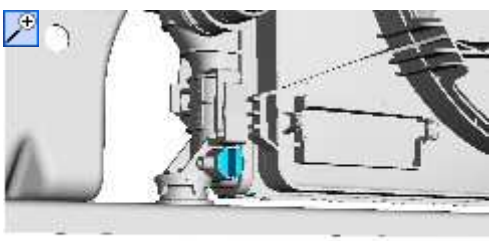
General Procedures

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.
2. 
E68577
3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
4. 
E65299
5. 
E69661
6. Install the radiator drain plug.
7. Lower the vehicle.

Filling and Bleeding

CAUTION: The fluid level must remain between the MAX and MIN marks.

1. Switch the interior heater blower off.
2. Fill the coolant expansion tank coolant level to

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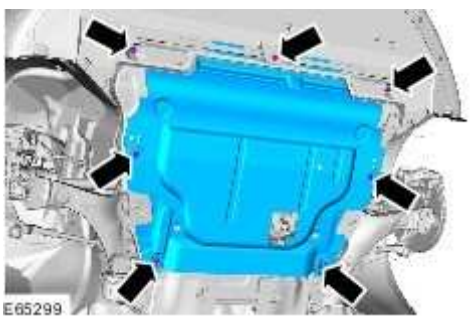
the neck of the coolant expansion tank.

3. Start the engine.
4. Raise the engine speed to 2500 RPM and maintain it for 1 minute.
5. Check the coolant expansion tank coolant level.
6. If the coolant expansion tank coolant level has fallen below the MIN mark, stop the engine and refill the coolant expansion tank level to the neck of the coolant expansion tank.
7. Install the coolant expansion tank cap.
8. Start the engine if stopped.
9. Raise the engine speed to 2500 RPM and maintain it for approximately 11 minutes while observing the coolant expansion tank coolant level.
10. Maintain the engine speed at 2500 RPM for a further 3 minutes.
11. Increase the engine speed to 4000 RPM and maintain it for 5 seconds.
12. Decrease the engine speed to 2500 RPM and maintain it for 3 minutes.
13. Switch the engine off.
14. Check the cooling system for leaks.
15. Check the coolant expansion tank coolant level.
16. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
17. 

18. Lower the vehicle.
19. Allow the engine to cool.
20. Fill the coolant expansion tank coolant level to the MAX mark.

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General Procedures

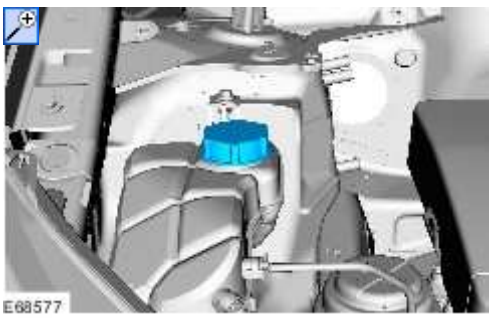
General Equipment

Cooling system vacuum tester and refiller
Fluid container

Draining

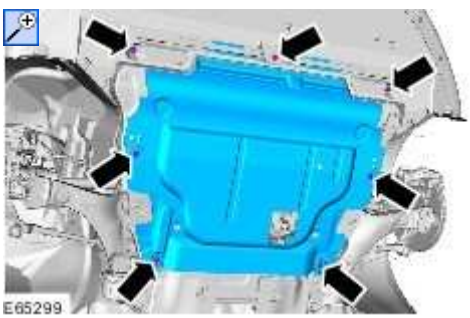
WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
NOTE: Always follow the manufacturer's instructions when handling the equipment.

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

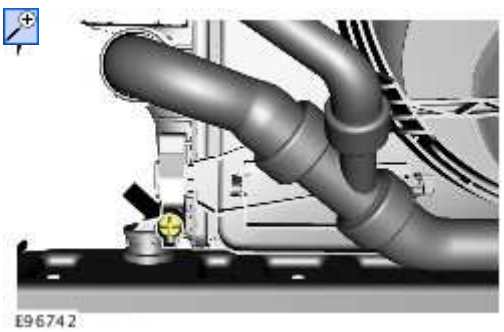

E68577

2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E65299

4.


E96742

5. WARNING: Be prepared to collect escaping fluid.
Use a suitable coolant hose to drain the coolant.

General Equipment: Fluid container
Loosen: 4 turn(s)

6.

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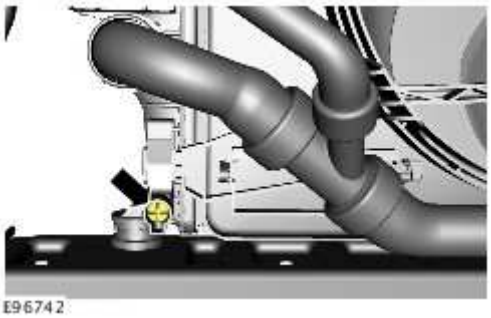
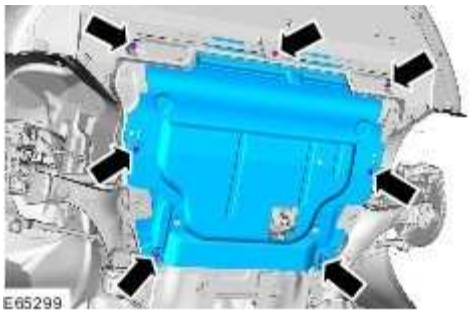

E96742

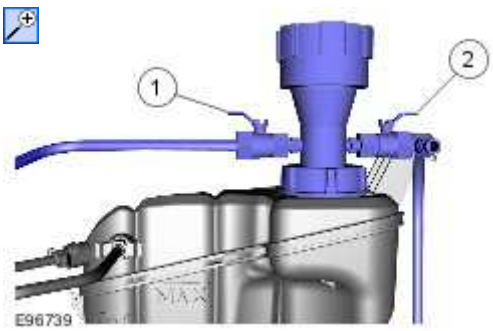

E65299

7.

Evacuating and Filling

1.

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.



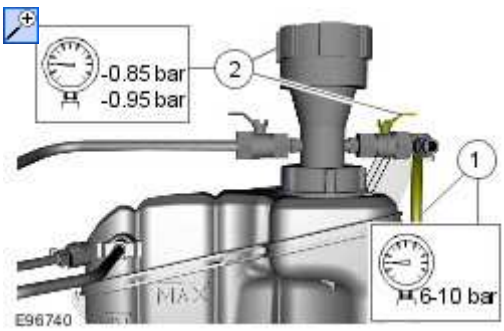
E96739

2.

- *General Equipment:* Cooling system vacuum tester and refiller

3.

1. Close the valve, install the coolant hose and place it into the fluid container.
2. Close the valve and connect the compressed air hose.



E96740

4.

2. Open the valve until the specificied vacuum is achieved.

5.

- Open the valve until the coolant reservoir fluid level is at the MAX mark.

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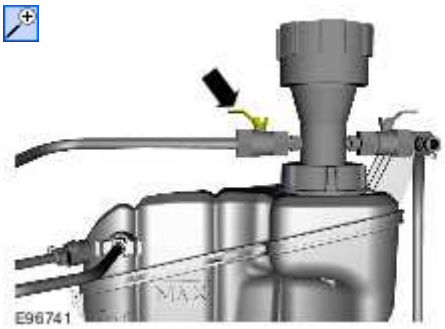
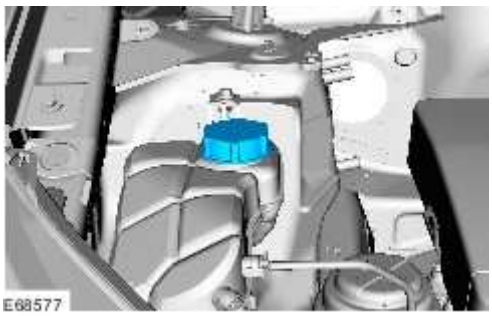


- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.



6.

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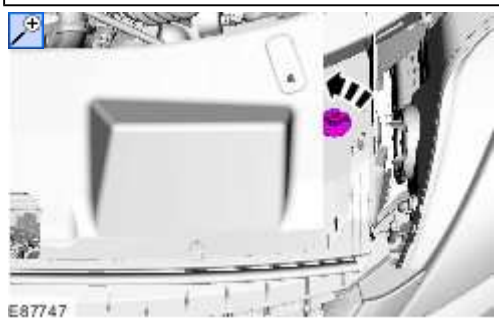
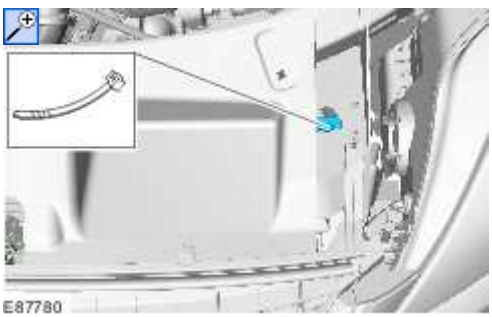
General Procedures

General Equipment

5 mm drill bit
Cable ties
Flat file


E87747

1. On both sides.

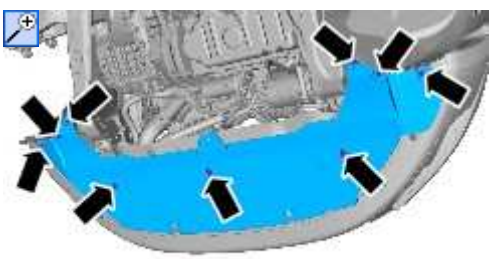

E87780

2. Secure the radiator and condenser assembly to the f panel (on both sides).

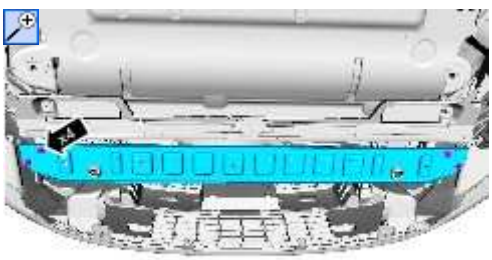
   General Equipment: Cable ties

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).


E68962

4.


E87748

5.

6.

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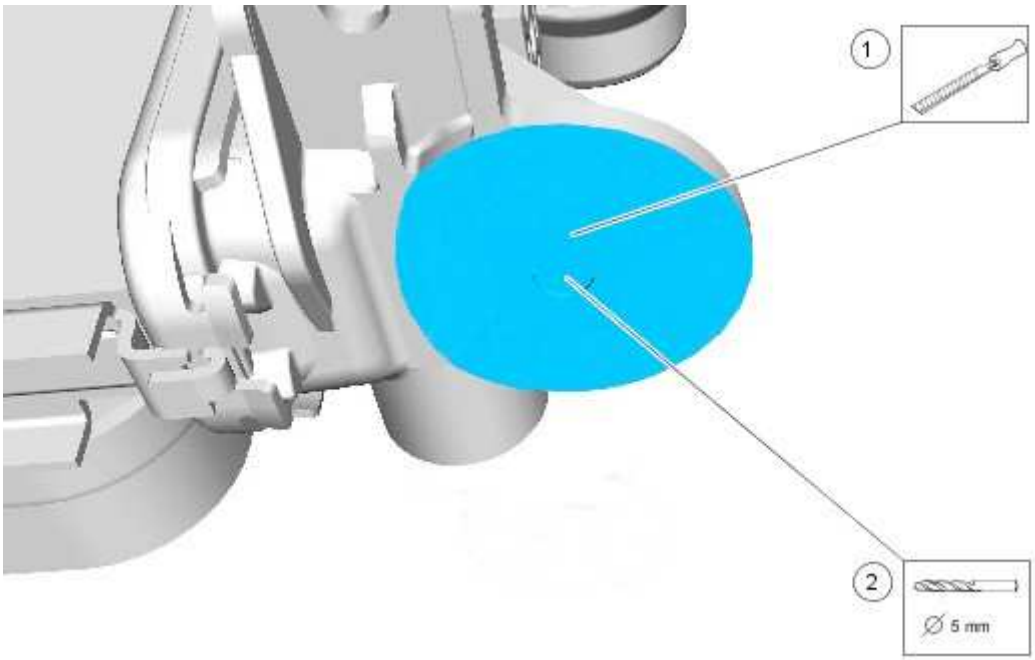
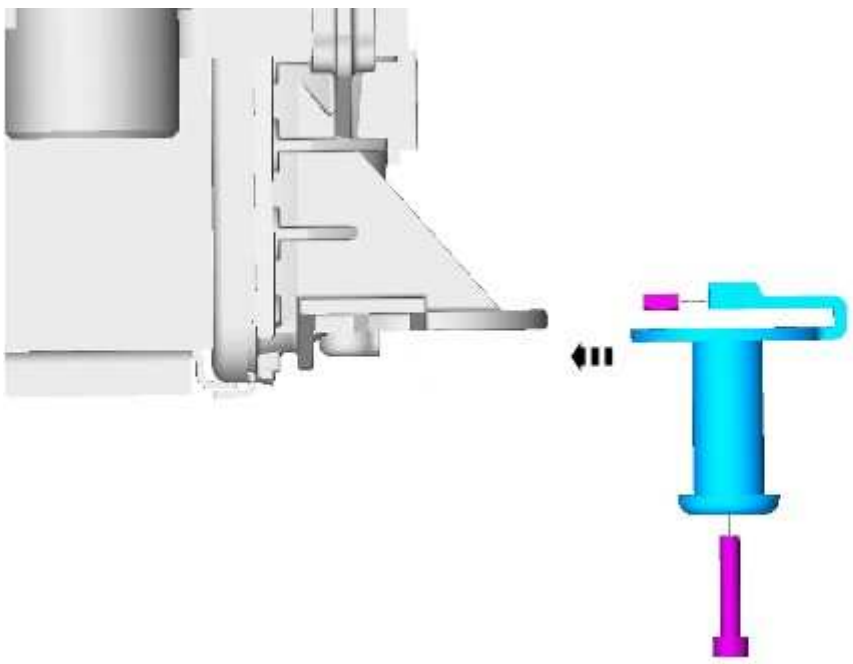


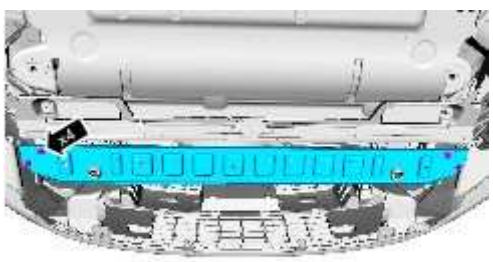
E87749

1. *Gen*
   Equi
   Flat
2. *Gen*
   Equi
   5 m
   bit

7.



E87750



E87748

8. *Torque:* 25 Nm

9. *Torque:* 8 Nm

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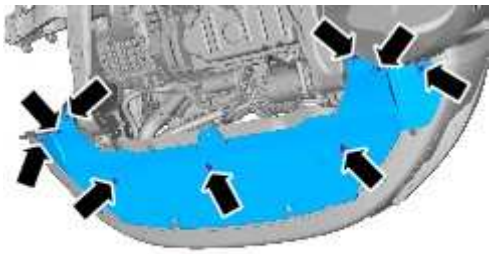
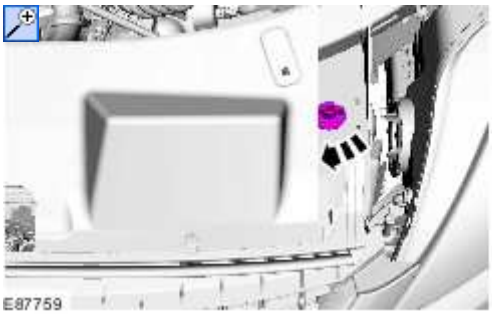


E68962

10. Lower the vehicle.
11. Remove the cable ties securing the radiator and con assembly.
    12. On both sides.



E87759

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Removal and Installation

General Equipment

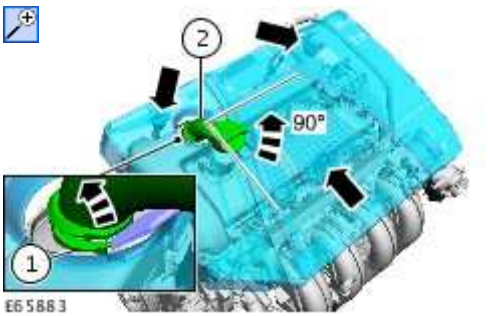
Hose clamp remover/installer

Removal

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

1. Drain the cooling system.

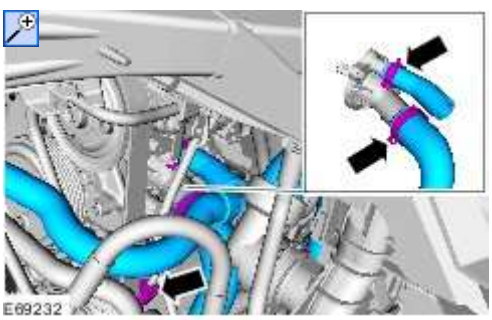
   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).



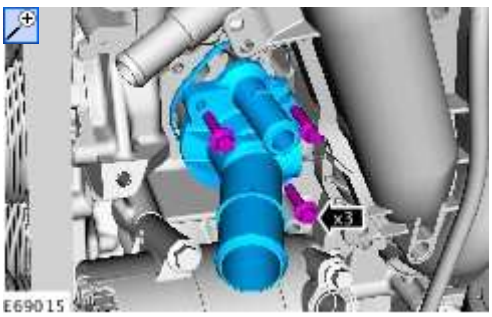
2.

3. Remove the right-hand side headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



4. *General Equipment:* Hose clamp remover/installer



5. NOTE: The gasket is to be reused unless damaged.
   Torque: 10 Nm

6.

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E69233

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

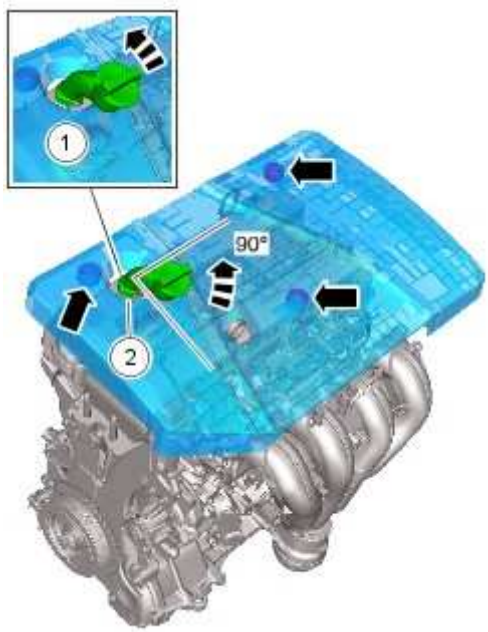
General Equipment

Hose clamp remover/installer

Removal

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

1.



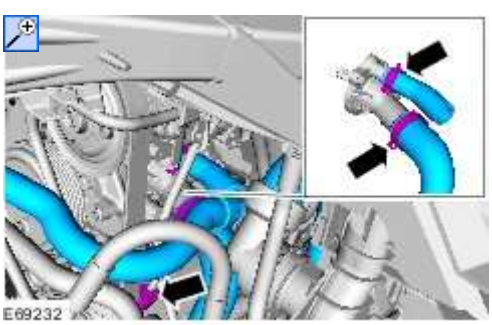
E77025

2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

3. Remove the right-hand side headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



E69232

4. *General Equipment:* Hose clamp remover/installer

5. NOTE: The gasket is to be reused unless

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damaged.
Torque: 10 Nm

6.

Installation

1. To install, reverse the removal procedure.

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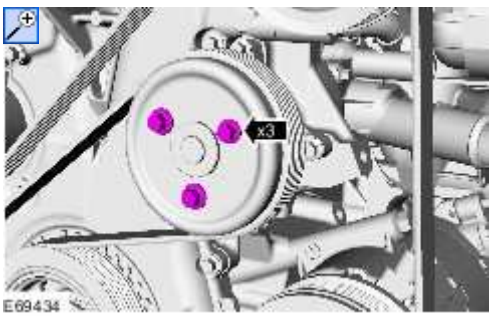
Removal and Installation

Removal

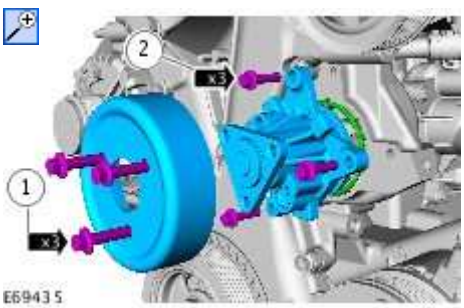
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
2. Remove the right-hand headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



3. *Loosen:* 3 turn(s)
4. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



5.
   1. NOTE: Do not fully tighten the bolts at this stage.
   2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. *Torque:* 20 Nm

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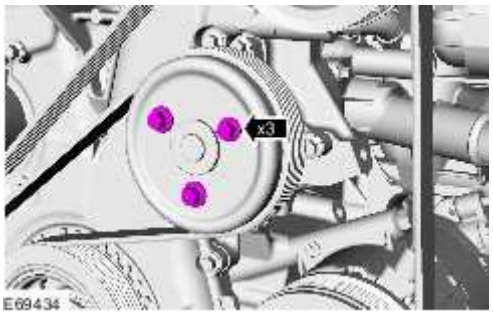

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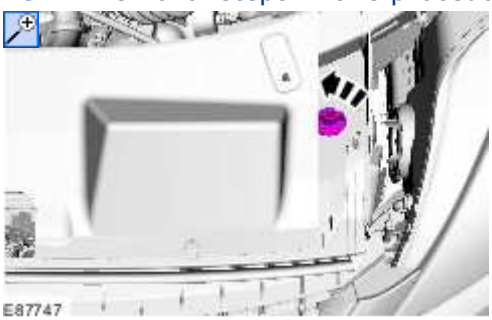
Removal and Installation

General Equipment

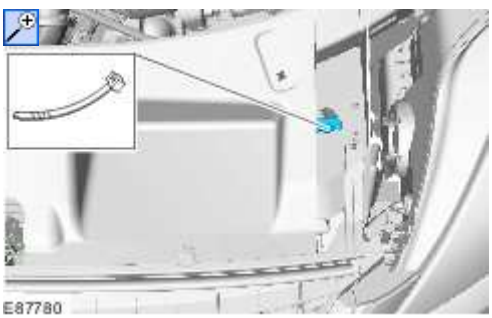
Cable ties

Removal

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

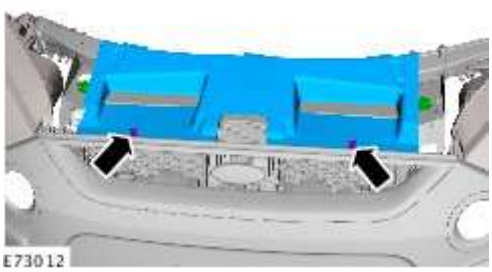


1. On both sides.

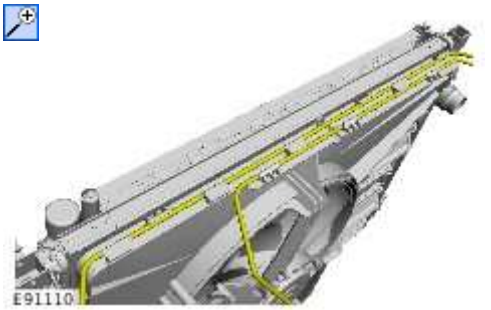


2. Loosely secure the radiator and condenser assembly to the front panel so that it can be lowered by approximately 70 mm (on both sides).

   General Equipment: Cable ties



3.



4.

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.

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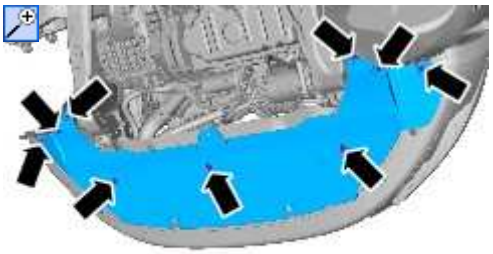
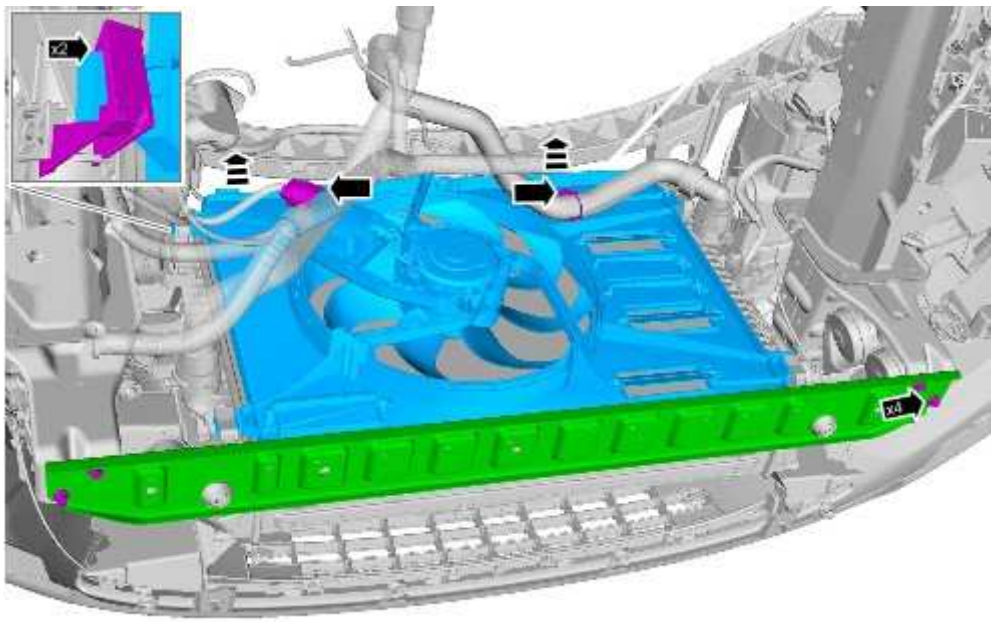


E68962



E71407

7. Lower the radiator and condenser assembly by approximately 70 mm.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Print

Removal and Installation

General Equipment

Cable ties

Removal

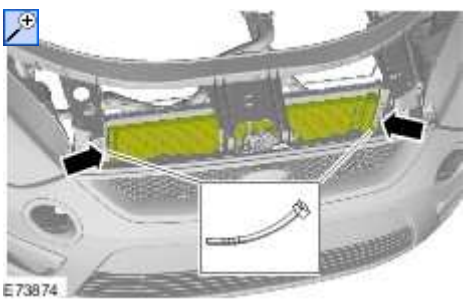
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
2. Remove the cooling fan motor and shroud.

   Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
3. Remove the charge air cooler (if equipped).

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).



4. Secure the air conditioning (A/C) condenser to the front panel.

   General Equipment: Cable ties
5.

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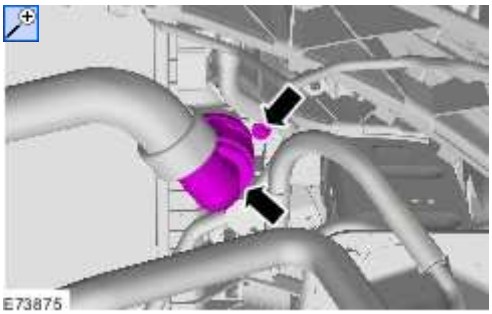

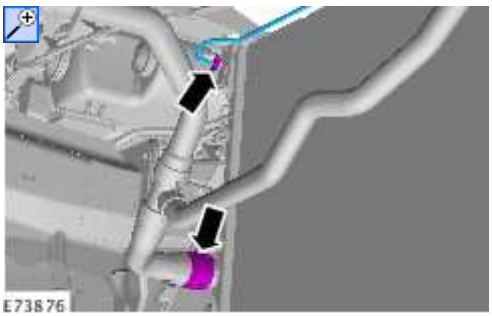

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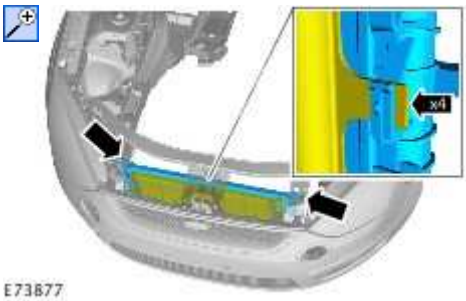

7. NOTE: This step requires the aid of another technician.
   NOTE: Radiator insulators are to be reused unless damaged.
   Remove the cable ties.

Installation

1. NOTE: Make sure that no components catch when installing the radiator.
   To install, reverse the removal procedure.

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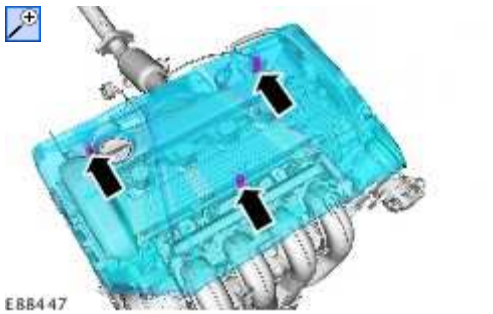
Removal and Installation

Materials

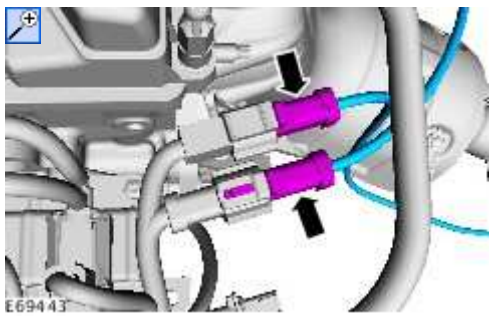
Name	Specification
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

Removal

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



1.



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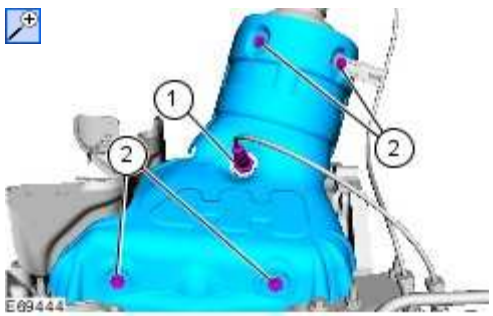
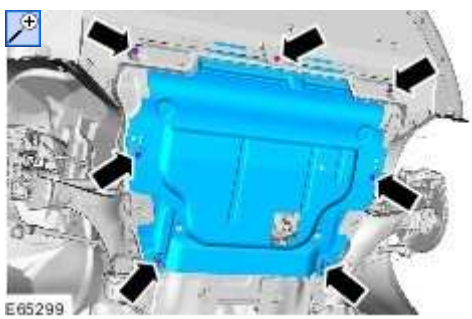


3.

1. *Torque:* 48 Nm
2. *Torque:* 10 Nm

4. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



5.

6. Refer to: Cooling System Draining, Filling and

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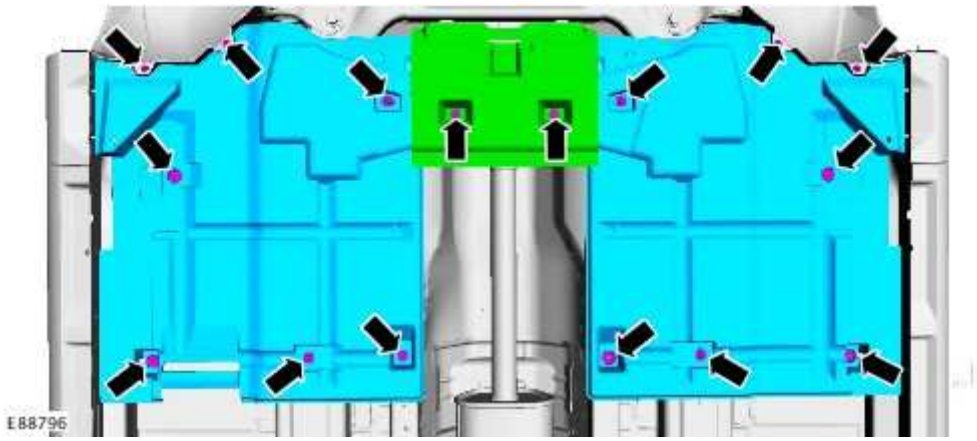
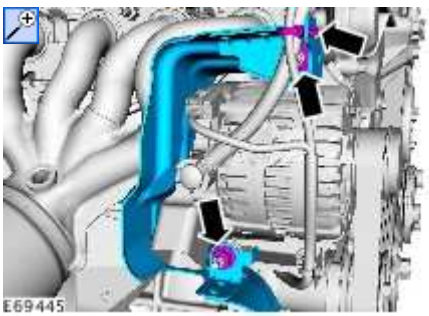
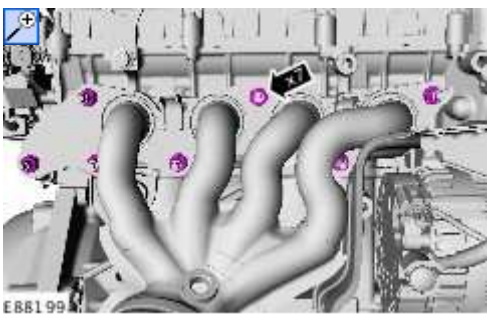
Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

7.





8. *Torque:* 20 Nm



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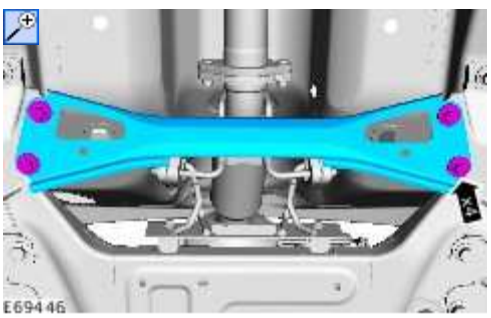
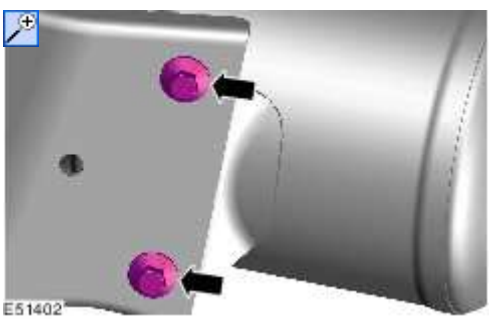


10. *Torque:* 60 Nm



11. *Torque:* 24 Nm

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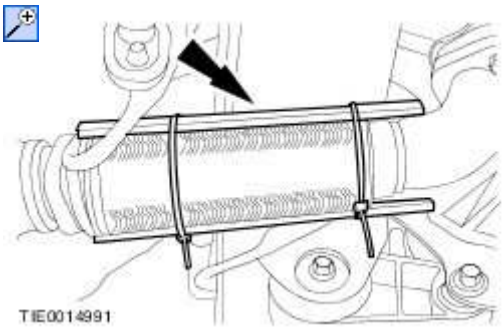
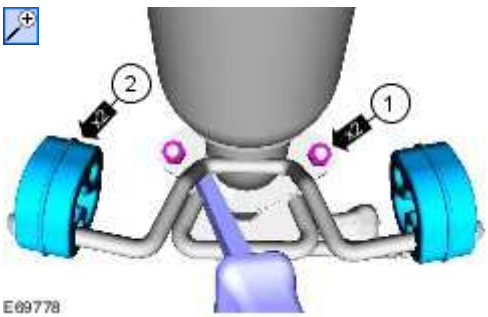
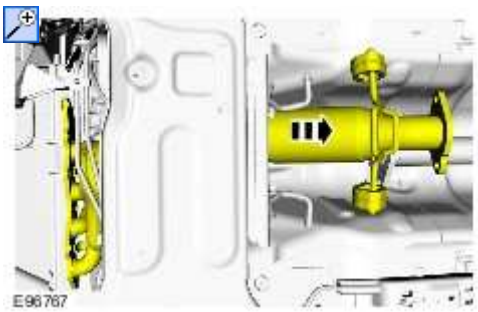


12. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



13. NOTE: Make sure that the exhaust pipe is not twisted.
Torque: 48 Nm



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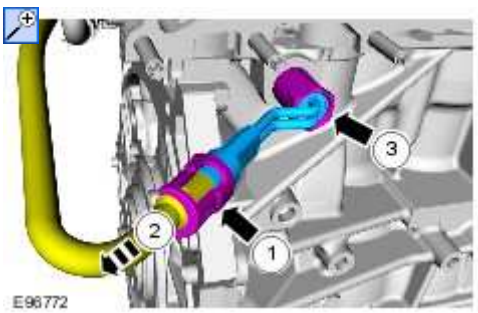
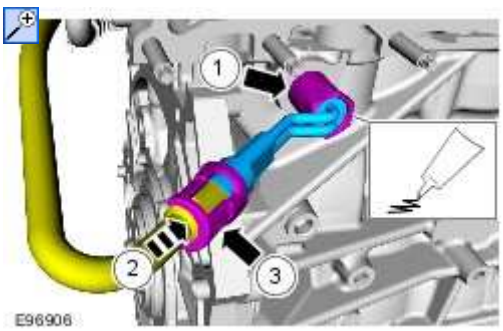


15.

Installation



1. To install reverse the removal procedure.
2.
    1. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
    Torque: 55 Nm
3. CAUTION: Jointing compound must not be used forward of the catalytic converter.

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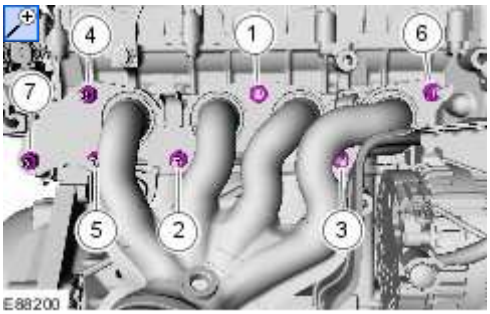

Torque: 55 Nm

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Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13° F)	–37°C (–35°F)

Cooling System Refill Capacity

Description	Liters
Cooling system and heater	6.2

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19.6 to 22.5)

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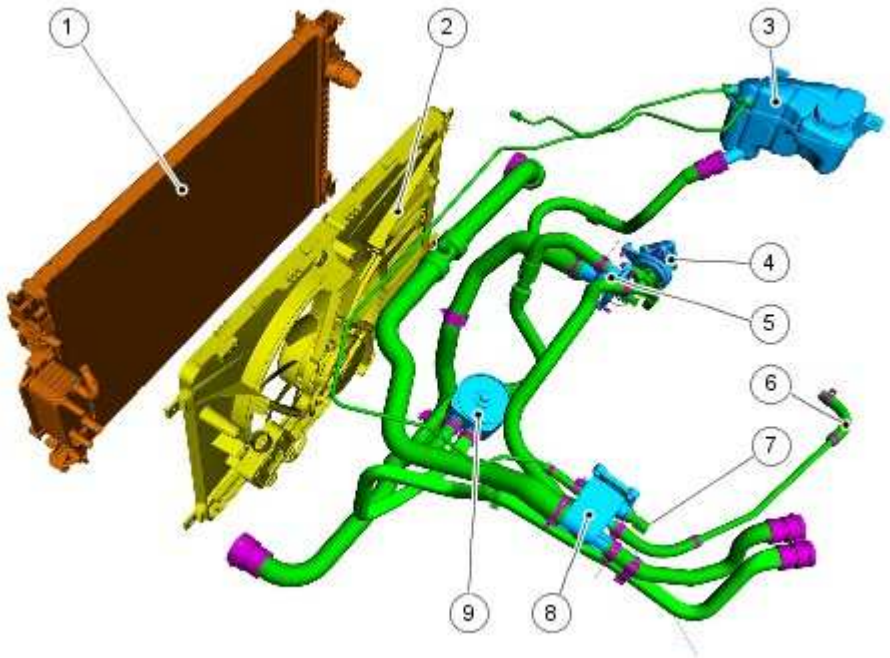
Description and Operation



E128359

Item	Description
1	Radiator
2	Radiator fan motor with bracket
3	Coolant expansion tank
4	Wate pump
5	Thermostat housing
6	Coolant connection, turbocharger
7	ECT (engine coolant temperature) sensor
8	Coolant distribution connection
9	Oil cooler

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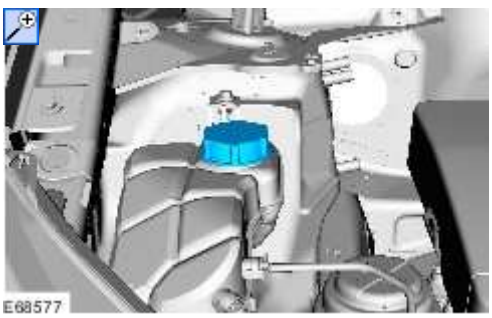
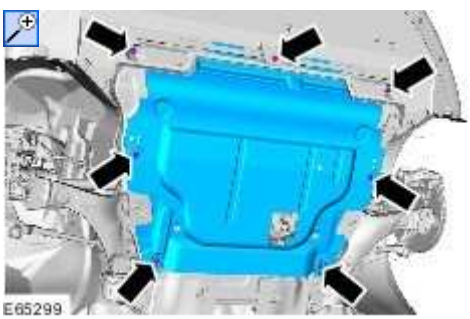
General Procedures

General Equipment

Fluid container

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.
3. 
E68577
4. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
5. 
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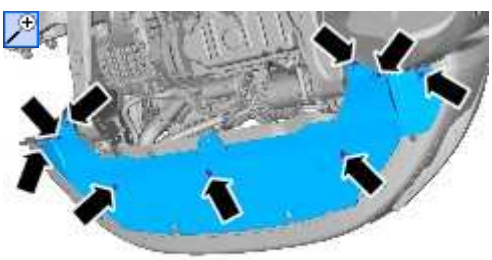
6. 
E68962
7. WARNING: Be prepared to collect escaping fluid.

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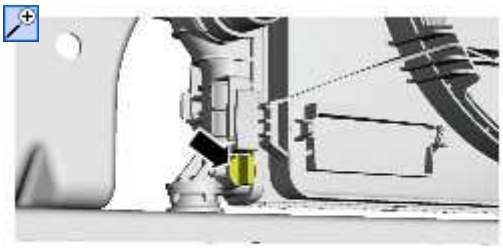
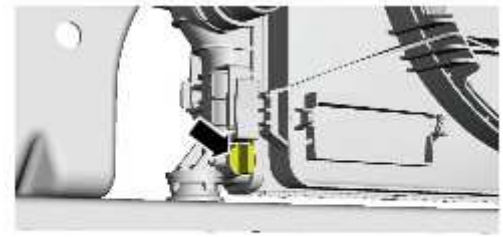


E127707

Use a suitable coolant hose to drain the coolant.

General Equipment: Fluid container
Loosen: 3 turn(s)

8.



E127707

9. Lower the vehicle.

Filling

CAUTION: The fluid level must remain between the MAX and MIN marks.

1. Switch the interior heater blower off.
2. Fill the coolant expansion tank coolant level to the neck of the coolant expansion tank.

Bleeding

1. Start the engine.
2. Raise the engine speed to 2500 RPM and maintain it for 1 minute.
3. Check the coolant expansion tank coolant level.
4. If the coolant expansion tank coolant level has fallen below the MIN mark, stop the engine and refill the coolant expansion tank level to the neck of the coolant expansion tank.
5. Install the coolant expansion tank cap.
6. Start the engine if stopped.
7. Raise the engine speed to 2500 RPM and maintain it for approximately 11 minutes while observing the coolant expansion tank coolant level.
8. Maintain the engine speed at 2500 RPM for a further 3 minutes.
9. Increase the engine speed to 4000 RPM and maintain it for 5 seconds.
10. Decrease the engine speed to 2500 RPM and maintain it for 3 minutes.
11. Switch the engine off.
12. Check the cooling system for leaks.

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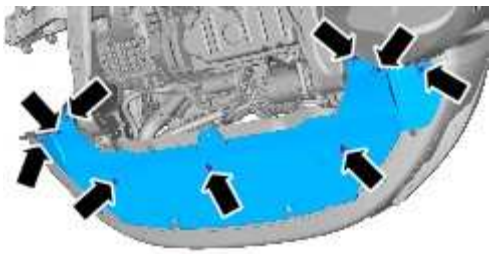
13. Check the coolant expansion tank coolant level.
14. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
15. *Torque:* 8 Nm



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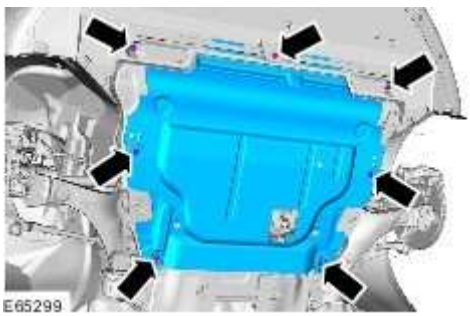

E65299

16.

17. Lower the vehicle.
18. Allow the engine to cool.
19. Fill the coolant expansion tank coolant level to the MAX mark.

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General Procedures

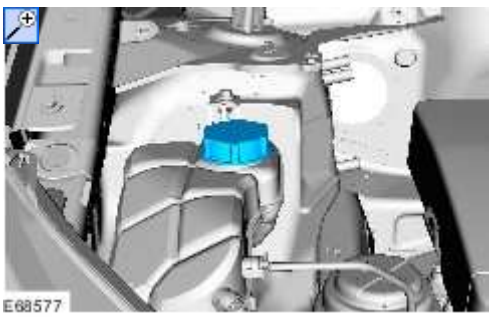
General Equipment

Cooling system vacuum tester and refiller
Fluid container

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
NOTE: Always follow the manufacturer's instructions when handling the equipment.

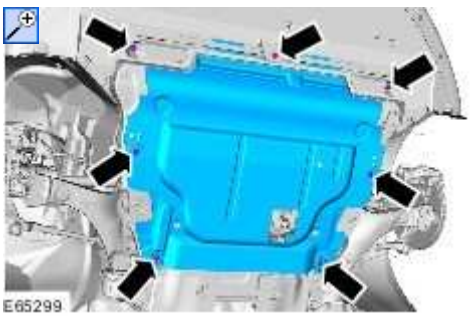
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).


E68577

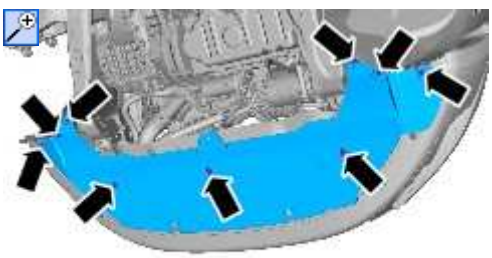
2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

4.


E65299

5.


E68962

6. WARNING: Be prepared to collect escaping fluid.
Use a suitable coolant hose to drain the coolant.

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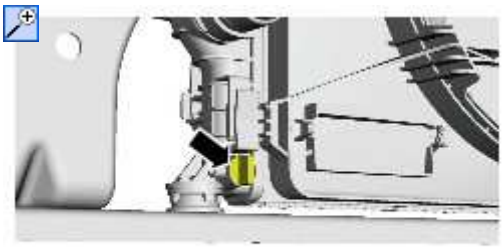


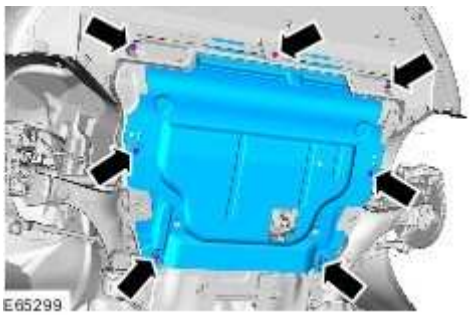
E127707

General Equipment: Fluid container
Loosen: 4 turn(s)

7.

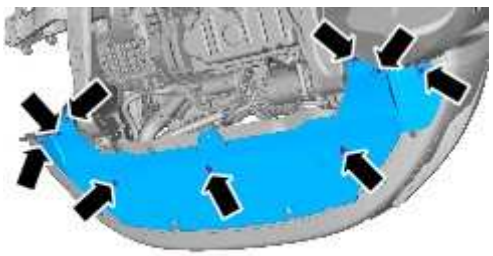
E127707

8.



E65299

9. *Torque:* 8 Nm



E68962

10. Lower the vehicle.

Filling

1.

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.

2.

- *General Equipment:* Cooling system

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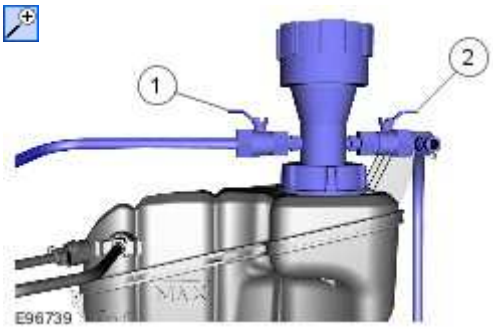
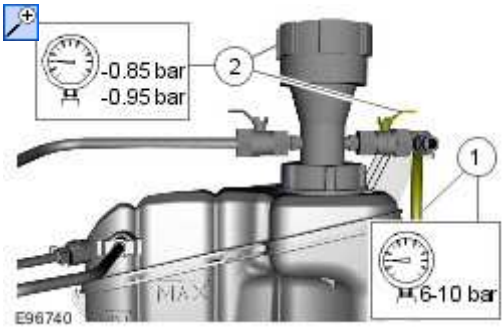
vacuum tester and refiller



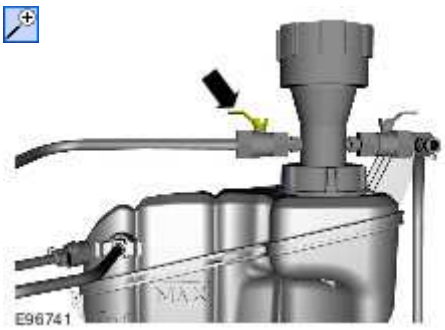
3.

1. Close the valve, install the coolant hose and place it into the fluid container.
2. Close the valve and connect the compressed air hose.



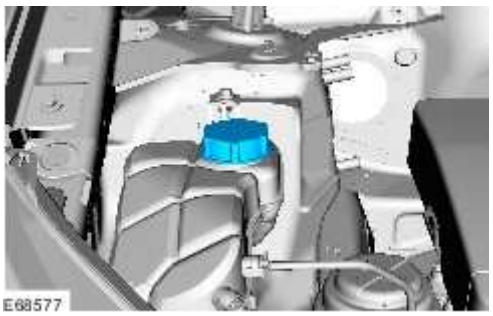
4.

2. Open the valve until the specificied vacuum is achieved.



5.

- Open the valve until the coolant reservoir fluid level is at the MAX mark.
- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.



6.

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Removal and Installation

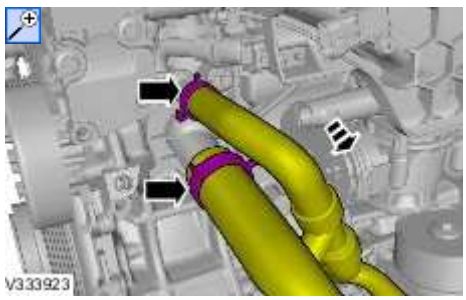
General Equipment

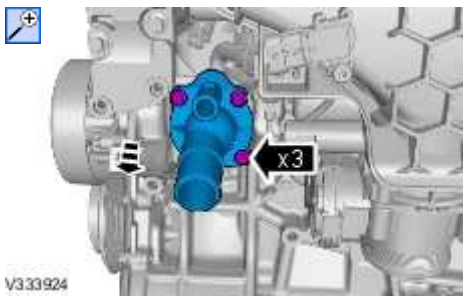
Hose clamp remover/installer

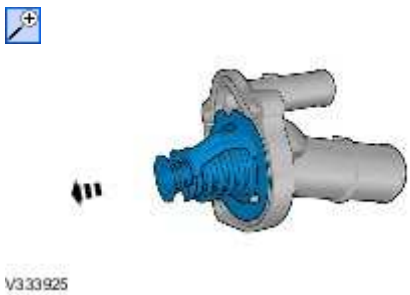
Removal

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

1. Refer to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).
2.

3. 

CAUTION: Use suitable paper to absorb any escaping fluid.
General Equipment: Hose clamp remover/installer
4. 

CAUTION: Use suitable paper to absorb any escaping fluid.
Torque: 10 Nm
5. 

Installation

1. To install, reverse the removal procedure.

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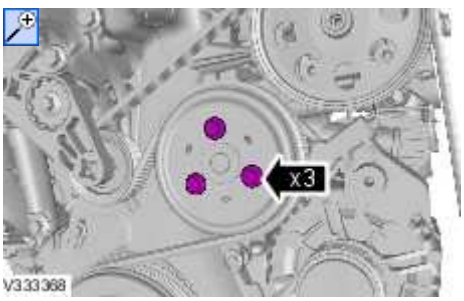
Removal and Installation

Removal

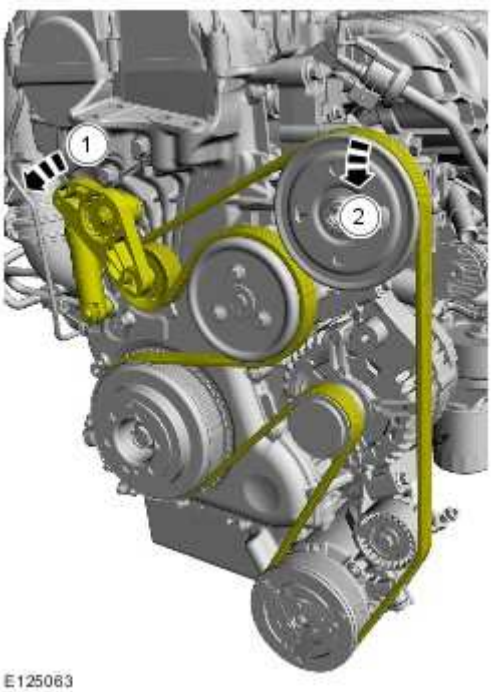
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).

2.



3. *Loosen:* 2 turn(s)



4. WARNING: Take extra care when handling the compressed spring.

5. NOTE: Only tighten the nut and bolts finger tight at this stage.

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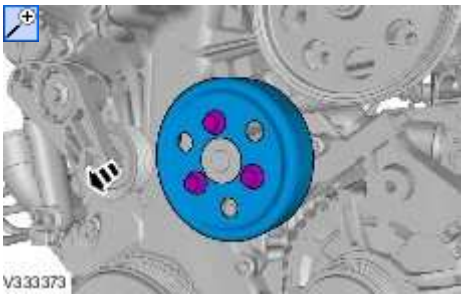
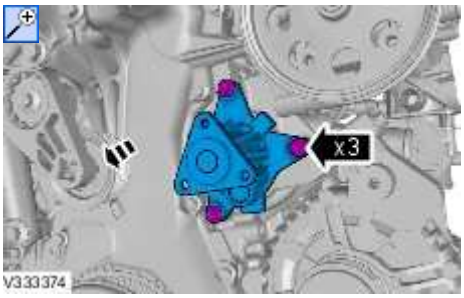
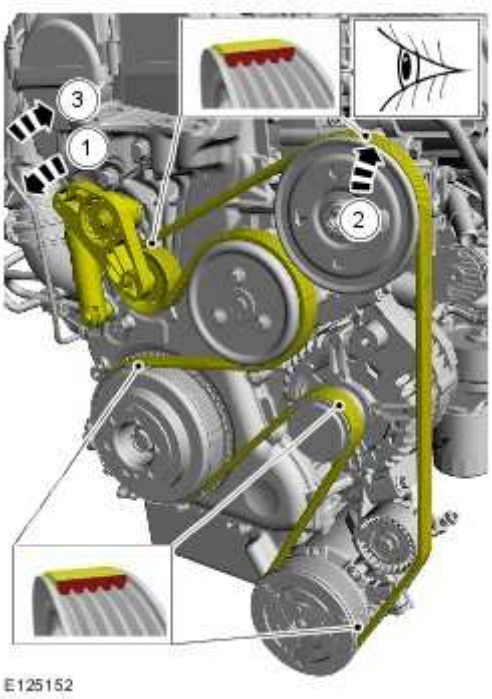




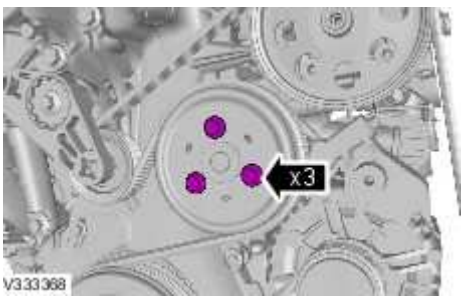
6. NOTE: Use suitable paper to absorb any escaping fluid.
   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.



2. WARNING: Take extra care when handling the compressed spring.



3. *Torque:* 20 Nm

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Removal and Installation

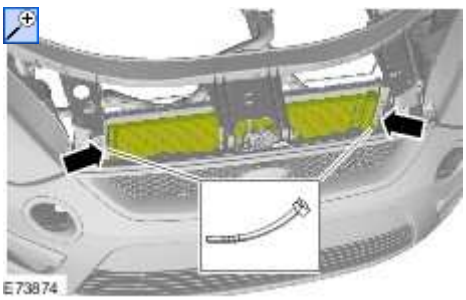
General Equipment

Cable ties
Hose clamp remover/installer

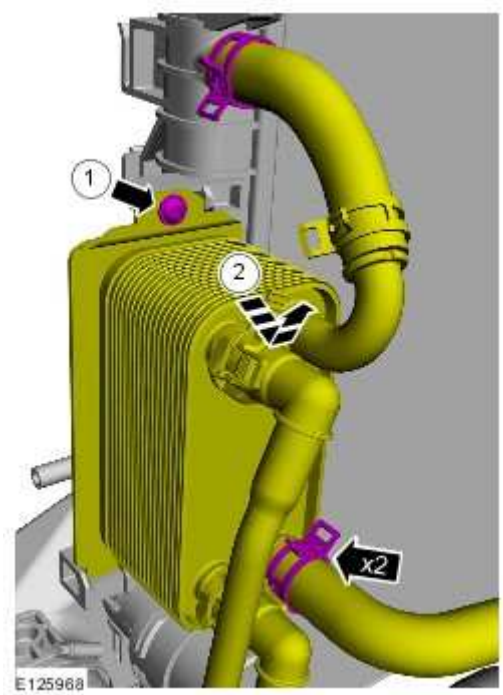
Removal

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

1. Refer to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).
2. Remove the following items:
    1. Refer to: Cooling Fan Motor and Shroud (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
    2. Refer to: Charge Air Cooler (303-12B Intake Air Distribution and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



3. *General Equipment:* Cable ties



4. *General Equipment:* Hose clamp remover/installer
   Torque: 4 Nm

5. *Torque:* 5 Nm

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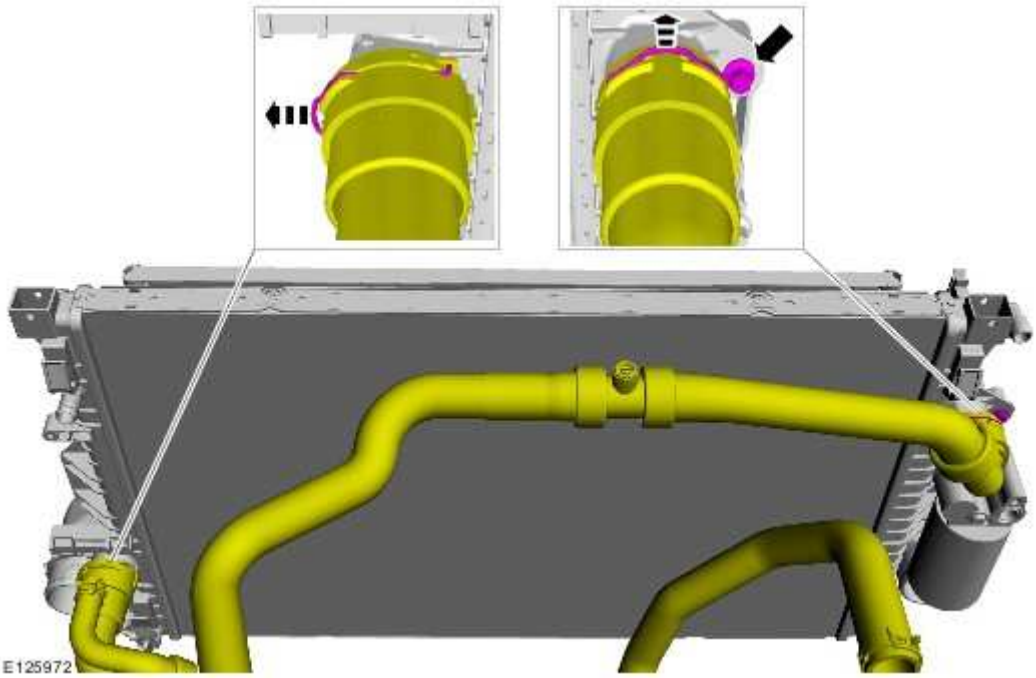

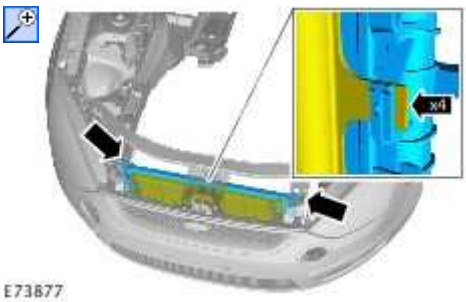

6. NOTE: This step requires the aid of another technician.
   NOTE: Radiator insulators are to be reused unless damaged.
   Remove the cable ties.

Installation

1. NOTE: Make sure that no components catch when installing the radiator.
   To install, reverse the removal procedure.

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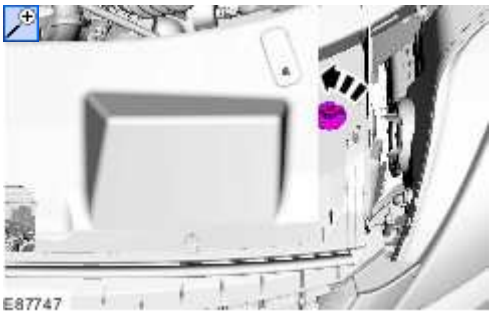
Removal and Installation

General Equipment

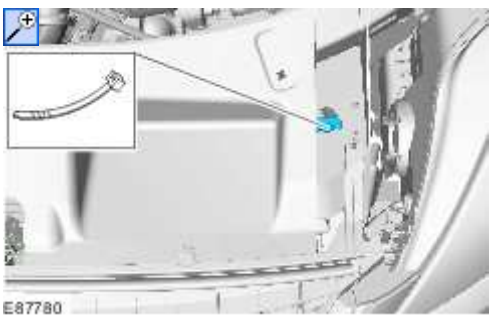
Cable ties

Removal

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

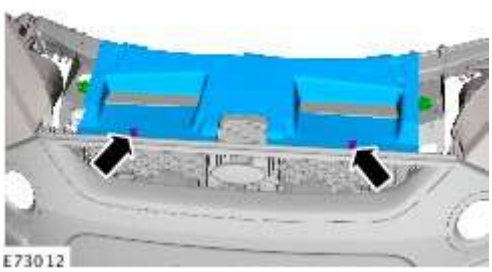


1. On both sides.

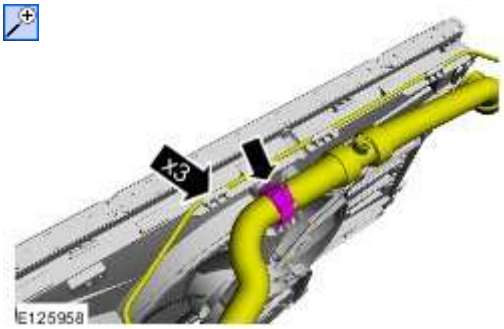


2. Loosely secure the radiator and condenser assembly to the front panel so that it can be lowered by approximately 70 mm (on both sides).

   General Equipment: Cable ties



3.



4.

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

6.

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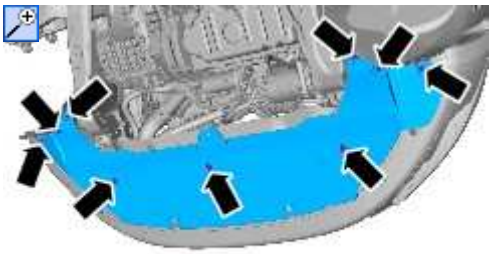

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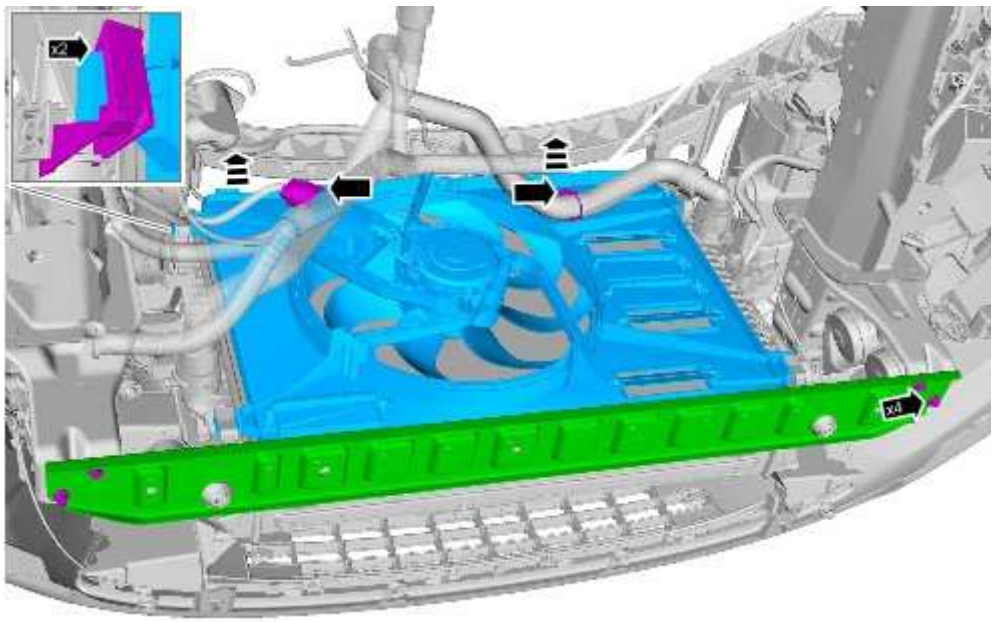

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7. Lower the radiator and condenser assembly by approximately 70 mm.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13° F)	–37°C (–35°F)

Cooling System Refill Capacities

Description	Liters
Cooling system and heater	7.1

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19.6 to 22.5)

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Diagnosis and Testing

Special Tool(s)

	Pressure Tester, Cooling System 303-396
	Adaptor for 303-396 303-396-09

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leak(s) • Gasket(s) or seal(s) • Hose(s) or hose joints • Coolant expansion tank cap and seal • Coolant expansion tank • Radiator • Coolant pump • Thermostat housing • Engine coolant temperature (ECT) sensor • Heater core	• Fuse(s) • Wiring harness • Electrical connector(s) • Engine coolant temperature (ECT) sensor • Cooling fan • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Loss of coolant	* Hose(s) or hose joint(s).	* INSPECT the hoses and hose joints. INSTALL a new hose(s) as necessary.
	* Radiator.	* INSPECT the radiator for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal

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		and Installation).
	* Coolant pump.	* INSPECT the coolant pump for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Thermostat housing.	* INSPECT the thermostat housing for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat Housing (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Coolant expansion tank cap or seal(s).	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as necessary.
	* Coolant expansion tank.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Heater core.	* CHECK the heater core for leaks.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
The engine overheats (signs of coolant boiling)	* Air in cooling system.	* BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), General Procedures).
	* Radiator grille.	* INSPECT the radiator grille for air restrictions or damage. REPAIR or INSTALL new parts as necessary.
	* Coolant expansion tank cap or seal(s).	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as necessary.
	* Coolant expansion tank.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Coolant level or condition.	* CHECK the coolant level. REFILL the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), General Procedures). * CHECK the coolant condition. If the coolant is in poor condition drain and refill with new coolant. REFER to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), General Procedures).
	* Coolant concentration.	* REFER to: Specifications (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), Specifications).
	* Cooling system does not hold pressure.	* INSPECT the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Cooling fan.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test

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		in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), Removal and Installation).
	* Coolant pump.	* CARRY OUT the Pressure Test Component Test in this section. INSPECT the coolant pump for leaks. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), Removal and Installation).
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
The engine does not reach normal operating temperature.	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), Removal and Installation).
	* Cooling fan.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
The cooling fan is inoperative	* Cooling fan.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.

Component Tests

Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.
NOTE: If the coolant expansion tank cap is rotated counterclockwise by ½ a full turn, the pressurized coolant will be vented to the underside of the coolant expansion tank cap.

1. **1.** Slowly remove the coolant expansion tank cap to release the cooling system pressure.
2. **2.** Install the coolant expansion tank cap.
3. **3.** Install the special tools 303-396 and 303-396-09 to the coolant expansion tank.
4. **4.** Pressurize the cooling system to the coolant expansion tank cap release pressure. REFER to: Specifications (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), Specifications).
5. **5.** Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the cooling system holds pressure, INSTALL a new coolant expansion tank cap. If the cooling system does not hold pressure, check the cooling system thoroughly for coolant leaks.

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6. **6.** Check the engine for coolant leaks. Drain the cooling system, repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.5L Duratec-ST (VI5), General Procedures).

7. **7.** Recheck the cooling system by repeating Steps 3 and 4 at least twice.

Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 138 kpa (20 psi) or damage may result.
Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 130 kpa (18 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. **1.** Remove the coolant expansion tank cap.

2. **2.** Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. **3.** Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing, and note the highest pressure reading obtained.

4. **4.** Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. **5.** If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

1. **1.** Connect the Ford approved diagnostic tool to the data link connector (DLC).

2. **2.** Using the Ford approved diagnostic tool datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- CHT - cylinder head temperature (CHT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

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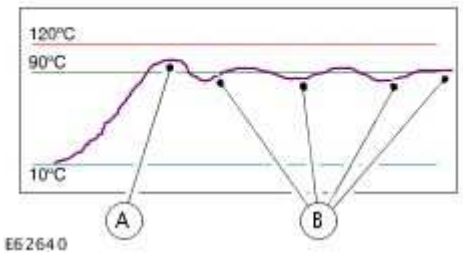
The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor or CHT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	-	Thermostat opens
B	-	Thermostat settles into a cyclic open and closure pattern

CAUTION: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
If the Ford approved diagnostic tool only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The CHT sensor output is useful to examine the cylinder head temperature rise during the warm-up cycle and later during the normal light throttle cruise test. This sensor output may vary between vehicles with manual transmission and vehicles with automatic transmission and should be used for reference only.

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford approved diagnostic tool in datalogger mode, the signals recorded

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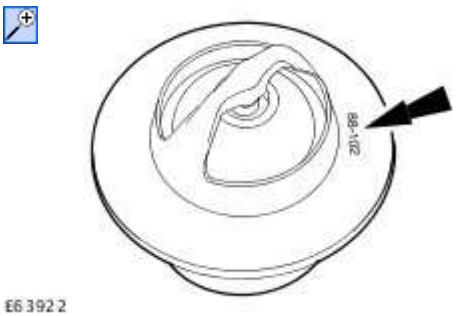
should remain within the DEFAULT values set by the Ford approved diagnostic tool.

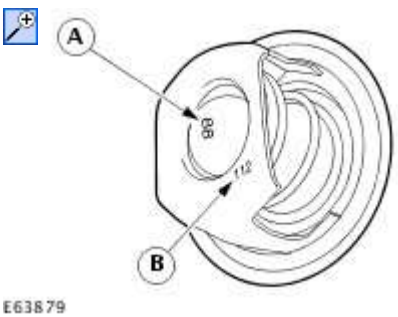
3. WARNING: Make sure that the Ford approved diagnostic tool is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford approved diagnostic tool in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.
   NOTE: The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford approved diagnostic tool can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.
   NOTE: The results from the test are more conclusive if the engine is cold when the test is started.
   3. Carry out a road test.
   REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

4. **4.** Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.
The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	-	Opening temperature
B	-	Fully open temperature

NOTE: Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.
The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical

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connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. **5.** INSTALL a new thermostat housing and thermostat housing gasket as necessary. REFER to: Thermostat Housing (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

6. **6.** Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. **7.** Using the Ford approved diagnostic tool, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

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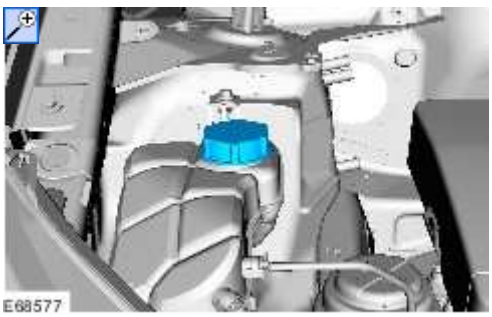
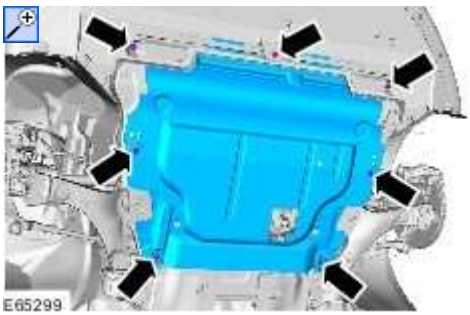
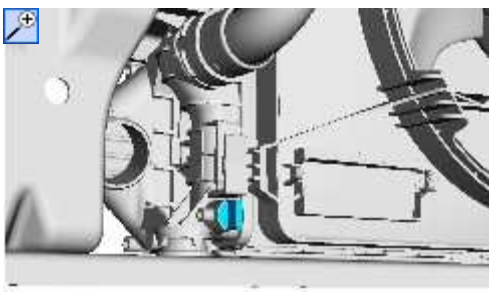
General Procedures

NOTE: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.
2. 
E68577
3. Raise and support the vehicle.

   Refer to: Lifting (100-02, Description and Operation).
4. 
E65299
5. 
E68578
6. Install the radiator drain plug.
7. Lower the vehicle.

CAUTION: The fluid level must remain between the MAX and MIN marks.

8. Switch the interior heater blower off.
9. Remove the right-hand front headlamp.

   Refer to: Headlamp Assembly (417-01, Removal and Installation).
10.

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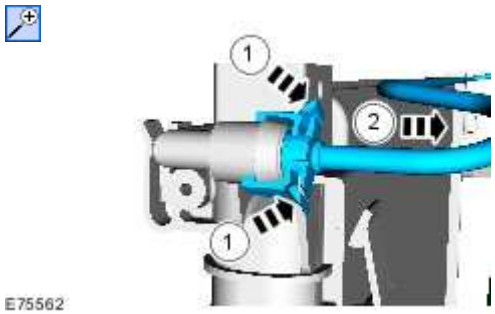
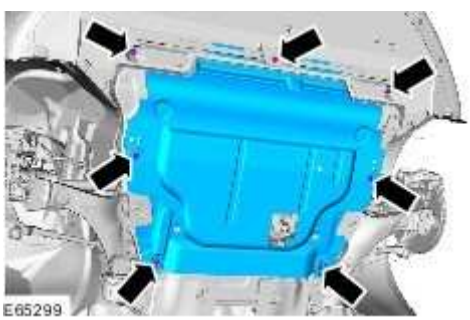


11. Fill the coolant expansion tank coolant level to the neck of the tank.
12. Connect the coolant degas hose to the radiator.
13. Install the right-hand front headlamp.
14. Install the coolant expansion tank cap to the coolant expansion tank.
15. Start the engine.
16. Raise the engine speed to 2500 revolutions per minute (RPM).
17. Monitor the coolant level for 3 minutes. If the coolant level falls below the MIN mark stop the engine, refill the cooling system and return to step 14.
18. Maintain the engine speed at 2500 RPM for 8 minutes until the engine is at normal operating temperature.
19. Maintain the engine speed at 2500 RPM for 3 minutes.
20. Increase the engine speed to 4000 RPM for 5 seconds.
21. Decrease the engine speed to 2500 RPM and maintain for 3 minutes.
22. Stop the engine.
23. Check the cooling system for leaks.
24. Raise and support the vehicle.

    Refer to: Lifting (100-02, Description and Operation).



25.

26. Lower the vehicle.
27. Allow the engine to cool.
28. Fill the coolant expansion tank coolant level to the MAX mark.

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General Procedures

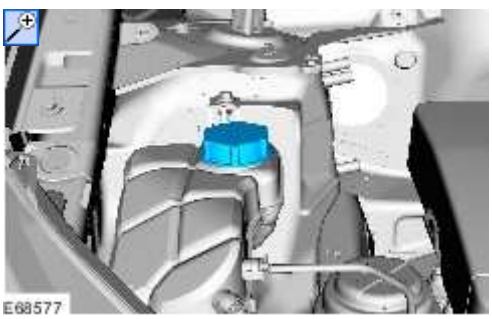
General Equipment

Cooling system vacuum tester and refiller
Fluid container

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
NOTE: Always follow the manufacturer's instructions when handling the equipment.

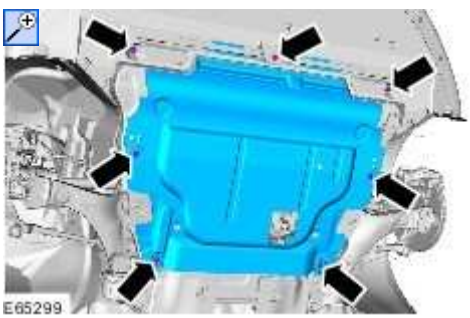
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

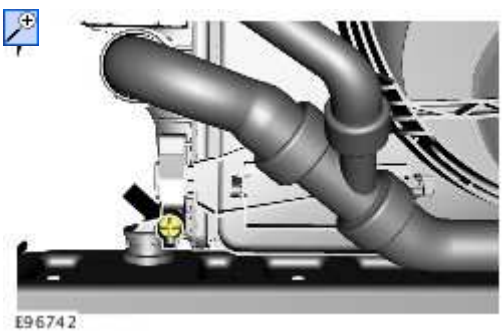

E68577

2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

4.


E65299


E96742

5. WARNING: Be prepared to collect escaping fluid.
Use a suitable coolant hose to drain the coolant.

General Equipment: Fluid container
Loosen: 4 turn(s)

6.

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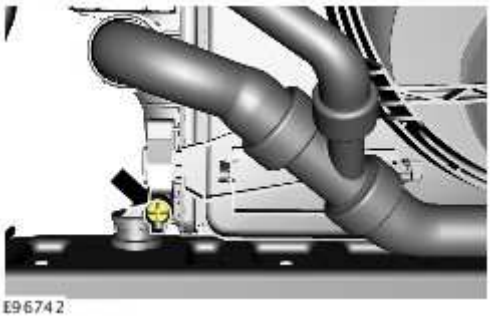
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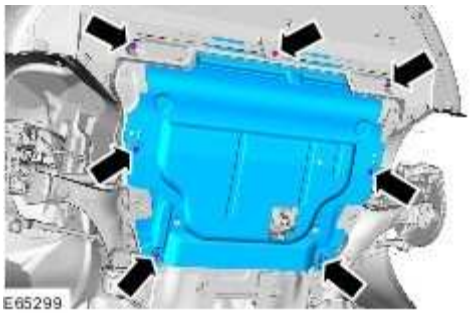
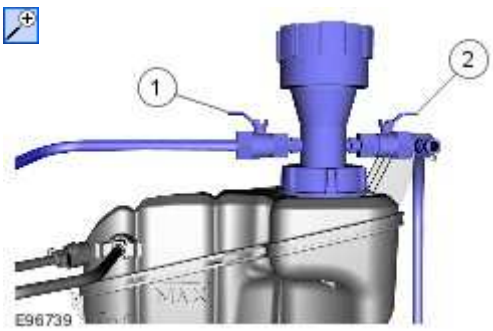

E65299

7.

Evacuating and Filling

1.

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.



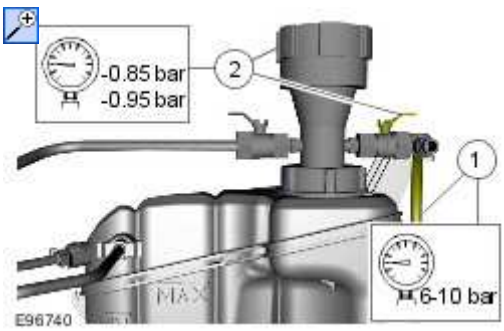
E96739

2.

- *General Equipment:* Cooling system vacuum tester and refiller

3.

1. Close the valve, install the coolant hose and place it into the fluid container.
2. Close the valve and connect the compressed air hose.



E96740

4.

2. Open the valve until the specificied vacuum is achieved.

5.

- Open the valve until the coolant reservoir fluid level is at the MAX mark.

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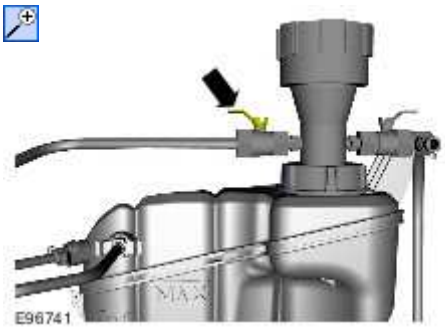
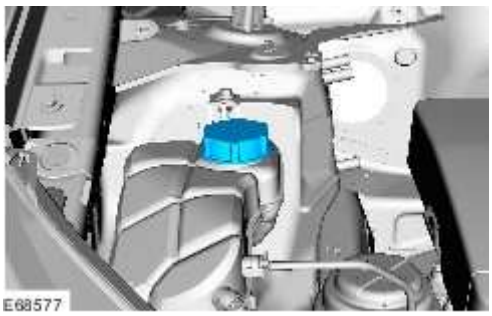


- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.



6.

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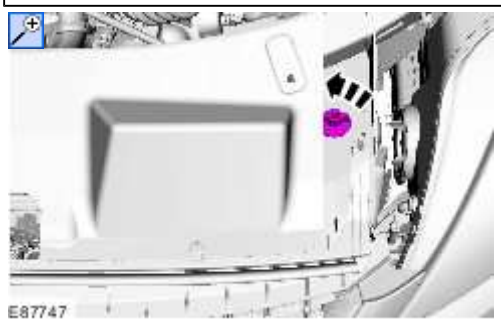
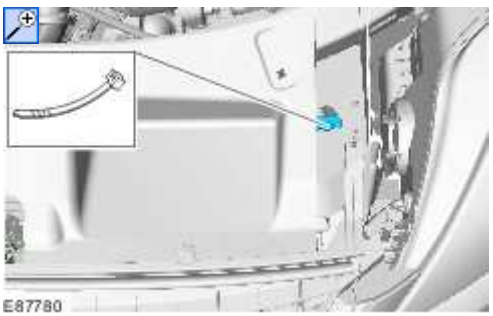
General Procedures

General Equipment

5 mm drill bit
Cable ties
Flat file


E87747

1. On both sides.

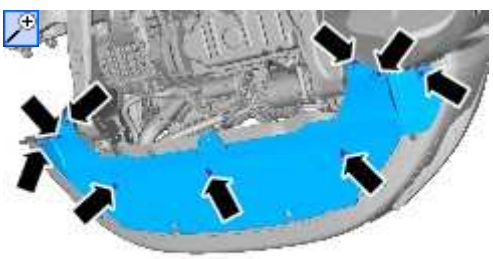

E87780

2. Secure the radiator and condenser assembly to the f panel (on both sides).

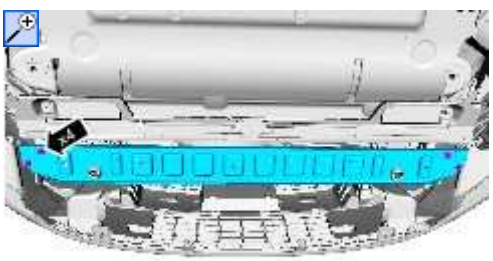
   General Equipment: Cable ties

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).


E68962

4.


E87748

5.

6.

1. *Gen Equi* Flat

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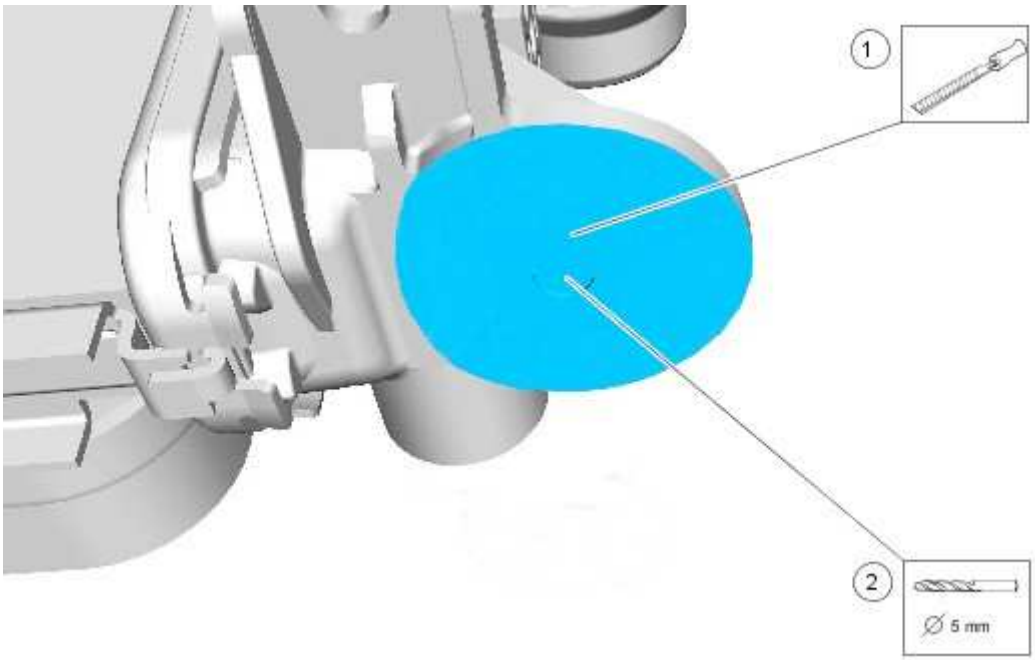
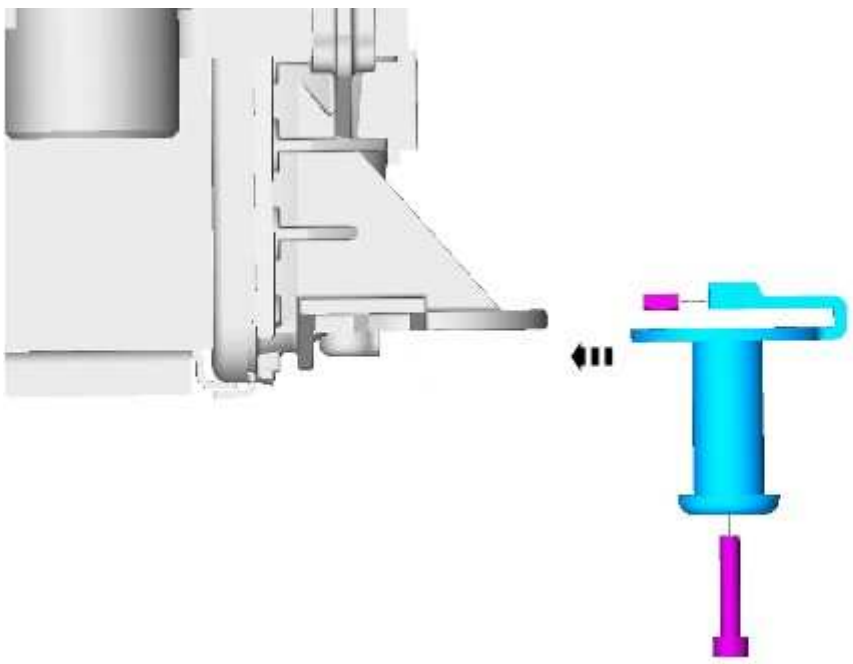


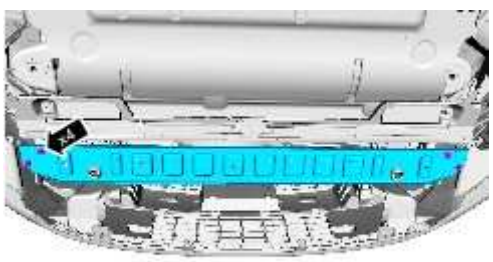
E87749

2. *Gen*
Equi
5 m
bit



E87750

7.



E87748

8. *Torque:* 25 Nm

9. *Torque:* 8 Nm

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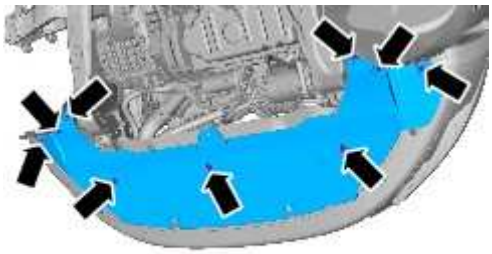
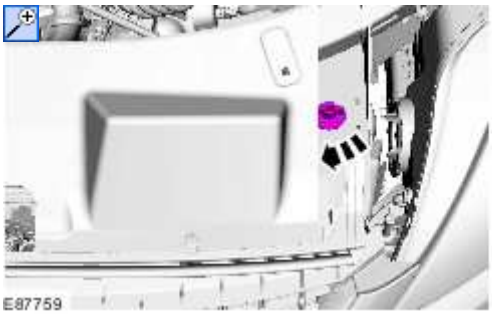


E68962

10. Lower the vehicle.
11. Remove the cable ties securing the radiator and con assembly.
    12. On both sides.



E87759

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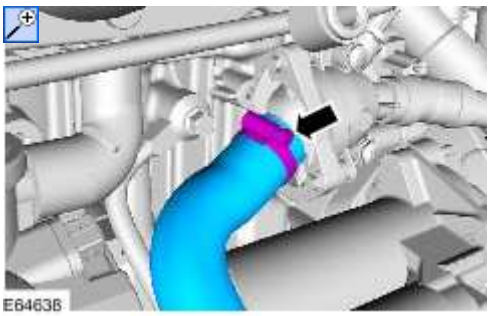
Removal and Installation

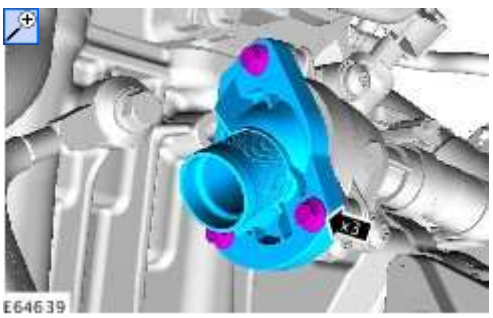
Removal

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

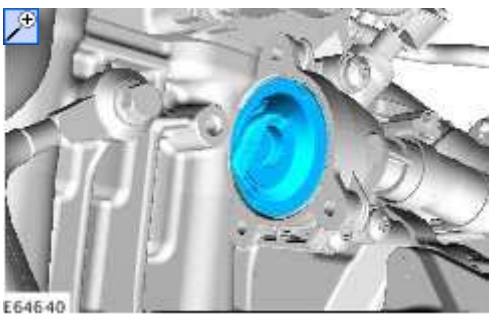
1. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



3.



4. *Torque:* 8 Nm



5.

Installation

1. To install, reverse the removal procedure.

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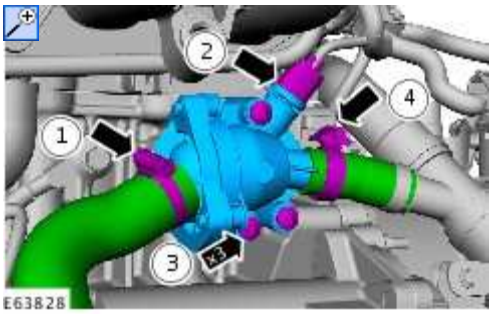
Removal and Installation

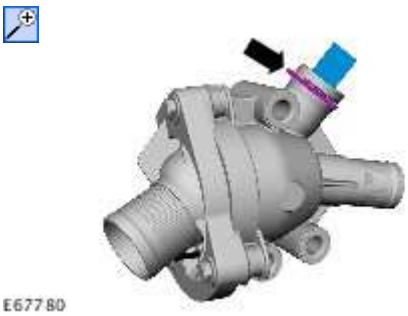
Removal

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

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. *Torque:* 17 Nm



4.



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Trolley jack

Removal

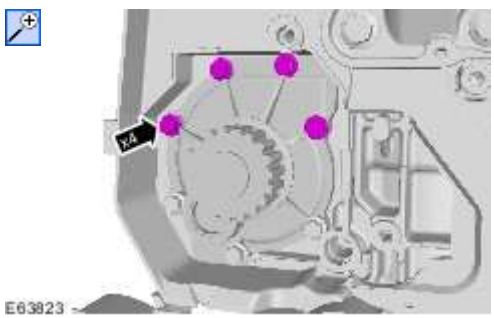
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
2. Remove the timing belt.

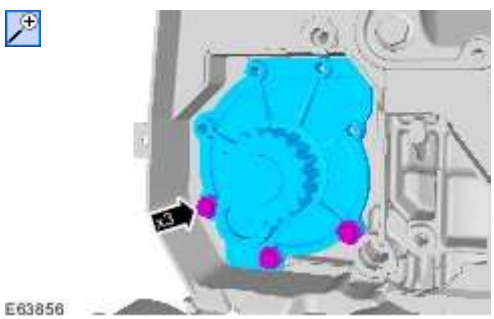
   Refer to: Timing Belt (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. CAUTION: Use a wooden block to protect the oil pan when supporting the engine.
   Position the trolley jack with the wooden block under the oil pan. Raise the trolley jack until the front of the engine is free from load and the coolant pump bolts can be accessed.

   General Equipment: Trolley jack



4. *Torque:* 17 Nm
5. Lower the engine.

   General Equipment: Trolley jack



6. *Torque:* 17 Nm

Installation

1. NOTE: Install all the bolts finger tight before final tightening.

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To install, reverse the removal procedure.

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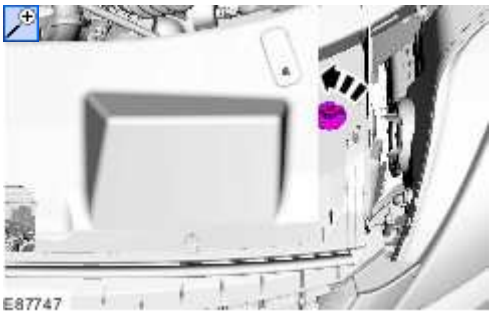
Removal and Installation

General Equipment

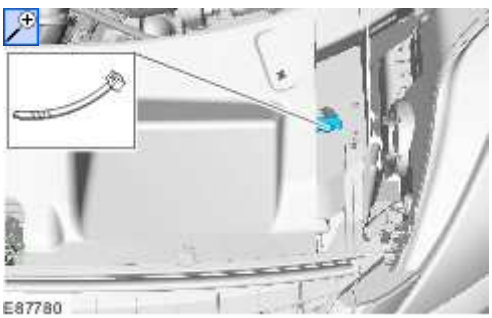
Cable ties

Removal

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

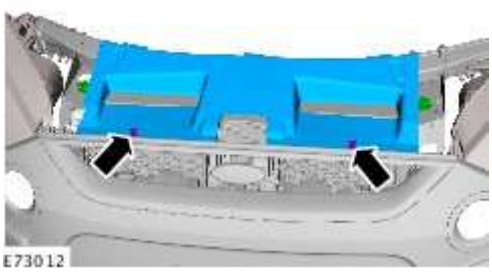


1. On both sides.

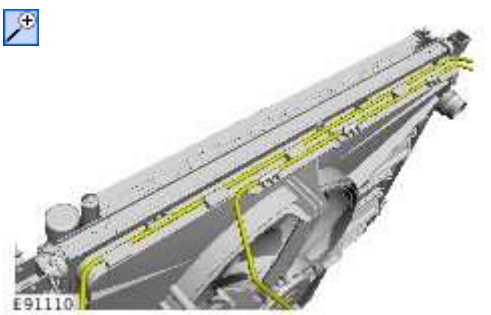


2. Loosely secure the radiator and condenser assembly to the front panel so that it can be lowered by approximately 70 mm (on both sides).

   General Equipment: Cable ties



3.



4.

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.

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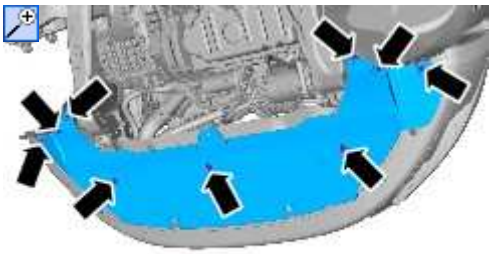

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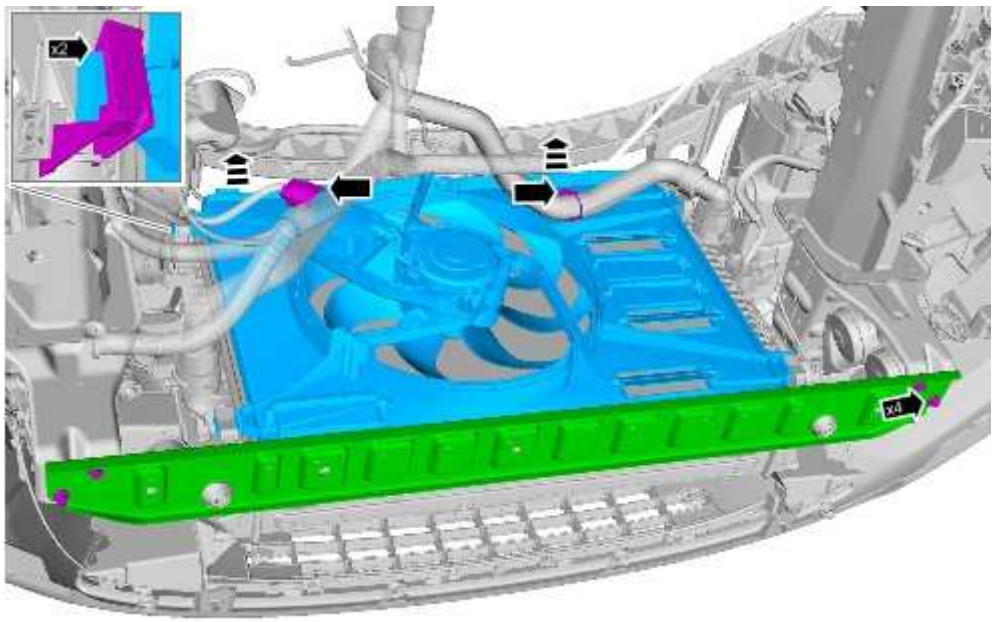

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7. Lower the radiator and condenser assembly by approximately 70 mm.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Cable ties

Removal

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

1. Drain the cooling system.

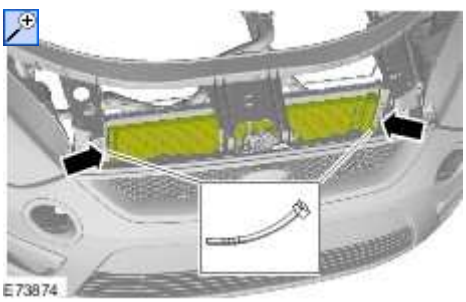
   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

2. Remove the cooling fan motor and shroud.

   Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

3. Remove the charge air cooler (if equipped).

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).



4. Secure the air conditioning (A/C) condenser to the front panel.

   General Equipment: Cable ties

5.

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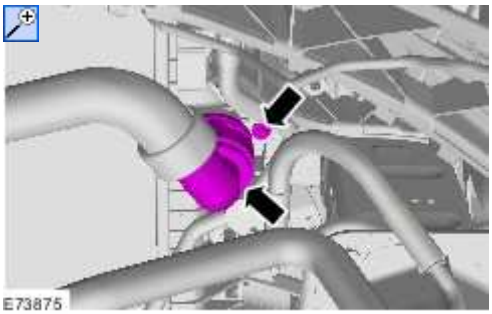
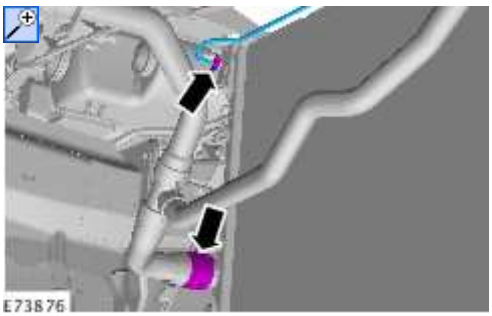
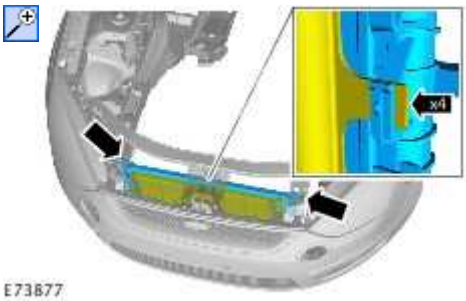




6.



7. NOTE: This step requires the aid of another technician.
   NOTE: Radiator insulators are to be reused unless damaged.
   Remove the cable ties.

Installation

1. NOTE: Make sure that no components catch when installing the radiator.
   To install, reverse the removal procedure.

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Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Specifications	S-MAX/Galaxy 2006.5 (02/2006-)

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Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13° F)	–37°C (–35°F)

Cooling System Refill Capacities

Description	Liters
Cooling system and heater	7.93

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19.6 to 22.5)

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Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Engine Cooling	S-MAX/Galaxy 2006.5 (02/2006-)

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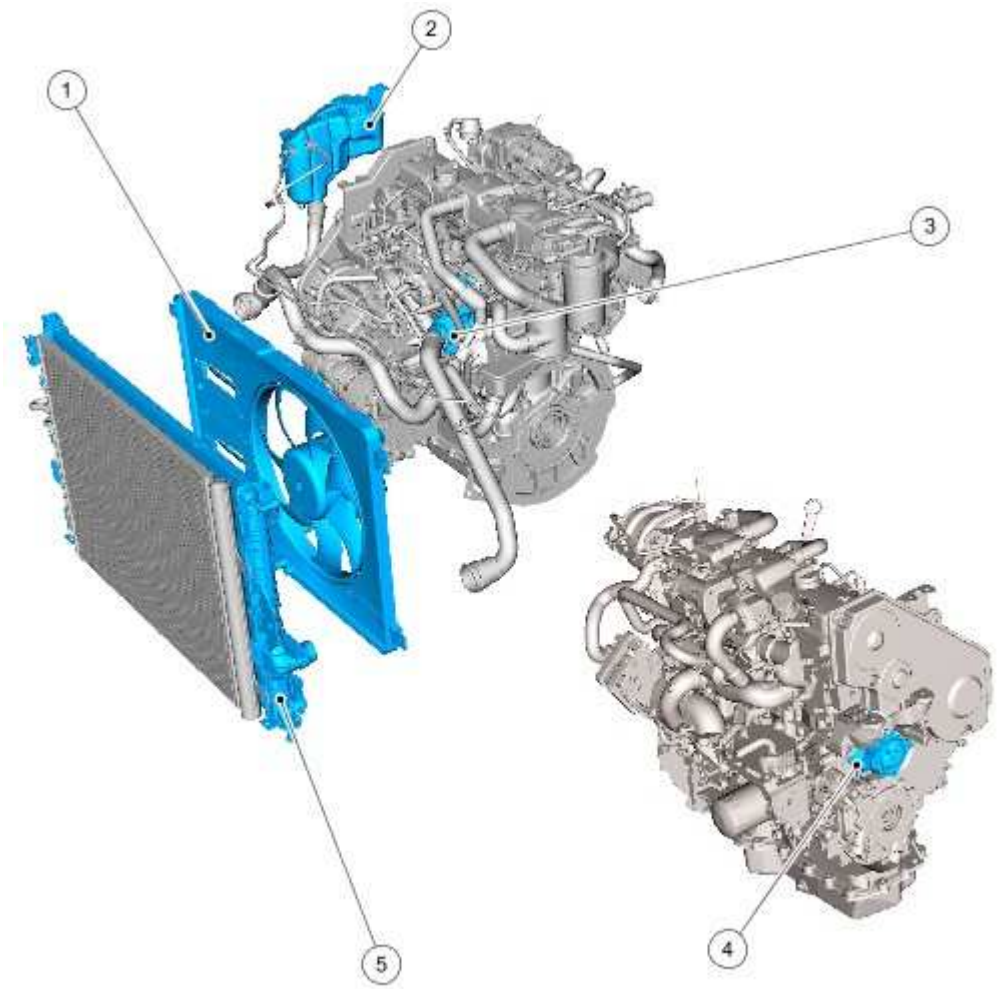
Description and Operation



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Item	Part Number	Description
1	-	Cooling fan motor and shroud
2	-	Coolant expansion tank
3	-	Thermostat housing
4	-	Coolant pump
5	-	Radiator

CAUTION: If the coolant concentration is insufficient, low temperature protection and corrosion resistance will be impaired.
NOTE: Providing the coolant has not been contaminated with other fluids or foreign material, the robust corrosion resistance properties of this coolant means that it can be reused after changing an aluminum cooling system component. The concentration should always be checked and maintained within the specification.
Coolant concentration should be checked through the neck of the coolant expansion tank with a hydrometer. The acceptable range of specific gravity (sg) must be maintained.

The coolant used is an orange colored Motorcraft Super Plus 2000 engine coolant. This is a

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non silicated organic acid technology (OAT) coolant that must not be mixed with other coolant types. For cooling system top up, only use coolant which meets the correct specification.

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Diagnosis and Testing

Special Tool(s)

	Pressure Tester, Cooling System 303-396 (24-001 A)
	Adaptor for 303-396 303-396-09

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Gaskets/seals • Core plug(s) • Hose(s)/hose joints • Coolant expansion tank cap and seal(s) • Coolant expansion tank • Radiator • Coolant pump • Thermostat • Heater core • Exhaust gas recirculation (EGR) cooler	• Fuse(s) • Wiring harness • Electrical connector(s) • Cylinder head temperature (CHT) sensor • Cooling fan motor • Cooling fan module • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Loss of coolant	* Hose(s)/hose joint(s).	* INSPECT the hoses and hose joints. INSTALL a new hose(s) as necessary.
	* Radiator.	* INSPECT the radiator for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new radiator as necessary. REFER to: Radiator (303-03E Engine Cooling - 2.0L

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		Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
	* Water pump.	* INSPECT the coolant pump for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new coolant pump or coolant pump gasket as necessary. REFER to: Coolant Pump (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Thermostat housing.	* INSPECT the thermostat housing for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL a new thermostat housing or thermostat housing gasket as necessary. REFER to: Thermostat Housing (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Coolant expansion tank cap or seal.	* CHECK the coolant expansion tank cap for tightness. If OK, CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
	* Coolant expansion tank.	* INSPECT the seal face on the coolant expansion tank for damage. INSTALL a new coolant expansion tank as necessary.
	* Heater core.	* CHECK the heater core for leaks.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
The engine overheats (signs of coolant boiling)	* Air in cooling system.	* BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Cooling system does not hold pressure.	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion tank cap as necessary. * INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Coolant level/condition.	* CHECK the coolant level. REFILL the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures). * CHECK the coolant condition and concentration. If the coolant is contaminated or the concentration is below specifications, drain and refill with new coolant.

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		REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Radiator grille.	* INSPECT the radiator grille for air restrictions/damage. REPAIR or INSTALL new parts as necessary.
	* Cooling fan motor.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Coolant pump.	* REMOVE AND INSPECT the coolant pump/impeller. INSTALL a new coolant pump/coolant pump gasket as necessary. REFER to: Coolant Pump (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
The engine does not reach normal operating temperature.	* CHT sensor.	* CHECK the cylinder head temperature. REFER to the Ford approved diagnostic tool.
	* Temperature gauge.	* CHECK the instrument cluster engine temperature gauge. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

Component Tests

Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.
NOTE: If the coolant expansion tank cap is rotated counterclockwise by ½ a full turn, the pressurized coolant will be vented to the underside of the coolant expansion tank cap.

1. **1.** Slowly remove the coolant expansion tank cap to release the cooling system pressure.

2. **2.** Install the coolant expansion tank cap.

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3. **3.** Install the special tools 303-396 and 303-396-09 to the coolant expansion tank.

4. **4.** Pressurize the cooling system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Specifications).

5. **5.** Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the cooling system holds pressure, INSTALL a new coolant expansion tank cap. If the cooling system does not hold pressure, check the cooling system thoroughly for coolant leaks.

6. **6.** Check the cooling system by repeating steps 3 and 4 at least twice.

7. **7.** If a coolant leak cannot be found, check the engine for cylinder leakage. Drain the cooling system. Repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).

Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.
Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of coolant scalding, Failure to follow this instruction may result in personal injury.

1. **1.** Remove the coolant expansion tank cap.

2. **2.** Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. **3.** Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing, and note the highest pressure reading obtained.

4. **4.** Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. **5.** If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

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Thermostat Test

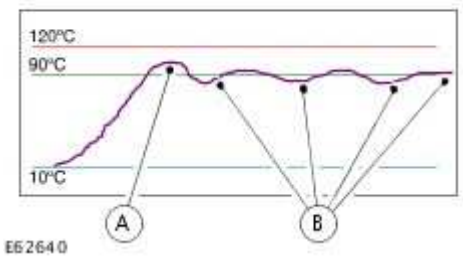
1. **1.** Connect the Ford approved diagnostic tool to the data link connector (DLC).

2. **2.** Using the Ford approved diagnostic tool datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- CHT - cylinder head temperature (CHT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor or CHT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	-	Thermostat opens
B	-	Thermostat settles into a cyclic open and closure pattern

CAUTION: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
If the Ford approved diagnostic tool only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The CHT sensor output is useful to examine the cylinder head temperature rise during the warm-up cycle and later during the normal light throttle cruise test. This sensor output may

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vary between vehicles with manual transmission and vehicles with automatic transmission and should be used for reference only.

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

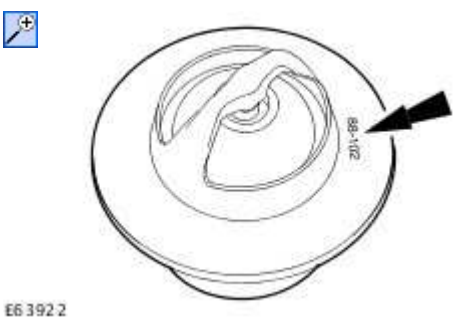
The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford approved diagnostic tool in datalogger mode, the signals recorded should remain within the DEFAULT values set by the Ford approved diagnostic tool.

3. WARNING: Make sure that the Ford approved diagnostic tool is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford approved diagnostic tool in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.
   NOTE: The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford approved diagnostic tool can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.
   NOTE: The results from the test are more conclusive if the engine is cold when the test is started.
   3. Carry out a road test.
   REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

4. **4.** Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.
The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.

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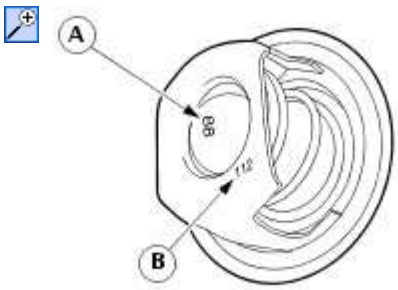

Item	Part Number	Description
A	-	Opening temperature
B	-	Fully open temperature

NOTE: Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.
The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. **5.** INSTALL a new thermostat.
   REFER to: Thermostat (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

6. **6.** Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. **7.** Using the Ford approved diagnostic tool, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

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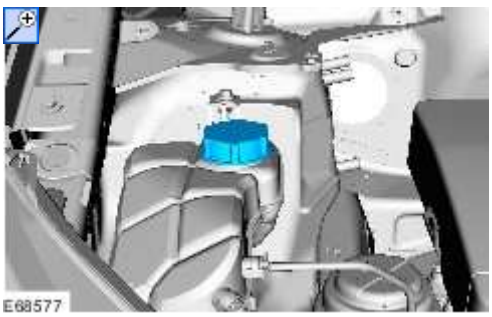
General Procedures

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

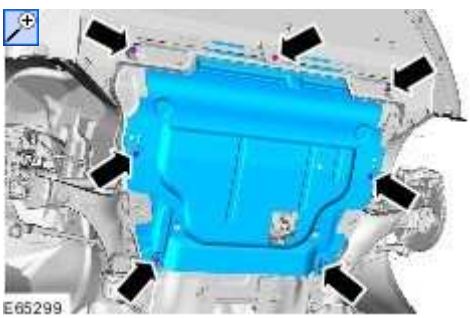
1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.


E68577

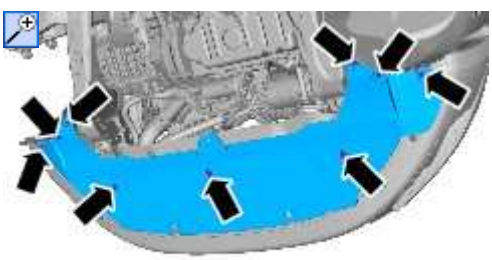
2.

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E65299

4.


E68962

5.

6.

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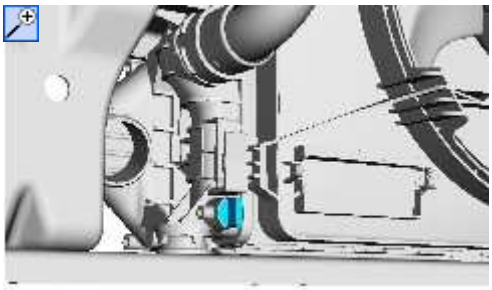

E68578

7. Install the radiator drain plug.
8. Lower the vehicle.

Filling and Bleeding

CAUTION: The fluid level must remain between the MAX and MIN marks.

1. Switch the interior heater blower off.
2. Fill the coolant expansion tank coolant level to the top of the neck.
3. Install the coolant expansion tank cap.
4. Start the engine.
5. Raise the engine speed to 2000 revolutions per minute (RPM) and maintain it for 3 minute.
6. Monitor the coolant level for approximately 3 minutes.
7. Switch the engine off.
8. Check the coolant level.
9. Fill the coolant expansion tank coolant level to the neck of the tank if necessary.
10. Install the coolant expansion tank cap.
11. Start the engine.
12. Raise the engine speed to 2000 RPM.
13. Maintain the engine speed at 2000 RPM for approximately 13 minutes until the engine has reached normal operating temperature.
14. Increase the engine speed to 3000 RPM and maintain it for 5 seconds.
15. Decrease the engine speed to 2000 RPM and maintain it for 15 minutes.
16. Switch the engine off.
17. Check the cooling system for leaks.
18. Raise and support the vehicle.

    Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
19.

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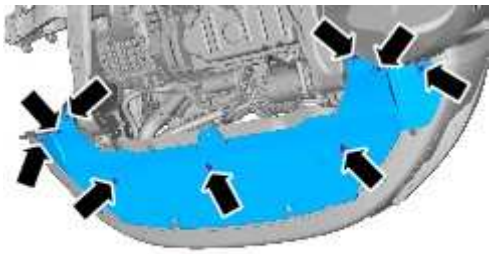
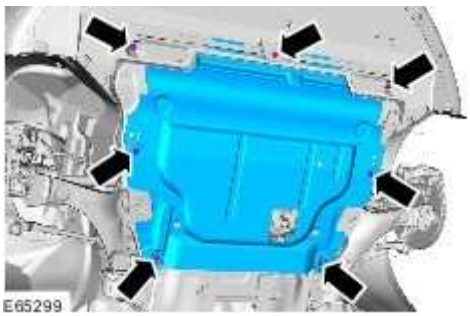


E68962



E65299

20.

21. Lower the vehicle.
22. Allow the engine to cool.
23. Fill the coolant expansion tank coolant level to the MAX mark.

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Print

General Procedures

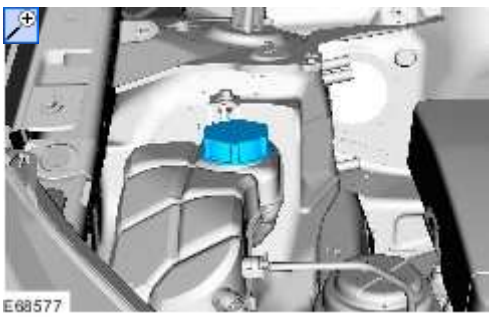
General Equipment

Cooling system vacuum tester and refiller
Fluid container

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
NOTE: Always follow the manufacturer's instructions when handling the equipment.

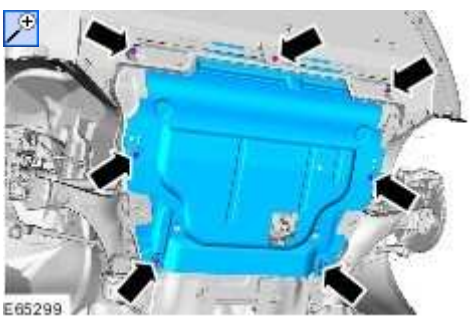
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

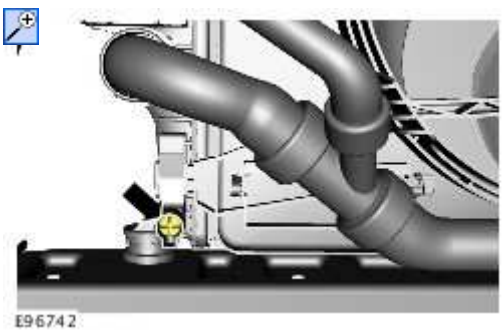

E68577

2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

4.


E65299


E96742

5. WARNING: Be prepared to collect escaping fluid.
Use a suitable coolant hose to drain the coolant.

General Equipment: Fluid container
Loosen: 4 turn(s)

6.

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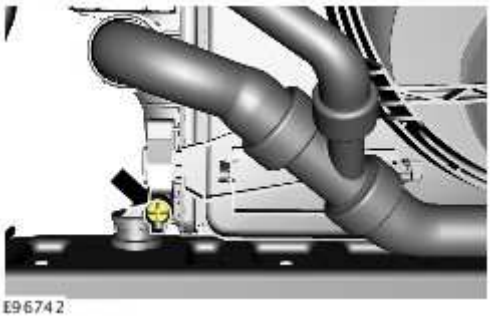
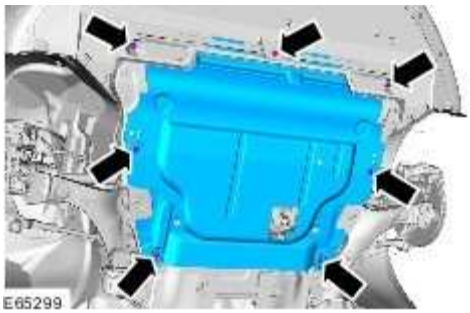

E96742

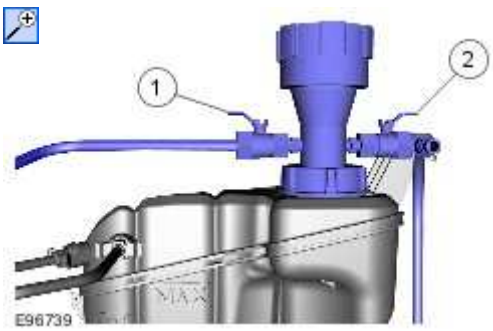

E65299

7.

Evacuating and Filling

1.

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.



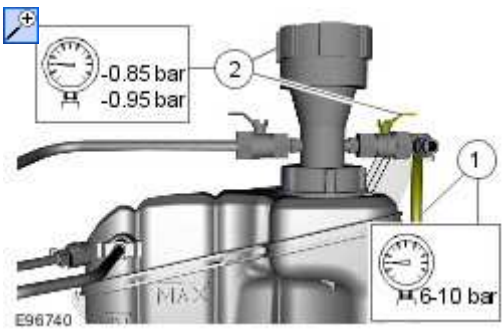
E96739

2.

- *General Equipment:* Cooling system vacuum tester and refiller

3.

1. Close the valve, install the coolant hose and place it into the fluid container.
2. Close the valve and connect the compressed air hose.



E96740

4.

2. Open the valve until the specificied vacuum is achieved.

5.

- Open the valve until the coolant reservoir fluid level is at the MAX mark.

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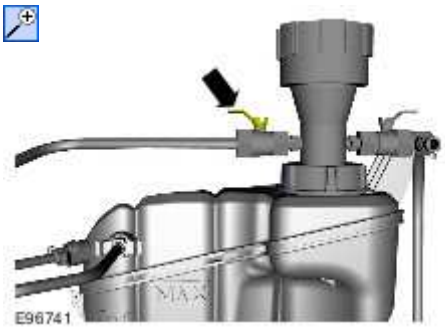
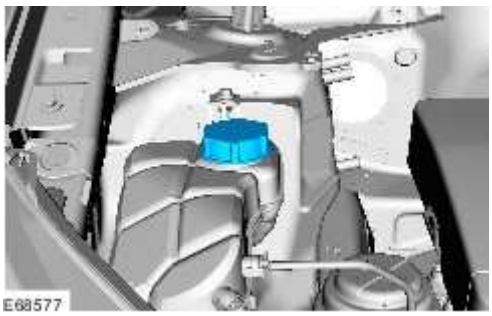


- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.



6.

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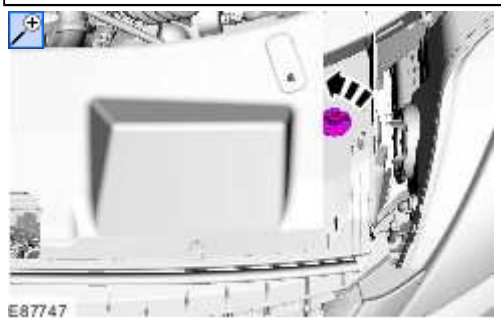
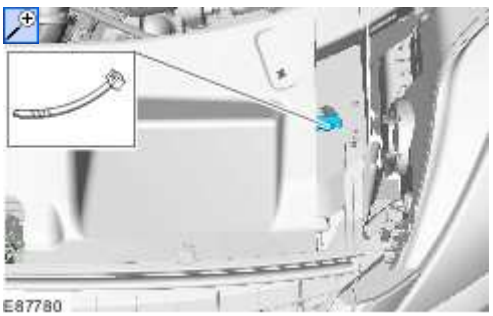
General Procedures

General Equipment

5 mm drill bit
Cable ties
Flat file


E87747

1. On both sides.

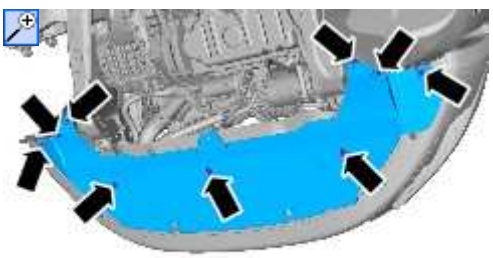

E87780

2. Secure the radiator and condenser assembly to the f panel (on both sides).

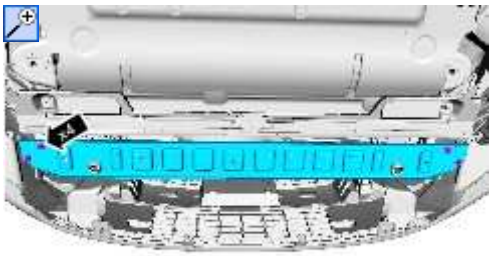
   General Equipment: Cable ties

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).


E68962

4.


E87748

5.

6.

1. *Gen*

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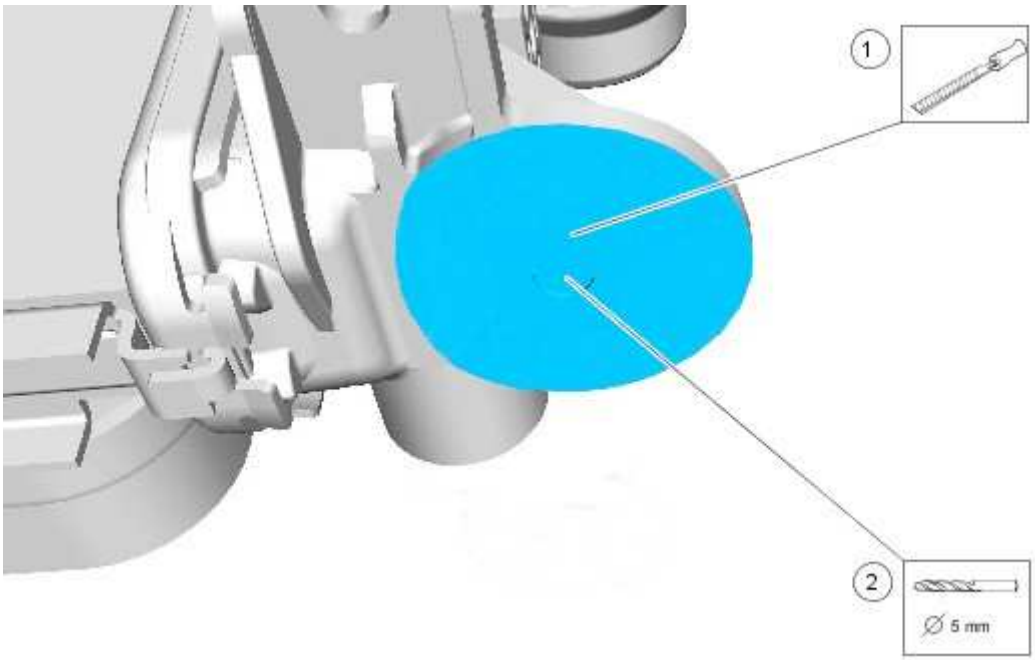

E87749

Equi
Flat

2. *Gen*
Equi
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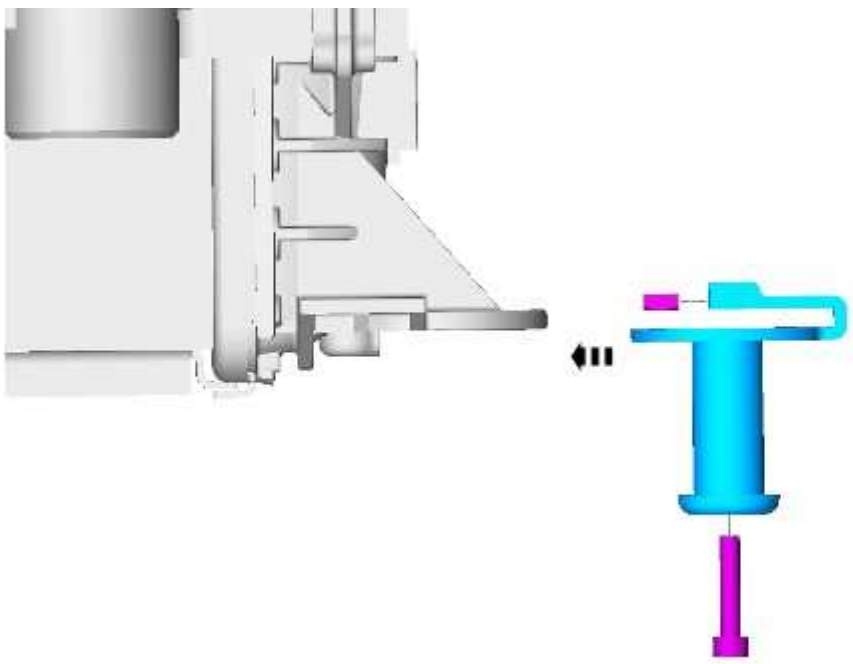
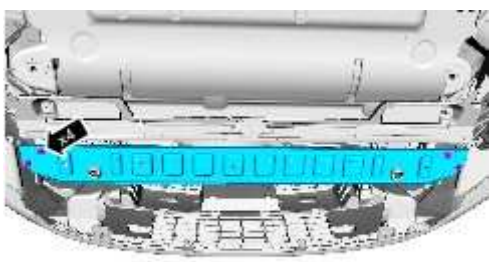
7.



E87750

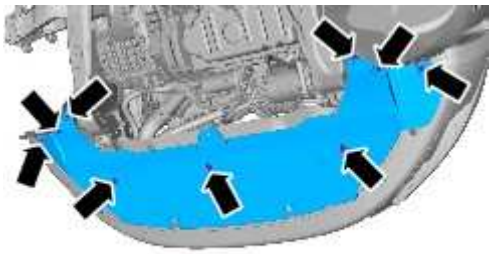
8. *Torque:* 25 Nm



E87748

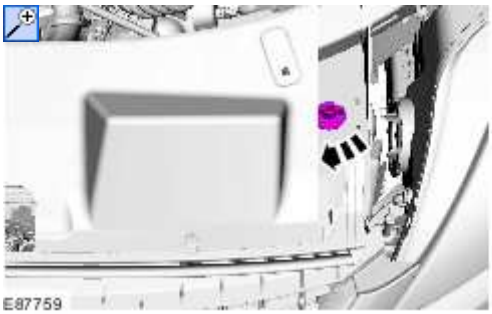
9. *Torque:* 8 Nm

http://vnx.su



E68962

10. Lower the vehicle.
11. Remove the cable ties securing the radiator and con assembly.
    12. On both sides.



E87759

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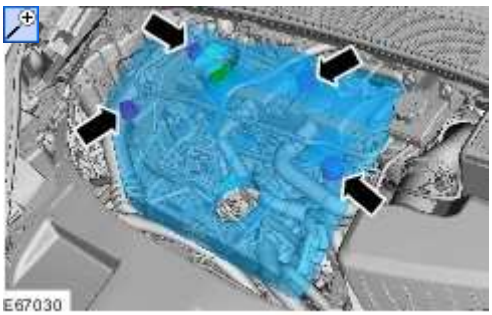
Print

Removal and Installation

Removal

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

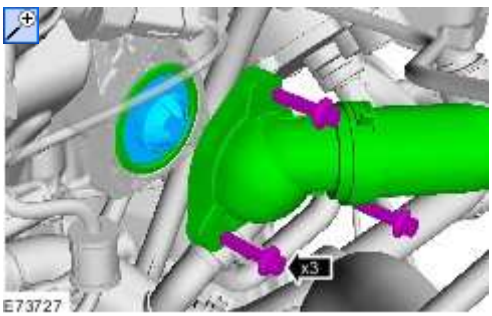


1.

2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).

3. Lower the vehicle.



4. NOTE: The O-ring seal is to be reused unless damaged.
   Torque: 9 Nm

Installation

1. To install, reverse the removal procedure.

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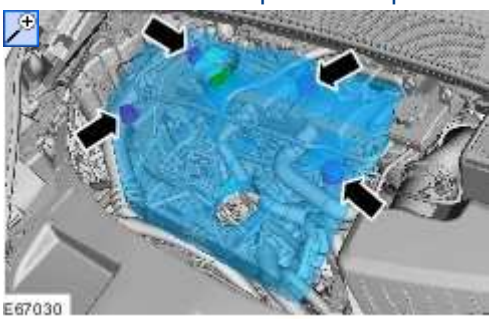
Removal and Installation

General Equipment

Hose clamp remover/installer

Removal

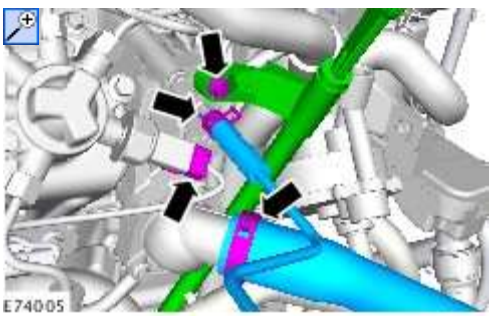
NOTE: Removal steps in this procedure may contain installation details.



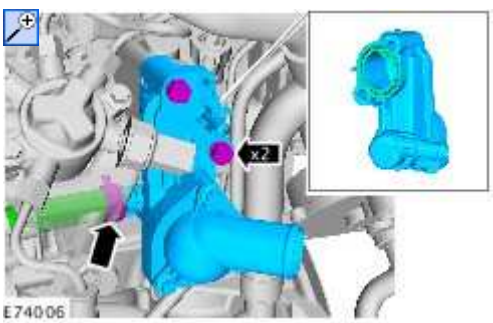
1.

2. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).



3. *General Equipment:* Hose clamp remover/installer
   Torque: 9 Nm



4. NOTE: The O-ring seal is to be reused unless damaged.
   General Equipment: Hose clamp remover/installer
   Torque: 23 Nm

5. NOTE: The O-ring seal is to be reused unless damaged.
   Torque: 9 Nm

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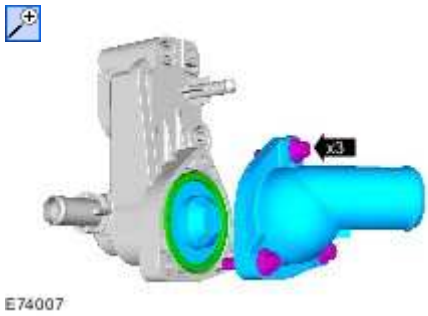

E74007

Installation

1. To install, reverse the removal procedure.

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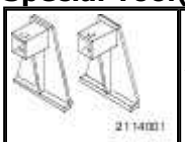
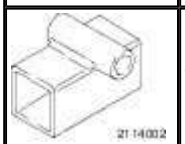
Removal and Installation

Special Tool(s)

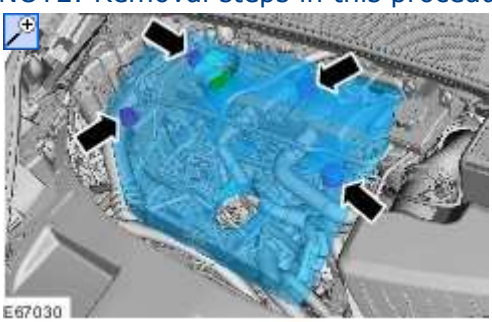
	303-290-01 Adapter for 303-290A
	303-290-02 Adapter for 303-290A
	303-290-03A Adapter for 303-290A
	303-290A Support Bar, Engine

General Equipment

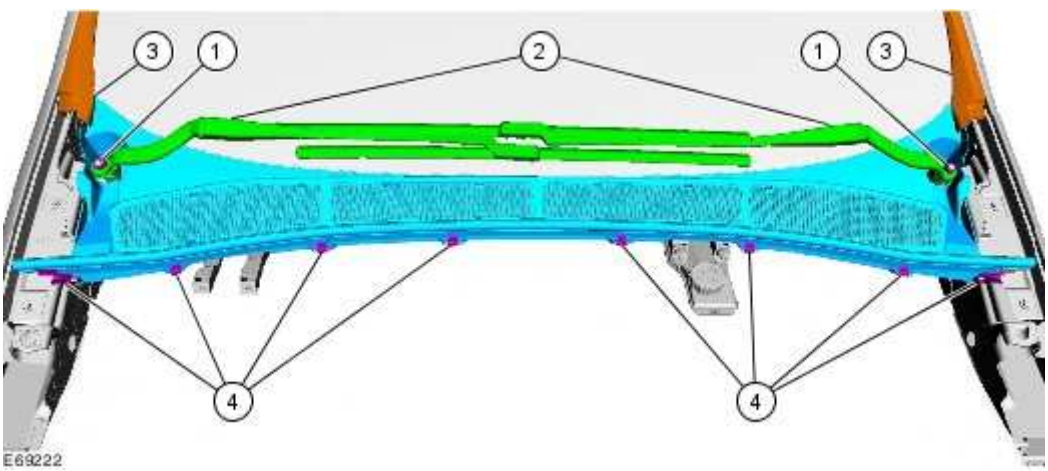
Laminated card

Removal

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



1.



2.

1. *Torq* 22 N
3. Deta the A pillar exte trim pane lowe clips

3.

2. *Torq* 10 N

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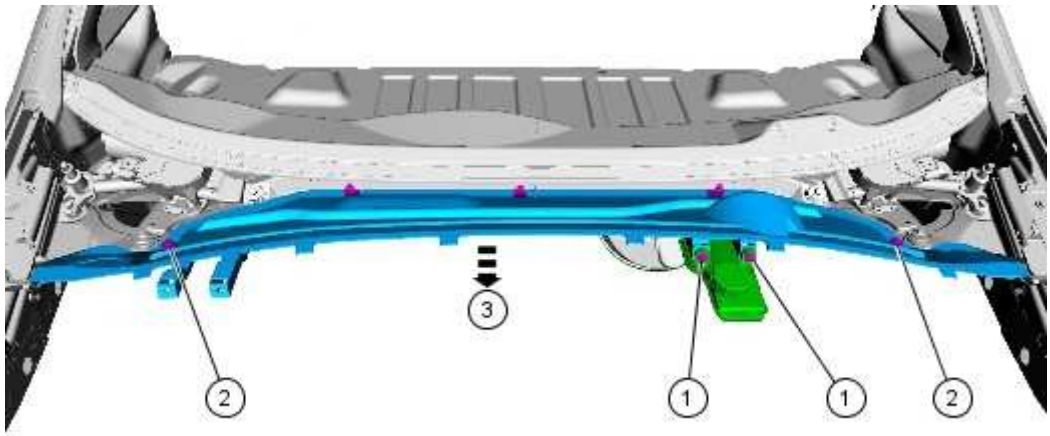
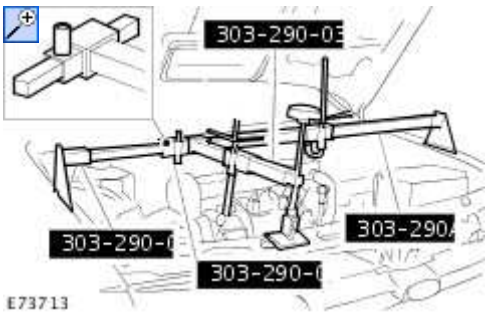


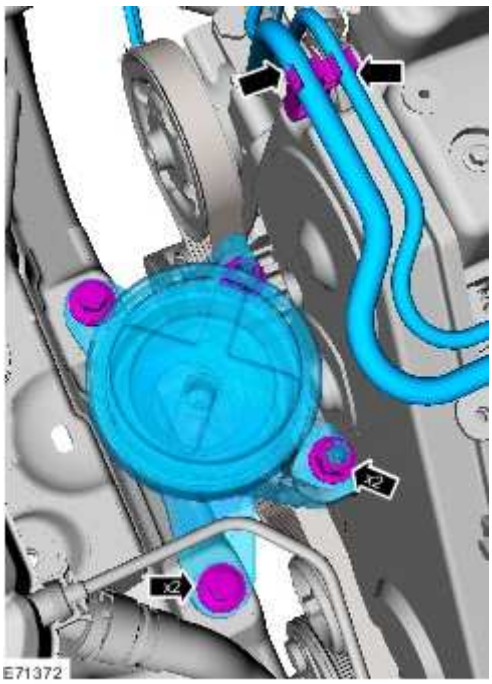
E69223



E73713

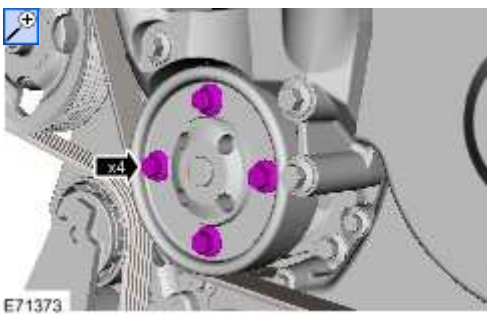
4. Assemble and install the special tools.

   Special Tool(s): 303-290A, 303-290-01, 303-290-02 303-290-03A



E71372

5. *Torque:* 80 Nm



E71373

6. Loosen the coolant pump pulley bolts.

   Torque: 23 Nm

7. Drain the cooling system.

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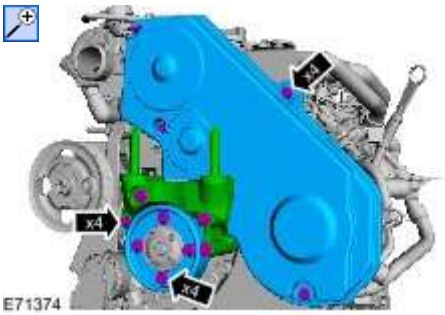
Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

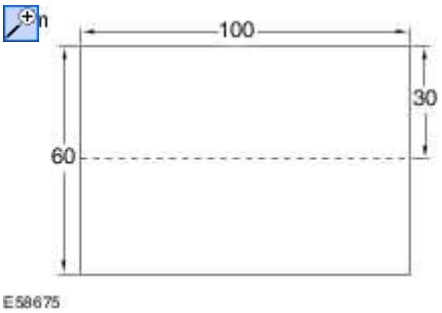
8. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1. Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

9. Lower the vehicle.

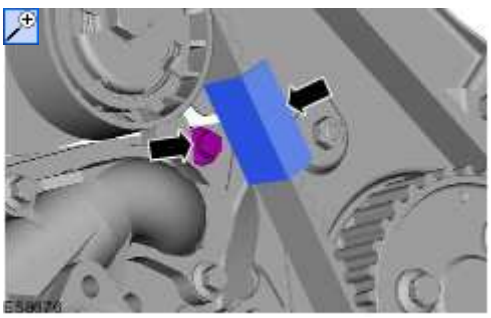


10. *Torque:*
    Engine front mount bracket bolts 28 Nm
    Timing belt cover bolts 7 Nm



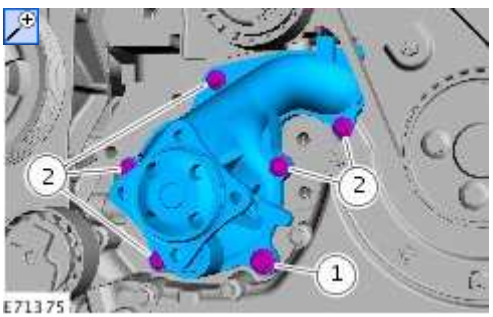
11. Fabricate a timing belt shield.

    General Equipment: Laminated card



12. Protect the timing belt.

    General Equipment: Laminated card
    Torque: 10 Nm



13.
    1. *Torque:* 23 Nm
    2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Bleed the cooling system.

   Refer to: Cooling System Draining, Filling and Bleedi

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(303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

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Removal and Installation

General Equipment

Cable ties

Removal

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

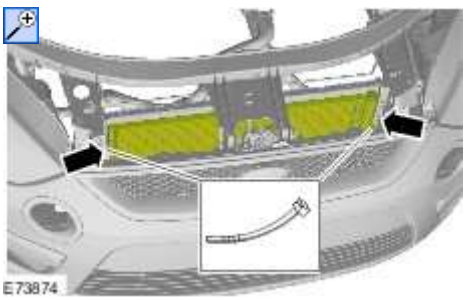
1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).
2. Remove the cooling fan motor and shroud.

   Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
3. Remove the charge air cooler (if equipped).

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
4. Secure the air conditioning (A/C) condenser to the front panel.

   General Equipment: Cable ties



5.

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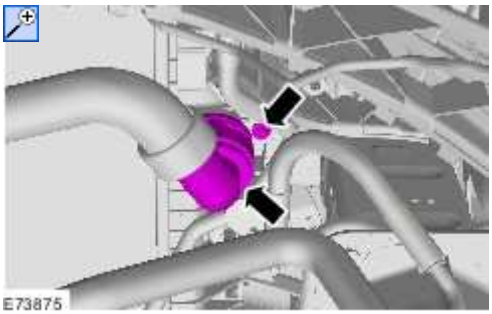
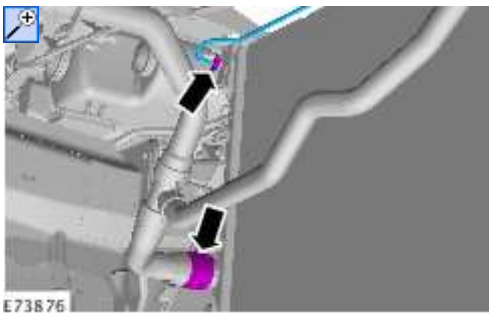
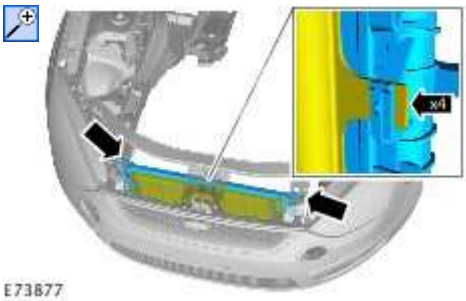




6.



7. NOTE: This step requires the aid of another technician.
   NOTE: Radiator insulators are to be reused unless damaged.
   Remove the cable ties.

Installation

1. NOTE: Make sure that no components catch when installing the radiator.
   To install, reverse the removal procedure.

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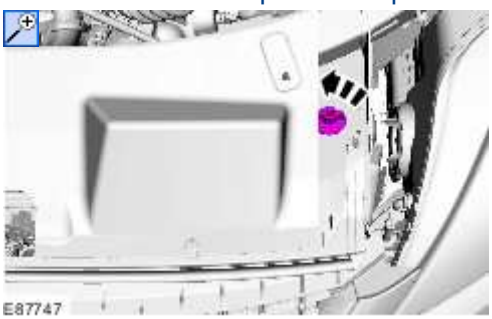
Removal and Installation

General Equipment

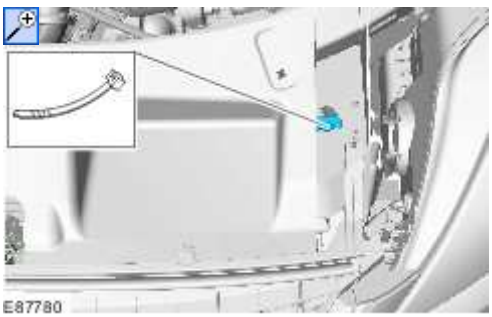
Cable ties

Removal

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

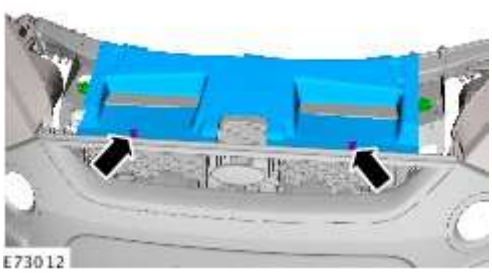


1. On both sides.

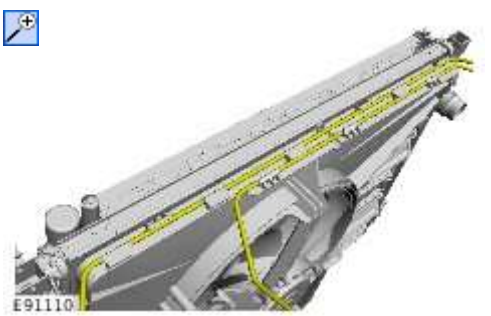


2. Loosely secure the radiator and condenser assembly to the front panel so that it can be lowered by approximately 70 mm (on both sides).

   General Equipment: Cable ties



3.



4.

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

6.

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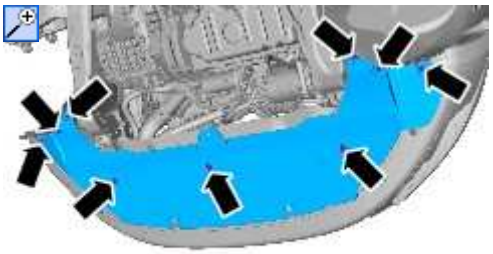
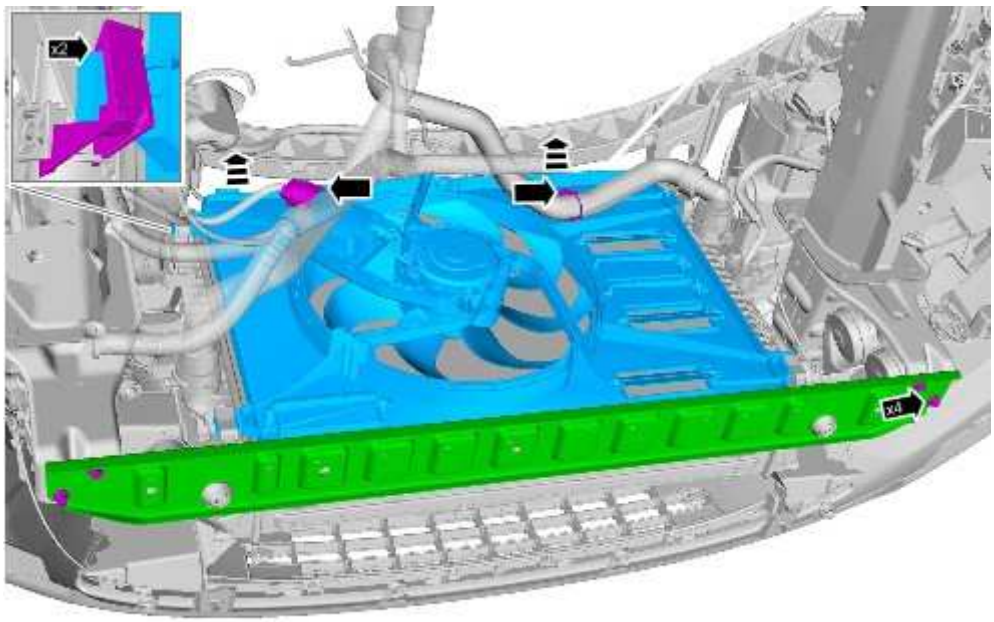


E68962



E71407

7. Lower the radiator and condenser assembly by approximately 70 mm.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Motorcraft Super Plus Antifreeze	WSS-M97B44–D

Antifreeze

Specific Gravity (providing no other additive is in coolant)	Approximate percentage of Anti-Freeze (by volume)	Remains Fluid to	Solidifies at
1.061 at +15°C	50%	–25°C (–13°F)	–37°C (–35°F)

Cooling System Refill Capacities

Description	Liters
Cooling system and heater	8.14

Cooling System Pressure Specification

Description	Pressure kpa (psi)
Radiator pressure test	138 (20)
Coolant expansion tank cap release pressure	135 to 155 (19.6 to 22.5)

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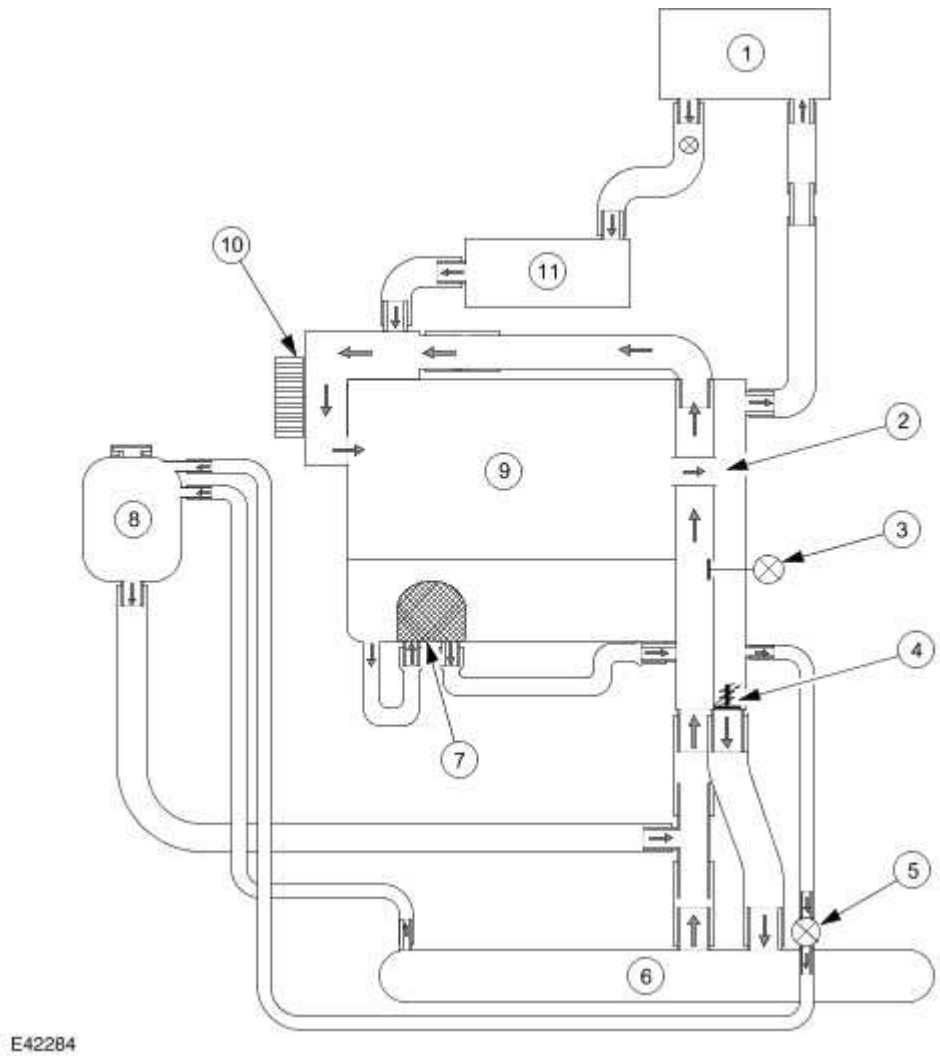
Description and Operation

Coolant circuit



E42284

Item	Part Number	Description
1	-	Heat exchanger
2	-	Thermostat housing
3	-	Bypass solenoid valve
4	-	Thermostat
5	-	Shutoff solenoid valve
6	-	Radiator
7	-	Oil/coolant heat exchanger
8	-	Coolant reservoir
9	-	Cylinder block
10	-	Coolant pump
	-	

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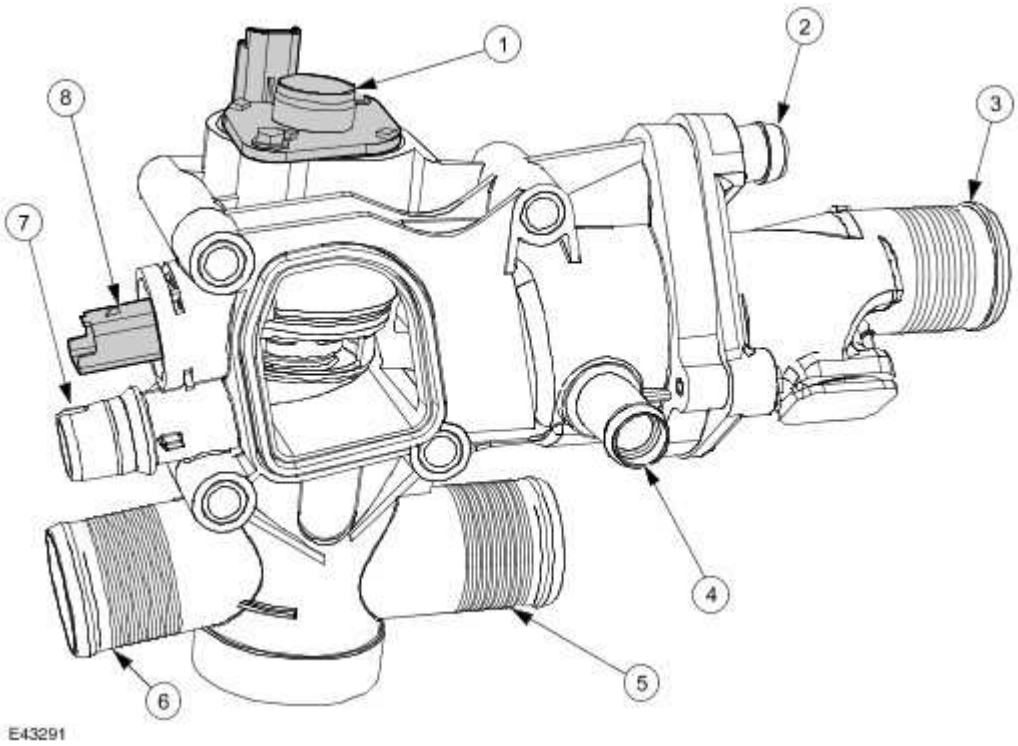
11		EGR cooler

Thermostat housing



Item	Part Number	Description
1	-	Bypass solenoid valve
2	-	Connection to coolant reservoir
3	-	Connection to radiator inlet
4	-	Connection to the oil/coolant heat exchanger
5	-	Connection to radiator outlet
6	-	Connection to coolant pump
7	-	Connection to heat exchanger
8	-	engine coolant temperature (ECT) sensor

WARNING: The ECT sensor must not be removed while the cooling system is pressurised.

The thermostat housing is attached to the cylinder head on the transmission side of the engine.

The ECT sensor is located on the thermostat housing and is attached by means of a clip.

The thermostat housing contains the thermostat and the bypass solenoid valve. The thermostat is a conventional design.

The thermostat housing is made of plastic and cannot be disassembled when the vehicle is serviced. The ECT sensor can be replaced separately.

Operating principle

The shut-off solenoid valve is located in the feed from the thermostat housing to the coolant reservoir. It limits coolant flow to the coolant reservoir during the engine warm up phase.

The bypass solenoid valve is located between the coolant outlet on the cylinder head and the supply to the coolant pump. It limits the coolant flow to the coolant pump during the

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warm up phase.

Most of the coolant is passed to the heat exchanger and flows back to the coolant pump via the exhaust gas recirculation (EGR) cooler.

At a certain coolant temperature, the bypass solenoid valve starts to open and remains open until the operating temperature of the engine is reached.

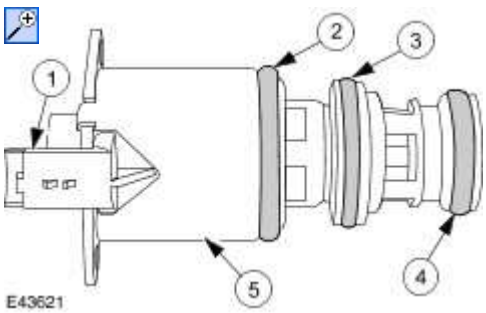
As soon as the engine reaches operating temperature, the thermostat is opened and the bypass solenoid valve closes proportionally in relation to the thermostat.

When the engine is warmed up, the thermostat is wide open, as is the shutoff solenoid valve, and the bypass solenoid valve is fully closed. The large coolant circuit is open in this state.

Using a shutoff solenoid valve and a bypass solenoid valve speeds up the warm up phase of the engine, and a faster temperature rise in the passenger compartment is achieved.

The bypass solenoid valve and the shutoff solenoid valve are controlled by the powertrain control module (PCM).

Bypass solenoid valve



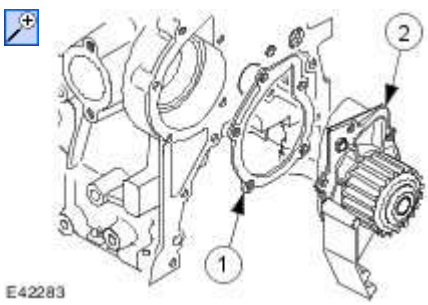
Item	Part Number	Description
1	-	Wiring harness electrical connector
2	-	External seal
3	-	Seal
4	-	Seal
5	-	Solenoid valve

Using a bypass solenoid valve enables the engine to reach operating temperature more quickly.

According to the value supplied by the PCM, the bypass solenoid valve partly or completely prevents the coolant flow between the coolant outlet on the cylinder head and the coolant pump.

It cannot be replaced by itself.

Coolant pump



Item	Part Number	Description
	-	

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1		Seal
	2 -	Coolant pump

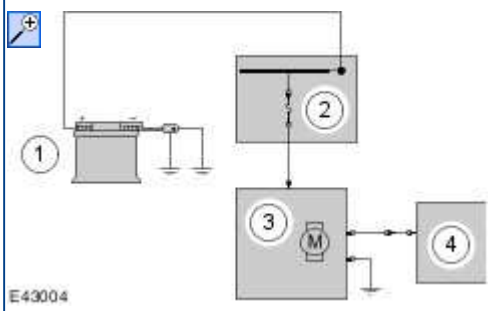
The coolant pump is installed on the timing end of the engine and is driven by the timing belt.

The coolant pump housing is made of an aluminium alloy and is secured with five bolts.

The impeller of the coolant pump is made of plastic.

The joint between the coolant pump and the cylinder block is made using a rubberised metal gasket.

Radiator fan control



Item	Part Number	Description
1	-	Vehicle battery
2	-	Battery junction box
3	-	Cooling fan module
4	-	PCM

Radiator fan speed is controlled by the radiator fan module as a function of input signals from the PCM.

The radiator fan module is located on the radiator fan housing.

Communication between the radiator fan module and the PCM is done on the CAN bus using pulse width modulation.

The cooling fan speed is regulated steplessly.

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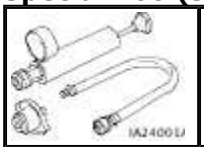
Diagnosis and Testing

Special Tool(s)

	Pressure Tester, Cooling System 303-396 (24-001 A)
	Adaptor for 303-396 303-396-09

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Gaskets/seals • Core plug(s) • Hose(s)/hose joints • Coolant expansion tank cap and seal(s) • Coolant expansion tank • Radiator • Coolant pump • Thermostat • Heater core • Exhaust gas recirculation (EGR) cooler	• Fuse(s) • Wiring harness • Electrical connector(s) • Engine coolant temperature (ECT) sensor • Cooling fan motor • Cooling fan module • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Loss of coolant	* Coolant expansion tank cap or seal(s).	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as necessary.
	* Cooling system.	* INSPECT the cooling system for leaks. CARRY OUT the Pressure Test Component Test in this section.

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		INSTALL new component(s) as necessary.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
The engine overheats (signs of coolant boiling)	* Air in cooling system.	* BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Cooling system does not hold pressure.	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion tank cap as necessary. * INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Coolant level/condition.	* CHECK the coolant level. REFILL the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures). * CHECK the coolant condition and concentration. If the coolant is contaminated or the concentration is below specifications, drain and refill with new coolant. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Radiator grille.	* INSPECT the radiator grille for air restrictions/damage. REPAIR or INSTALL new parts as necessary.
	* Cooling fan motor.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
	* Coolant pump.	* REMOVE AND INSPECT the coolant pump/impeller. INSTALL a new coolant pump/coolant pump gasket as necessary. REFER to: Coolant Pump (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L

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		Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
The engine does not reach normal operating temperature.	* ECT sensor.	* CHECK the engine coolant temperature. REFER to the Ford approved diagnostic tool.
	* Temperature gauge.	* CHECK the instrument cluster engine temperature gauge. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Component Tests

Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.
NOTE: If the coolant expansion tank cap is rotated counterclockwise by ½ a full turn, the pressurized coolant will be vented to the underside of the coolant expansion tank cap.

1. **1.** Slowly remove the coolant expansion tank cap to release the cooling system pressure.
2. **2.** Install the coolant expansion tank cap.
3. **3.** Install the special tools 303-396 and 303-396-09 to the coolant expansion tank.
4. **4.** Pressurize the cooling system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Specifications).
5. **5.** Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the cooling system holds pressure, INSTALL a new coolant expansion tank cap. If the cooling system does not hold pressure, check the cooling system thoroughly for coolant leaks.
6. **6.** Check the cooling system by repeating steps 3 and 4 at least twice.
7. **7.** If a coolant leak cannot be found, check the engine for cylinder leakage. Drain the cooling system. Repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) -

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DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).

Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.
Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of coolant scalding, Failure to follow this instruction may result in personal injury.

1. **1.** Remove the coolant expansion tank cap.

2. **2.** Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. **3.** Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing, and note the highest pressure reading obtained.

4. **4.** Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. **5.** If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

1. **1.** Connect the Ford approved diagnostic tool to the data link connector (DLC).

2. **2.** Using the Ford approved diagnostic tool datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- CHT - cylinder head temperature (CHT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor or CHT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

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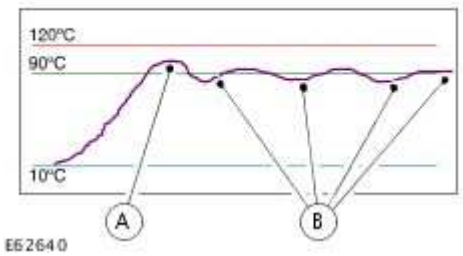
The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	-	Thermostat opens
B	-	Thermostat settles into a cyclic open and closure pattern

CAUTION: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.

If the Ford approved diagnostic tool only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The CHT sensor output is useful to examine the cylinder head temperature rise during the warm-up cycle and later during the normal light throttle cruise test. This sensor output may vary between vehicles with manual transmission and vehicles with automatic transmission and should be used for reference only.

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford approved diagnostic tool in data logger mode, the signals recorded should remain within the DEFAULT values set by the Ford approved diagnostic tool.

3. WARNING: Make sure that the Ford approved diagnostic tool is placed in the

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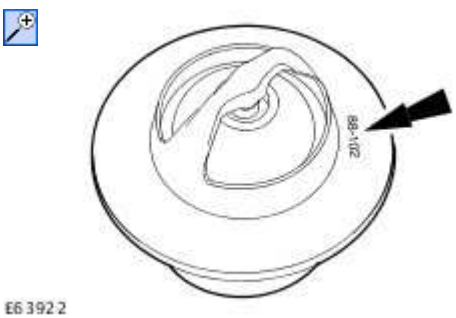
vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford approved diagnostic tool in the deployment path of any air bag. Failure to follow these instructions may result in personal injury.
NOTE: The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford approved diagnostic tool can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.
NOTE: The results from the test are more conclusive if the engine is cold when the test is started.

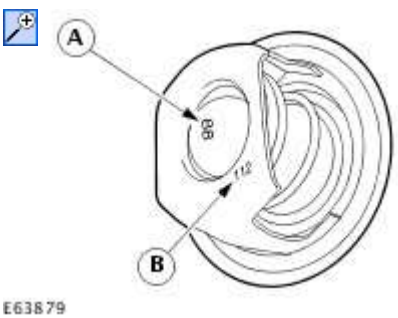
3. Carry out a road test.
REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

4. **4.** Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.
The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	-	Opening temperature
B	-	Fully open temperature

NOTE: Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.
The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

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If the ECT value fails to maintain a constant value and falls back to lower figures, typically between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. **5.** INSTALL a new thermostat.
   REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

6. **6.** Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. **7.** Using the Ford approved diagnostic tool, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

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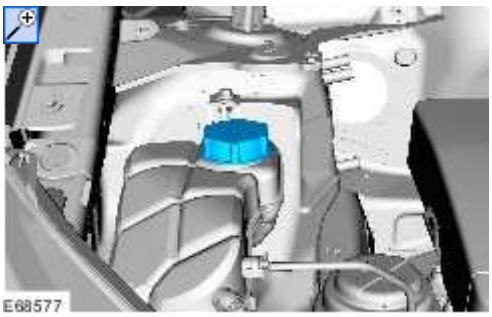
General Procedures

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

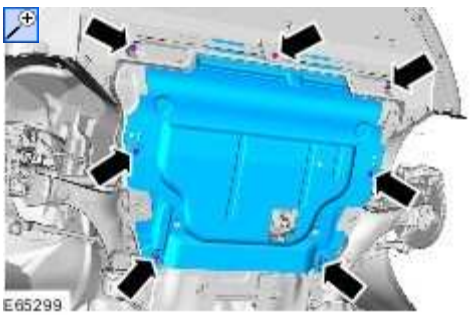
1. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.


E68577

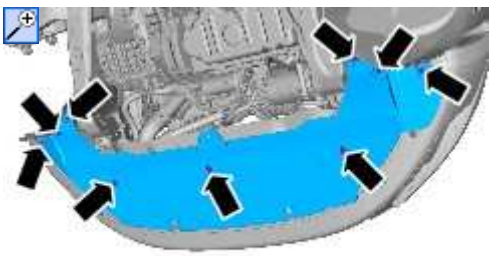
2.

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E65299

4.


E68962

5.

6.

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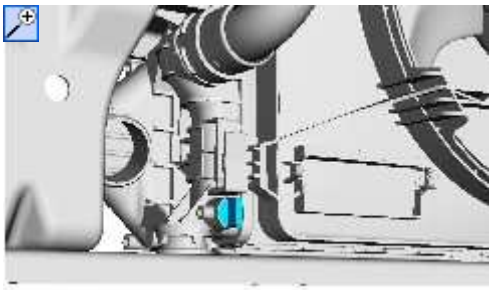

E68578

7. Install the radiator drain plug.
8. Lower the vehicle.

Filling and Bleeding

CAUTION: The fluid level must remain between the MAX and MIN marks.

1. Switch the interior heater blower off.
2. Fill the coolant expansion tank coolant level to the top of the neck.
3. Install the coolant expansion tank cap.
4. Start the engine.
5. Raise the engine speed to 2000 revolutions per minute (RPM) and maintain it for 3 minute.
6. Monitor the coolant level for approximately 3 minutes.
7. Switch the engine off.
8. Check the coolant level.
9. Fill the coolant expansion tank coolant level to the neck of the tank if necessary.
10. Install the coolant expansion tank cap.
11. Start the engine.
12. Raise the engine speed to 2000 RPM.
13. Maintain the engine speed at 2000 RPM for approximately 13 minutes until the engine has reached normal operating temperature.
14. Increase the engine speed to 3000 RPM and maintain it for 5 seconds.
15. Decrease the engine speed to 2000 RPM and maintain it for 15 minutes.
16. Switch the engine off.
17. Check the cooling system for leaks.
18. Raise and support the vehicle.

    Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
19.

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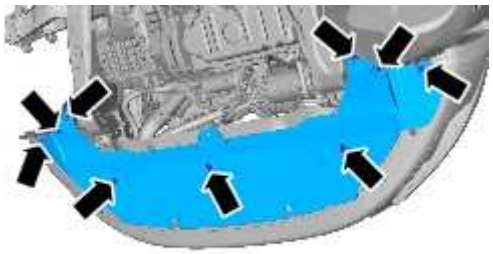
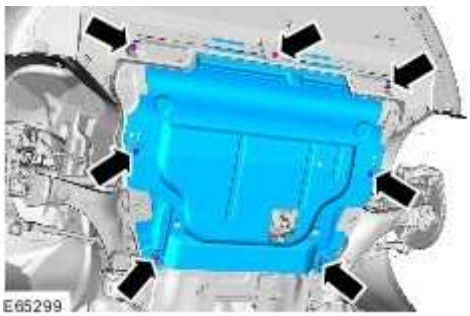


E68962



E65299

20.

21. Lower the vehicle.
22. Allow the engine to cool.
23. Fill the coolant expansion tank coolant level to the MAX mark.

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General Procedures

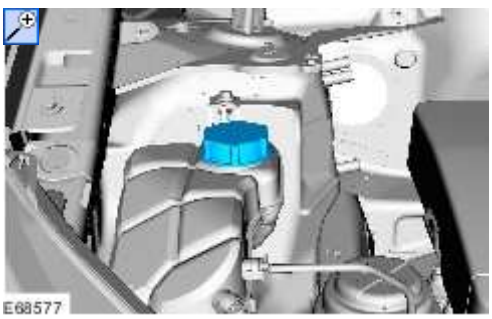
General Equipment

Cooling system vacuum tester and refiller
Fluid container

Draining

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
NOTE: Always follow the manufacturer's instructions when handling the equipment.

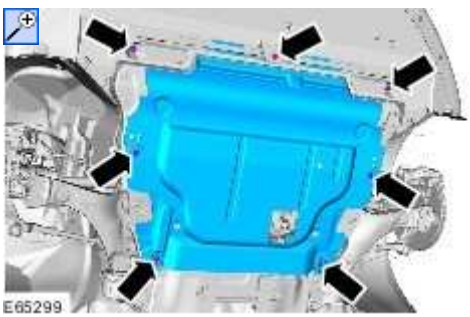
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Description and Operation).

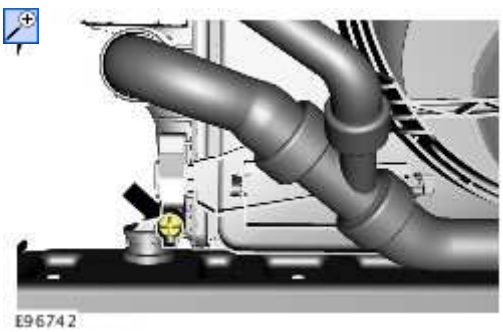

E68577

2. Release the cooling system pressure by slowly turning the coolant expansion tank cap between 2 and 3 turns.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

4.


E65299


E96742

5. WARNING: Be prepared to collect escaping fluid.
Use a suitable coolant hose to drain the coolant.

General Equipment: Fluid container
Loosen: 4 turn(s)

6.

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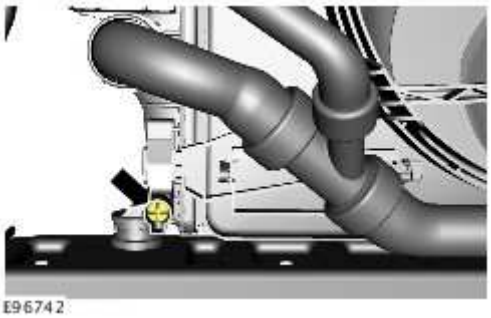
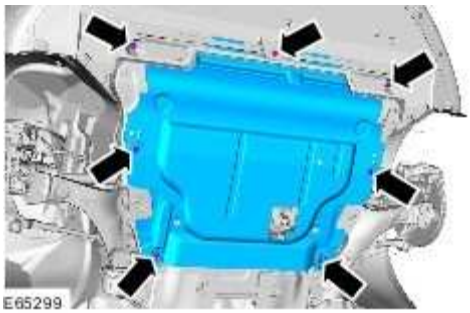

E96742

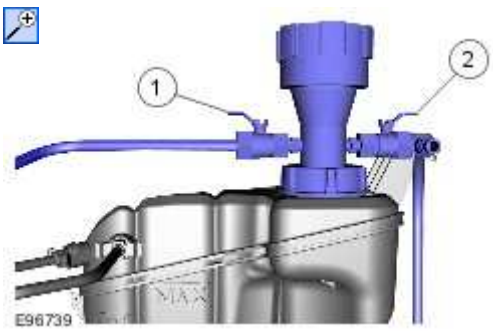

E65299

7.

Evacuating and Filling

1.

- If the cooling system was completely drained, fill the fluid container with the full cooling system fill capacity plus 0.5L of additional coolant.
- If the cooling system was partially drained, fill the fluid container with the removed and spilled amount of coolant plus 1.0L of additional coolant. When in doubt always use the full cooling system fill capacity plus 0.5L of additional coolant.



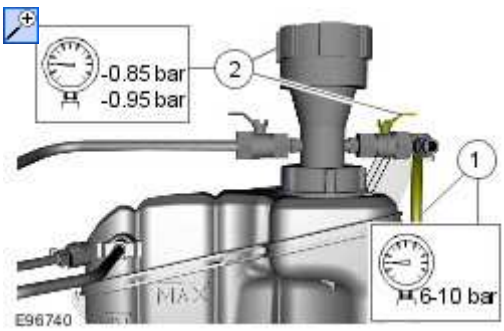
E96739

2.

- *General Equipment:* Cooling system vacuum tester and refiller

3.

1. Close the valve, install the coolant hose and place it into the fluid container.
2. Close the valve and connect the compressed air hose.



E96740

4.

2. Open the valve until the specificied vacuum is achieved.

5.

- Open the valve until the coolant reservoir fluid level is at the MAX mark.

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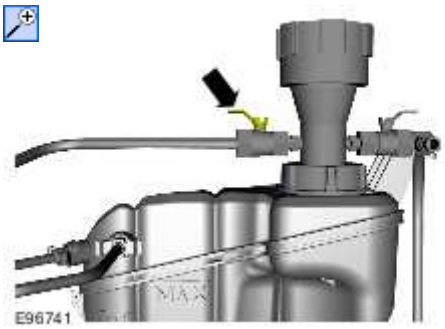
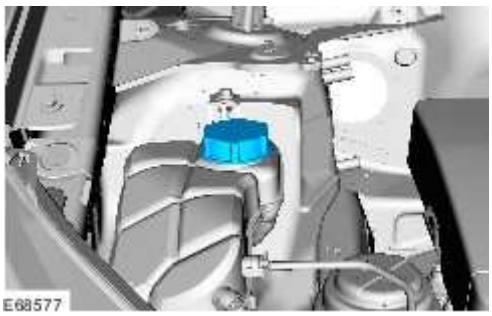


- If no coolant is visible in the coolant expansion tank, add 2.0L of coolant to the fluid container and repeat the evacuating and filling procedure.



6.

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Removal and Installation

General Equipment

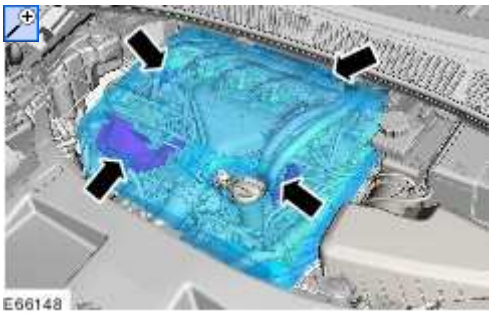
Hose clamp remover/installer

Removal

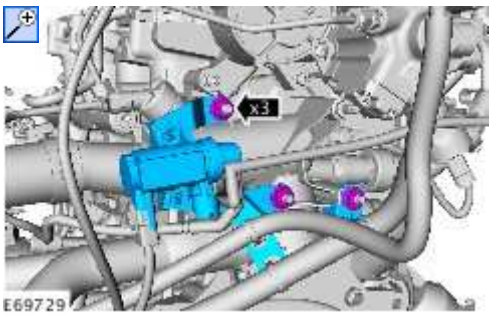
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

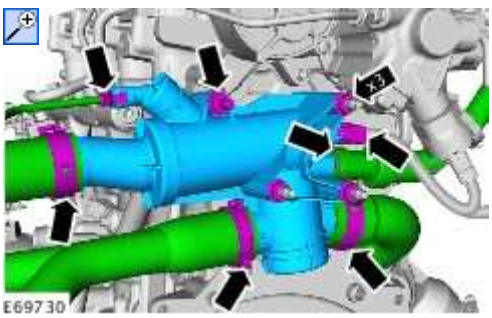
   Refer to: Cooling System Draining, Filling and Bleeding (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



2.



3. *Torque:* 18 Nm



4. *General Equipment:* Hose clamp remover/installer
   Torque: 10 Nm

5. NOTE: The O-ring seal is to be reused unless damaged
   General Equipment: Hose clamp remover/installer

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Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

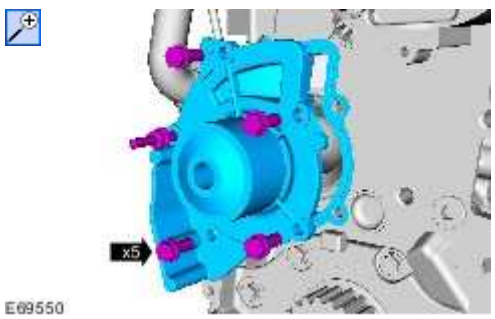
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

2. Remove the timing belt.

   Refer to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



3. *Torque:* 16 Nm

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material.
   To install, reverse the removal procedure.

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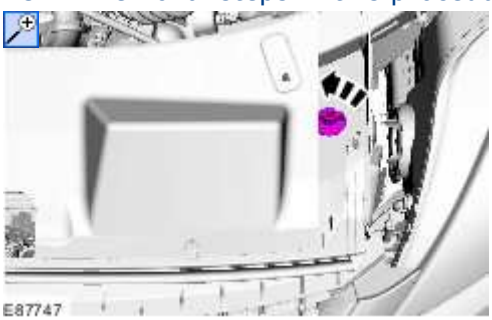
Removal and Installation

General Equipment

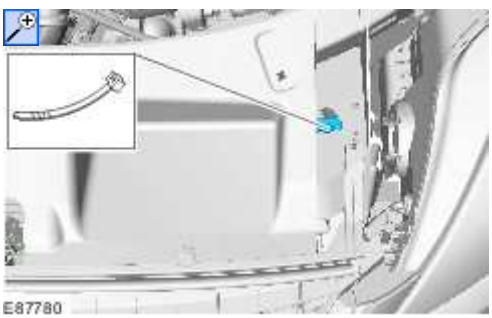
Cable ties

Removal

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

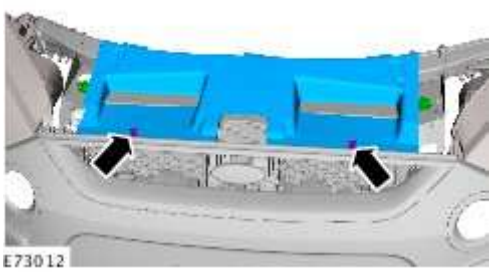


1. On both sides.

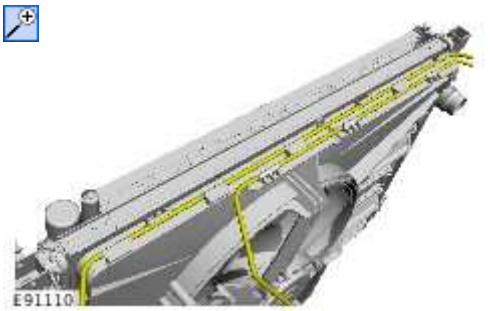


2. Loosely secure the radiator and condenser assembly to the front panel so that it can be lowered by approximately 70 mm (on both sides).

   General Equipment: Cable ties



3.



4.

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.

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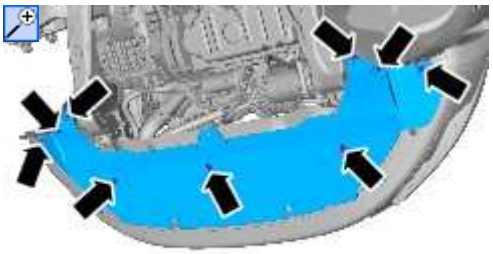

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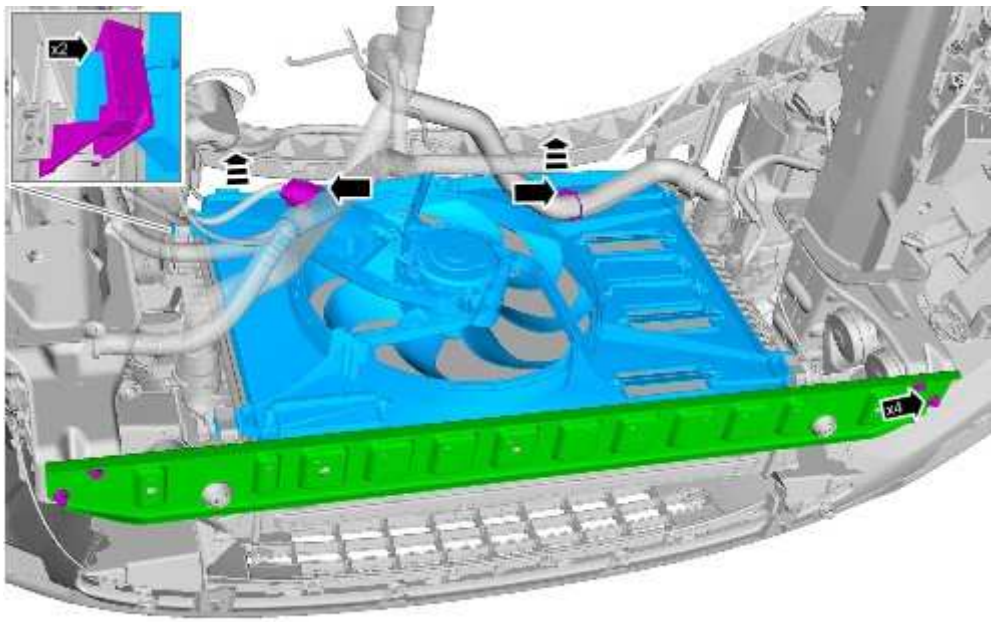

E71407

7. Lower the radiator and condenser assembly by approximately 70 mm.

   Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Cable ties

Removal

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

1. Drain the cooling system.

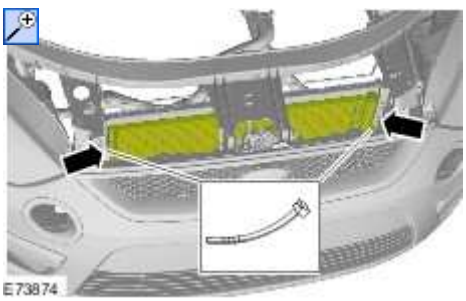
   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

2. Remove the cooling fan motor and shroud.

   Refer to: Cooling Fan Motor and Shroud (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

3. Remove the charge air cooler (if equipped).

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).



4. Secure the air conditioning (A/C) condenser to the front panel.

   General Equipment: Cable ties

5.

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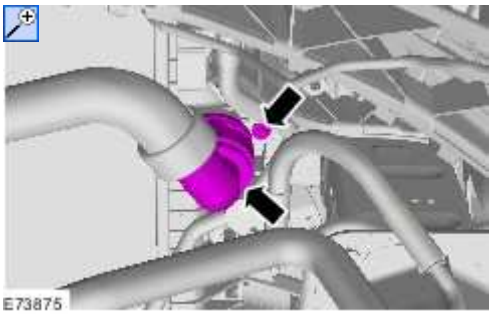
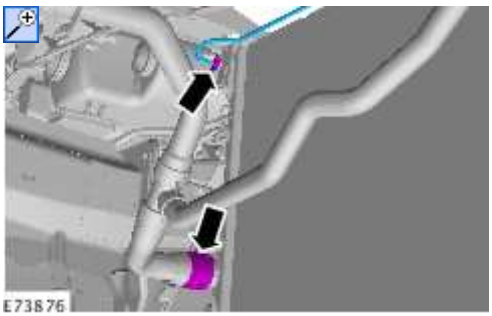
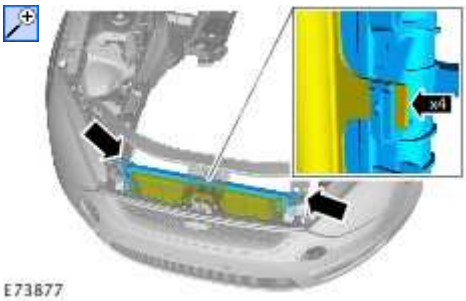




6.



7. NOTE: This step requires the aid of another technician.
   NOTE: Radiator insulators are to be reused unless damaged.
   Remove the cable ties.

Installation

1. NOTE: Make sure that no components catch when installing the radiator.
   To install, reverse the removal procedure.

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Diagnosis and Testing

Special Tool(s)

	Pressure Tester, Cooling System 303-396 (24-001 A)
	Adaptor for 303-396 303-396-09

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Coolant leaks • Gaskets/seals • Core plug(s) • Hose(s)/hose joints • Coolant expansion tank cap and seal(s) • Coolant expansion tank • Radiator • Coolant pump • Thermostat • Heater core • Exhaust gas recirculation (EGR) cooler	• Fuse(s) • Wiring harness • Electrical connector(s) • Engine coolant temperature (ECT) sensor • Cooling fan motor • Cooling fan module • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Loss of coolant	* Coolant expansion tank cap or seal(s).	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion cap as necessary.
	* Cooling system.	* INSPECT the cooling system for leaks. CARRY OUT the Pressure Test Component Test in this section. INSTALL new component(s) as necessary.
	* Engine.	* INSPECT the engine, cylinder head, cylinder block and cylinder head gasket.

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		REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
The engine overheats (signs of coolant boiling)	* Air in cooling system.	* BLEED the cooling system. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Cooling system does not hold pressure.	* CHECK the coolant expansion tank cap for tightness and damage. INSTALL a new coolant expansion tank cap as necessary. * INSPECT the engine, cylinder head, cylinder block and cylinder head gasket. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Coolant level/condition.	* CHECK the coolant level. REFILL the cooling system as necessary. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures). * CHECK the coolant condition and concentration. If the coolant is contaminated or the concentration is below specifications, drain and refill with new coolant. REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).
	* Radiator grille.	* INSPECT the radiator grille for air restrictions/damage. REPAIR or INSTALL new parts as necessary.
	* Cooling fan motor.	* CHECK the operation of the cooling fan. REFER to the Ford approved diagnostic tool.
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
	* Coolant pump.	* REMOVE AND INSPECT the coolant pump/impeller. INSTALL a new coolant pump/coolant pump gasket as necessary. REFER to: Coolant Pump (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).
	* Engine.	* INSPECT the engine, cylinder head, cylinder block

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		and cylinder head gasket. REFER to: Cylinder Head (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
The engine does not reach normal operating temperature.	* ECT sensor.	* CHECK the engine coolant temperature. REFER to the Ford approved diagnostic tool.
	* Temperature gauge.	* CHECK the instrument cluster engine temperature gauge. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
	* Thermostat.	* CARRY OUT the Thermostat Test Component Test in this section. INSTALL a new thermostat as necessary. REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Component Tests

Pressure Test

WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth to prevent the possibility of coolant scalding. Failure to follow this instruction may result in personal injury.
NOTE: If the coolant expansion tank cap is rotated counterclockwise by ½ a full turn, the pressurized coolant will be vented to the underside of the coolant expansion tank cap.

1. **1.** Slowly remove the coolant expansion tank cap to release the cooling system pressure.
2. **2.** Install the coolant expansion tank cap.
3. **3.** Install the special tools 303-396 and 303-396-09 to the coolant expansion tank.
4. **4.** Pressurize the cooling system to the coolant expansion tank cap release pressure.
   REFER to: Specifications (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Specifications).
5. **5.** Observe the cooling system pressure tester gauge reading for approximately two minutes. The pressure should not drop during this time. If the cooling system holds pressure, INSTALL a new coolant expansion tank cap. If the cooling system does not hold pressure, check the cooling system thoroughly for coolant leaks.
6. **6.** Check the cooling system by repeating steps 3 and 4 at least twice.
7. **7.** If a coolant leak cannot be found, check the engine for cylinder leakage. Drain the cooling system. Repair any coolant leaks found and fill and bleed the cooling system as necessary.
   REFER to: Cooling System Draining, Filling and Bleeding (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).

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Radiator Leak Test, Removed From Vehicle

CAUTION: Radiator internal pressure must not exceed 130 kpa (20 psi) or damage may result.
Clean the radiator thoroughly before leak testing it, to prevent contamination of the water in the test tank. Leak test the radiator in clean water with 138 kpa (20 psi) air pressure. Check it thoroughly for air leaks. INSTALL a new radiator if necessary.
REFER to: Radiator (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

Coolant Expansion Tank Cap Pressure Test

WARNING: When releasing the cooling system pressure, cover the expansion tank cap with a thick cloth to prevent the possibility of coolant scalding, Failure to follow this instruction may result in personal injury.

1. **1.** Remove the coolant expansion tank cap.

2. **2.** Use water to clean the area of the rubber seal and pressure relief valve. Install the pressure tester and adapter and immerse the coolant expansion tank cap in water .

NOTE: If the plunger of the pump is depressed too quickly, an erroneous pressure reading will result.

3. **3.** Slowly depress the plunger of the pressure test pump until the pressure gauge reading stops increasing, and note the highest pressure reading obtained.

4. **4.** Release pressure by turning the pressure relief screw counterclockwise. Tighten the pressure relief screw and repeat step 3 at least twice to make sure the pressure test reading is repeatable and within acceptable gauge reading limits of the coolant expansion tank cap.

5. **5.** If the pressure test gauge readings are not within the acceptable gauge reading limits, INSTALL a new coolant expansion tank cap.

Thermostat Test

1. **1.** Connect the Ford approved diagnostic tool to the data link connector (DLC).

2. **2.** Using the Ford approved diagnostic tool datalogger function, SELECT the following sensors (as applicable to the application):

- IAT - intake air temperature (IAT) sensor
- ECT - engine coolant temperature (ECT) sensor
- CHT - cylinder head temperature (CHT) sensor
- LOAD - engine load
- VSS - vehicle speed sensor (VSS)
- RPM - engine speed
- DSRPM - desired engine speed

The IAT sensor output is useful if the engine being tested is cold or after an over-night cold soak. The ECT sensor or CHT sensor and the IAT sensor should either indicate the same value or be within 1 to 2 degrees Celsius of each other.

The ECT sensor output is important to display as it indicates the engine warm-up and opening temperature for the thermostat. It will initially indicate a slightly higher reading

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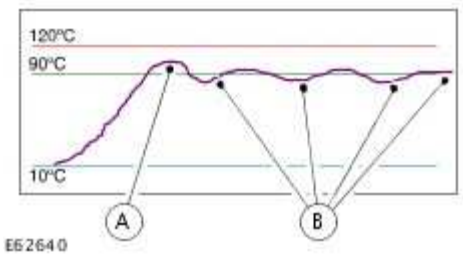
just before the thermostat opens and then drops back before settling to a near flat line output (see graphic below).



Item	Part Number	Description
A	-	Thermostat opens
B	-	Thermostat settles into a cyclic open and closure pattern

CAUTION: If the ECT sensor output reaches the 120ºC default line under normal cooling system pressure, internal damage may be caused to the engine and a diagnostic trouble code (DTC) will be set in the PCM. The test should be stopped and the cause located and corrected. If the cooling system does not pressurize, the coolant will boil at 100ºC which may also damage the engine. CARRY OUT the Coolant Expansion Tank Cap Pressure Test Component Test in this section.
If the Ford approved diagnostic tool only allows the ECT sensor to be displayed in volts, refer to the following table for corresponding Celsius values:

Volts	ºCelsius
1.33	60
1.02	70
0.78	80
0.60	90
0.46	100
0.35	110
0.27	120

The CHT sensor output is useful to examine the cylinder head temperature rise during the warm-up cycle and later during the normal light throttle cruise test. This sensor output may vary between vehicles with manual transmission and vehicles with automatic transmission and should be used for reference only.

The LOAD display is used for reference as it is necessary to maintain a stable load line during the test. It is necessary to carry out the test under normal light throttle cruise driving conditions and average loads, typically 40% to 70% of the load value.

The VSS output is used for reference but can help to identify misfires and sensors which fail during the warm-up cycle.

The RPM display indicates the engine speed and can be compared with the DSRPM.

The DSRPM is the desired or calculated idle speed which the PCM commands the engine to reach. If the thermostat opens too early (before the correct opening temperature has been reached), the engine will not reach this value.

When using the Ford approved diagnostic tool in data logger mode, the signals recorded should remain within the DEFAULT values set by the Ford approved diagnostic tool.

3. WARNING: Make sure that the Ford approved diagnostic tool is placed in the vehicle so that it does not interfere with the safe operation of the vehicle. Do not place the Ford approved diagnostic tool in the deployment path of any air bag.

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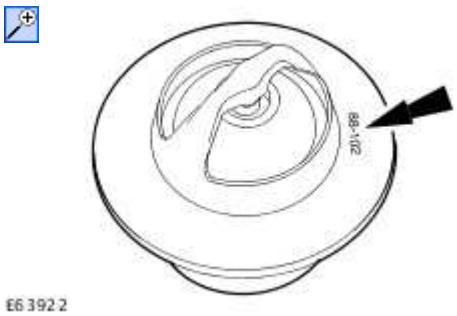
Failure to follow these instructions may result in personal injury.
NOTE: The road test is best carried out with the aid of another technician in the vehicle to enable the vehicle to be driven safely while the sensor outputs are monitored within datalogger. If there is only one technician available, the Ford approved diagnostic tool can be set up (using the record/capture mode camera icon) before leaving the workshop to record a 16 km (10 mile) test.
NOTE: The results from the test are more conclusive if the engine is cold when the test is started.

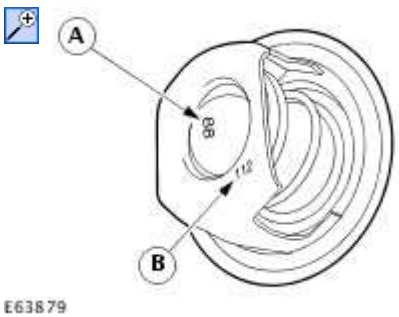
3. Carry out a road test.
REFER to: Road/Roller Testing (100-00 General Information, Description and Operation).

4. **4.** Drive the vehicle at a constant throttle opening and set speed until the ECT value settles into a shallow rise and fall signal, close to a straight line. This indicates that the thermostat is functioning correctly.

NOTE: Some thermostats indicate the temperature(s) in Celsius and Fahrenheit.
The graphic below shows the location and an example of the opening temperature (88ºC) and fully open temperature (102ºC) of a thermostat.



The graphic below shows an alternative method used to show the opening temperature (88ºC) and fully open temperature (112ºC) of a thermostat.



Item	Part Number	Description
A	-	Opening temperature
B	-	Fully open temperature

NOTE: Generally, most thermostats maintain a coolant temperature between 88ºC (190ºF) and 92ºC (198ºF) although dual stage electric thermostats may increase the coolant temperature up to 100ºC (212ºF) under light engine load conditions.
The engine should start cleanly and the ECT value will rise quite quickly with smooth progression. If the ECT signal appears unstable or erratic, the ECT sensor, electrical connector and wiring harness to the PCM need to be visually inspected for damage, chafing or water ingress.

The temperature should rise to approximately 90ºC for a thermostat that has an 88ºC value. The signal value will then fall as cooler coolant enters the engine.

If the ECT value fails to maintain a constant value and falls back to lower figures, typically

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between 60ºC (140ºF) and 70ºC (150ºF), the thermostat and its sealing function within the thermostat housing must be checked.

5. **5.** INSTALL a new thermostat.
   REFER to: Thermostat (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Removal and Installation).

6. **6.** Carry out another road test from step 1 using the same criteria to confirm that the concern has been rectified.

7. **7.** Using the Ford approved diagnostic tool, clear the PCM keep alive memory (KAM) or electrically erasable programmable read only memory (EEPROM) so that new drive values can be learnt.

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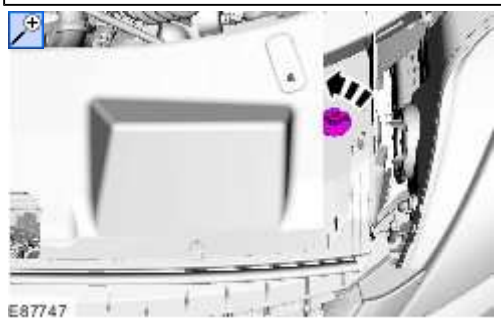
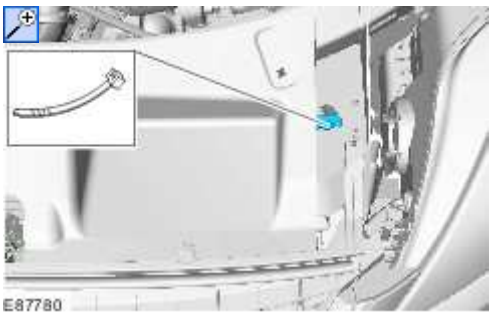
General Procedures

General Equipment

5 mm drill bit
Cable ties
Flat file


E87747

1. On both sides.

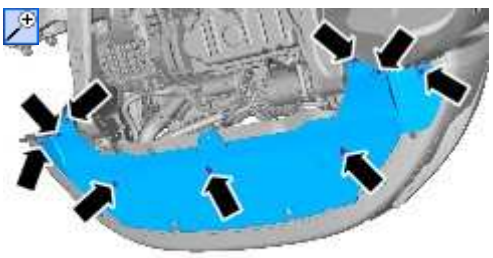

E87780

2. Secure the radiator and condenser assembly to the f panel (on both sides).

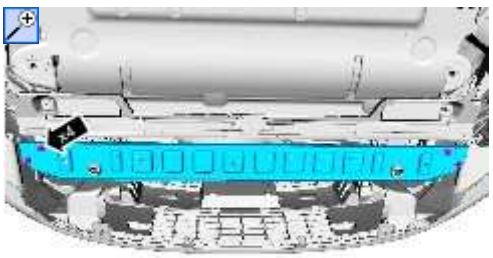
   General Equipment: Cable ties

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).


E68962

4.


E87748

5.

6.

1. *Gen*
   Equi

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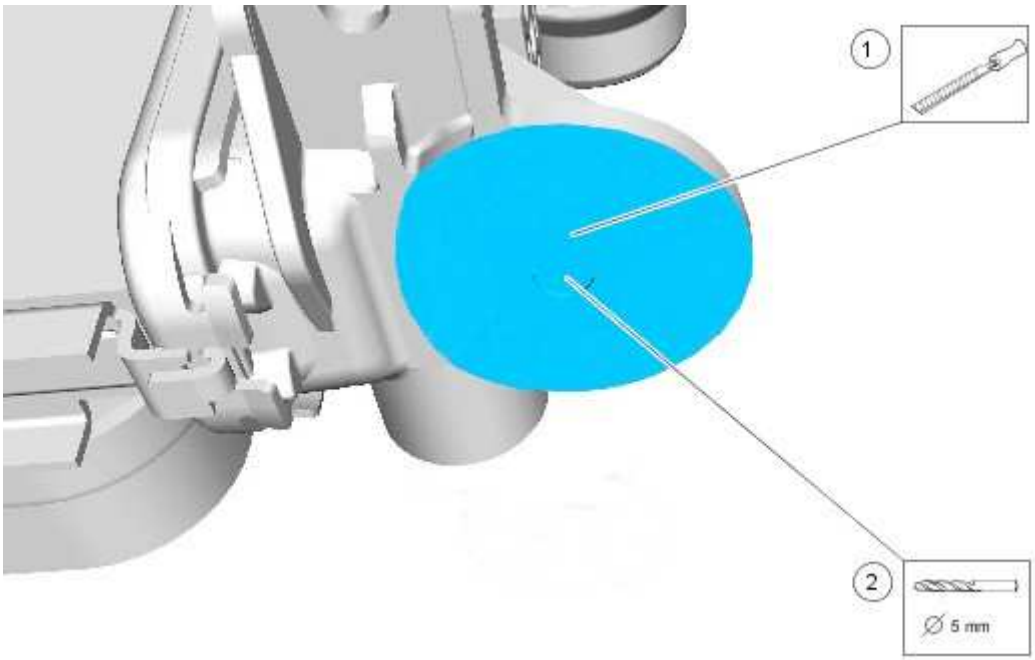

E87749

2. Flat
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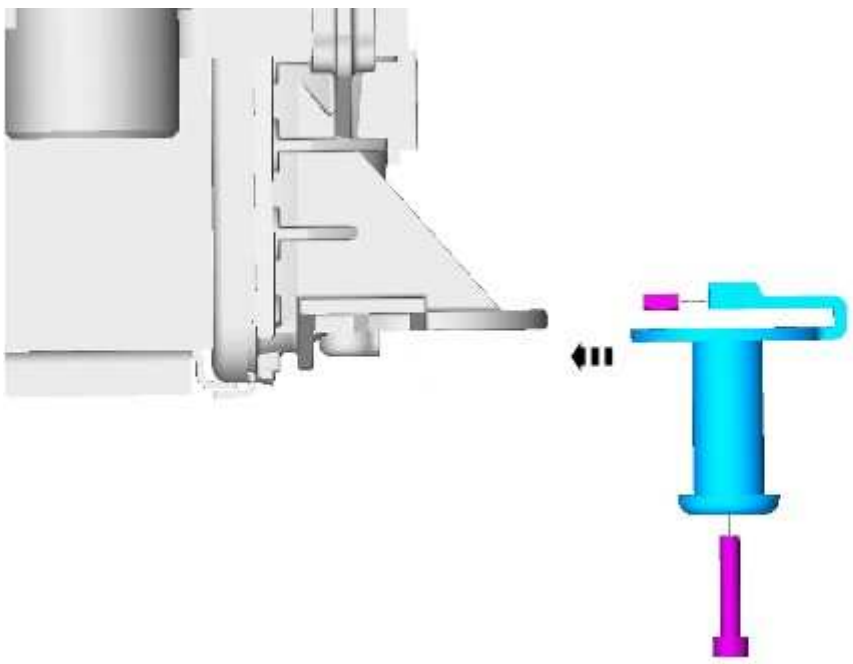

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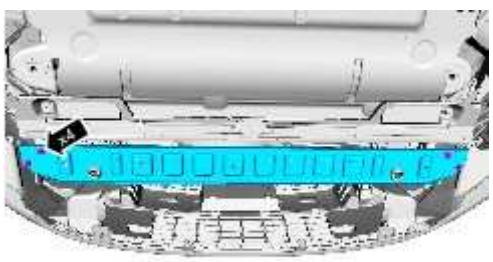

E87748

8. *Torque:* 25 Nm

9. *Torque:* 8 Nm

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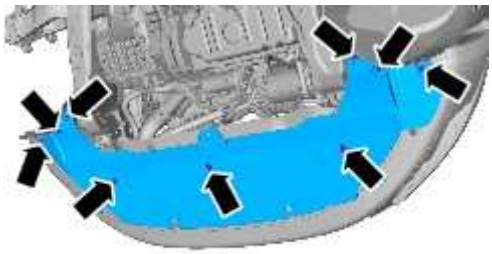
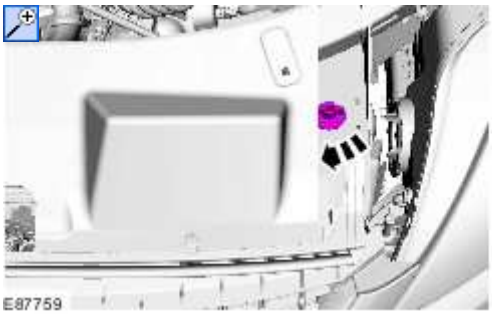


E68962

10. Lower the vehicle.
11. Remove the cable ties securing the radiator and con assembly.
    12. On both sides.



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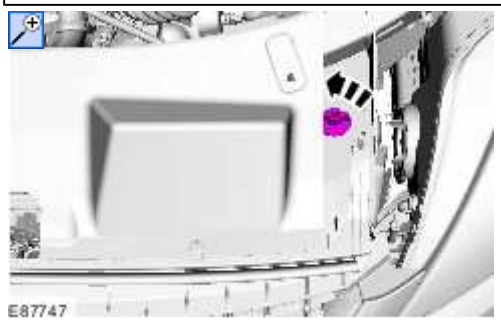
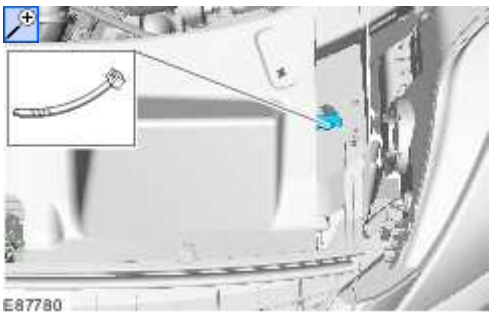
General Procedures

General Equipment

5 mm drill bit
Cable ties
Flat file


E87747

1. On both sides.

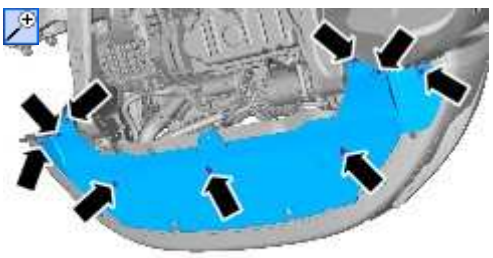

E87780

2. Secure the radiator and condenser assembly to the f panel (on both sides).

   General Equipment: Cable ties

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).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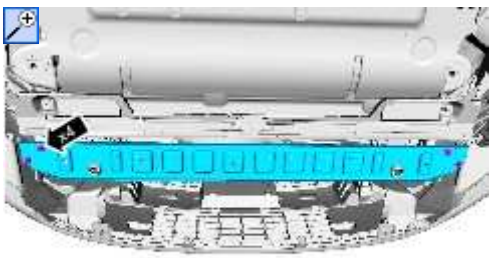
E87748

5.

6.

1. *Gen*
   Equi

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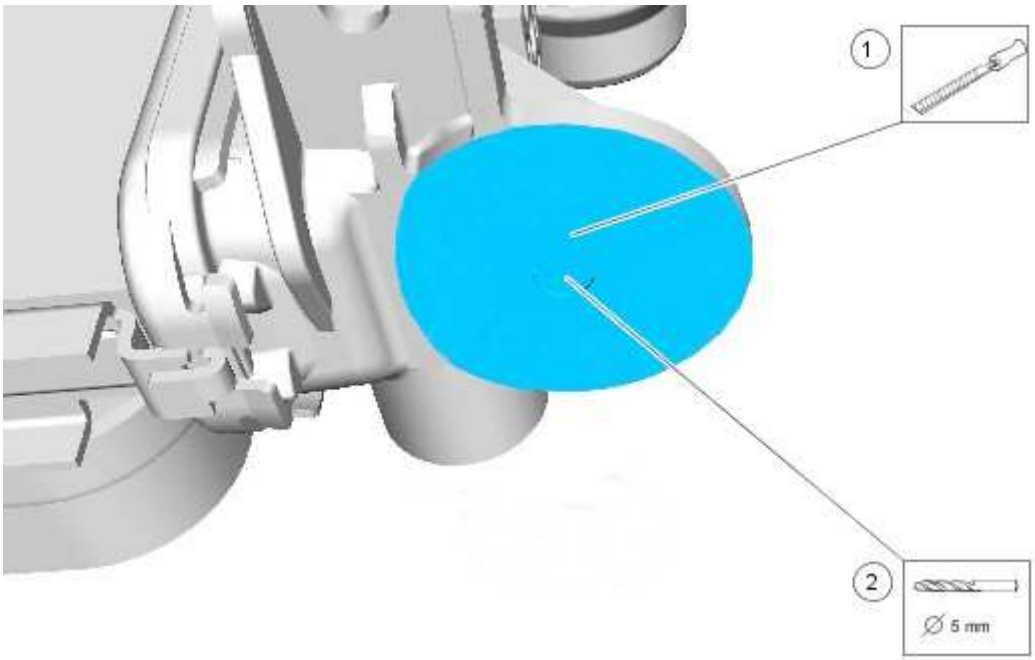

E87749

2. Flat
Gen
Equi
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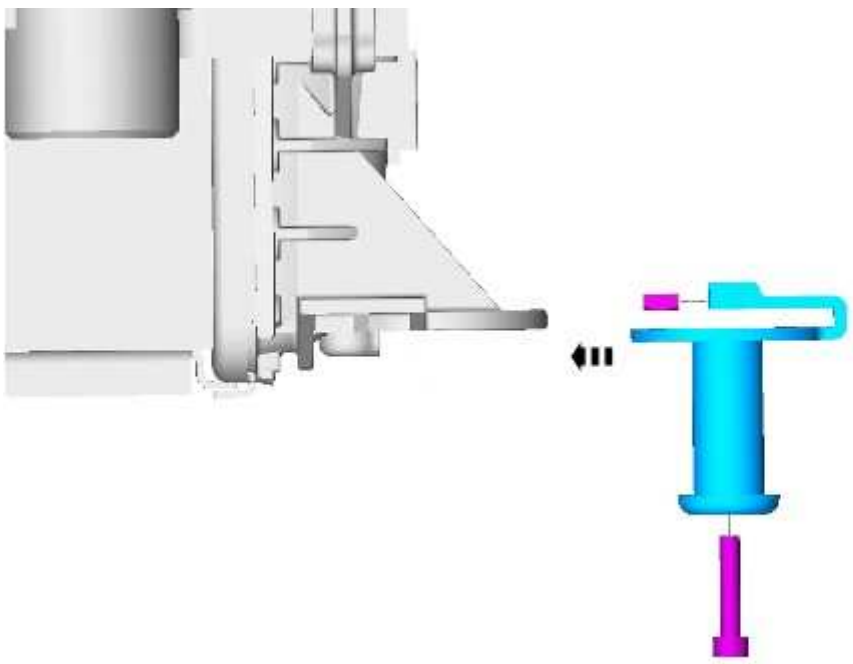
bit

7.



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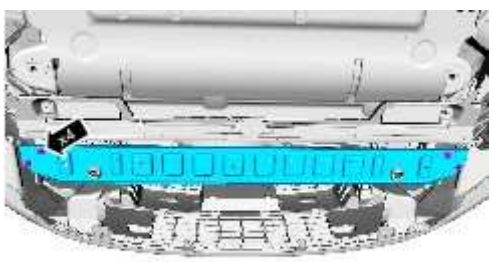

E87748

8. *Torque:* 25 Nm

9. *Torque:* 8 Nm

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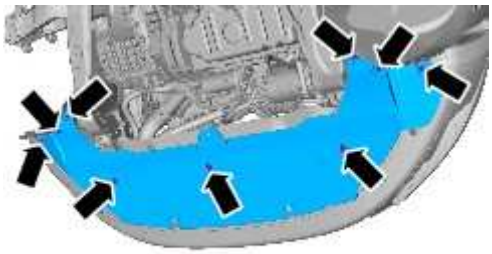
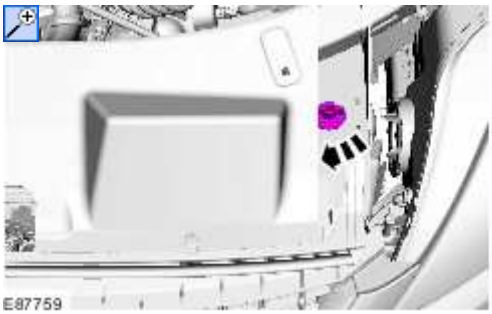


E68962

10. Lower the vehicle.
11. Remove the cable ties securing the radiator and con assembly.
    12. On both sides.



E87759

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Removal and Installation

General Equipment

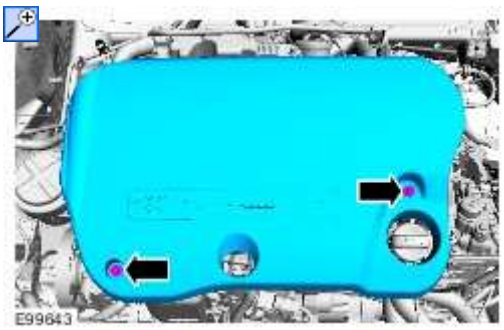
Hose clamp remover/installer

Removal

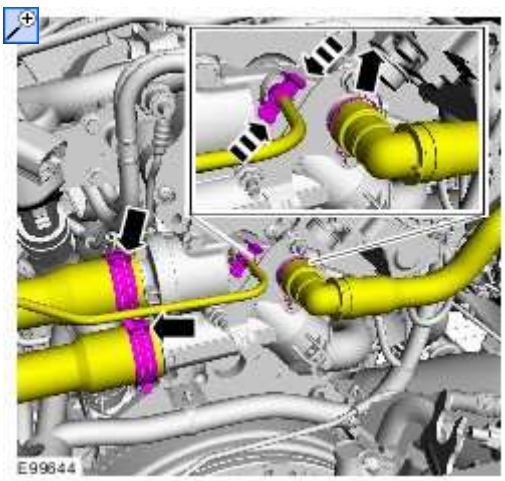
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

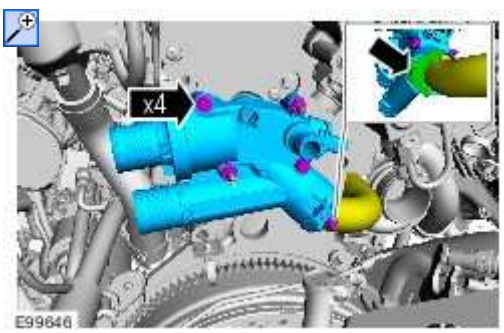
   Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).



2.



3. *General Equipment:* Hose clamp remover/installer



4. NOTE: The O-ring seal is to be reused unless damaged
   General Equipment: Hose clamp remover/installer
   Torque: 8 Nm

Installation

1. To install, reverse the removal procedure.

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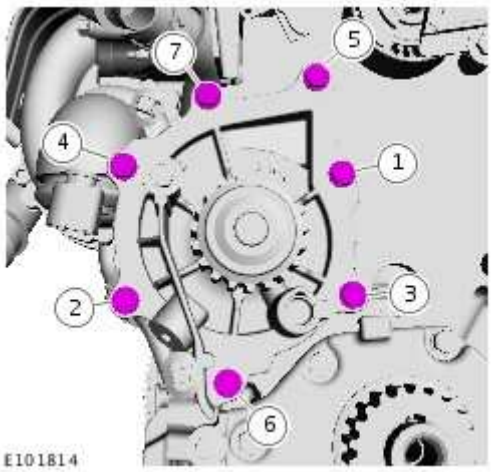
Removal and Installation

Removal

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

1. Refer to: Cooling System Draining, Filling and Bleeding (303-03F Engine Cooling - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).
2. Refer to: Timing Belt (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



3. *Torque:*
   Stage 1: 5 Nm
   Stage 2: 16 Nm

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material.
   To install, reverse the removal procedure.

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Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 - Specifications	S-MAX/Galaxy 2006.5 (02/2006-)

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Torque Specifications

Description	Nm	lb-ft	lb-in
Throttle body retaining bolts	10	—	89
Fuel injection supply manifold retaining bolts	25	18	—

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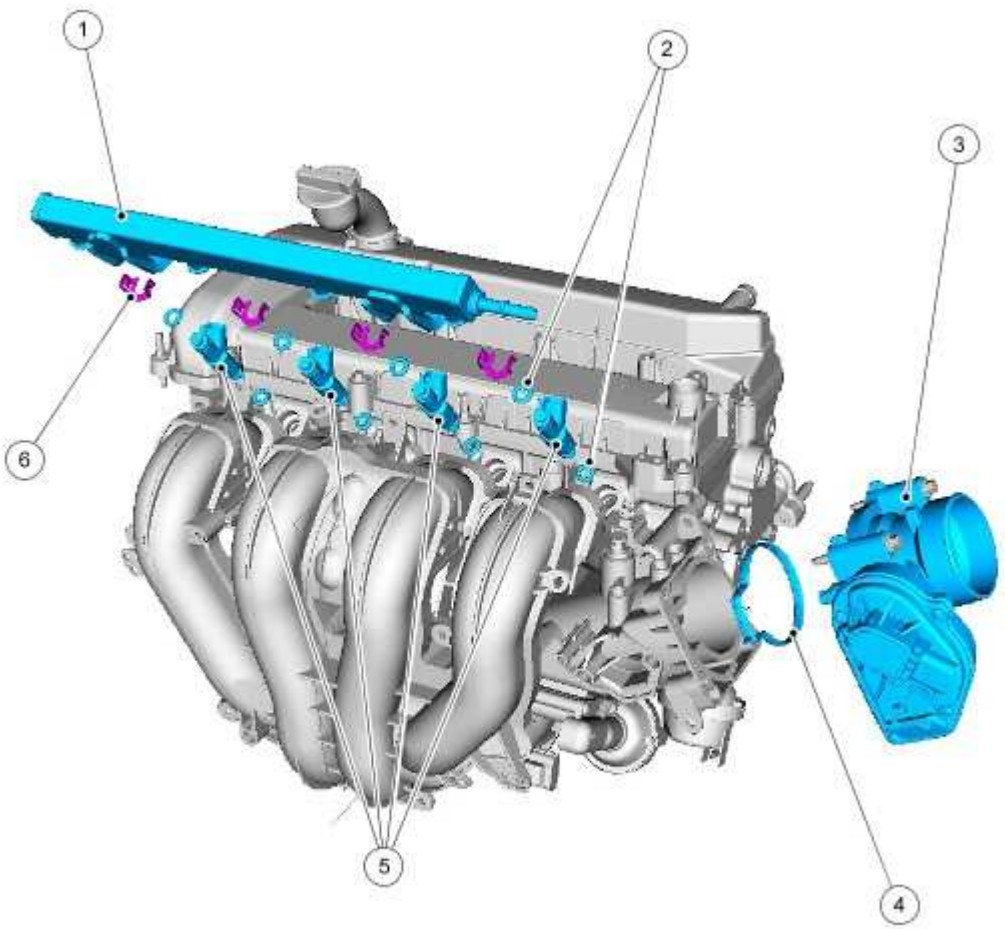
Description and Operation



E64385

Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel injector O-ring seal(s)
3	-	Throttle body
4	-	Throttle body gasket
5	-	Fuel injector(s)
6	-	Fuel injector retaining clip(s)

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Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 - Fuel Charging and Controls— Vehicles With: Ethanol Capability - Overview	S-MAX/Galaxy 2006.5 (02/2006-)

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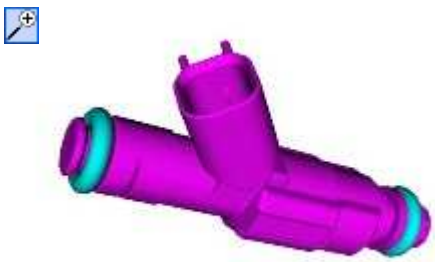
Description and Operation

The fuel injectors and fuel rail are different for petrol vehicles and for vehicles with ethanol E85 and must not be mixed up.

The theoretical air-fuel ratio for vehicles operated with ethanol is 9.7 kg air / kg fuel. For petrol vehicles, the ratio is 14.5:1 This results in a 30% higher fuel requirement in order to achieve Lambda = 1.

Fuel injectors



E59688

The increased fuel consumption is compensated for through fuel injectors with a greater throughput.

Fuel rail

The interior of the fuel rail is nickel-coated.

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Fuel leak(s) • Vacuum line(s) • Gasket(s) • Seal(s) • Fuel injector(s) • Throttle body • Fuel rail • Fuel supply line	• Wiring harness • Electrical connector(s) • Throttle body • Fuel injector(s) • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Engine does not crank	* Passive anti-theft system (PATS).	* CHECK the PATS LED extinguishes within 3 seconds when the ignition is turned on. REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Diagnosis and Testing).
	* Starting system.	* REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starting System (303-06C Starting System - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing) / Starting System (303-06E Starting System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Ignition switch.	* REFER to the Wiring Diagrams.
	* Powertrain control module	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved

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	(PCM).	diagnostic tool.
Engine cranks but does not start	* Inertia fuel shutoff (IFS) switch.	* RESET the IFS switch.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
	* Fuel lines damaged or blocked.	* INSPECT the fuel lines. INSTALL new components as necessary. TEST the system for normal operation.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Fuel pump and sender unit.	* REFER to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Crankshaft position (CKP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Camshaft position (CMP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* PCM.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel rail pressure (FRP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* TEST the cylinder compression.
Poor starting	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
	* Fuel system	* CHECK the system for fuel leak(s). REPAIR

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	leak.	the system as necessary.
	* Fuel system restriction.	* INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Incorrect engine oil.	* INSTALL a new engine oil filter and engine oil.
	* Incorrect power steering fluid.	* DRAIN and REFILL the power steering system with the correct fluid. REFER to: (211-00 Steering System - General Information) Power Steering System Bleeding (General Procedures), Power Steering System Flushing (General Procedures), Power Steering System Filling (General Procedures).
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Engine coolant temperature (ECT) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injector (s).	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low cylinder compression.	* TEST the engine cylinder compression.
Engine starts but immediately stops	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* PCM.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) -

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		MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
	* Fuel system restriction.	* INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
Poor idling	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel

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		(107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Knock sensor (KS).	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
Engine stumbling	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
Engine lacks power	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Brakes binding.	* CHECK the braking system. REFER to: Anti-Lock Control (206-09A Anti-Lock Control, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.

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etc).	
* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
* Kinked or restricted fuel lines.	* INSPECT the fuel lines. INSTALL new components as necessary. TEST the system for normal operation.
* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and

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		Testing).
	* Vehicle speed sensor (VSS).	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* CHECK the cylinder compression.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: (309-00A Exhaust System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Catalytic Converter - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Catalytic Converter - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
Black smoke at idle	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: (309-00A Exhaust System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Catalytic Converter - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Catalytic Converter - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* Incorrect valve timing.	* CHECK the valve timing.

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Excessive black smoke during acceleration	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
Black smoke at cruising speeds	* Air cleaner element	* INSTALL a new air cleaner element.

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	blocked.	
	* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
Blue smoke	* Engine burning oil.	* CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 litre per 1000 km (600 miles).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* Positive crankcase ventilation	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.

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	(PCV) system.	
	* Worn or damaged valve guide(s), piston ring(s), cylinder bore(s), cylinder head or gasket.	* REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
White smoke	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* Coolant in the combustion chamber.	* CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
Engine misfire	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter.

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	REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
* Engine operating temperature too high.	* REFER to: Engine Cooling (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel

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		injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low cylinder compression.	* CHECK the engine compression.
	* Worn or damaged valve (s), tappet(s) or camshaft(s).	* REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
	* Damaged cylinder head gasket.	* REMOVE the cylinder head. INSPECT the cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
Engine knock at idle	* Low engine oil level.	* CHECK the engine oil level. REFILL as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Fuel Rail - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (Removal and Installation), Fuel Rail - 2.3L Duratec-HE (118kW/160PS) - MI4 (Removal and Installation).
	* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.

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	* Fuel injector (s).	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Excessive carbon build up.	* REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
	* Worn or damaged oil pump. * Worn or damaged timing chain or sprocket. * Major mechanical engine failure.	* INSPECT the engine components.
Engine knock during acceleration	* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Major mechanical engine failure.	* REFER to: Engine (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Diagnosis and Testing), Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
NOTE: Before proceeding with any of the actions in relation to the possible sources for excessive fuel consumption, a fuel consumption test located in the toolbox menu of the Ford approved diagnostic tool must be carried out. Excessive fuel consumption	* Brakes binding.	* CHECK the braking system. REFER to: Anti-Lock Control (206-09A Anti-Lock Control, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel system leak(s).	* CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec

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		(162kW/220PS) - VI5, Removal and Installation).
	* Incorrect engine oil.	* INSTALL a new oil filter and engine oil.
	* Generator.	* REFER to the Ford approved diagnostic tool.
	* EGR valve sticking open.	* REFER to: (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4) Engine Emission Control (Diagnosis and Testing), Engine Emission Control (Diagnosis and Testing).
	* Slipping clutch (if equipped).	* REFER to: (308-01A Clutch - Vehicles With: 5-Speed Manual Transaxle - MTX75) Clutch (Diagnosis and Testing), Clutch (Diagnosis and Testing), Clutch (Diagnosis and Testing).
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* PCM calibration.	* Using the Ford approved diagnostic tool, CHECK for the availability of a calibration update.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* CHECK the engine compression.
Engine cuts out during hard acceleration	* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 (310-00 Fuel System - General Information, General Procedures).

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Removal and Installation

Special Tool(s)

	310-137 Disconnect Tool, Fuel Line

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

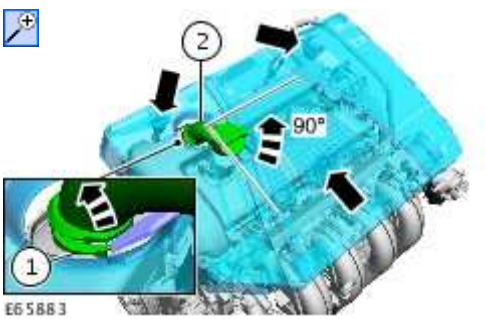
General Equipment

Flat-bladed screwdriver

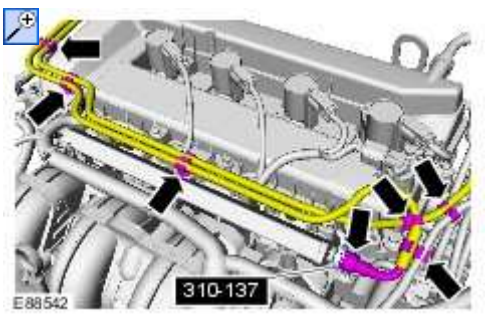
Removal

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

1. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).



2. *General Equipment:* Flat-bladed screwdriver



3. *Install the Special Tool(s):* 310-137

4.

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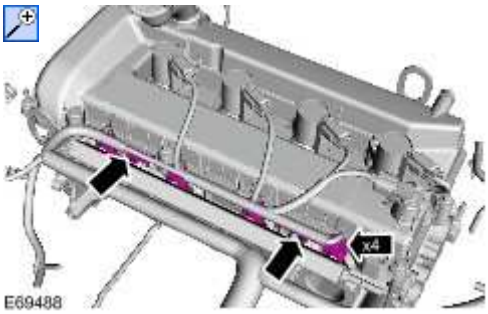
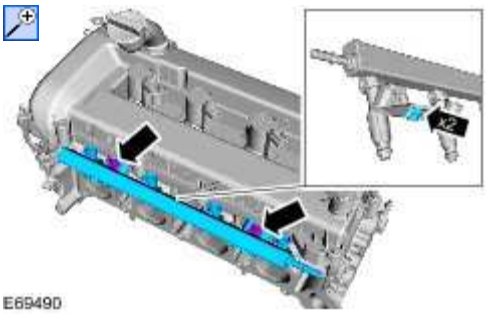
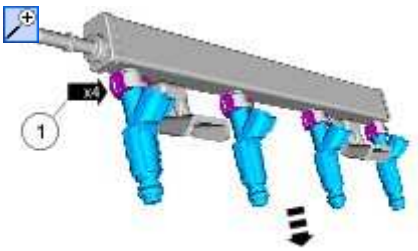




5. *Torque:* 25 Nm



6.
   1. NOTE: Make sure that new components are installed.

7. CAUTION: Only use the specified material to lubricate the seals.
   NOTE: Make sure that new components are installed.
   Material: Engine Oil - 5W-30 (WSS-M2C913-C)

Installation

1. To install , reverse the removal procedure.

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Removal and Installation

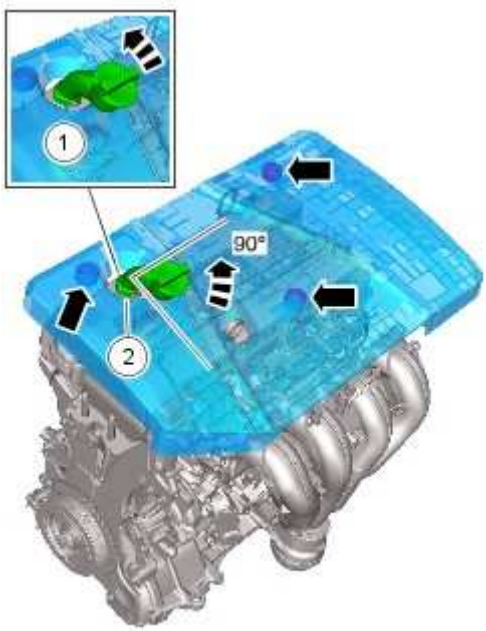
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

Removal

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

1. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
2.



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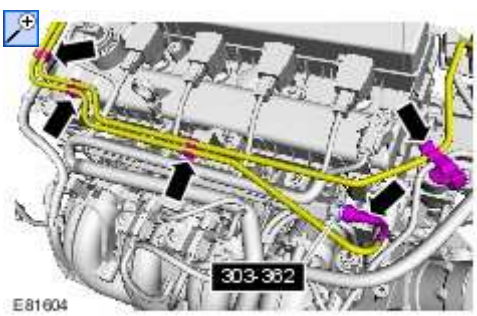

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3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
   Torque: 10 Nm
4. *Torque:* 25 Nm

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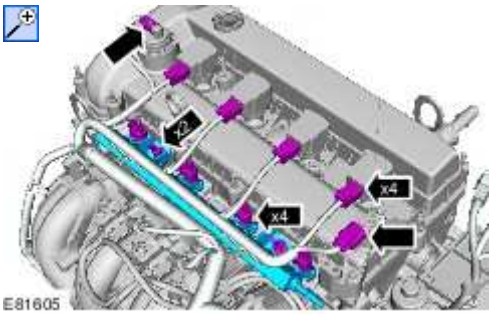
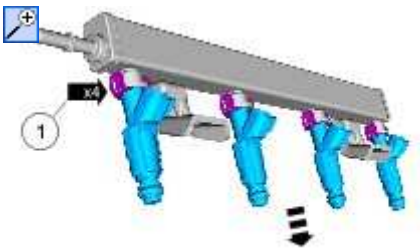


E81605



E69489

E69491

5.
1. NOTE: Make sure that new components are installed.

6. CAUTION: Only use the specified material to lubricate the seals.
NOTE: Make sure that new components are installed.
Material: Engine Oil - 5W-30 (WSS-M2C913-C)

Installation

1. To install, reverse the removal procedure.

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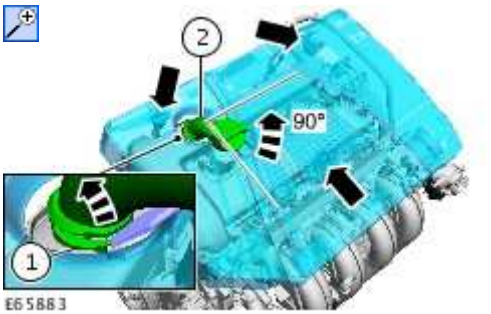
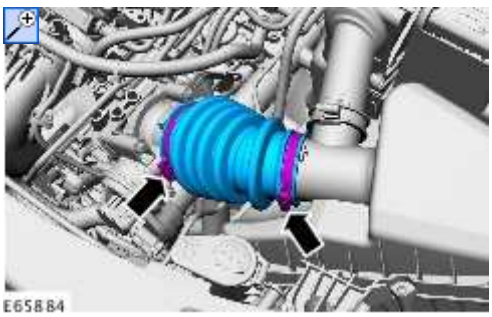
Removal and Installation

Removal

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



1.



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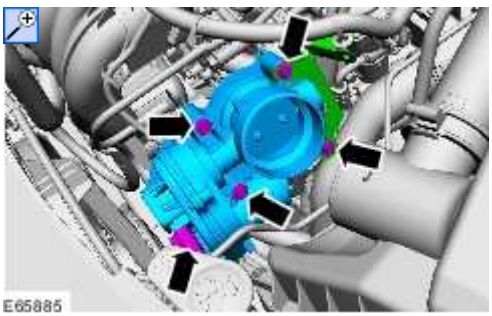

3. NOTE: The gasket is to be reused unless damaged.
   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.
2. NOTE: Make sure that the pedals remain in the rest position during the initialization.
   Turn the ignition key to position II and wait for one minute to initialize the throttle body.
3. Turn the ignition key to the OFF position.

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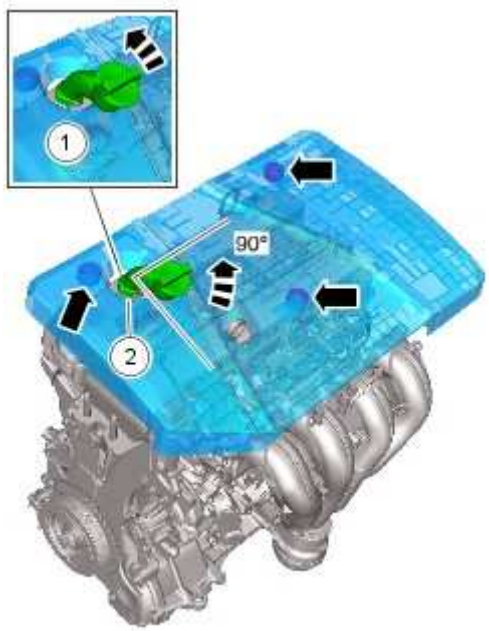
Removal and Installation

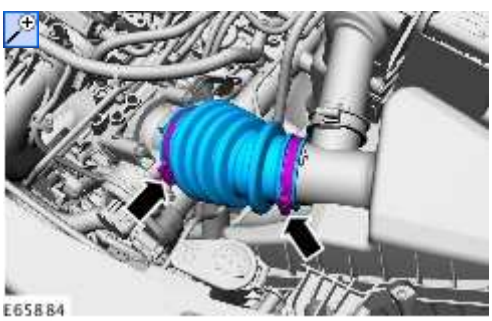
Removal

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

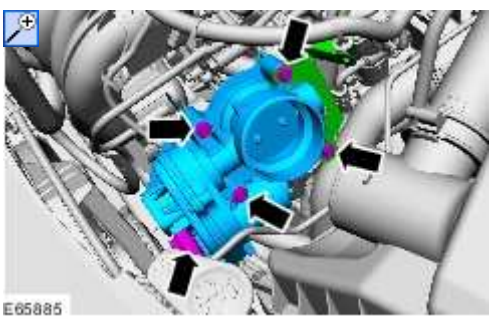


E77025

1.


E65884

2.


E65885

3. NOTE: The gasket is to be reused unless damaged.
Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.
2. NOTE: Make sure that the pedals remain in the rest position during the initialization.

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Turn the ignition key to position II and wait for one minute to initialize the throttle body.

3. Turn the ignition key to the OFF position.

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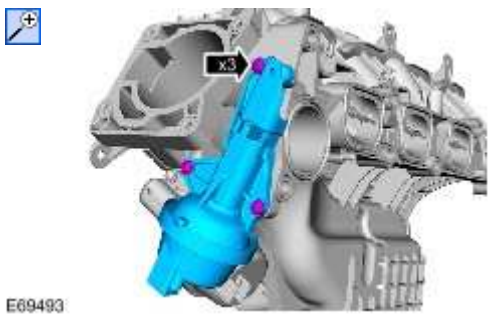
Removal and Installation

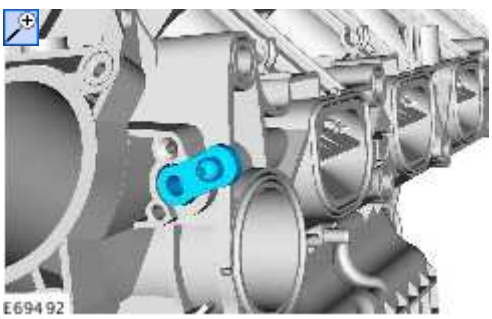
Removal

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

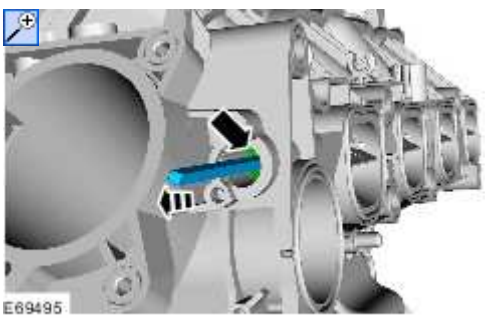
1. Refer to: Intake Manifold (303-01A Engine - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Removal and Installation).
   Refer to: Intake Manifold (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



2. *Torque:* 2 Nm



3.



4. NOTE: The O-ring seal is to be reused unless damaged.

5. NOTE: The gaskets are to be reused unless damaged.

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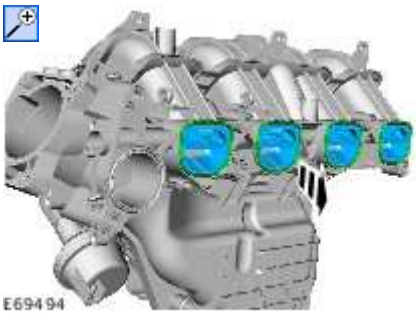

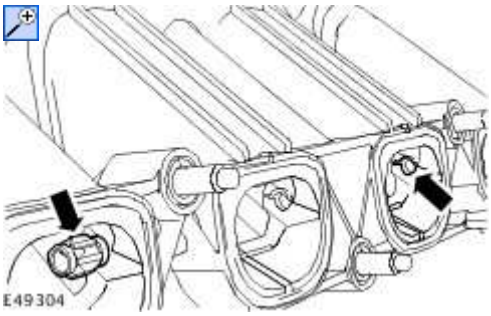

6. Discard the swirl plates actuating rod bearings.

Installation

1. NOTE: Make sure that new components are installed.
   To install, reverse the removal procedure.

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Removal and Installation

Removal and Installation

1. Refer to: Fuel Rail (303-04B Fuel Charging and Controls - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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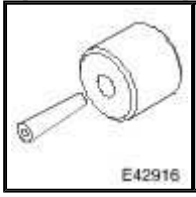
Removal and Installation

Special Tool(s)

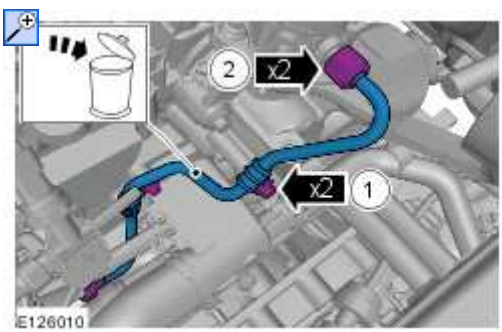
 E42916	310-128 Installer Set, Teflon Seal

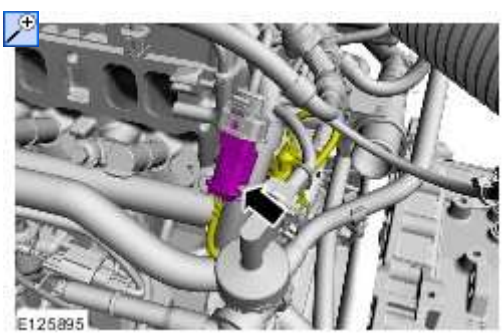
General Equipment

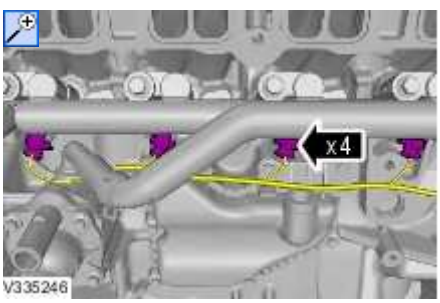
Knife

Removal

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

1. Refer to: Fuel System Pressure Release - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
2. Refer to: Intake Manifold (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
3. 

4. 

5. 

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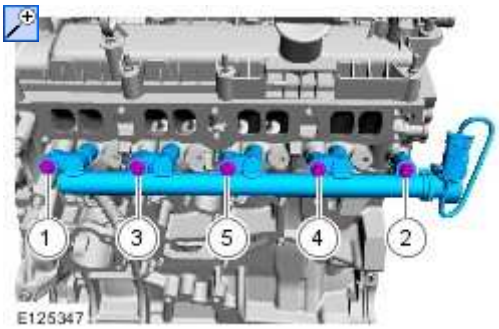
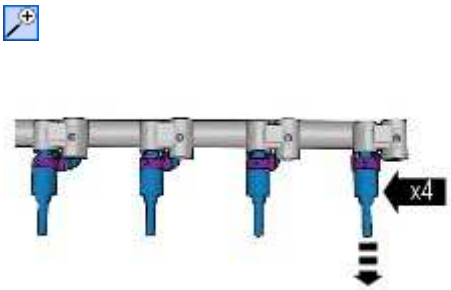


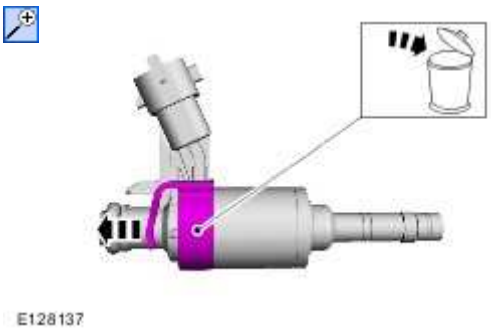
6. CAUTION: Take extra care when handling the components.
NOTE: Only use moderate force.



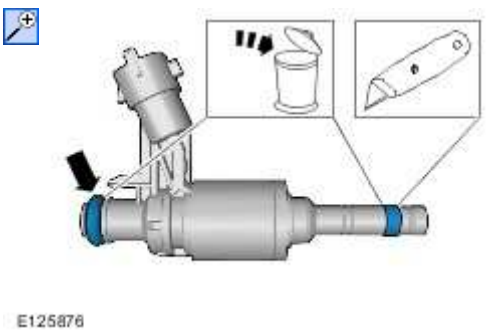
7. CAUTIONS:

Take extra care when handling the components.

Make sure that the area around the component is clean and free of foreign material.
NOTE: Only use moderate force.



8. NOTE: Make sure that a new component is installed.



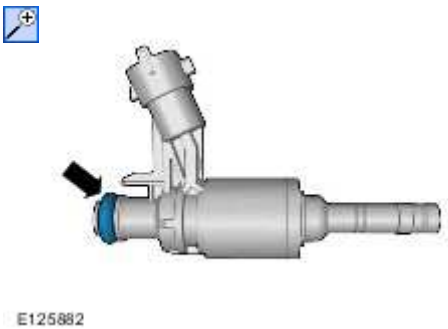
9. CAUTIONS:

Take extra care when handling the components.

Make sure that the area around the component is clean and free of foreign material.
General Equipment: Knife

Installation

1. To install, reverse the removal procedure.



2. CAUTIONS:

Take extra care when handling the components.

Make sure that the area around the component is clean and free of foreign material.
NOTE: Make sure that a new component is installed.

3. CAUTIONS:

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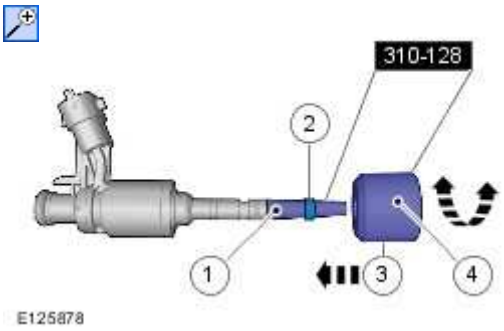
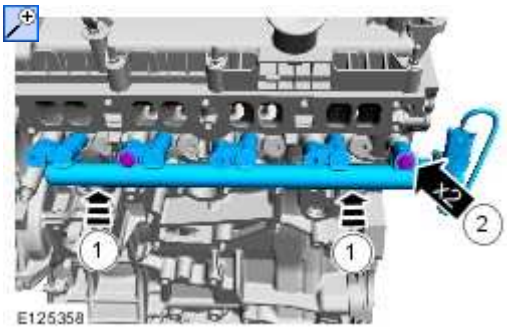


⚠Take extra care when handling the components.

⚠Make sure that the area around the component is clean and free of foreign material.

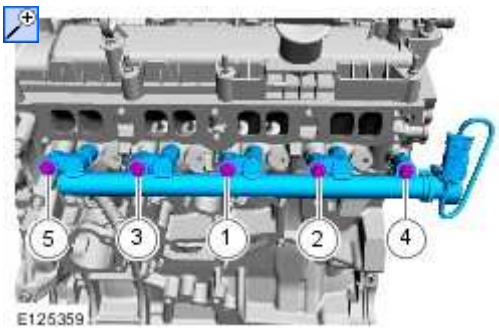
Remove the following items:

1. *Special Tool(s):* 310-128
2. NOTE: Make sure that a new component is installed.
3. *Special Tool(s):* 310-128
4.



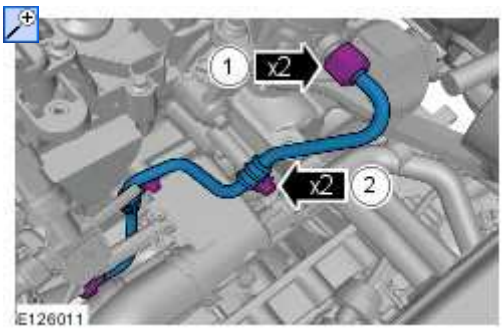
4.

1. ⚠CAUTION: Only use moderate force.
2. NOTE: Only tighten the bolts finger tight at this stage.



5. NOTE: Only tighten the bolts finger tight at this stage.

6. *Torque:*
   Stage 1: 8 Nm
   Stage 2: Loosen: 3 turn(s)
   Stage 3: 8 Nm
   Stage 4: 26°



7. NOTE: Make sure that a new component is installed.
   NOTE: Only tighten the nuts and bolts finger tight at this stage.

8. *Torque:*
   1 7 Nm
   2 10 Nm
   1
      Stage 1: 10 Nm
      Stage 2: 45°

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Removal and Installation

Special Tool(s)

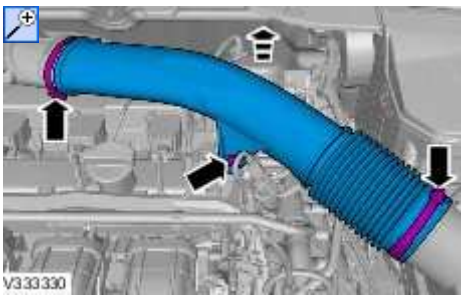
	310-137 Disconnect Tool, Fuel Line

Removal

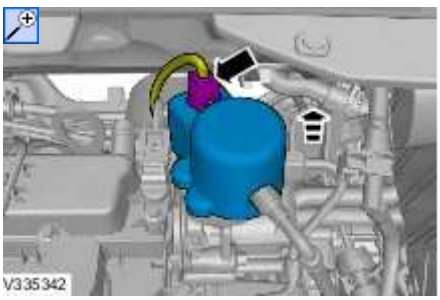
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel System Pressure Release - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 (310-00 Fuel System - General Information, General Procedures).

2.



3. *Torque:* 10 Nm



4.

5. CAUTION: Make sure that the quick release couplings are correctly engaged. *Special Tool(s):* 310-137

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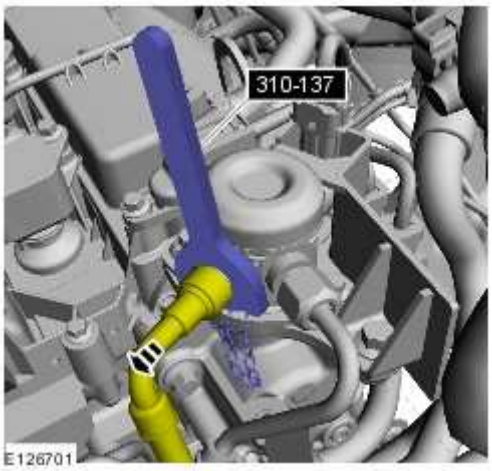
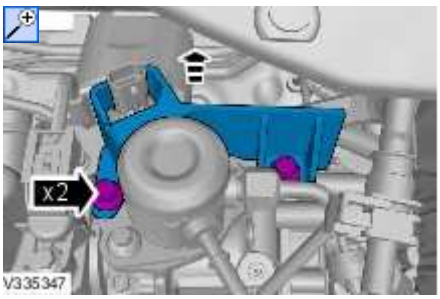
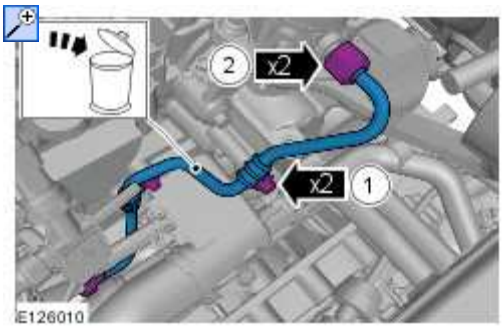
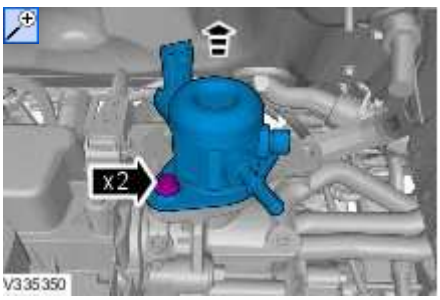




6. *Torque:* 17 Nm



7.



8. CAUTIONS:

   Make sure that new bolts are installed.

   Take extra care when handling the components.
   NOTE: Only tighten the bolts finger tight at this stage.

9. *Torque:*
   Stage 1: 5 Nm
   Stage 2: 13 Nm

10.

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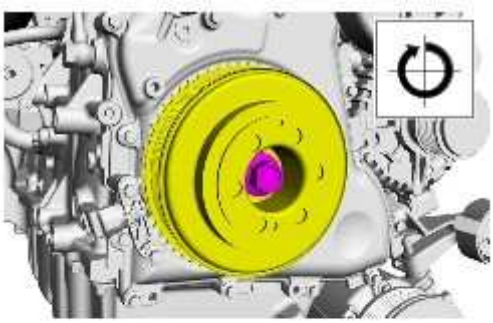
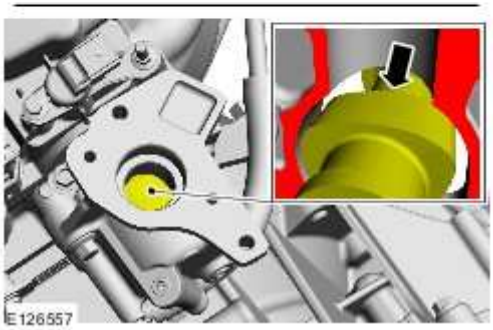
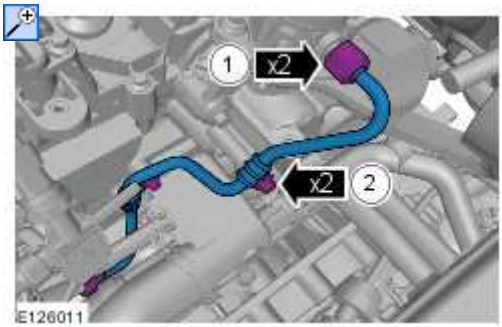
Installation

1. To install, reverse the removal procedure.



2. CAUTION: Only rotate the crankshaft clockwise.





3. NOTE: Make sure that a new component is installed.
   NOTE: Only tighten the nuts and bolts finger tight at this stage.

4. *Torque:*
   1 7 Nm
   2 10 Nm
   1
   Stage 1: 10 Nm
   Stage 2: 45°

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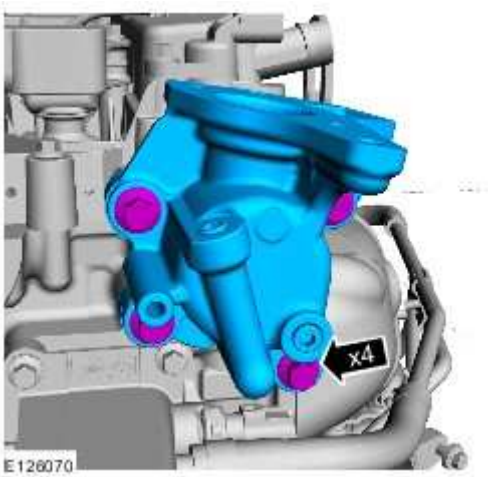
Removal and Installation

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA

Removal



1. Refer to: Fuel Pump (303-04B Fuel Charging and Controls - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
2. *Torque:* 20 Nm

Installation

1. To install, reverse the removal procedure.
2. NOTE: Make sure that a new component is installed.
   NOTE: The component must be installed within 10 minutes of applying the sealant.
   Material: Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)

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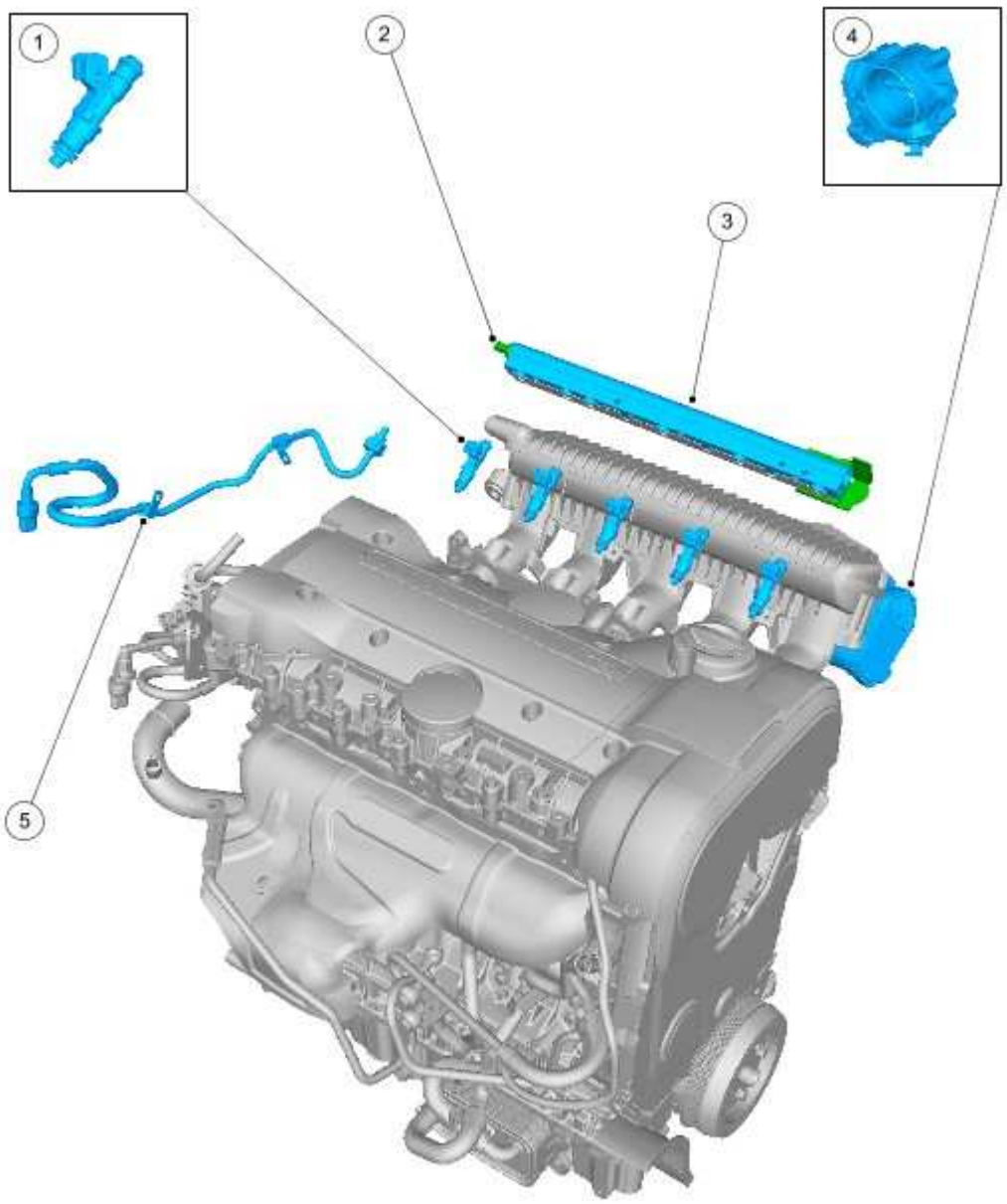
Description and Operation



E64777

Item	Part Number	Description
1	-	Fuel Injectors
2	-	Fuel rail pressure relief valve
3	-	Fuel rail
4	-	Throttle body
5	-	Fuel tank to fuel rail fuel supply line

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Fuel leak(s) • Vacuum line(s) • Gasket(s) • Seal(s) • Fuel injector(s) • Throttle body • Fuel rail • Fuel supply line	• Wiring harness • Electrical connector(s) • Throttle body • Fuel injector(s) • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Engine does not crank	* Passive anti-theft system (PATS).	* CHECK the PATS LED extinguishes within 3 seconds when the ignition is turned on. REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Diagnosis and Testing).
	* Starting system.	* REFER to: Starting System (303-06A, Diagnosis and Testing) / Starting System (303-06B, Description and Operation) / Starting System (303-06C, Diagnosis and Testing) / Starting System (303-06D, Diagnosis and Testing) / Starting System (303-06E, Diagnosis and Testing).
	* Ignition switch.	* REFER to the Wiring Diagrams.
	* Powertrain control module (PCM).	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
Engine cranks but does not start	* Inertia fuel shutoff (IFS) switch.	* RESET the IFS switch.
	* Low fuel system	* Check the fuel system pressure.

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	pressure.	REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* Fuel lines damaged or blocked.	* INSPECT the fuel lines. INSTALL new components as necessary. TEST the system for normal operation.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Fuel pump and sender unit.	* INSTALL a new fuel pump and sender unit. REFER to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Crankshaft position (CKP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Camshaft position (CMP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* PCM.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel rail fuel pressure (FRP) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* TEST the cylinder compression.
Poor starting	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* Fuel system leak.	* CHECK the system for fuel leak(s). REPAIR the system as necessary.
	* Fuel system restriction.	* INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.

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	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Incorrect engine oil.	* INSTALL a new engine oil filter and engine oil.
	* Incorrect power steering fluid.	* DRAIN and REFILL the power steering system with the correct fluid. REFER to: Power Steering System Bleeding (211-00 Steering System - General Information, General Procedures) / Power Steering System Flushing (211-00 Steering System - General Information, General Procedures) / Power Steering System Filling (211-00 Steering System - General Information, General Procedures).
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Engine coolant temperature (ECT) sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injector(s).	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter as necessary.
	* Low cylinder compression.	* TEST the engine cylinder compression.
Engine starts but immediately stops	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* PCM.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure

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		Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* Fuel system restriction.	* INSPECT the fuel system. INSTALL new components as necessary. TEST the system for normal operation.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
Poor idling	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN

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		the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Knock sensor (KS).	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
Engine stumbling	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
Engine lacks power	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Brakes binding.	* CHECK the braking system. REFER to: Anti-Lock Control (206-09A Anti-Lock Control, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
	* Kinked or restricted fuel lines.	* INSPECT the fuel lines. INSTALL new components as necessary. TEST the system for normal operation.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter.

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		REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Vehicle speed sensor (VSS).	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* CHECK the cylinder compression.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00C Exhaust System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
Black smoke at idle	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new

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		set of injectors as required only after the checks have been carried out.
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00C Exhaust System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Incorrect valve timing.	* CHECK the valve timing.
Excessive black smoke during acceleration	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in

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		the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00C Exhaust System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
Black smoke at cruising speeds	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00C Exhaust System - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
Blue smoke	* Engine burning oil.	* CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 liter per 1000 km (600 miles).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec

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		(162kW/220PS) - VI5, Removal and Installation).
	* Positive crankcase ventilation (PCV) system.	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	* Worn or damaged valve guide(s), piston ring(s), cylinder bore(s), cylinder head or gasket.	* REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
White smoke	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Coolant in the combustion chamber.	* CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03 Engine Cooling - 2.5L Duratec (VI5), Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
Engine misfire	* Engine ignition.	* Carry out an ignition system diagnosis using the Ford approved diagnostic tool.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean

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	gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).
* Engine operating temperature too high.	* REFER to: Engine Cooling (303-03 Engine Cooling - 2.5L Duratec (VI5), Diagnosis and Testing).
* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in Ford approved diagnostic tool.
* Low cylinder compression.	* CHECK the engine compression.
* Worn or damaged valve(s), tappet (s) or camshaft (s).	* REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
* Damaged cylinder head	* REMOVE the cylinder head. INSPECT the cylinder head gasket and cylinder

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	gasket.	bores for wear or damage. REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
Engine knock at idle	* Low engine oil level.	* CHECK the engine oil level. REFILL as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean gasoline. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). * INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out. * INSTALL a new fuel rail. REFER to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* KS.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injector(s).	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Excessive carbon build up.	* REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
	* Worn or damaged oil pump. * Worn or damaged timing chain or sprocket. * Major mechanical engine failure.	* INSPECT the engine components.
Engine knock during acceleration	* KS.	* Carry out a full engine diagnosis

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		using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* Major mechanical engine failure.	* REFER to: Cylinder Head (303-01 Engine - 2.5L Duratec (VI5), Removal and Installation).
NOTE: Before proceeding with any of the actions in relation to the possible sources for excessive fuel consumption, a fuel consumption test located in the toolbox menu of the Ford approved diagnostic tool must be carried out. Excessive fuel consumption	* Brakes binding.	* CHECK the braking system. REFER to: Anti-Lock Control (206-09A Anti-Lock Control, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel system leak (s).	* CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Incorrect engine oil.	* INSTALL a new oil filter and engine oil.
	* Generator.	* REFER to the Ford approved diagnostic tool.
	* Slipping clutch.	* REFER to: Clutch (308-01 Clutch - Vehicles With: 6-Speed Manual Transmission (M66), Diagnosis and Testing).
	* ECT sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Fuel injectors.	* INSPECT the fuel injectors. CLEAN the fuel injectors or INSTALL a new set of fuel injectors as required only after the checks have been carried out.
	* PCM calibration.	* Using the Ford approved diagnostic tool, CHECK for the availability of a calibration update.
	* Incorrect valve timing.	* CHECK the valve timing.
	* Low cylinder compression.	* CHECK the engine compression.

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Engine cuts out during hard acceleration	* CMP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* CKP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* FRP sensor.	* Carry out a full engine diagnosis using the guided diagnostic menu in the Ford approved diagnostic tool.
	* Low fuel system pressure.	* Check the fuel system pressure. REFER to: Fuel System Pressure Check - 2.5L Duratec (162kW/220PS) - VI5 (310-00 Fuel System - General Information, General Procedures).

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Removal and Installation

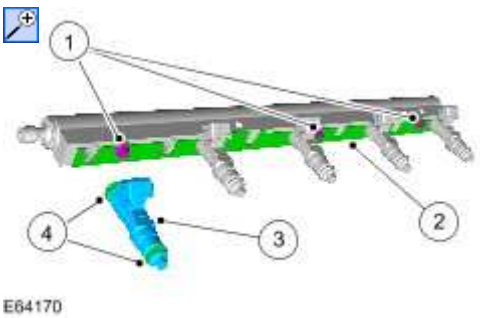
Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C911-A

Removal

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

1. Refer to: Fuel Rail (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



2.
   1. *Torque:* 10 Nm
   4. *Material:* Engine Oil - 5W-30 (WSS-M2C911-A)

Installation

1. To install, reverse the removal procedure.

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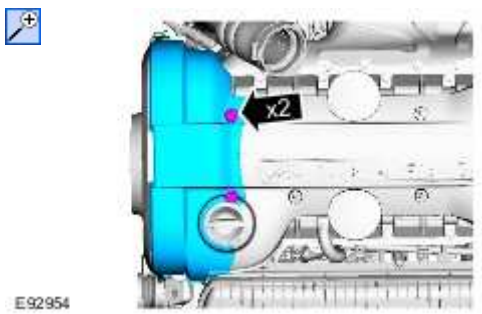
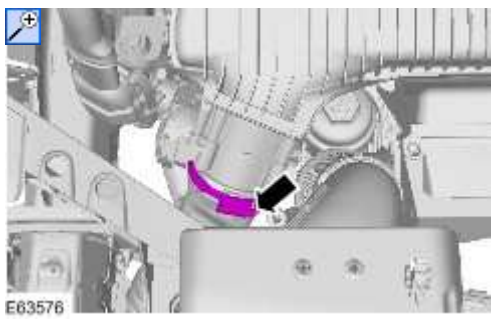
Removal and Installation

Removal

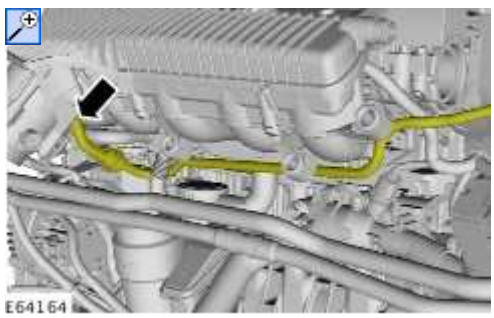
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00 Fue System - General Information, General Procedures).
3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
4. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
5. *Torque:* 10 Nm





6. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
Torque: 4 Nm



7. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

8. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

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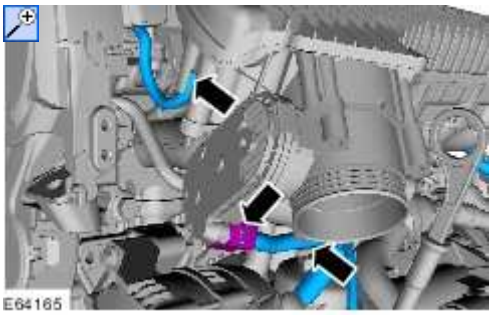
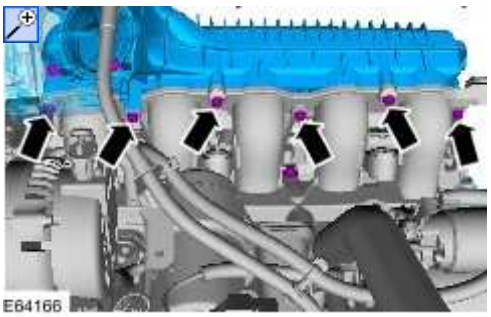
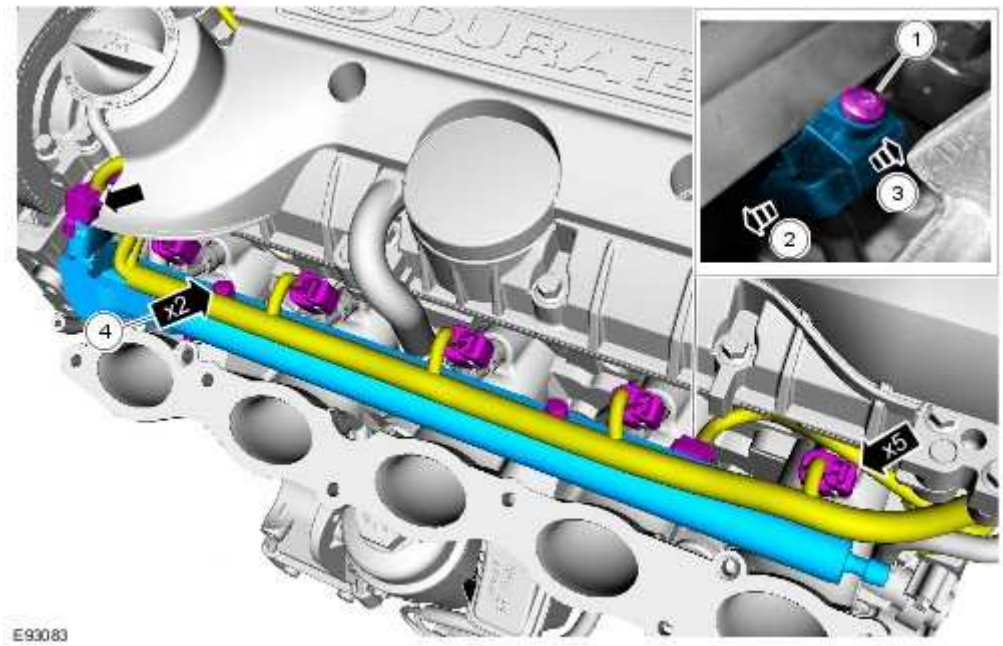




9. *Torque:* 10 Nm



10.
    1. *Torque* 2 Nm
    4. *Torque* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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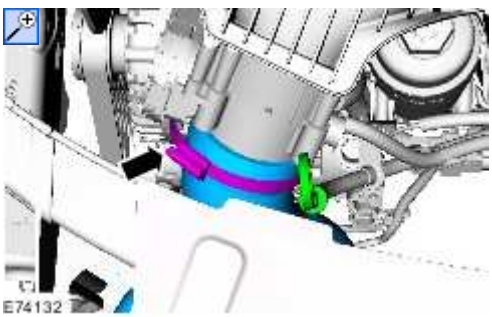
Removal and Installation

Removal

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

1. Remove the right-hand side headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



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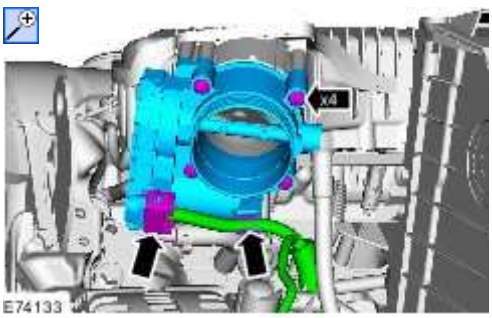

3. NOTE: The gasket is to be reused unless damaged.
   Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.
2. NOTE: Make sure that the pedals remain in the rest position.
   Turn the ignition key to position II and wait for one minute to initialize the throttle body.
3. Turn the ignition key to the OFF position.

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Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel injector clamp retaining bolt	a	-	–
Fuel injection supply manifold retaining bolts	28	21	–
Fuel pump shield lower retaining bolts	33	24	–
Fuel pump shield upper retaining bolt	8	–	71
Fuel pump shield to fuel pump support bracket bolts	23	17	–
Fuel pump sprocket bolts	24	18	–
Fuel pump seal retaining nuts	10	–	89
Fuel pump pulley bolts	42	31	–
High-pressure fuel supply lines	40	30	–
Fuel pump retaining bolts	20	15	–
Charge air cooler intake pipe nut	9	–	80
Charge air cooler outlet pipe nut	9	–	80
Charge air cooler retaining bolts	5	–	44
Fuel metering valve retaining bolts	a	-	-

a) Refer to the relevant procedure in this section.

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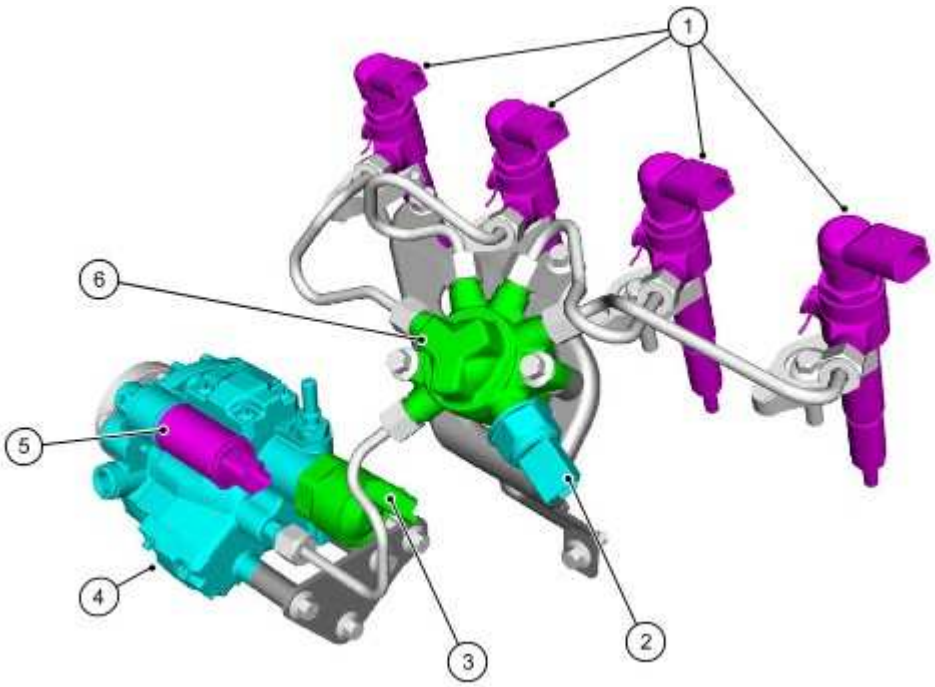
Description and Operation

Overview



E59297

Item	Part Number	Description
1	-	Fuel injector(s)
2	-	Fuel rail pressure (FRP) sensor
3	-	Fuel pressure regulator
4	-	Fuel pump
5	-	Fuel metering valve
6	-	Fuel rail

General

A Siemens common rail fuel injection system is used on the 1.8L Duratorq-TDCi (Kent) diesel engine with stage 4 emission level (vehicle identification number (VIN) plate emission level code: S).

Within the fuel pump there is an integral fuel transfer pump which draws the fuel from the fuel tank to the fuel pump.

A fuel metering valve is located in the supply port to the high-pressure chamber of the fuel pump. The fuel metering valve varies the quantity of fuel supplied to the fuel rail and fuel injector(s), in relation to the driving conditions.

The fuel is supplied at high-pressure to the fuel rail and to the fuel injectors ready for injection. Depending on engine operating conditions, the fuel injection pressure varies between 200 bar and 1600 bar.

Fuel system pressure is measured using an FRP sensor located in the fuel rail. The FRP sensor converts the fuel system pressure into a voltage signal. This voltage signal acts as an input signal to the powertrain control module (PCM) for calculation of the fuel injection

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quantity.

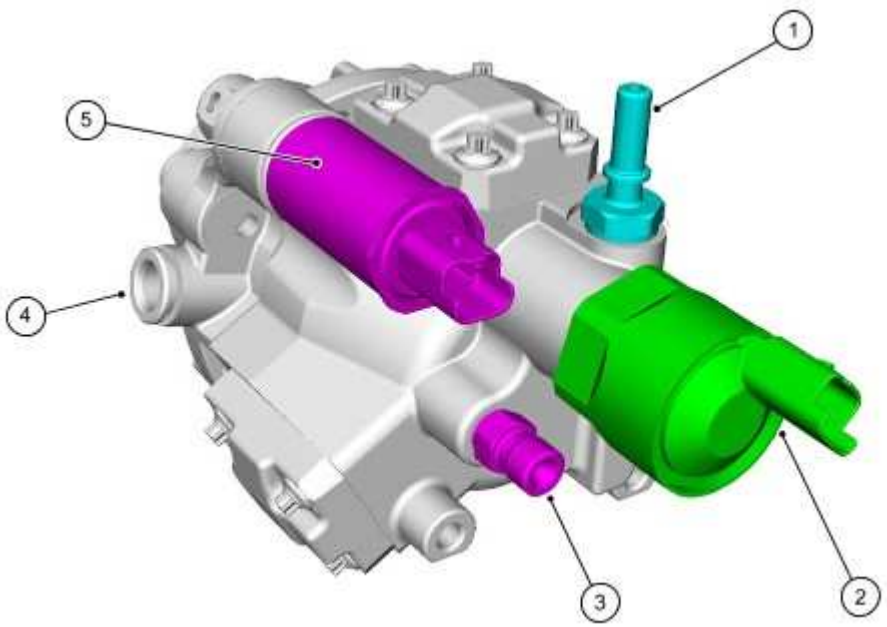
The PCM calculates the time of fuel injection and the fuel injection quantity depending on various input variables.

The specified quantity of fuel is injected into the respective combustion chamber through the piezo-electrically actuated fuel injector(s).

The excess fuel is returned to the fuel tank through the fuel return line.

The fuel pressure regulator on the high-pressure outlet of the fuel pump regulates the fuel pressure in the fuel rail.

Fuel pump



E59298

Item	Part Number	Description
1	-	Fuel pump fuel return port
2	-	Fuel pressure regulator
3	-	High-pressure fuel supply line port
4	-	Fuel pump fuel supply port
5	-	Fuel metering valve

The fuel pump is driven clockwise at half the engine speed by the timing belt.

The fuel pump has three pump elements, each offset from each other by 120 degrees.

The fuel transfer pump is incorporated into the fuel pump and is located on the drive flange. The fuel transfer pump is a vane type pump.

The fuel metering valve is actuated by the PCM using pulse width modulation.

The fuel pressure regulator is located on the fuel pump. The fuel pressure regulator operates electromagnetically and is actuated by the PCM.

Fuel rail

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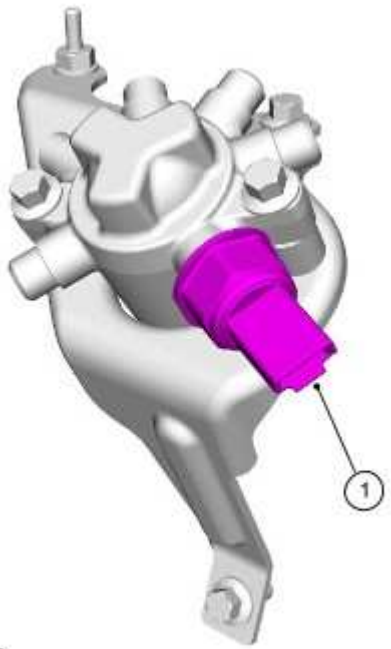


E59299

Item	Part Number	Description
1	-	FRP sensor

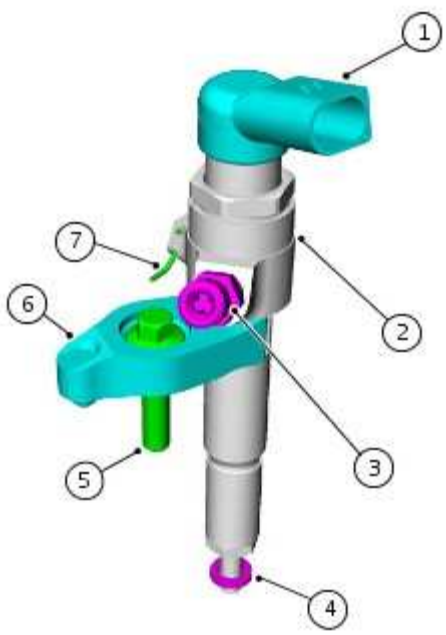
CAUTION: The FRP sensor must not be detached or removed from the fuel rail. Failure to follow this instruction may result in foreign material ingress to the fuel injection system.

The fuel rail is made from forged steel and is retained by a support bracket located on the cylinder block.

The fuel is delivered to the fuel rail by one high-pressure fuel supply line from the fuel pump.

From the fuel rail, the fuel travels through high-pressure fuel supply line(s) to the fuel injector(s).

Fuel injectors



E59300

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Item	Part Number	Description
1	-	Fuel injector electrical connector
2	-	Fuel injector
3	-	High-pressure fuel supply port
4	-	Sealing washer
5	-	Fuel injector retaining clamp bolt
6	-	Fuel injector retaining clamp
7	-	Fuel injector fuel return line retaining clip

NOTE: New fuel injector fuel return line retaining clips must be installed, when the fuel injector fuel return line has been removed from the fuel injectors.

The fuel injector(s) are offset by 20 degrees from vertical in the cylinder head upper section and are attached by means of retaining clamps.

The fuel injector(s) are sealed from the combustion chamber by means of a copper sealing washer located between the fuel injector and the cylinder head. A new sealing washer must always be installed when carrying out installation work.

The fuel injectors are controlled directly by the PCM.

The fuel return line(s) are attached to the fuel injectors by using the fuel injector fuel return line retaining clips and are connected in parallel.

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Diagnosis and Testing

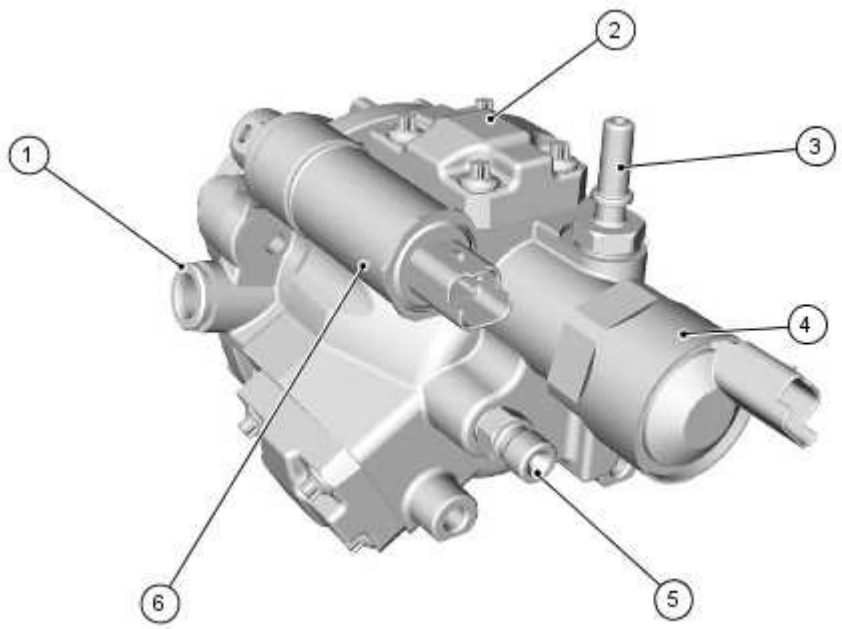
General Equipment

Ford approved diagnostic tool

Principles of Operation

The systems main components consist of a fuel pump, fuel rail, electrically operated fuel injectors and a fuel temperature sensor.

Fuel pump



E59967

Item	Part Number	Description
1	-	Fuel pump fuel supply port
2	-	High-pressure fuel pump chamber
3	-	Fuel pump fuel supply union
4	-	Fuel pressure regulator
5	-	High-pressure fuel supply line port
6	-	Fuel metering valve

The fuel pump consists of a transfer pump and a high-pressure fuel delivery pump. The transfer pump draws fuel from the fuel tank through the fuel filter and delivers the fuel to the three high-pressure fuel pump chambers through a fuel metering valve.

Fuel is also delivered to the high-pressure fuel pump chambers through a internal scavenging valve to lubricate and maintain fuel in the fuel pump.

The fuel metering valve controls the quantity of fuel that is allowed to enter the high-pressure fuel pump chambers. Excess fuel volume developed in the high-pressure fuel pump chamber is returned to the fuel tank. The fuel metering valve is controlled by the powertrain control module (PCM) using a pulse-width modulated signal.

The high-pressure fuel pump supply pressure is controlled by an electronic fuel metering

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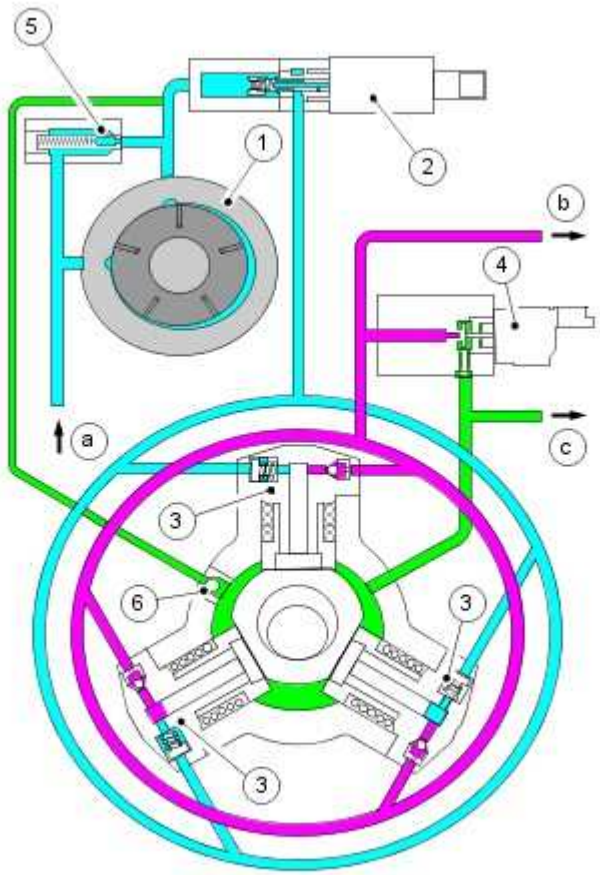
valve which is also controlled by the PCM.



E60065

Item	Part Number	Description
1	-	Transfer pump
2	-	Fuel metering valve
3	-	High-pressure fuel pump chambers
4	-	Fuel pressure regulator
5	-	Fuel pump internal pressure regulator
6	-	Scavenging valve
a	-	Fuel pump fuel supply port
b	-	High-pressure fuel supply port
c	-	Fuel pump fuel return port

Fuel rail

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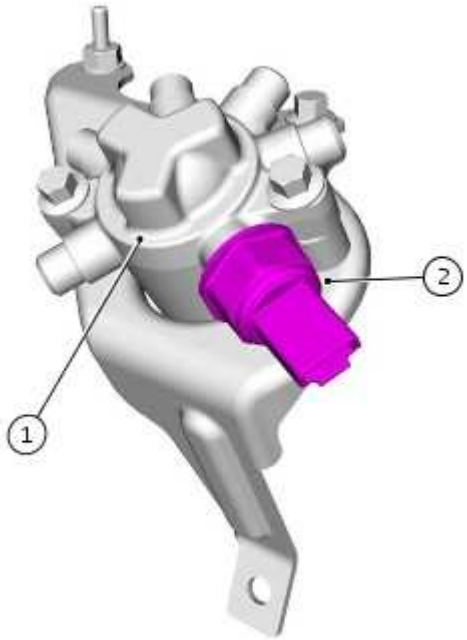
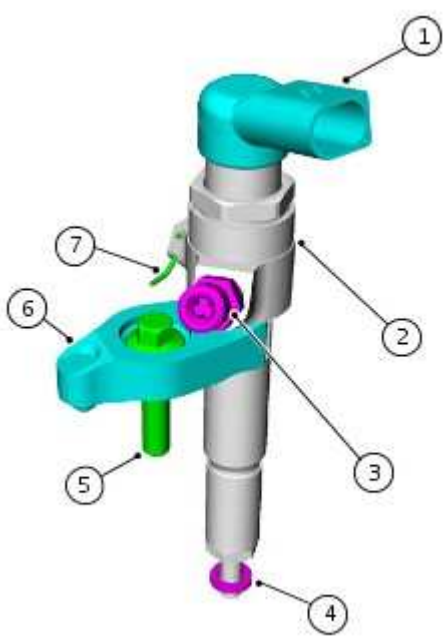


E59968

Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel rail pressure (FRP) sensor

The fuel rail provides a reservoir of high-pressure fuel which is available for all four fuel injectors. The fuel rail also provides pulse damping of the pressure surges in high-pressure fuel system. Attached to the fuel rail is a FRP sensor. The FRP sensor monitors the fuel pressure in the fuel rail. The FRP sensor provides a controlled variable voltage signal to the PCM, which is converted into a pressure signal.

Fuel injectors



E59100

Item	Part Number	Description
1	-	Fuel injector electrical connector
2	-	Fuel injector
	-	

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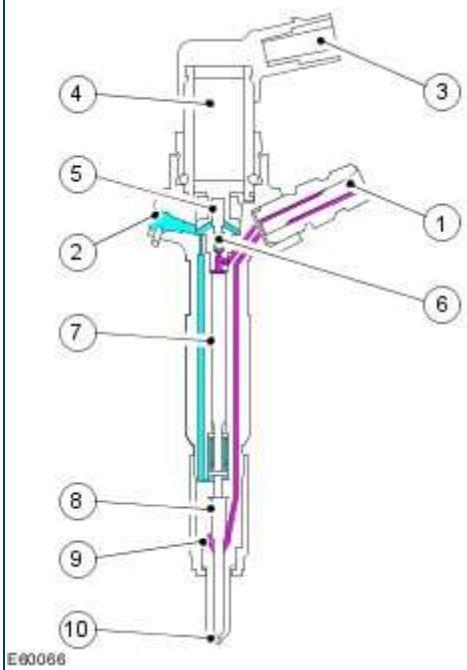
3			High-pressure fuel supply port
	4	-	Sealing washer
5		-	Fuel injector retaining clamp bolt
6		-	Fuel injector retaining clamp
7		-	Fuel injector fuel return line retaining clip



Item	Part Number	Description
1	-	High-pressure fuel supply port
2	-	Fuel injector fuel return port
3	-	Fuel injector electrical connector
4	-	Piezoelectric actuator
5	-	Piezoelectric actuated valve
6	-	needle valve
7	-	Injection control valve
8	-	Fuel injection valve
9	-	High-pressure fuel chamber
10	-	Fuel injector fuel delivery holes

The fuel injectors have a Piezoelectric actuator. The advantages of using Piezoelectric instead of traditional solenoid actuators are the reduction in reaction switching times and the lower switching currents. Both of which improve the control and therefore the efficiency of the fuel injector.

Fuel temperature sensor

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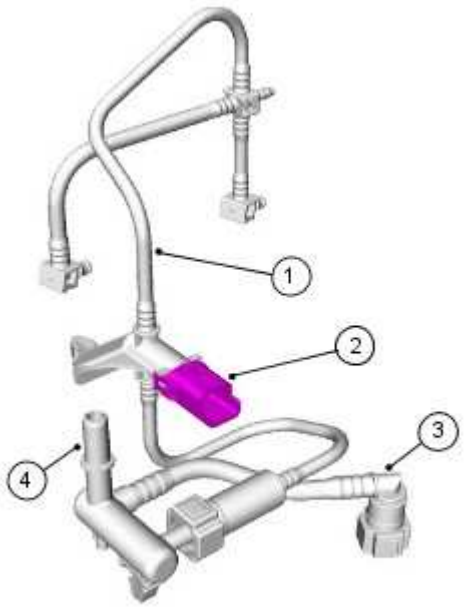

E60045

Item	Part Number	Description
1	-	Fuel injector fuel return line
2	-	Fuel temperature sensor
3	-	Fuel pump fuel return line
4	-	Fuel tank fuel return line union

The fuel temperature sensor is installed into the fuel injector to fuel tank fuel return line. The temperature sensor monitors the temperature of the fuel returning to the fuel tank from the fuel injectors and sends a signal to the PCM.

Inspection and Verification

WARNINGS:

Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

This procedure involves fuel handling. Be prepared for fuel spillage at all times. Failure to follow this instruction may result in personal injury.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.
NOTE: As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard diagnostic trouble code (DTC) is detected by the powertrain control module (PCM). Soft DTCs are also stored by the PCM but will only be known if the system is checked for DTCs using Ford approved diagnostic tool.
NOTE: If a DTC is detected, all DTCs must be cleared after the concern is rectified. Failure to clear all DTCs may cause driveability concerns.
NOTE: If the fuel level in the fuel tank drops below approximately four litres, rough running will occur. This is to signal to the driver that the vehicle requires refuelling in order to prevent the fuel system from running dry.

1. **1.** Verify the customer concern.

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2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
Fuel leak(s)	Fuse(s)
Fuel filter	Relay(s)
Air cleaner element	Wiring harness
Vacuum line(s)/vacuum connections	Electrical connector(s)
Hose(s)/hose connections	Sensor(s)
Tube(s)/tube connections	
Contaminated fuel	
Fuel supply line(s)	
Fuel return line(s)	
High-pressure fuel supply line(s)	
Fuel injectors	
Fuel rail	
Fuel pump	

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Ford approved diagnostic tool to retrieve the diagnostic trouble codes (DTCs).

5. **5.** If no DTCs related to the concern are retrieved, proceed to the Symptom Chart below to continue diagnostics.

Symptom Chart

Symptom	Possible Sources	Action
Engine does not crank and passive anti-theft system (PATS) LED is flashing	* PATS system fault detected.	* REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Diagnosis and Testing).
Engine does not crank and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine does not crank	* Starting system.	* REFER to: Starting System (303-06D Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
Engine cranks but does not start and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine cranks but does not start	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four litres. If the fuel tank fuel level is less then four litres, FILL with fuel.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and

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		Installation).
	* Fuel lines damaged or blocked.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Glow plugs.	* REFER to the Ford approved diagnostic tool.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Low cylinder compression.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Crankshaft position (CKP) sensor.	* REFER to the Ford approved diagnostic tool.
	* Camshaft position (CMP) sensor.	* REFER to the Ford approved diagnostic tool.
	* Cylinder head temperature (CHT) sensor.	* REFER to the Ford approved diagnostic tool.
	* PCM.	* REFER to the Ford approved diagnostic tool.
	* Fuel rail fuel pressure sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
Poor starting and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Poor starting	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four litres. If the fuel tank fuel level is less then four litres, FILL with fuel.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Glow plugs.	* REFER to the Ford approved diagnostic tool.
	* Fuel system leak.	* CHECK the system for fuel leak(s). REPAIR the system as necessary.
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Fuel system restriction.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information,

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		Diagnosis and Testing).
	* Incorrect engine oil.	* INSTALL a new engine oil filter and engine oil.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
	* Low cylinder compression.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* CHT sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel temperature sensor.	* REFER to the Ford approved diagnostic tool.
	* Mass air flow (MAF) sensor.	* REFER to the Ford approved diagnostic tool.
	* Manifold absolute pressure (MAP) sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold Exhaust gas recirculation (EGR) throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Engine starts but immediately stops and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine starts but immediately stops	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* PCM relay.	* CARRY OUT the relay component test. REFER to Wiring Diagrams.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* CMP sensor.	* REFER to the Ford approved diagnostic tool.
	* CHT sensor.	* REFER to the Ford approved diagnostic tool.
	* PCM.	* REFER to the Ford approved diagnostic tool.
	* Fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions.

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		* REFER to the Ford approved diagnostic tool.
Poor idling and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Poor idling	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four litres. If the fuel tank fuel level is less then four litres, FILL with fuel.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* MAF sensor.	* REFER to the Ford approved diagnostic tool.
	* MAP sensor.	* REFER to the Ford approved diagnostic tool.
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pressure	* REFER to the Ford approved diagnostic tool.

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	regulator.	
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Engine stumbling and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine stumbling	* Low fuel level.	* CHECK the fuel tank level is greater than four litres. If the fuel tank level is less than four litres, FILL with fuel.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Accelerator pedal position (APP) sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
Engine lacks power and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine lacks power	* Brakes binding.	* CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Kinked or restricted fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Turbocharger. * Turbocharger vacuum diaphragm unit.	* INSPECT the vacuum line(s) for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary. REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-

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	TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
* Low cylinder compression.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
* Charge air cooler blocked or cracked. * Charge air cooler pipes split or cracked. * Charge air cooler pipe retaining clips missing or loose.	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
* Vehicle speed sensor (VSS).	* REFER to the Ford approved diagnostic tool.
* CHT sensor.	* REFER to the Ford approved diagnostic tool.
* MAF sensor.	* REFER to the Ford approved diagnostic tool.
* MAP sensor.	* REFER to the Ford approved diagnostic tool.
* APP sensor.	* REFER to the Ford approved diagnostic tool.
* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.

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	* Fuel temperature sensor.	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Black smoke at idle and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Black smoke at idle	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Glow plug system.	* REFER to the Ford approved diagnostic tool.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
	* CHT sensor.	* REFER to the Ford approved diagnostic tool.
	* MAF sensor.	* REFER to the Ford approved diagnostic tool.
	* MAP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Excessive black smoke during acceleration and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Excessive black smoke during acceleration	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and

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		Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
	* APP sensor.	* REFER to the Ford approved diagnostic tool.
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Black smoke at cruising speeds and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Black smoke at cruising speeds	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Turbocharger.	* REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary.
	* CHT sensor.	* REFER to the Ford approved diagnostic tool.
	* MAF sensor.	* REFER to the Ford approved diagnostic tool.
	* MAP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR	* CHECK the intake manifold EGR throttle

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	throttle.	butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Blue smoke and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Blue smoke	* Engine burning oil.	* CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 of a litre per 1000 km (600 miles). REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	* Worn or damaged valve guide(s), piston ring(s), cylinder bore (s), cylinder head or gasket.	* REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Positive crankcase ventilation (PCV) system.	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	* Turbocharger oil return tube blocked or damaged.	* REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
White smoke and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
White smoke	* Water in fuel.	* CHECK for signs of water in the diesel.

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		* If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Coolant in the combustion chamber.	* CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
Engine misfire and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine misfire	* Low fuel tank level.	* CHECK the fuel tank level is greater than four litres. If the fuel tank level is less than four litres, FILL with fuel.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

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	INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
* Low cylinder compression.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
* Worn or damaged valve(s), tappet(s) or camshaft(s).	* REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
* Damaged cylinder head gasket.	* REMOVE the cylinder head. INSPECT the cylinder head gasket and cylinder bores for wear or damage. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
* Engine overheats.	* REFER to: Engine Cooling (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
* CHT sensor.	* REFER to the Ford approved diagnostic tool.
* CKP sensor.	* REFER to the Ford approved diagnostic tool.
* CMP sensor.	* REFER to the Ford approved diagnostic tool.
* MAF sensor.	* REFER to the Ford approved diagnostic tool.
* MAP sensor.	* REFER to the Ford approved diagnostic tool.
* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
* FRP sensor.	* REFER to the Ford approved diagnostic tool.
* Fuel pump.	* REFER to the Ford approved diagnostic tool.
* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
* Intake manifold EGR	* CHECK the intake manifold EGR throttle vacuum

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	throttle vacuum control solenoid.	control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Engine knock at idle and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Engine knock at idle	* Low engine oil level.	* CHECK the engine oil level. REFILL as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or petrol in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx) Fuel Pump (Removal and Installation), Fuel Injectors (Removal and Installation), Fuel Rail (Removal and Installation).
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Excessive carbon build up.	* REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up. REFER to: Cylinder Head (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Worn or damaged oil pump. * Major mechanical engine failure.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
Engine knock during acceleration and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.

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Engine knock during acceleration	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* Major mechanical engine failure.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.
Excessive fuel consumption and glow plug indicator is flashing	* DTC detected.	* REFER to the Ford approved diagnostic tool.
Excessive fuel consumption	* Brakes binding.	* CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Fuel system leak(s).	* CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Incorrect engine oil.	* INSTALL a new oil filter and engine oil.
	* Generator.	* REFER to the Ford approved diagnostic tool.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
	* Turbocharger.	* REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
	* Slipping clutch.	* REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).
	* Low cylinder compression.	* REFER to: Engine (303-01C Engine - 2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).

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	* CHT sensor.	* REFER to the Ford approved diagnostic tool.
	* MAF sensor.	* REFER to the Ford approved diagnostic tool.
	* MAP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel injector(s).	* REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle.	* CHECK the intake manifold EGR throttle butterfly for obstructions and correct operation. * REFER to the Ford approved diagnostic tool.
	* Intake manifold EGR throttle vacuum control solenoid.	* CHECK the intake manifold EGR throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the Ford approved diagnostic tool.
Engine cuts out during hard acceleration	* CMP sensor.	* REFER to the Ford approved diagnostic tool.
	* CKP sensor.	* REFER to the Ford approved diagnostic tool.
	* FRP sensor.	* REFER to the Ford approved diagnostic tool.
	* Fuel pressure regulator.	* REFER to the Ford approved diagnostic tool.
	* Fuel pump.	* REFER to the Ford approved diagnostic tool.

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General Procedures

Materials

Name	Specification
Brake Cleaner	3U7J-2C410-AA

General Equipment

Pneumatic vacuum gun

CAUTION: Use lint free cloth.

1. Refer to: Solvents, Sealants and Adhesives (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2.

3. CAUTION: Use lint free cloth.
   Material: Brake Cleaner (3U7J-2C410-AA)

4. Using a new brush that will not lose its bristles, brush a suitable evaporative cleaning agent onto the components being removed and onto the surrounding area.
5. Remove all traces of evaporative cleaning agent

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and foreign material.

General Equipment: Pneumatic vacuum gun

6. Dispose of any unused evaporative cleaning agent and the brush after completing the repair.

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Removal and Installation

General Equipment

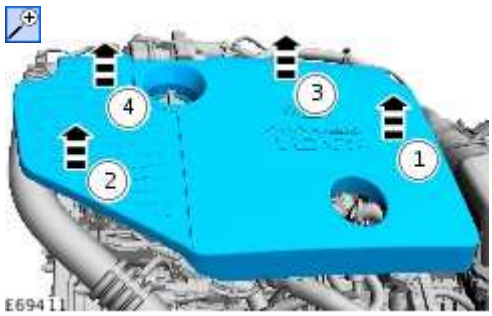
Hose clamp remover/installer

Removal

WARNINGS:

Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

Wait for a minimum of 1 minute after the engine has stopped before commencing any repair to the fuel injection system.

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. CAUTION: Use lint free cloth.
   Protect the generator to prevent contamination.
4. Clean the fuel pump, fuel rail, high-pressure fuel supply line and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, General Procedures).
5. *General Equipment:* Hose clamp remover/installer

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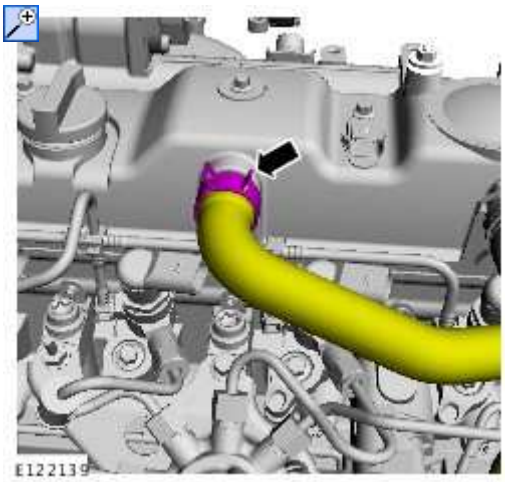
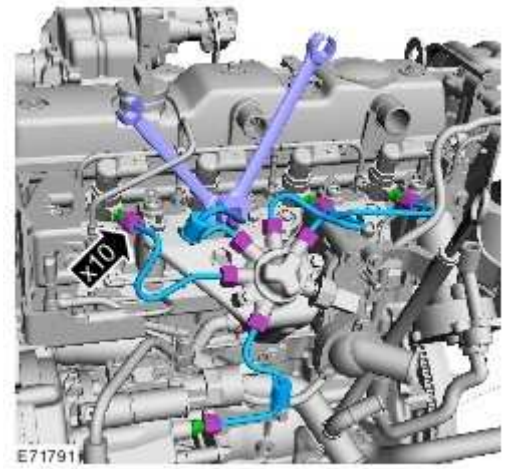




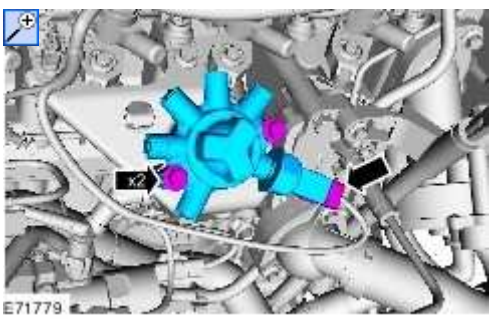
6. CAUTIONS:

   Use an open-ended wrench to prevent the component from turning.

   Make sure that all openings are sealed. Use new blanking caps.

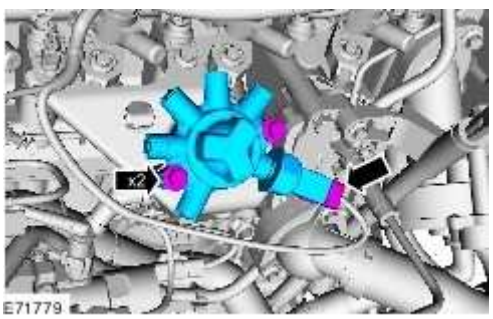
   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.



7.

Installation



1. NOTE: Only tighten the bolts finger tight at this stage.

2. NOTE: Make sure that a new component is installed.
   NOTE: Only tighten the union nuts finger tight at this stage.

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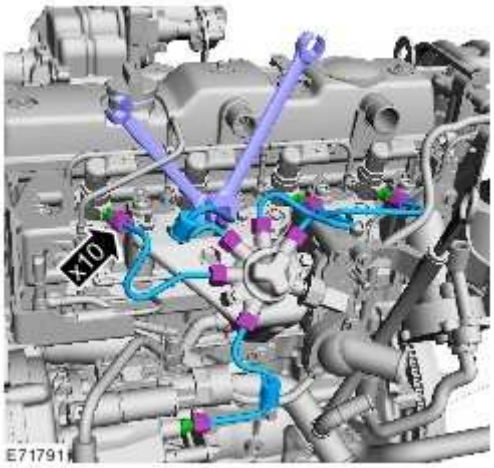
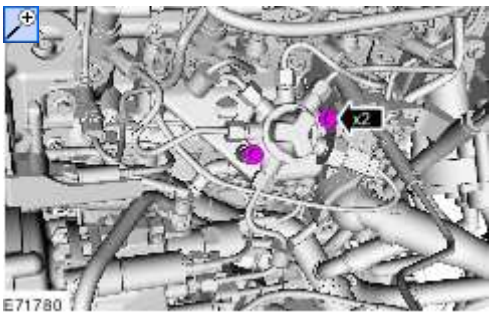
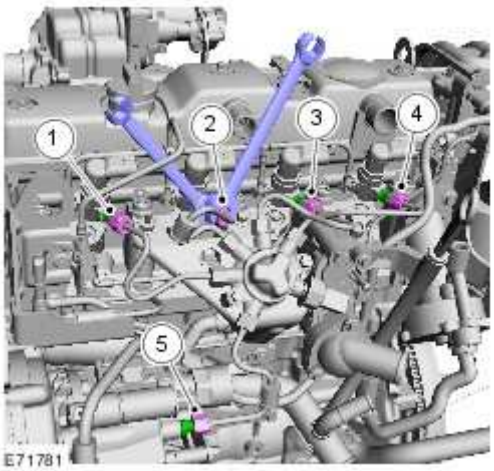
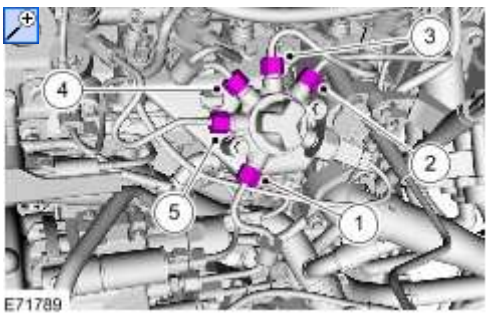




3. *Torque:* 24 Nm



4. CAUTION: Use an open-ended wrench to prevent the component from turning.
Torque: 25 Nm



5. *Torque:* 38 Nm

6. *General Equipment:* Hose clamp remover/installer

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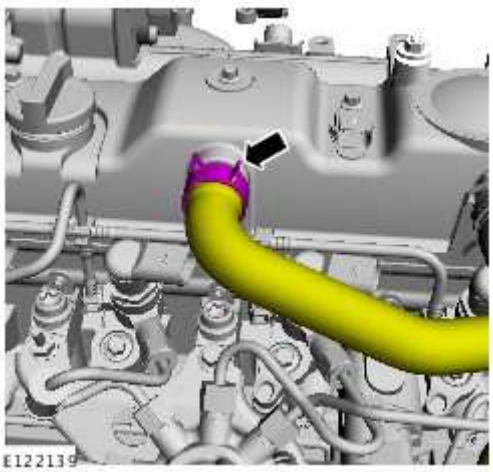
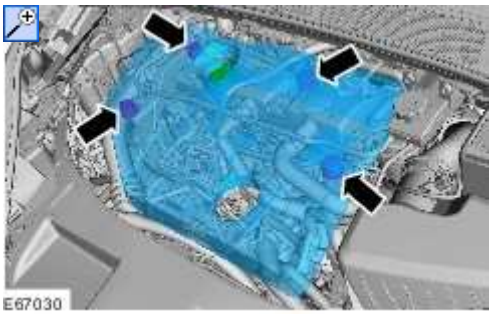


7. Remove the lint-free material.
8. Refer to: Fuel System Bleeding - 1.8L Duratorq-TDCi (Lynx) Diesel (310-00 Fuel System - General Information, General Procedures).
9.



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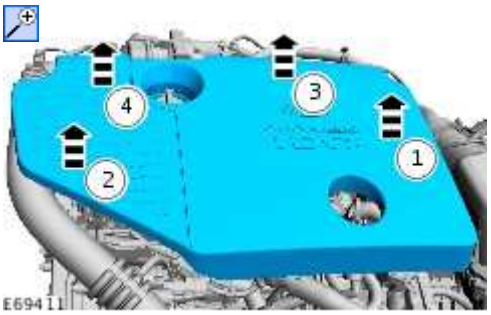
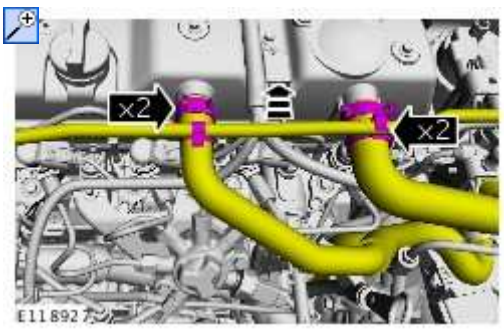
Removal and Installation

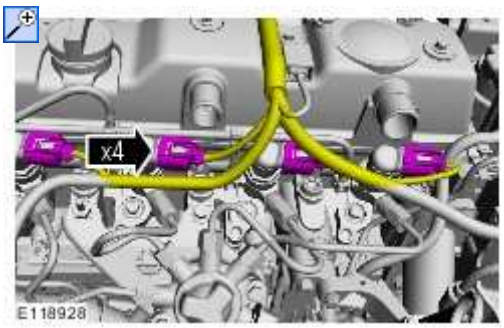
General Equipment

Flat-bladed screwdriver
Hose clamp remover/installer
Long nose pliers

Removal

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Descriptio Operation).
2. 

3. *General Equipment:* Hose clamp remover/installer


4. 

5. Refer to: Fuel Injection Component Cleaning (303-0 Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/13 - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Em Requirements: Stage IV, General Procedures).
6. CAUTIO

Use open-en wrench

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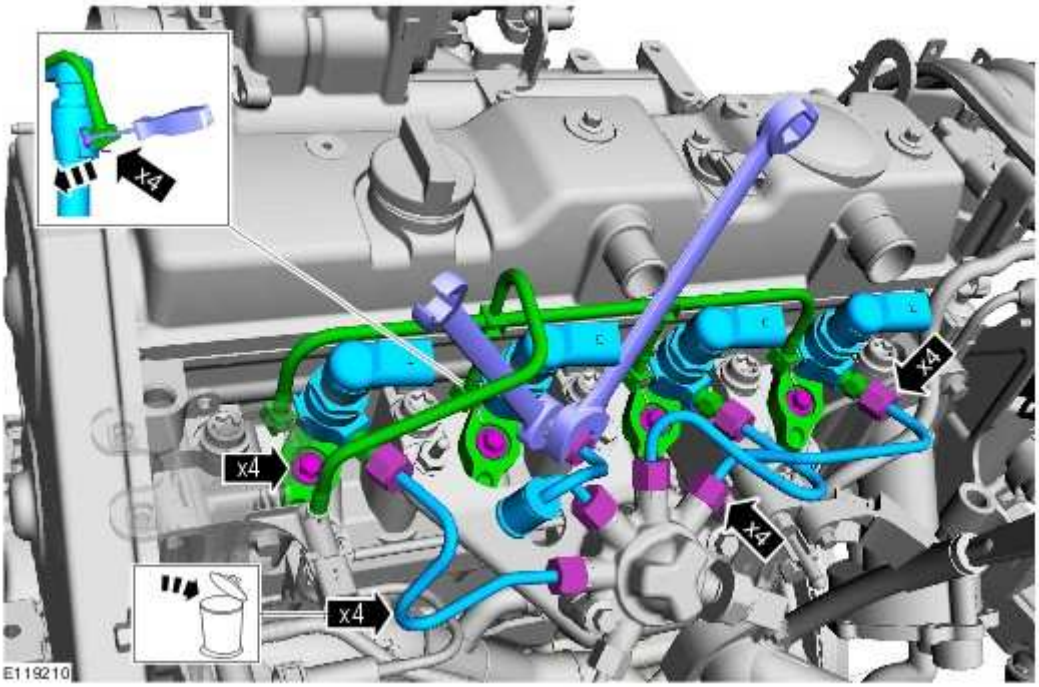

prevent
compone
from
turning.

Mak
sure tha
the fuel
remains
contact
both enc
until bot
unions n
have bee
unscrew
and the
area aro
the joint
thorough
cleaned.

Vac
any fore
material
from the
fuel pum
and fuel
unions
before
sealing t
unions w
blanking
caps.

Mak
sure tha
openings
are seale
Use new
blanking
caps.
General
Equipme
Flat-blad
screwdri

7.

Installation

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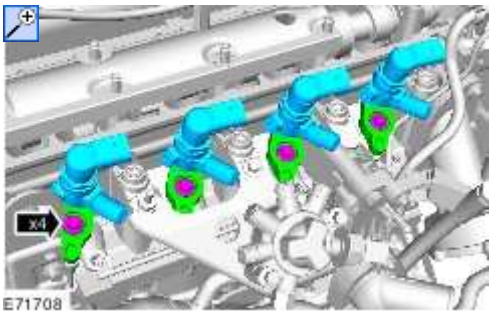
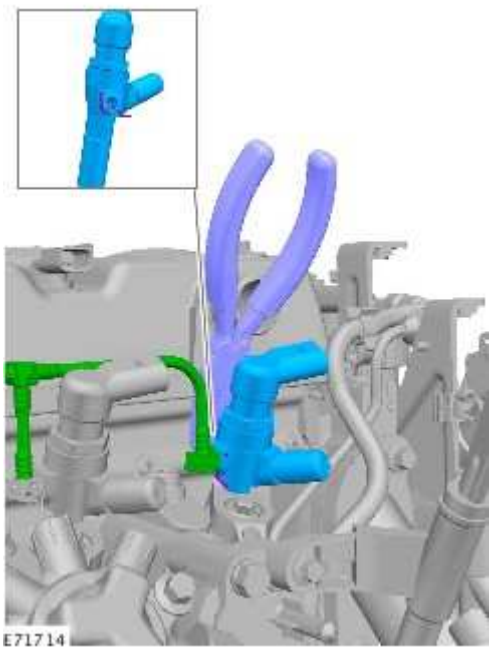
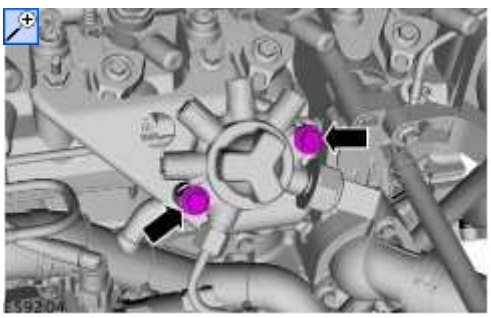
1. NOTE: Make sure that a new component is installe



2. NOTE: Make sure that the component is installed t the position noted before removal.
Torque:
Stage 1: 5 Nm
Stage 2: 90°



3. *General Equipment:* Long nose pliers
General Equipment: Flat-bladed screwdriver



4. *Loosen:* 5 turn(s)

5. NOTE: Make sure that new components are install
NOTE: Only tighten the union nuts finger tight at t stage.
Discard the blanking caps.

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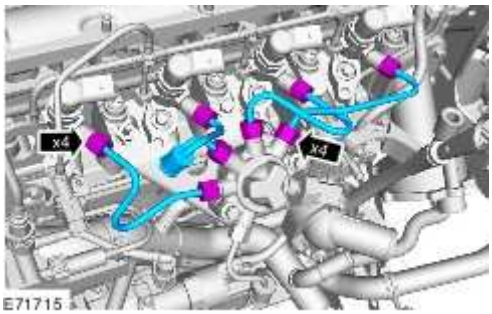
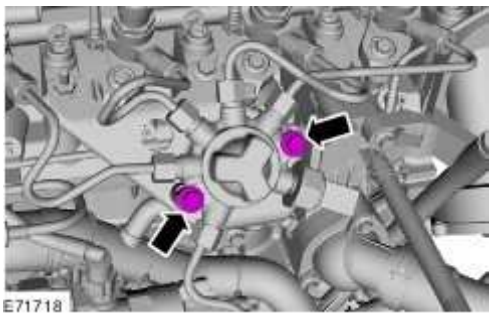
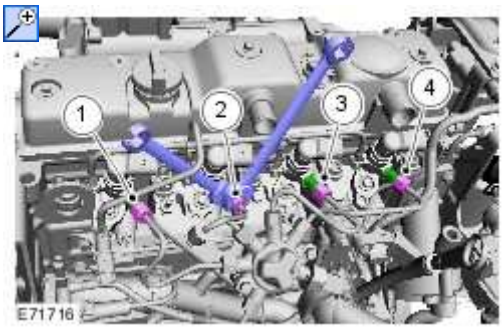
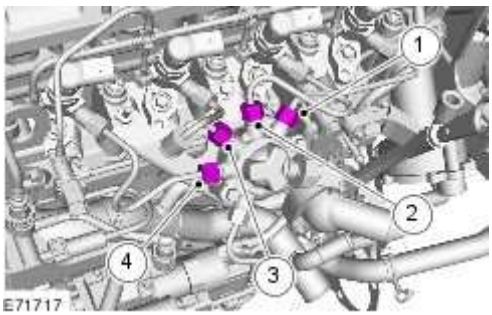




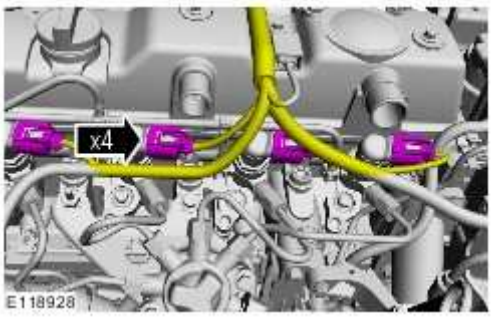
6. *Torque:* 24 Nm



7. CAUTION: Use an open-ended wrench to prev the component from turning.
Torque: 25 Nm



8. *Torque:* 38 Nm



9.

10. *General Equipment:* Hose clamp remover/installer

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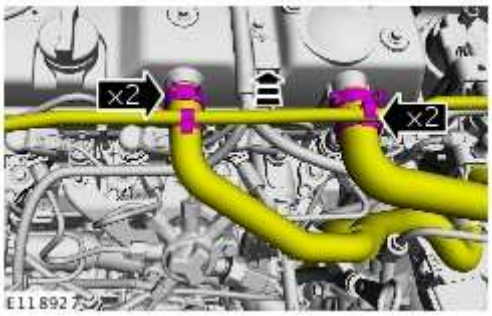

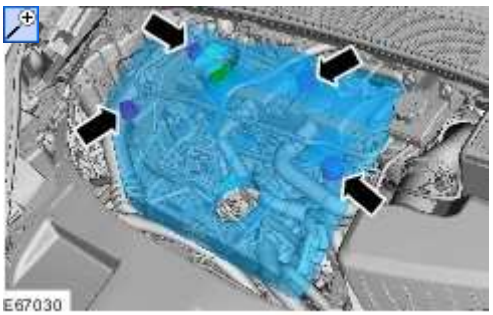

11.

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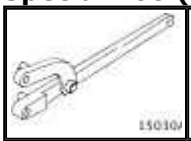
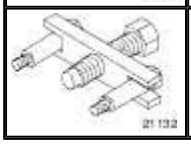
Removal and Installation

Special Tool(s)

	205-072 Universal Flange Holding Wrench
	303-249 Remover, Crankshaft Timing Pulley

Materials

Name	Specification
Silicone Sealant LB	WSE-M4G323-A4 / 2U7J-M4G323-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

Removal

WARNINGS:

Make sure that the fuel pressure has dropped to zero and that the fuel temperature is at ambient temperature.

Wait for a minimum of 1 minute after the engine has stopped before commencing any repair to the fuel injection system.

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the timing belt.

   Refer to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
3. CAUTION: Use lint free cloth.
   Protect the generator to prevent contamination.
4. Clean the fuel pump, fuel rail, high-pressure fuel supply line and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).
5. CAUTIONS:

   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

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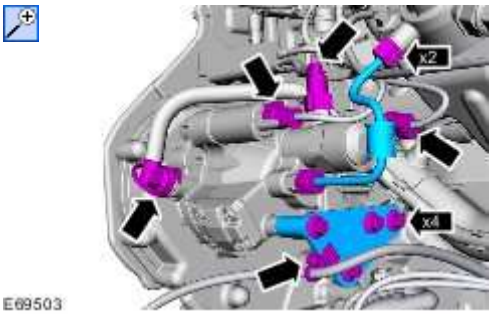
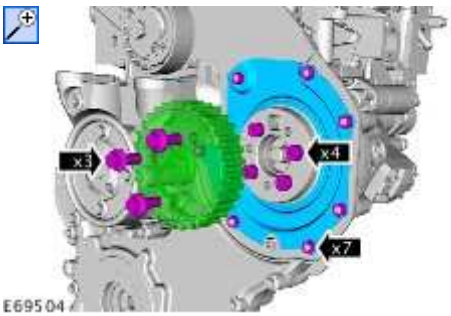


E69503

⚠ Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.

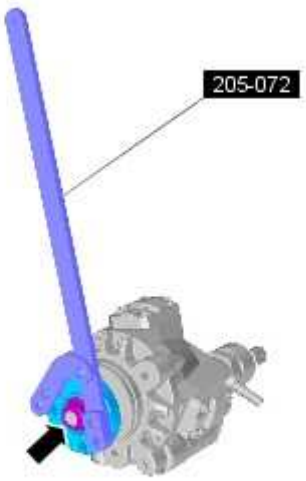
⚠ Make sure that all openings are sealed. Use new blanking caps.
Discard the high-pressure fuel supply line.



E69504

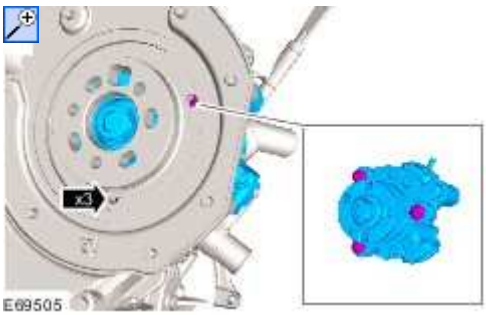
6.

7. *Special Tool(s):* 205-072



E69506

Vehicles built up to 07/2007



E69505

8. NOTE: Access the fuel pump bolts through the holes provided. The bolts cannot be removed.

Vehicles built 07/2007 onwards

9.

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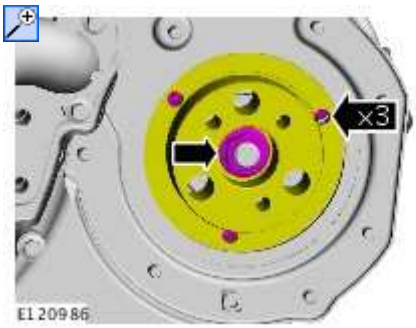
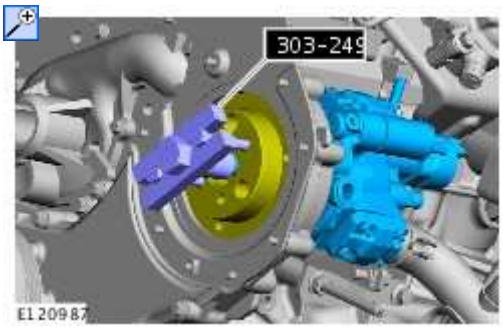
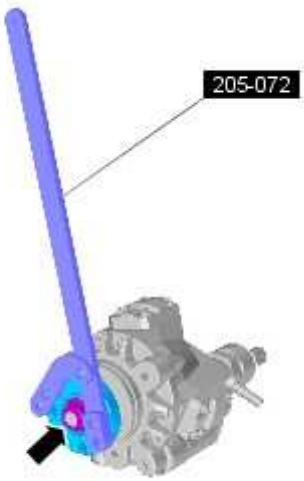




10. *Special Tool(s):* 303-249

Installation

1. *Special Tool(s):* 205-072
   Torque: 45 Nm



2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)

Vehicles built up to 07/2007

3. NOTE: Access the fuel pump bolts through the holes provided. The bolts cannot be

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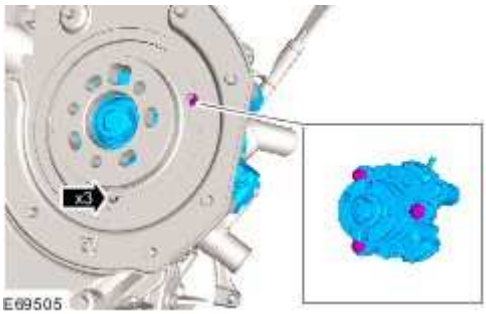
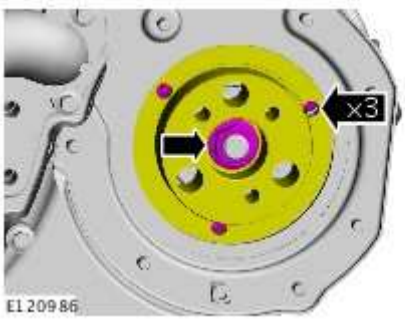


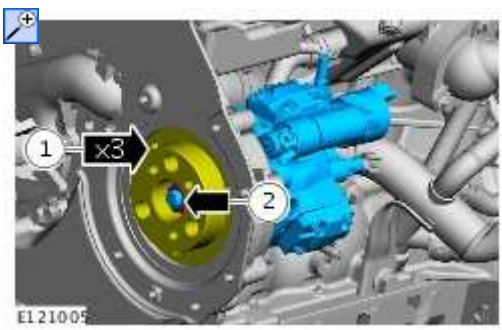
removed.
Torque: 20 Nm

4. *Torque:* 24 Nm

Vehicles built 10/2007 onwards

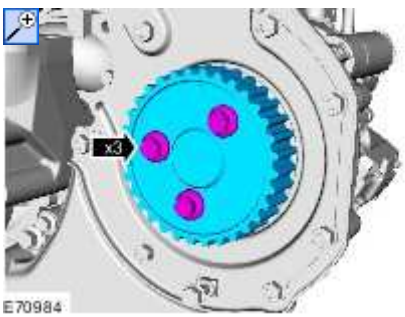


5.



6.
1. *Torque:* 26 Nm
2. *Torque:* 50 Nm

All vehicles



7. *Torque:* 42 Nm

8. *Torque:* 10 Nm

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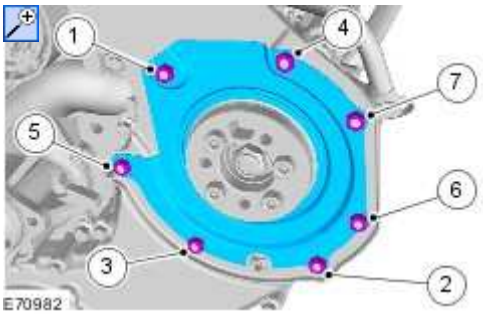
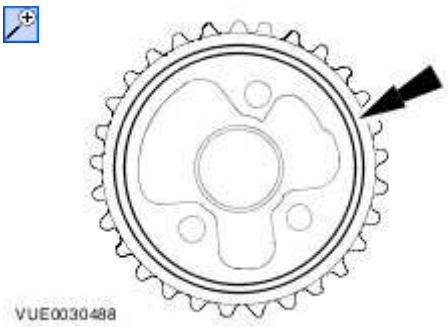
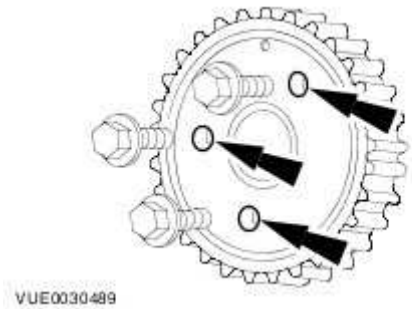
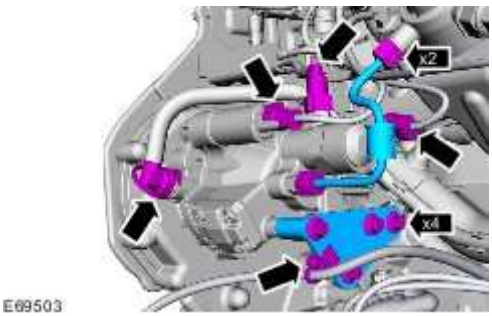




9. *Material:* Silicone Sealant LB (WSE-M4G323-A4 / 2U7J-M4G323-AA)



10. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)



11. NOTE: Make sure that a new component is installed.
    Discard the blanking plugs.

    Torque:
    Fuel pump high-pressure fuel supply line union 25 Nm
    Fuel rail high-pressure fuel supply line union 38 Nm
    Fuel pump bracket bolts 23 Nm
12. Remove the lint-free material.
13. Install the timing belt.

    Refer to: Timing Belt (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
14. Install a new fuel filter element.

    Refer to: Fuel Filter Element (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

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Torque Specifications

Item	Nm	lb-ft	lb-in
Windshield wiper arm retaining nuts	15	11	-
Fuel filter crash protection shield retaining bolts	9	-	80
Fuel filter support bracket retaining bolts	9	-	80
High-pressure fuel injection supply pipe unions	23	17	-
Fuel injection supply manifold retaining bolts	22	16	-
Intake manifold retaining bolts	9	-	80
Timing belt upper cover retaining bolts	7	-	62
Fuel injector retaining bracket nuts	a	-	-
Fuel pump retaining bolts	20	15	-

a) Refer to the relevant procedure in this section.

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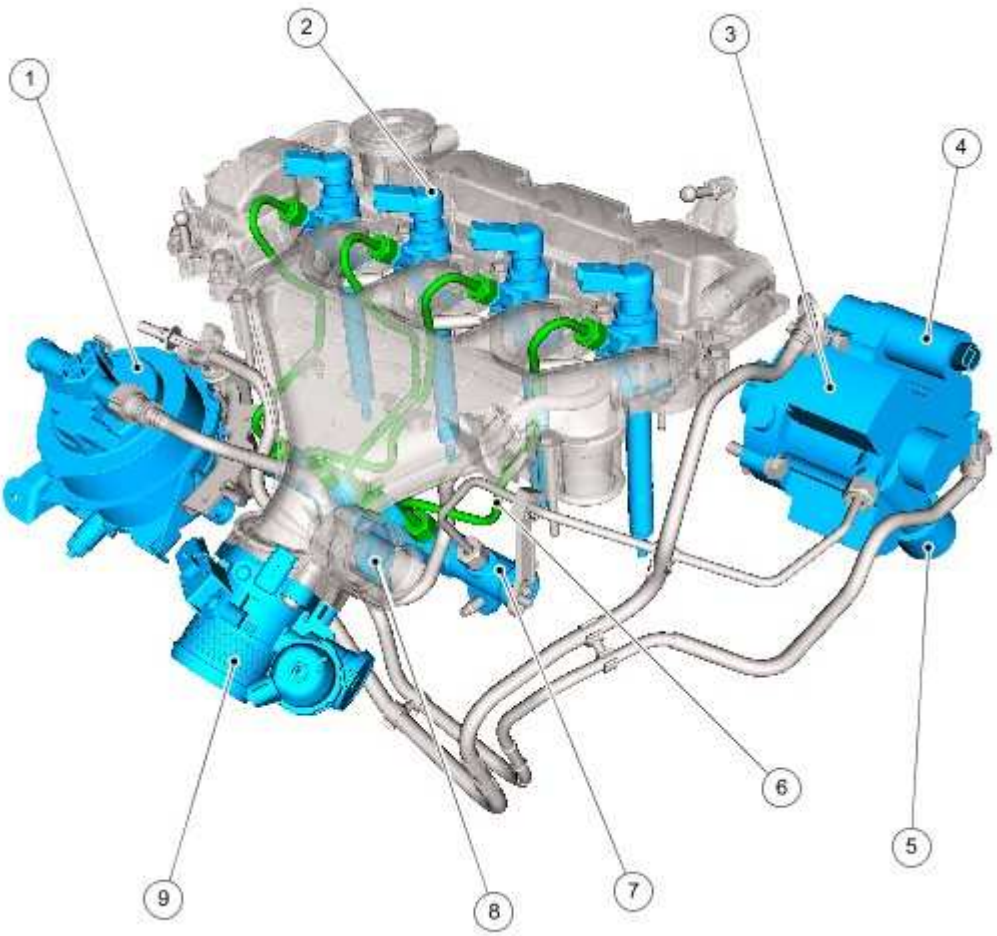
Description and Operation

General Overview



E65811

Item	Part Number	Description
1	-	Fuel filter housing
2	-	Fuel injector(s)
3	-	Fuel pump
4	-	Fuel metering valve
5	-	Fuel pressure regulator
6	-	High-pressure fuel supply line(s)
7	-	Fuel rail
8	-	Fuel rail pressure (FRP) sensor
9	-	Intake air shutoff throttle

A Siemens common rail diesel injection system is used on the 2.0L Duratorq TDCi (DW10)

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engine.

Within the fuel pump is an integral fuel transfer pump which delivers the fuel from the fuel tank to the fuel pump.

A fuel metering valve is located in the feed port to the high-pressure chamber of the fuel pump. The fuel metering valve varies the quantity of fuel supplied to the fuel pump elements, in accordance with driving conditions.

At high-pressure, the fuel is sent to the fuel rail and then to the fuel injectors ready for fuel injection. Depending on engine operating conditions, the fuel injection pressure varies between approximately. 350 bar and 1650 bar.

Fuel pressure is measured using a FRP sensor on the fuel rail. The FRP sensor converts the fuel system pressure into a voltage signal. This voltage signal acts as an input signal to the powertrain control module (PCM) for calculation of the correct fuel injection quantity.

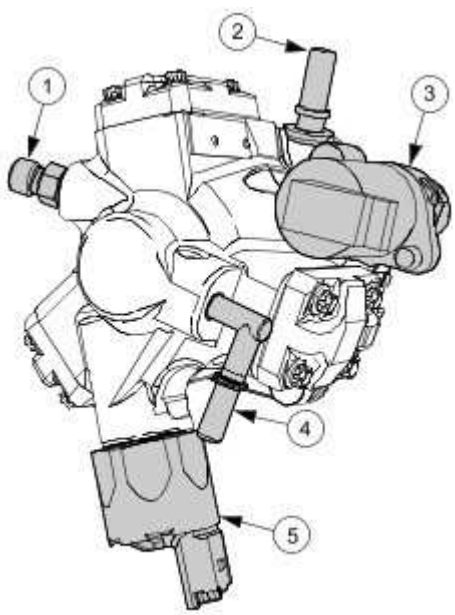
The PCM calculates the time of fuel injection and the fuel injection quantity depending on various input variables.

The specified quantity of fuel is injected into the respective combustion chamber through the piezo-electrically actuated fuel injectors. In doing so, a pre-injection and a main injection occur each time.

The excess fuel is returned to the fuel tank through the fuel return line.

The fuel pressure regulator on the high-pressure outlet of the fuel pump regulates the fuel pressure and thereby also the pressure within the fuel rail.

Fuel pump



E43101

Item	Part Number	Description
1	-	High-pressure outlet union
2	-	Fuel pump fuel supply union
3	-	Fuel metering valve
4	-	Fuel return union
5	-	Fuel pressure regulator

The fuel pump is attached to the cylinder head on the transmission side and is driven directly by the exhaust camshaft through a drive flange.

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The fuel pump has three pump elements, each offset from each other by 120 degrees.

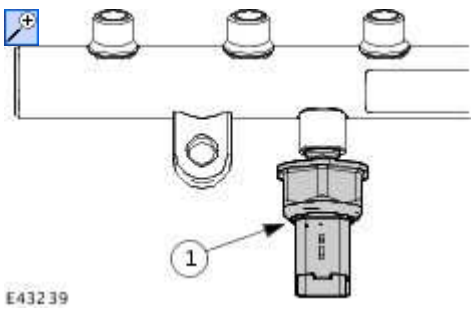
The fuel transfer pump is incorporated into the fuel pump and is located on the drive flange. The fuel transfer pump is a vane type pump.

The fuel metering valve is located in the feed port between the high-pressure pump elements and the fuel transfer pump. It is controlled by the PCM using pulse width modulation.

The high-pressure outlets of the three high-pressure pump elements are grouped together in a high-pressure connection.

The fuel pressure regulator is located on the high-pressure outlet to the fuel rail. The fuel pressure regulator operates electromagnetically and is actuated by the PCM.

Fuel rail



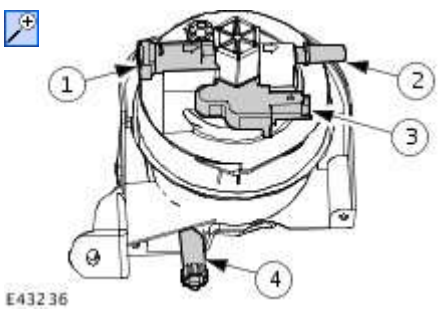
Item	Part Number	Description
1	-	Fuel rail pressure (FRP) sensor

The fuel rail is made from forged steel and is attached directly to the cylinder block.

The high-pressure fuel is delivered through one high-pressure fuel supply line from the fuel pump to the fuel rail.

From the fuel rail, the high-pressure fuel is directed to four more high-pressure fuel supply lines for fuel injection delivery by the fuel injectors.

Fuel filter



Item	Part Number	Description
1	-	Fuel filter fuel supply union
2	-	Fuel pump fuel supply union
3	-	Electric fuel heater
4	-	Drain plug

The fuel filter is located above the fuel rail and is attached to the cylinder head by means of a bracket.

The fuel filter has an electric fuel heater which is located centrally on the fuel filter between the supply connection and the drain connection.

The fuel filter forms a single component with the housing and can only be renewed as a

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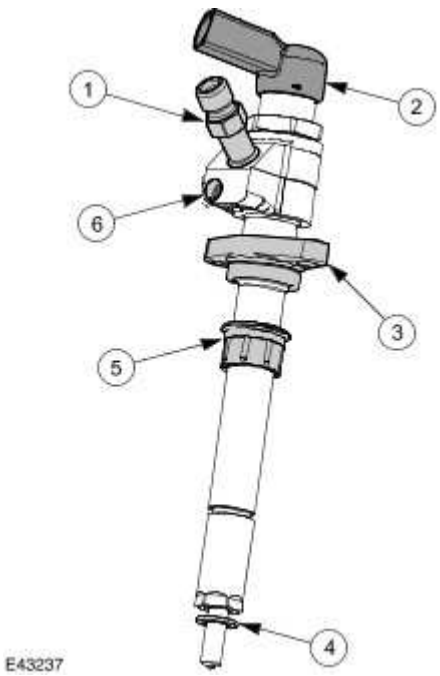
complete unit.

The fuel filter also has a drain plug. This must be drained regularly in accordance with maintenance instructions.

Fuel injectors



Item	Part Number	Description
1	-	High-pressure fuel supply union
2	-	Electrical connector
3	-	Fuel injector clamp
4	-	Copper sealing washer
5	-	Plastic guide bush
6	-	Fuel injector fuel return port

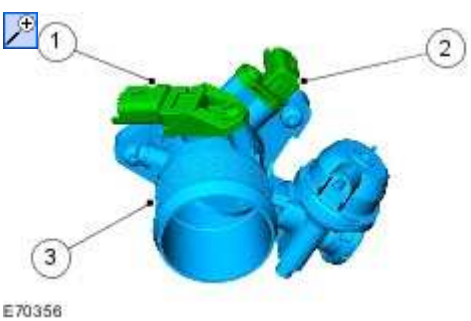
The fuel injectors are located centrally on the cylinder head upper section and are attached by means of clamps.

The guide bushes in the cylinder head lower section and the plastic guide bushes on the fuel injectors make sure that they are centred properly.

The fuel injectors are sealed off from the combustion chamber by means of a copper sealing washer located between the fuel injector and the cylinder head. A new sealing washer must be installed when servicing the fuel injectors.

The fuel return lines are attached to the top of the fuel injector and are connected in series.

Intake air shutoff throttle



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Item	Part Number	Description
1	-	Manifold absolute pressure (MAP) sensor
2	-	Intake air temperature (IAT) sensor
3	-	Intake air shutoff throttle

The intake air shutoff throttle is located on the intake air side of the intake manifold.

The intake air shutoff throttle is electronically controlled by the PCM and is used to control vehicle characteristics while the engine is switched off. This will also prevent the engine being continuously fuelled by the engine oil after the ignition key has been turned to position 0. This is achieved by reducing the intake air through the intake manifold.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

The 2.0L DW10 engine uses a second generation Siemens common rail fuel injection system. The systems main components consist of a fuel pump, fuel rail, electrically operated fuel injectors, a fuel temperature sensor and a fuel rail pressure sensor.

Fuel Pump

E52462

Item	Part Number	Description
1	-	Fuel pump fuel intake
2	-	Fuel pump high-pressure fuel outlet
3	-	Fuel metering valve
4	-	High-pressure fuel pump chamber
5	-	Fuel pump fuel return outlet
6	-	High pressure fuel control valve

The fuel pump consists of a transfer pump and a high-pressure fuel delivery pump. The transfer pump draws fuel from the fuel tank through the fuel filter and delivers the fuel to the three high-pressure fuel pump chambers through a fuel metering valve. The fuel metering valve controls the quantity of fuel that is allowed to enter the high-pressure fuel pump chambers. Excess fuel volume developed by the transfer pump is returned to the fuel tank. The fuel metering valve is controlled by the powertrain control module (PCM) using a pulse-width modulated signal. The high-pressure fuel pump outlet pressure is controlled by an electronic fuel control valve which is also controlled by the PCM.

Fuel Rail

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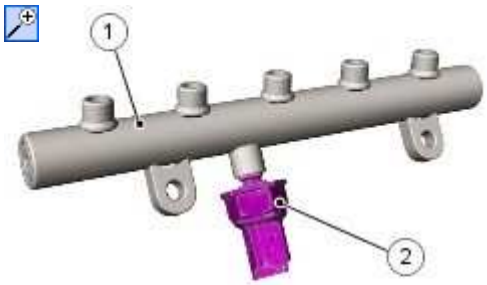
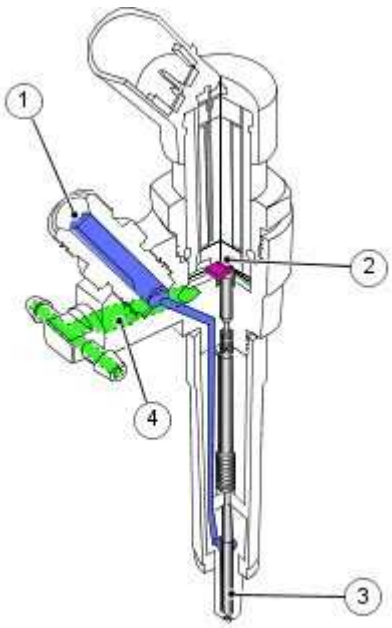


E52463

Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel rail pressure (FRP) sensor

The fuel rail function is to supply a reservoir of fuel to all four fuel injectors with no variations in fuel pressure for any one fuel injector. The fuel rail acts as a pulse damper eliminating surges in fuel pressure. Attached to the fuel rail is a FRP sensor, which monitors the fuel pressure at the fuel injectors. The FRP sensor develops a pressure conscious variable resistance which provides a controlled variable voltage signal to the PCM.

Fuel Injectors



E52464

Item	Part Number	Description
1	-	High-pressure fuel intake
2	-	Piezoelectric actuator
3	-	Fuel injector control valve
4	-	Fuel injector fuel return

The fuel injectors have a Piezoelectric actuator. The advantages of using Piezoelectric instead of traditional solenoid actuators are the reduction in reaction switching times and the lower switching currents. Both of which improve the control and therefore the efficiency of the fuel injector. During manufacture, the fuel injectors are graded according to their

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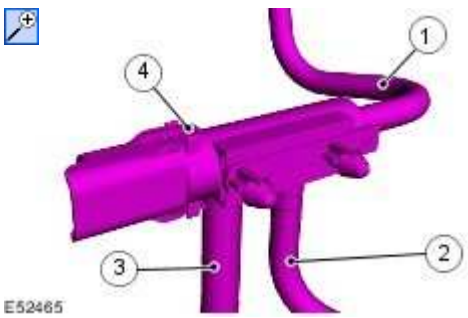
flow characteristics into one of three grades. The grade is printed on the top of the fuel injector and can be the number 4, 5, or 6. All four fuel injectors must be of a matching grade for any one engine application. The grade value is used by the PCM to adjust the fuel injector injection signal to achieve optimum efficiency. The fuel injectors are designed to allow a quantity of fuel to return to the fuel tank. The returned fuel is developed during the opening cycle of the fuel injector control valve. This returned fuel is used to lubricate the fuel injector moving components and is essential to the operation of the fuel injector. This lubricating fuel is returned to the fuel tank through the fuel injector fuel return line. Only by accurate measurement, at precise engine conditions, can the volumes of fuel from the fuel injector fuel return be used to diagnose concerns with the fuel charging control system.

Fuel Temperature Sensor



Item	Part Number	Description
1	-	Fuel injector fuel return line
2	-	Fuel pump fuel return line
3	-	Fuel temperature sensor to fuel tank fuel return line
4	-	Fuel temperature sensor

The fuel temperature sensor is fitted into the fuel pump to fuel tank fuel return line. The temperature sensor monitors the temperature of the fuel returning to the fuel tank from the fuel pump and the fuel injectors. The fuel temperature sensor housing acts as a venturi. The venturi assists with the fuel return from the fuel injectors by creating a pressure reduction in the fuel injector fuel return line.

Inspection and Verification

WARNINGS:

REFER to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

This procedure involves fuel handling. Be prepared for fuel spillage at all times. Failure to follow this instruction may result in personal injury.

CAUTION: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always fit blanking plugs to any open orifices or lines.
NOTE: As well as carrying out its normal function the glow plug indicator also acts as an engine check lamp which will flash continuously when a hard diagnostic trouble code (DTC) is detected by the powertrain control module (PCM). Soft DTCs are also stored by the PCM but will only be known if the system is checked for DTCs using the WDS.
NOTE: If a DTC is detected, all DTCs must be cleared after the concern is rectified. Failure to clear all DTCs may cause driveability concerns.
NOTE: If the fuel level in the fuel tank drops below approximately four liters, rough running will occur. This is to signal to the driver that the vehicle requires refuelling in order to prevent the fuel system from running dry.

1. **1.** Verify the customer concern.

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2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
Fuel leak(s)	Fuse(s)
Fuel filter	Relay(s)
Air cleaner element	Wiring harness
Vacuum line(s)/vacuum connections	Electrical connector(s)
Hose(s)/hose connections	Sensor(s)
Tube(s)/tube connections	
Contaminated fuel	
Fuel supply line(s)	
Fuel return line(s)	
High-pressure fuel supply line(s)	
Fuel injectors	
Fuel rail	
Fuel pump	

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the WDS to retrieve the diagnostic trouble codes (DTCs).

5. **5.** If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnostics.

Symptom Chart

Symptom	Possible Sources	Action
Engine does not crank and passive anti-theft system (PATS) LED is flashing	* PATS system fault detected.	* REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Diagnosis and Testing).
Engine does not crank and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine does not crank	* Starting system.	* REFER to: Starting System (303-06E Starting System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
Engine cranks but does not start and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine cranks but does not start	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW,

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		Emission Requirements: Stage IV, Removal and Installation).
	* Fuel lines damaged or blocked.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Glow plugs.	* REFER to the WDS.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Low cylinder compression.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Crankshaft position (CKP) sensor.	* REFER to the WDS.
	* Camshaft position (CMP) sensor.	* REFER to the WDS.
	* Engine coolant temperature (ECT) sensor.	* REFER to the WDS.
	* PCM.	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
Poor starting and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Poor starting	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Glow plugs.	* REFER to the WDS.
	* Fuel system leak.	* CHECK the system for fuel leak(s). REPAIR the system as necessary.
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information,

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		Diagnosis and Testing).
	* Fuel system restriction.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, Diagnosis and Testing).
	* Incorrect engine oil.	* INSTALL a new engine oil filter and engine oil.
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Low cylinder compression.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* CKP sensor.	* REFER to the WDS.
	* ECT sensor.	* REFER to the WDS.
	* Fuel temperature sensor.	* REFER to the WDS.
	* Mass air flow (MAF) sensor.	* REFER to the WDS.
	* Manifold absolute pressure (MAP) sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air sut-off throttle for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Engine starts but immediately stops and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine starts but immediately stops	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, Diagnosis and Testing).
	* PCM relay.	* CARRY OUT a relay component test.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* CKP sensor.	* REFER to the WDS.
	* CMP sensor.	* REFER to the WDS.

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	* ECT sensor.	* REFER to the WDS.
	* PCM.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Poor idling and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Poor idling	* Low fuel tank fuel level.	* CHECK the fuel tank fuel level is greater than four liters. If the fuel tank fuel level is less then four liters, FILL with fuel.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal

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		and Installation).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, Diagnosis and Testing).
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Fuel injector(s).	* REFER to the WDS.
	* MAF sensor.	* REFER to the WDS.
	* MAP sensor.	* REFER to the WDS.
	* CKP sensor.	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Engine stumbling and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine stumbling	* Low fuel level.	* CHECK the fuel tank level is greater than four litres. If the fuel tank level is less than four litres, FILL with fuel.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Accelerator pedal position (APP) sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
Engine lacks power and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine lacks power	* Brakes binding.	* CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi

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	(103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
* Kinked or restricted fuel lines.	* REFER to: Spring Lock Couplings (310-00, General Procedures).
* Air ingress into the fuel lines.	* REFER to: Spring Lock Couplings (310-00, General Procedures).
* Turbocharger. * Turbocharger vacuum diaphragm unit.	* INSPECT the vacuum line(s) for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary. REFER to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
* Low cylinder compression.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
* Charge air cooler blocked or cracked. * Charge air cooler pipes split or cracked. * Charge air cooler pipe retaining clips missing or loose.	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi

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		(103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
	* Vehicle speed sensor (VSS).	* REFER to the WDS.
	* ECT sensor.	* REFER to the WDS.
	* MAF sensor.	* REFER to the WDS.
	* MAP sensor.	* REFER to the WDS.
	* APP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* Fuel temperature sensor.	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Black smoke at idle and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Black smoke at idle	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Glow plug system.	* REFER to the WDS.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi

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		(100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* ECT sensor.	* REFER to the WDS.
	* MAF sensor.	* REFER to the WDS.
	* MAP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Excessive black smoke during acceleration and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Excessive black smoke during acceleration	* Air cleaner element blocked.	* INSTALL a new air cleaner element as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
	* Catalytic converter	* REMOVE and visually INSPECT the catalytic

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	blocked.	converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* APP sensor.	* REFER to the WDS.
	* CKP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Black smoke at cruising speeds and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Black smoke at cruising speeds	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
	* Turbocharger vacuum diaphragm unit.	* REFER to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
	* Catalytic converter blocked.	* REMOVE and visually INSPECT the catalytic converter for damage. INSTALL a new catalytic converter as necessary. REFER to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* ECT sensor.	* REFER to the WDS.
	* MAF sensor.	* REFER to the WDS.
	* MAP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Blue smoke and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Blue smoke	* Engine burning oil.	* CARRY OUT a controlled oil consumption test over 1000 km (600 miles). CONFIRM that the oil consumption is less than 0.1 of a liter per

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		1000 km (600 miles). REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
	* Positive crankcase ventilation (PCV) system.	* INSPECT for visible signs of damage or blockage. CLEAN, REPAIR or INSTALL new parts as necessary.
	* Turbocharger oil return tube blocked or damaged.	* REFER to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
	* Worn or damaged valve guide(s), piston ring(s), cylinder bore (s), cylinder head or gasket.	* REMOVE the cylinder head. INSPECT the cylinder head, pistons and cylinder bores for signs of wear or damage.
White smoke and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
White smoke	* Water in fuel.	* CHECK for signs of water in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel.

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		REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
	* Fuel injector(s).	* REFER to the WDS.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Coolant in the combustion chamber.	* CARRY OUT a cooling system pressure test. REFER to: Engine Cooling (303-03D Engine Cooling - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing). REMOVE the cylinder head. INSPECT the cylinder head, cylinder head gasket and cylinder bores for wear or damage.
Engine misfire and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine misfire	* Low fuel tank level.	* CHECK the fuel tank level is greater than four liters. If the fuel tank level is less than four liters, FILL with fuel.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

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	INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel injection supply manifold, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Kent) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00, Diagnosis and Testing).
* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
* Low cylinder compression.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
* Engine overheats.	* REFER to: Engine Cooling (303-03D Engine Cooling - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
* ECT sensor.	* REFER to the WDS.
* CKP sensor.	* REFER to the WDS.
* CMP sensor.	* REFER to the WDS.
* MAF sensor.	* REFER to the WDS.
* MAP sensor.	* REFER to the WDS.
* Fuel injector(s).	* REFER to the WDS.
* FRP sensor.	* REFER to the WDS.
* Fuel pump.	* REFER to the WDS.
* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
* Worn or damaged valve(s), tappet(s) or camshaft(s).	* REMOVE the cylinder head. INSPECT the cylinder head, valves, tappets and camshafts for signs of wear or damage.
* Damaged cylinder	* REMOVE the cylinder head. INSPECT the

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	head gasket.	cylinder head gasket and cylinder bores for wear or damage.
Engine knock at idle and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine knock at idle	* Low engine oil level.	* CHECK the engine oil level. REFILL as necessary.
	* Incorrect or contaminated fuel.	* CHECK for signs of contamination such as strange odors from the fuel tank. * CHECK for signs of water or gasoline in the diesel. * If contaminated fuel is found, DRAIN the complete fuel system. FLUSH the fuel system through with clean diesel. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures). INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). INSTALL a new fuel pump, fuel injectors, fuel rail, and high-pressure fuel supply lines. REFER to: Fuel Pump (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Injectors (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation) / Fuel Rail (303-04D Fuel Charging and Controls - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation).
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Excessive carbon build up.	* REMOVE the cylinder head. INSPECT the cylinder head and pistons for signs carbon build up.
	* Worn or damaged oil pump. * Major mechanical engine failure.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).

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	* CKP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
Engine knock during acceleration and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Engine knock during acceleration	* Fuel injector(s).	* REFER to the WDS.
	* Major mechanical engine failure.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.
Excessive fuel consumption and glow plug indicator is flashing	* DTC detected.	* REFER to the WDS.
Excessive fuel consumption	* Brakes binding.	* CHECK the braking system. REFER to: Brake System (206-00 Brake System - General Information, Diagnosis and Testing).
	* Vehicle overloaded, or excessive wind resistance (roof racks, towing etc).	* ADVISE the customer about the effects of overloading the vehicle and wind resistance on the fuel consumption.
	* Air cleaner element blocked.	* INSTALL a new air cleaner element.
	* Fuel filter blocked.	* INSTALL a new fuel filter element. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Fuel system leak(s).	* CHECK the system for fuel leak(s). REPAIR or INSTALL new parts as necessary.
	* Dual mass flywheel.	* INSPECT the dual mass flywheel for damage. INSTALL a new dual mass flywheel as necessary.
	* Incorrect engine oil.	* INSTALL a new oil filter and engine oil.
	* Generator.	* REFER to the WDS.
	* EGR valve incorrect operation.	* REFER to: Engine Emission Control (303-08D, Diagnosis and Testing).
	* Turbocharger vacuum diaphragm unit.	* REFER to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* REFER to: Fuel System - 1.8L Duratorq-TDCi (Kent) Diesel/2.0L Duratorq-TDCi (DW) Diesel (310-00, Diagnosis and Testing).
	* Incorrect valve timing.	* CHECK the valve timing. REFER to: Timing Belt (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission

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		Requirements: Stage IV, Removal and Installation).
	* Turbocharger.	* REFER to: Turbocharger (303-04G Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (DW) Diesel, Diagnosis and Testing).
	* Slipping clutch (If equipped).	* REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).
	* Low cylinder compression.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* ECT sensor.	* REFER to the WDS.
	* MAF sensor.	* REFER to the WDS.
	* MAP sensor.	* REFER to the WDS.
	* Fuel injector(s).	* REFER to the WDS.
	* Intake air shut-off throttle.	* CHECK the intake air shut-off throttle butterfly for obstructions and correct operation. * REFER to the WDS.
	* Intake air shut-off throttle vacuum control solenoid.	* CHECK the intake air shut-off throttle vacuum control solenoid vacuum lines for kinks or restrictions. * REFER to the WDS.
Engine cuts out during hard acceleration	* CMP sensor.	* REFER to the WDS.
	* CKP sensor.	* REFER to the WDS.
	* FRP sensor.	* REFER to the WDS.
	* Fuel pump fuel pressure regulator.	* REFER to the WDS.
	* Fuel pump.	* REFER to the WDS.

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General Procedures

Materials

Name	Specification
Brake Cleaner	3U7J-2C410-AA

General Equipment

Pneumatic vacuum gun

CAUTION: Use lint free cloth.

1. Refer to: Solvents, Sealants and Adhesives (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2.

3. CAUTION: Use lint free cloth.
   Material: Brake Cleaner (3U7J-2C410-AA)

4. Using a new brush that will not lose its bristles, brush a suitable evaporative cleaning agent onto the components being removed and onto the surrounding area.

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5. Remove all traces of evaporative cleaning agent and foreign material.

   General Equipment: Pneumatic vacuum gun

6. Dispose of any unused evaporative cleaning agent and the brush after completing the repair.

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Removal and Installation

Removal

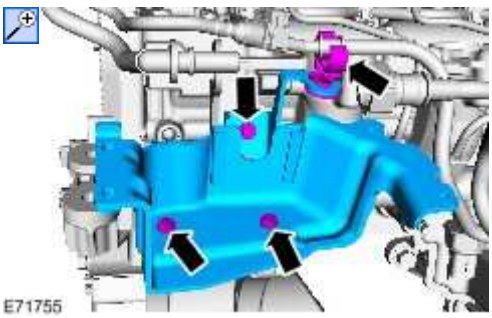
WARNING: Make sure that the fuel pressure has dropped to zero and that the fuel temper is at ambient temperature.

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

1. Refer to: Diesel Fuel System Health and Safety Preca (100-00 General Information, Description and Opera
2. Remove the intake manifold.

   Refer to: Intake Manifold (303-01F Engine - 2.0L Du TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/1 DW, Emission Requirements: Stage IV, Removal anc Installation).
3. Remove the fuel filter.

   Refer to: Fuel Filter (310-01C Fuel Tank and Lines - Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-T (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/1 DW, Emission Requirements: Stage IV, Removal anc Installation).



4. *Torque:* 9 Nm
5. Vacuum foreign material from the high-pressure fuel line unions and component threads.

   Refer to: Fuel Injection Component Cleaning (303-0 Charging and Controls - 2.0L Duratorq-TDCi (85kW/ DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, General Procedures).
6.

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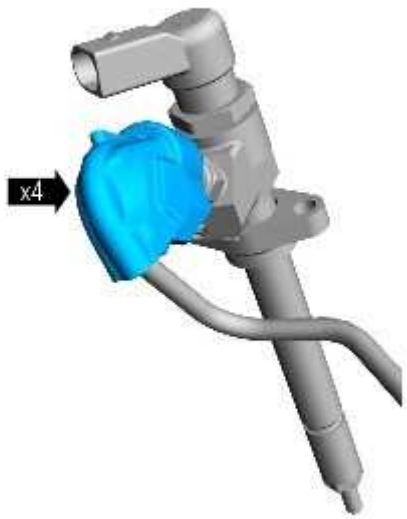

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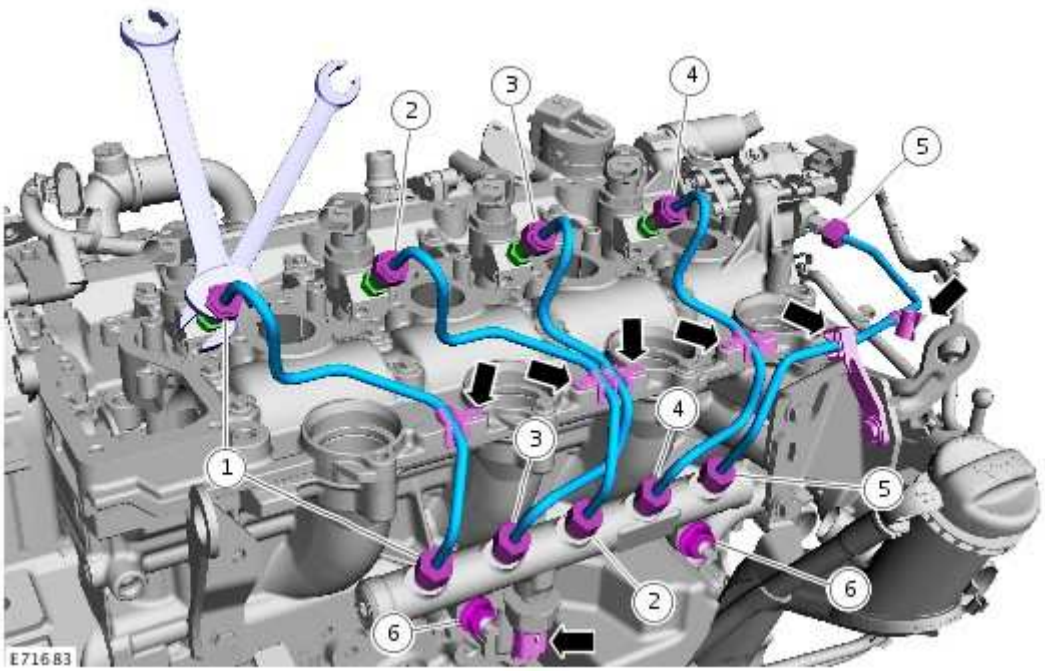

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Installation

1. To install, reverse the removal procedure.

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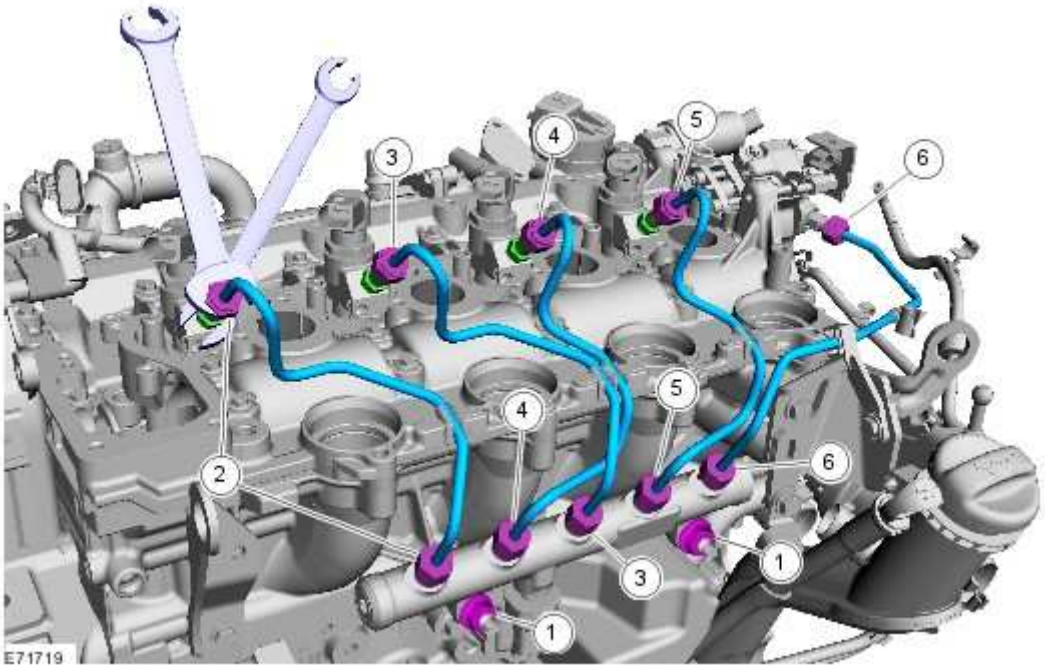

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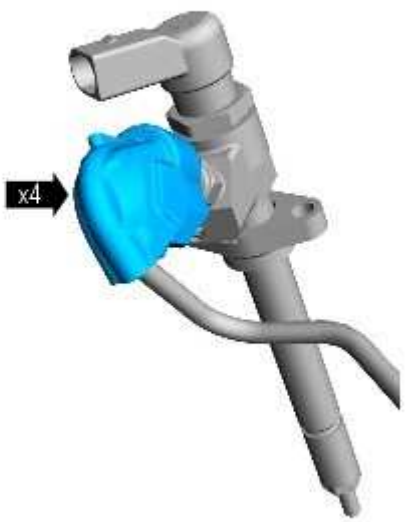

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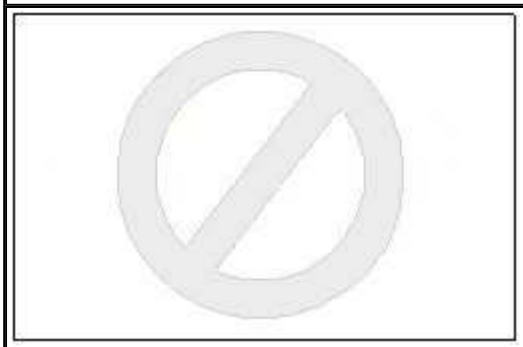
Removal and Installation

Special Tool(s)

	303-174 Gauge, Bolt Angle
	310-110A Hand Pressure Pump with Adapter Kit

Removal

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

1. Refer to: Diesel Fuel System Health and Safety Preca (100-00 General Information, Description and Opera
2. Remove the intake manifold.

   Refer to: Intake Manifold (303-01F Engine - 2.0L Du TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100k - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Em Requirements: Stage IV, Removal and Installation).
3. Clean the fuel injectors, fuel rail, high-pressure fuel and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-0 Charging and Controls - 2.0L Duratorq-TDCi (85kW/ DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L TDCi (103kW/140PS) - DW, Emission Requirements: General Procedures).
4.

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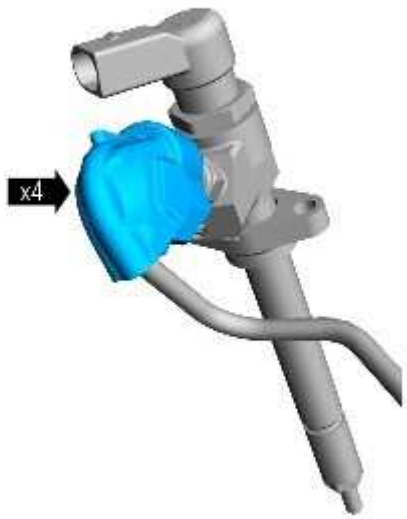

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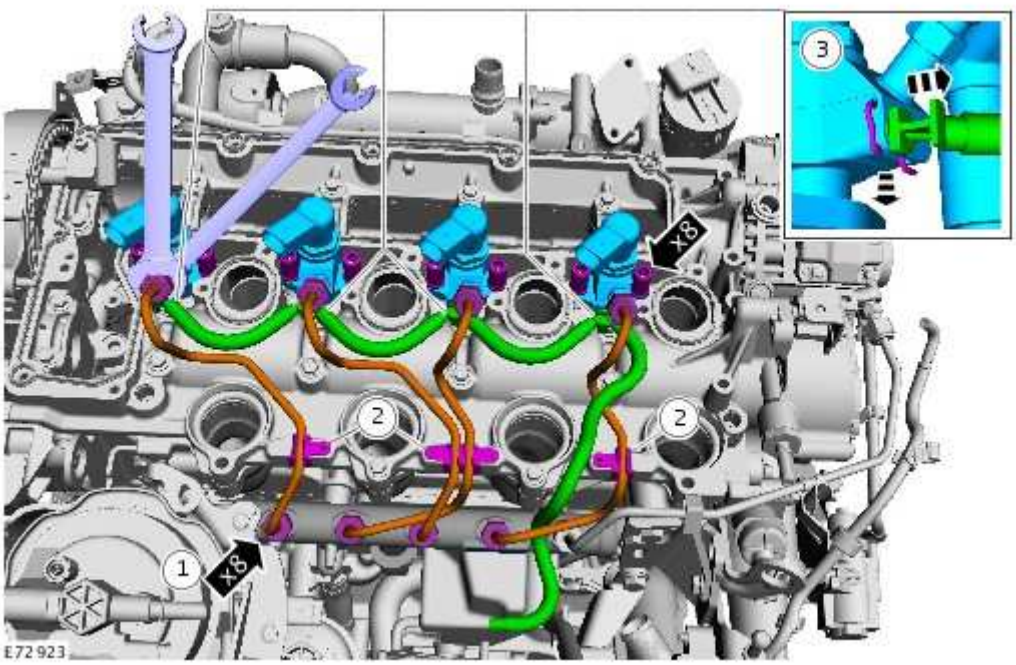

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Installation

1. NOTE: Make sure that new components are install

2. CAUTION: Make sure that the clips are correct located.

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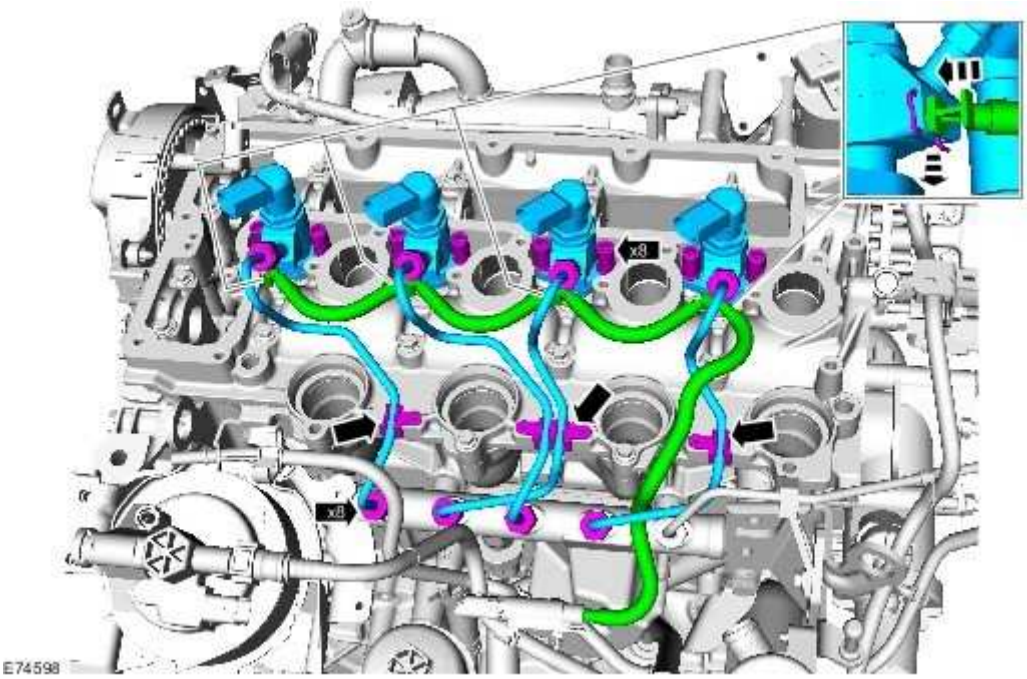
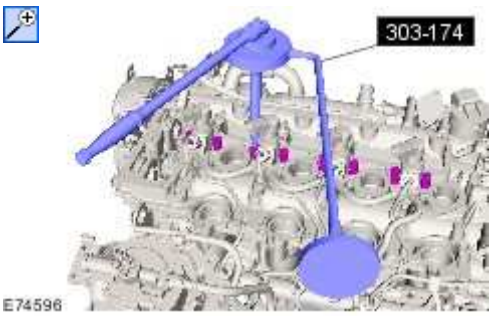
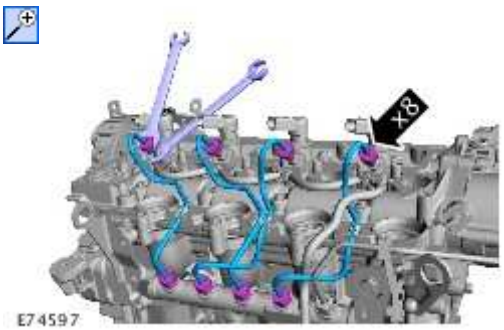




4. *Special Tool(s):* 303-174
Torque:
Stage 1: 4 Nm
Stage 2: 45°



5. CAUTION: Use an open-ended wrench to prev component from turning.
Torque:
Stage 1: 19 Nm
Stage 2: 30 Nm

6.

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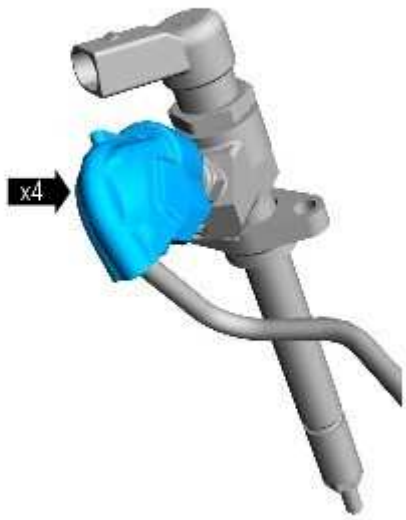

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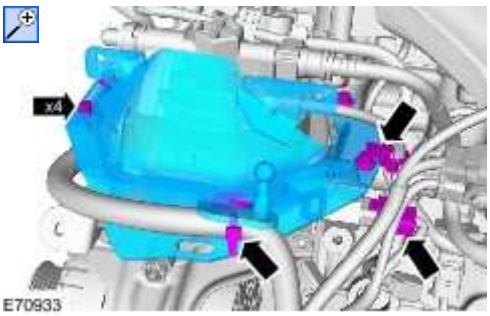


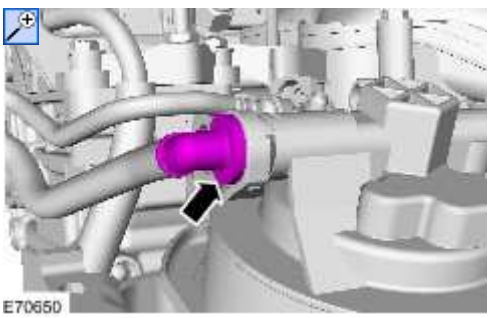
E70933

7.

8. CAUTION: Use lint free cloth.
Protect the generator to prevent contamination.

9. Install the intake manifold.

Refer to: Intake Manifold (303-01F Engine - 2.0L Du
TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100k
- DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Em
Requirements: Stage IV, Removal and Installation).



E70650

10. Refer to: Quick Release Coupling (310-00 Fuel Syste
General Information, General Procedures).

11. *Special Tool(s):* 310-110A

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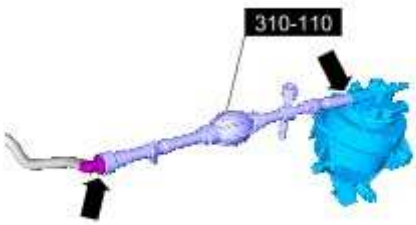
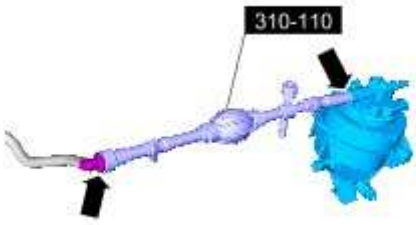


E70649

12. Operate the hand pressure pump at least 30 times.
13. CAUTION: The starter motor operation must r exceed 10 seconds at a time. After 10 seconds tur ignition switch to position 0 and allow the starter r cool for 30 seconds before operating the starter m again.
    Start the engine and allow to idle until it reaches nor operating temperature
14. Stop the engine.
15. *Special Tool(s):* 310-110A



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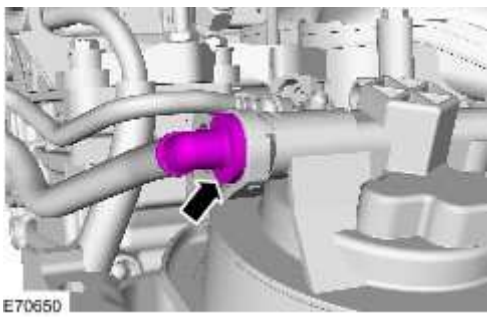
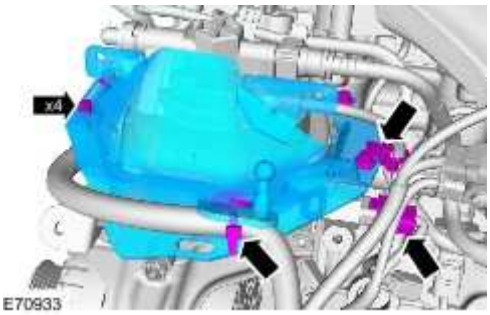

E70650

16. Refer to: Quick Release Coupling (310-00 Fuel Syste General Information, General Procedures).

17. Remove the lint-free material.
18. *Torque:* 9 Nm



E70933

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Removal and Installation

Removal

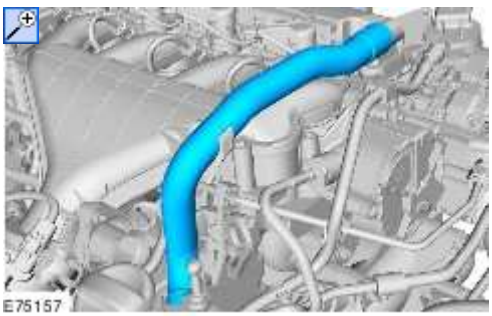
WARNING: Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the exhaust manifold to exhaust gas recircu (EGR) valve tube.

   Refer to: Exhaust Manifold to Exhaust Gas Recirculat Valve Tube (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-T (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/1 DW, Emission Requirements: Stage IV, Removal anc Installation).

2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12E Intake Air Distributio Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2 Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq- (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/1 DW, Emission Requirements: Stage IV/Stage V, Rem Installation).

3. 

4. Clean the fuel pump, fuel rail, high-pressure fuel sup and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-0 Charging and Controls - 2.0L Duratorq-TDCi (85kW/ DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L TDCi (103kW/140PS) - DW, Emission Requirements: General Procedures).

5. CAUTIONS

   Make that the fu remains ir contact at ends until unions nut been unsc

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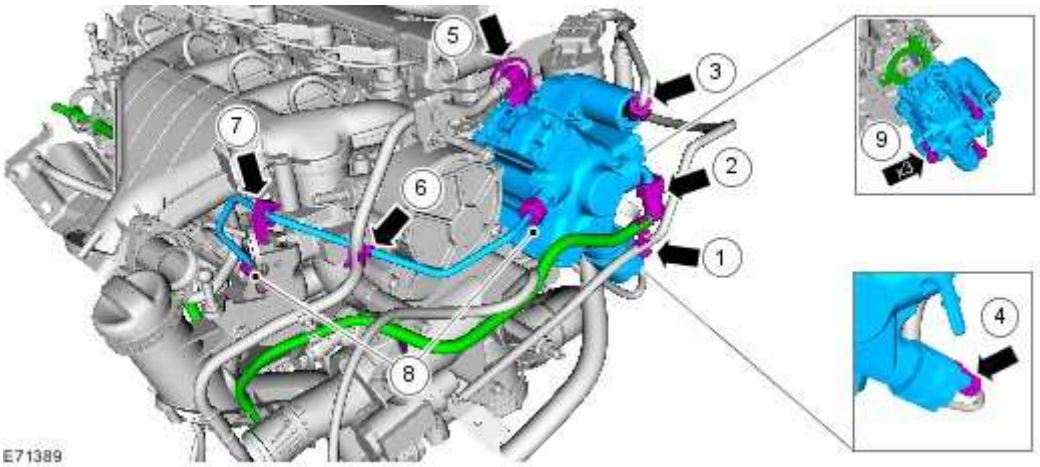

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6. Remove and discard the fuel filter.

   Refer to: Fuel Filter (310-01C Fuel Tank and Lines - Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-T (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/1

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DW, Emission Requirements: Stage IV, Removal and Installation).

Installation

1. NOTE:
   To install, reverse the removal procedure.

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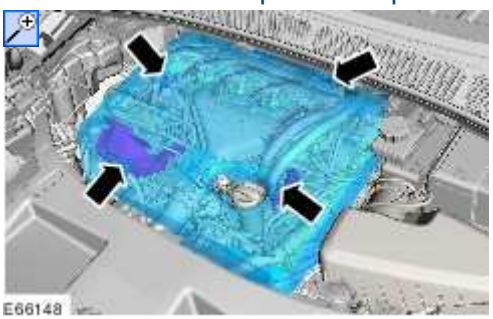
Removal and Installation

Removal

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



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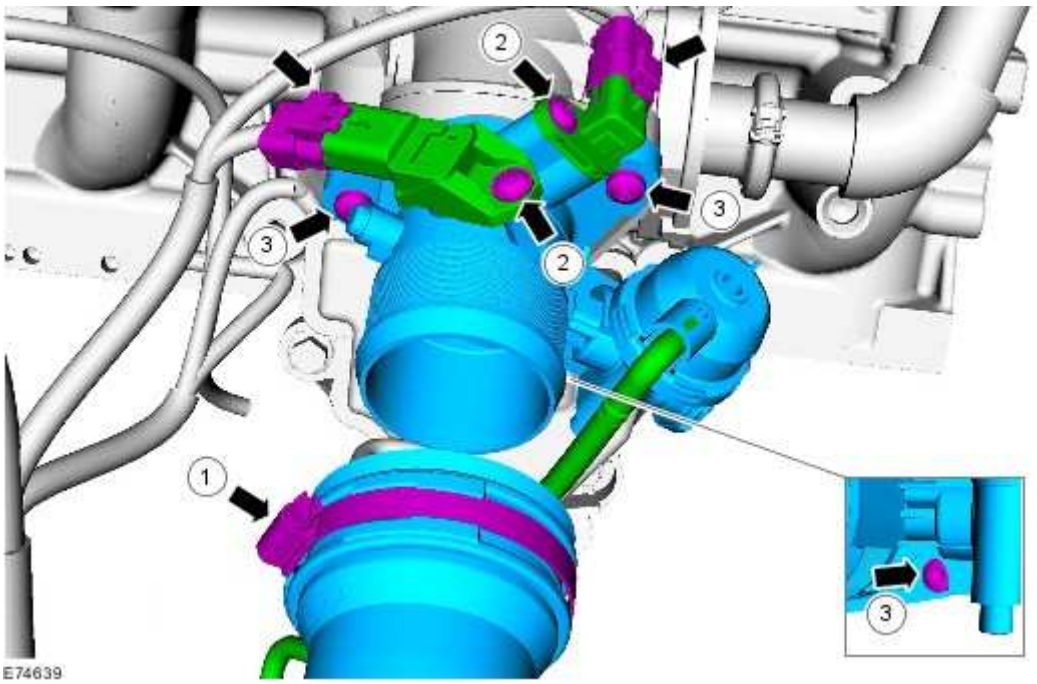

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   1. *Torq*
      Nm
   2. *Torq*
      Nm
   3. *Torq*
      Nm

Installation

1. To install, reverse the removal procedure.

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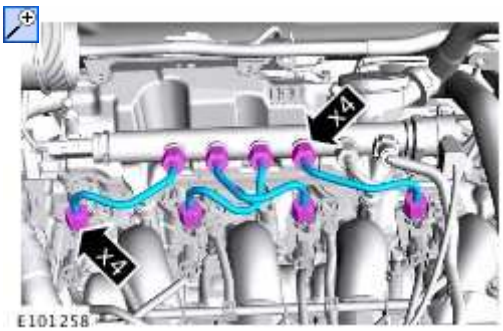
Removal and Installation

Removal

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

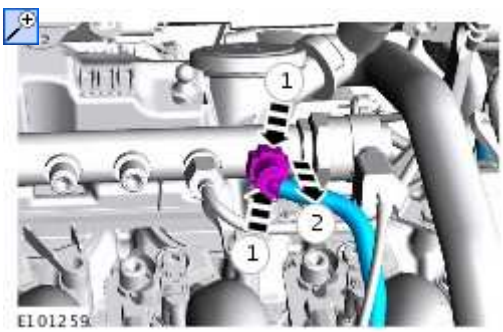
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



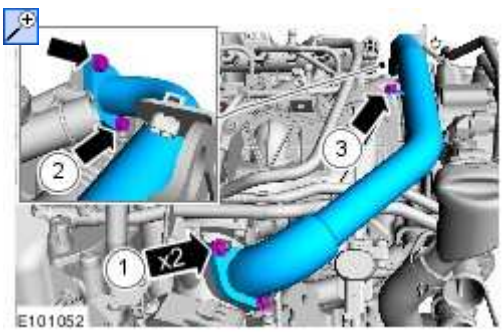
2. CAUTIONS:

   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   Make sure that all openings are sealed. Use new blanking caps.
   Refer to: Fuel Injection Component Cleaning (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).
   Torque:
   Stage 1: 22 Nm
   Stage 2: 25 Nm



3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



4. NOTE: Make sure that a new component is installed.
   Torque:
   1: 10 Nm
   2: 8 Nm
   3: 10 Nm

5. *Torque:* 8 Nm

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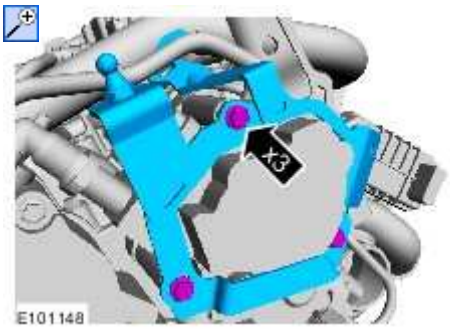
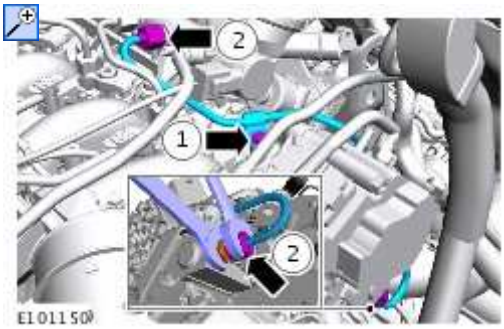




6. CAUTIONS:

   Use an open-ended wrench to prevent the component from turning.

   Make sure that all openings are sealed. Use new blanking caps.

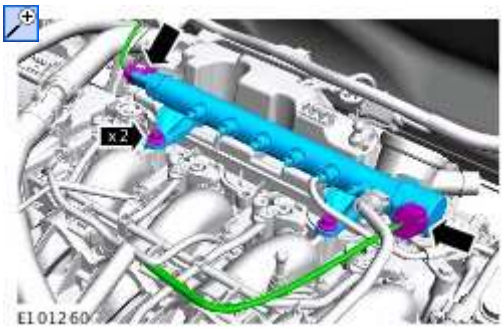
   Make sure that the area around the component is clean and free of foreign material.

   NOTE: Install all the bolts finger tight before final tightening.

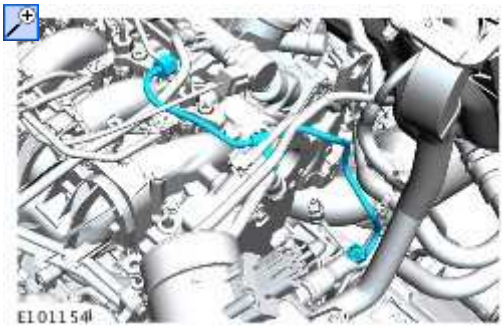
   1. *Torque:* 8 Nm
   2. *Torque:*

      Stage 1: 22 Nm

      Stage 2: 25 Nm



7. *Torque:* 18 Nm



8.

Installation

1. To install, reverse the removal procedure.

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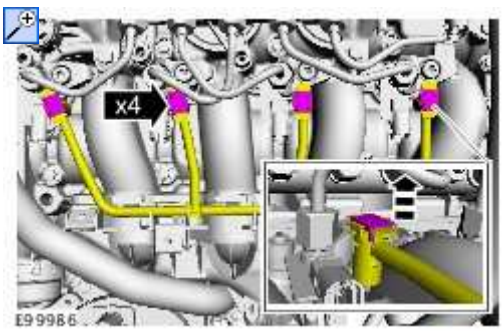
Removal and Installation

Removal

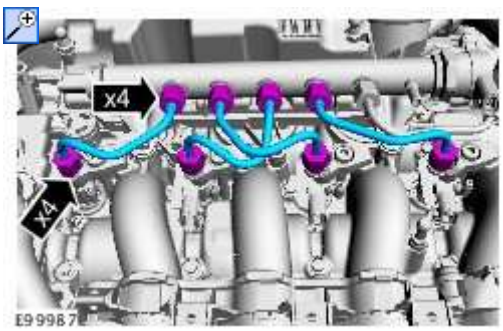
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Intake Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
2. Clean the fuel injectors, fuel rail, high-pressure fuel supply lines and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).



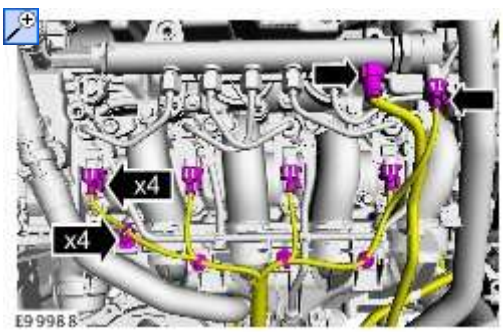
3.



4. CAUTIONS:

   Make sure that the fuel line remains in contact at both ends until both unions nuts have been unscrewed and the area around the joints thoroughly cleaned.

   Make sure that all openings are sealed. Use new blanking caps.
   Discard the high-pressure fuel supply lines.



5.

6.

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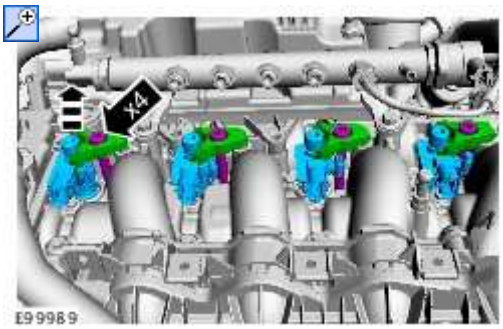
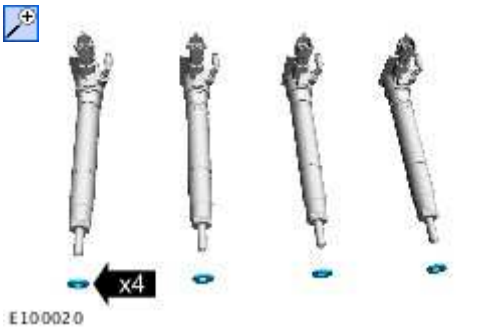
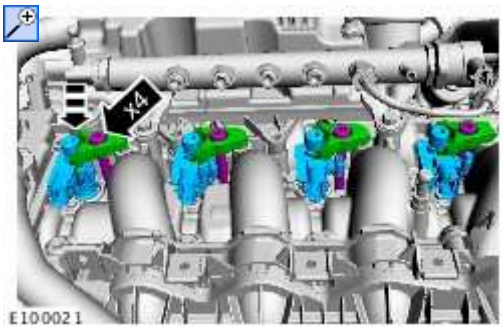


7.

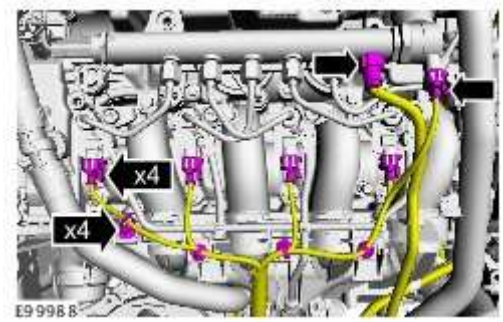
Installation



1. NOTE: Make sure that new components are installed.
   NOTE: Make sure that the seal is correctly located.



2. NOTE: Install all the bolts finger tight before final tightening.
   Torque:
   Stage 1: 5 Nm
   Stage 2: 130°



3.

4. *Torque:*
   Stage 1: 22 Nm
   Stage 2: 25 Nm

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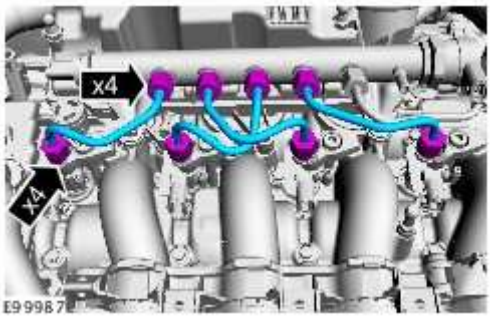

5. To install, reverse the removal procedure.

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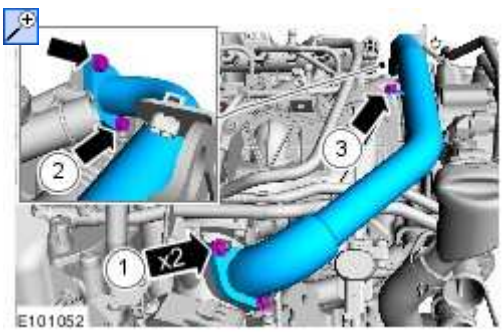
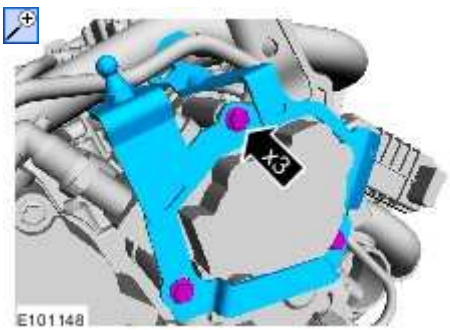
Removal and Installation

Removal

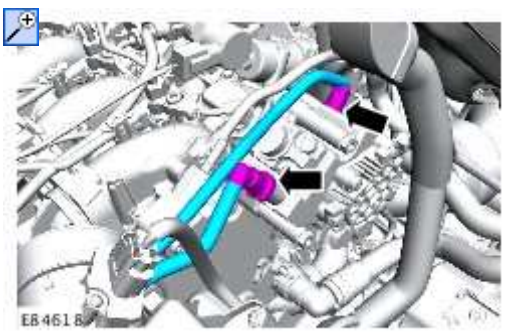
1. NOTE: Vacuum any foreign material from the fuel pump and fuel rail unions before sealing the unions with blanking caps.
   NOTE: Removal steps in this procedure may contain installation details.
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
   Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



3. NOTE: Make sure that a new component is installed.
   Torque:
   1: 10 Nm
   2: 8 Nm
   3: 10 Nm



4. *Torque:* 8 Nm



5. CAUTIONS:

   Make sure that the area around the component is clean and free of foreign material.

   Make sure that all openings are sealed. Use new blanking caps.
   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
6. CAUTIONS:

   Use an open-ended wrench to prevent

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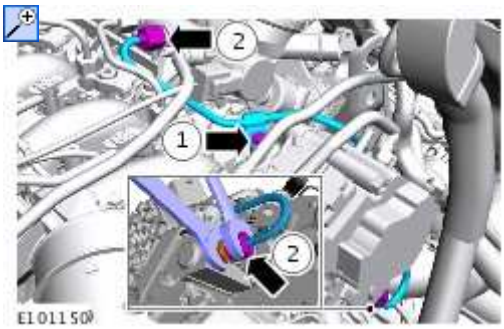


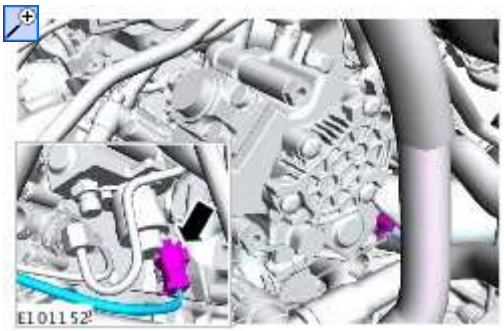
the component from turning.

Make sure that all openings are sealed. Use new blanking caps.

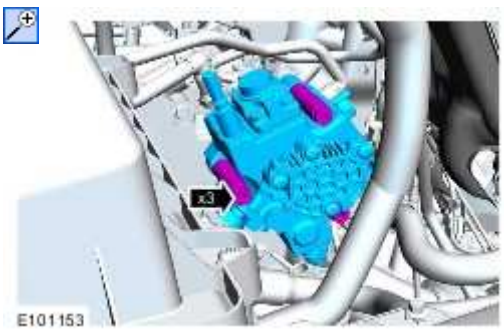
Make sure that the area around the component is clean and free of foreign material.

NOTE: Install all the bolts finger tight before final tightening.

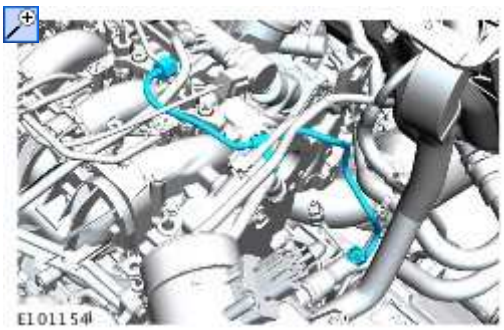
1. *Torque:* 8 Nm
2. *Torque:*
   Stage 1: 22 Nm
   Stage 2: 25 Nm



7.



8. *Torque:* 22 Nm



9. NOTE: Make sure that a new component is installed.

Installation

1. To install, reverse the removal procedure.

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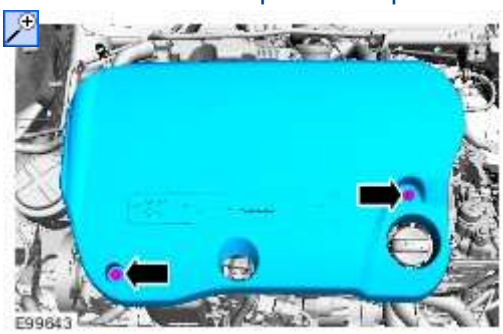
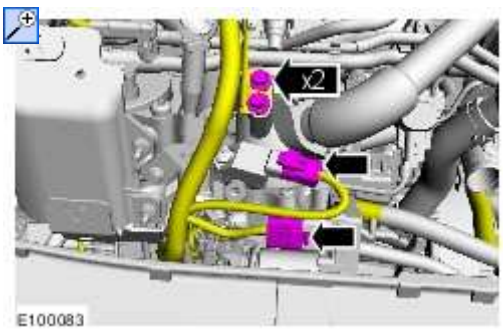
Removal and Installation

Removal

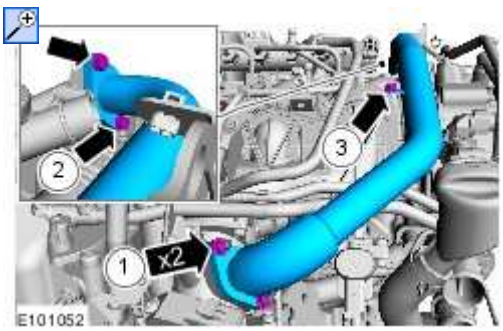
NOTE: Removal steps in this procedure may contain installation details.



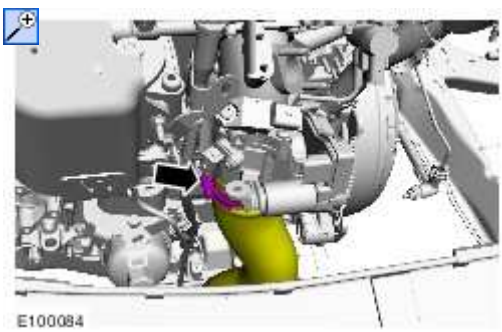
1. *Torque:* 10 Nm



2. *Torque:* 8 Nm



3. NOTE: Make sure that a new component is installed.
   Torque:
   1 10 Nm
   2 10 Nm
   3 8 Nm



4.

5. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   Torque: 10 Nm

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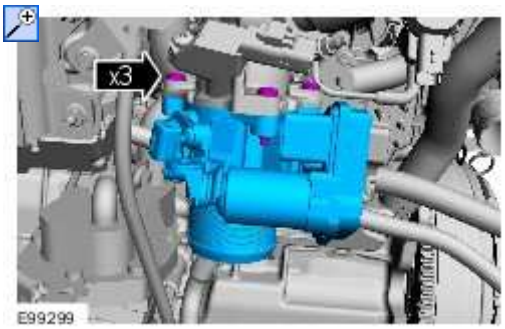

Installation

1. To install, reverse the removal procedure.

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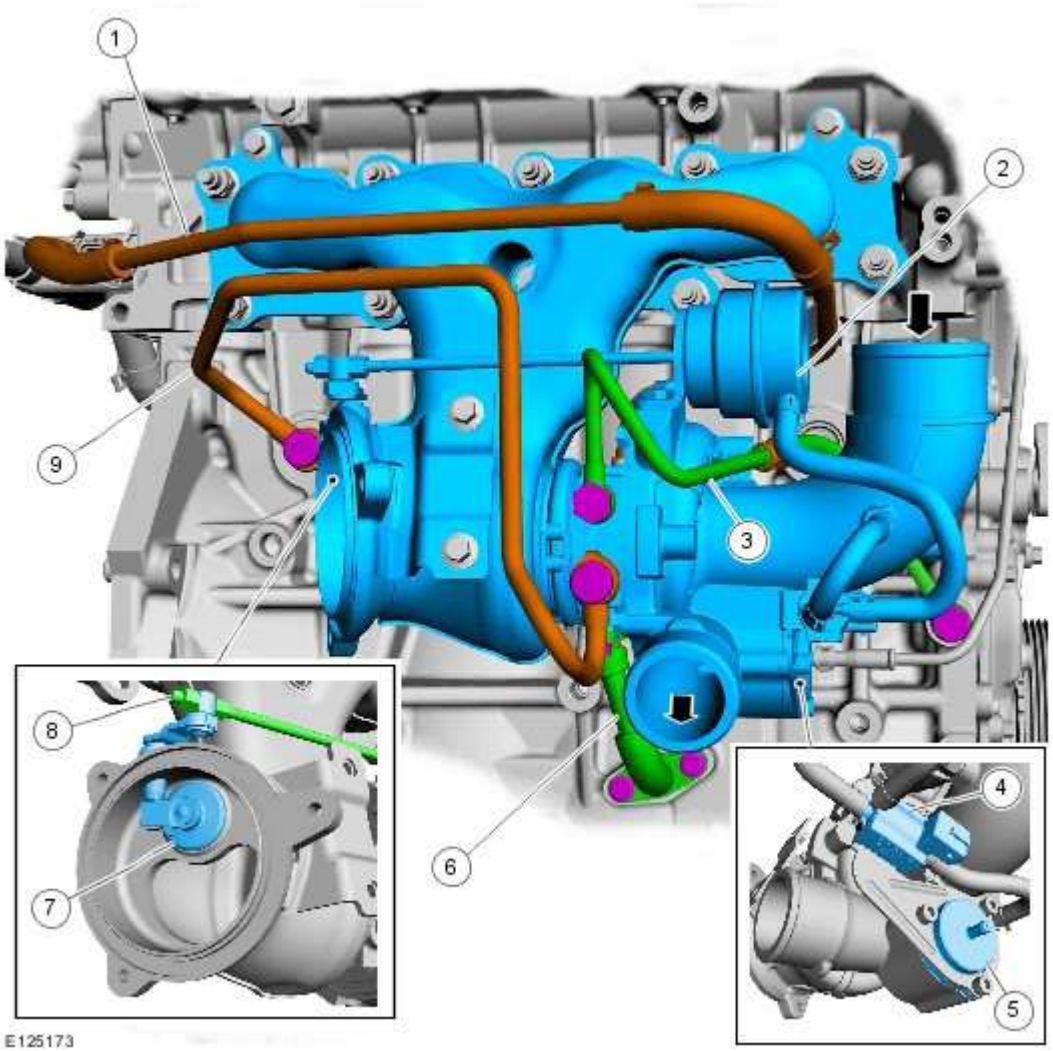
Description and Operation



Item	Description
1	TC (turbocharger) coolant outlet line
2	TC vacuum actuator
3	TC oil supply tube
4	Wastegate control solenoid
5	Recirculated air valve
6	TC oil return tube
7	Wastegate control valve
8	Wastegate control valve connecting rod
9	TC coolant inlet line

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Fuel Charging and Controls - Turbocharger - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 - Turbocharger - Overview	S-MAX/Galaxy 2006.5 (02/2006-)

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Description and Operation

Cooling and lubrication

The TC (turbocharger) is cooled by the engine coolant and oil circuit. The engine oil circuit also lubricates the turbine bearings.

Closed-loop control

The TC is controlled on the exhaust side by the wastegate control valve and on the charge air side by the turbocharger bypass valve. This double control is required in order to achieve optimal turbocharging and optimal response under all operating conditions.

The wastegate control valve is closed when de-energised. The entire incoming flow of exhaust gas flows through the exhaust turbine and drives it. As soon as the maximum permissible charge pressure is exceeded, the wastegate control valve opens and guides part of the flow of exhaust gas into the exhaust system.

The recirculated air valve ensures short-term adjustments to the charge pressure on the charge air side. Sudden closing of the throttle plate causes backpressure in the intake tract between the throttle plate and compressor wheel. This results in sharp braking of the compressor wheel and thereby the turbine shaft. When the vehicle is accelerated again, this results in a significant loss of charge pressure or power (turbo-hole). The recirculated air valve prevents this backpressure by opening the bypass. The bypass guides the charge pressure back to the intake side of the compressor. The turbine speed remains constant. The recirculated air valve is controlled by a vacuum line. This vacuum line is connected to the intake manifold between the engine and the throttle plate. When the throttle plate is suddenly closed, an increased vacuum occurs in the intake manifold. This causes the recirculated air valve to open the bypass.

Repair and maintenance instructions

Oil return tube: If the TC is removed, a new TC oil return tube must be fitted during installation.

Turbocharger: The TC and the exhaust manifold are one unit and must not be separated from each other. In the event of damage, the entire unit must be replaced.

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Removal and Installation

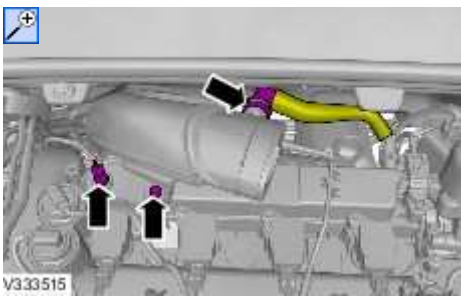
General Equipment

Hose clamp remover/installer

Removal

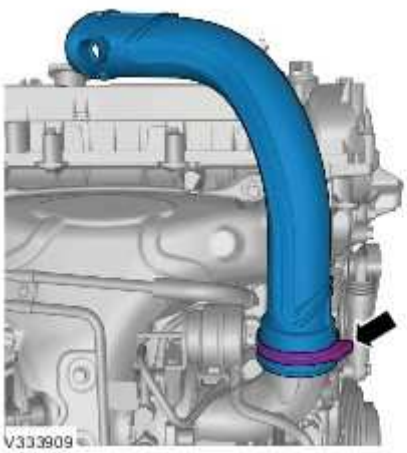
NOTE: Removal steps in this procedure may contain installation details.

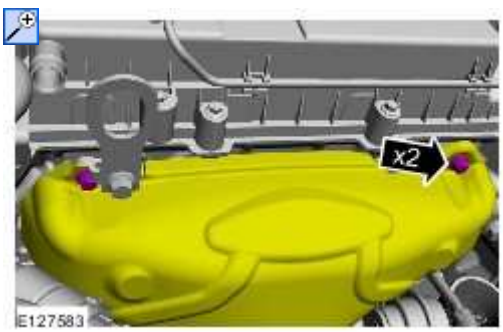
1. Refer to: Cooling System Draining and Vacuum Filling (303-03B Engine Cooling - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, General Procedures).
2. Refer to: Catalytic Converter (309-00B Exhaust System - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).



3. *Torque:* 10 Nm

4. *Torque:* 4 Nm





5. *Torque:* 10 Nm

6. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
7. *Torque:* 4 Nm

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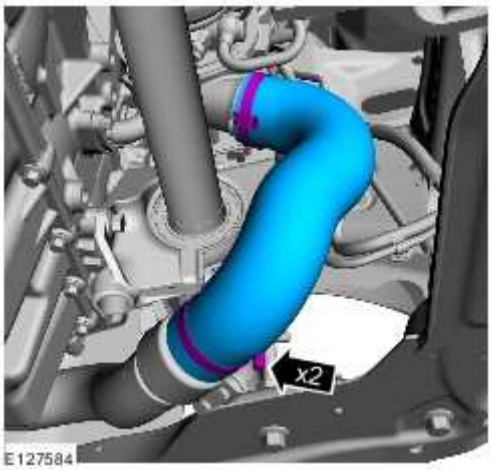
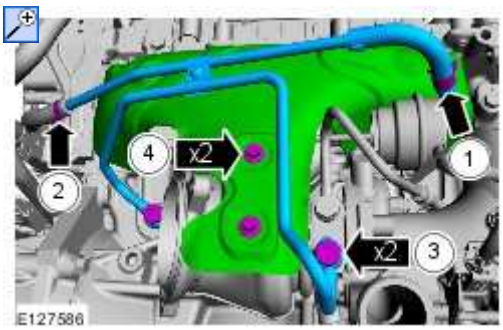
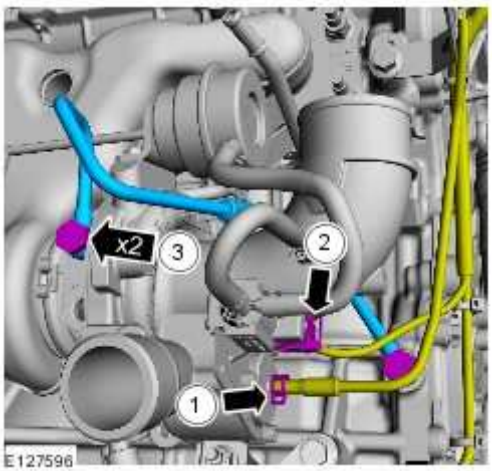
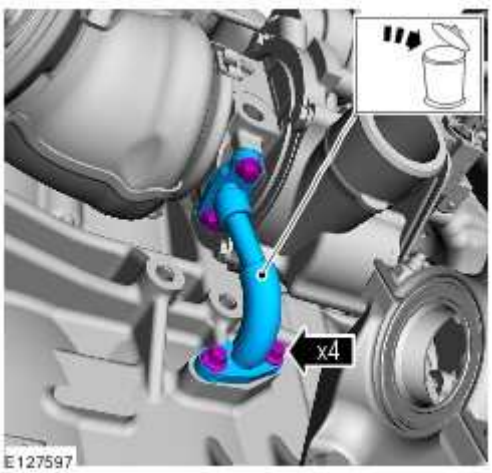




8.
1. *General Equipment:* Hose clamp remover/installer
3. *Torque:* 28 Nm
4. *Torque:* 10 Nm



9.
1. *General Equipment:* Hose clamp remover/installer
3. NOTE: Make sure that a new component is installed.
   Torque: 25 Nm



10. NOTE: Make sure that a new component is installed.
    Torque: 10 Nm

11. *Torque:* 50 Nm

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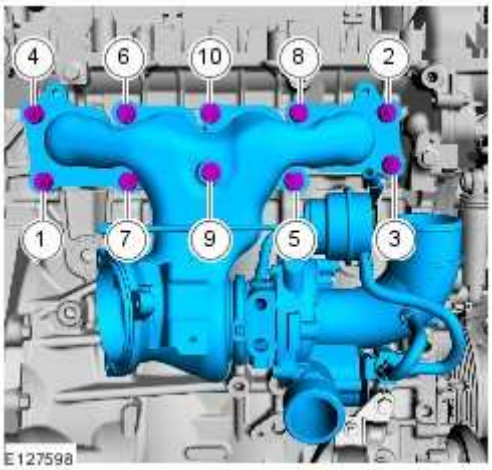

Installation

1. To install, reverse the removal procedure.

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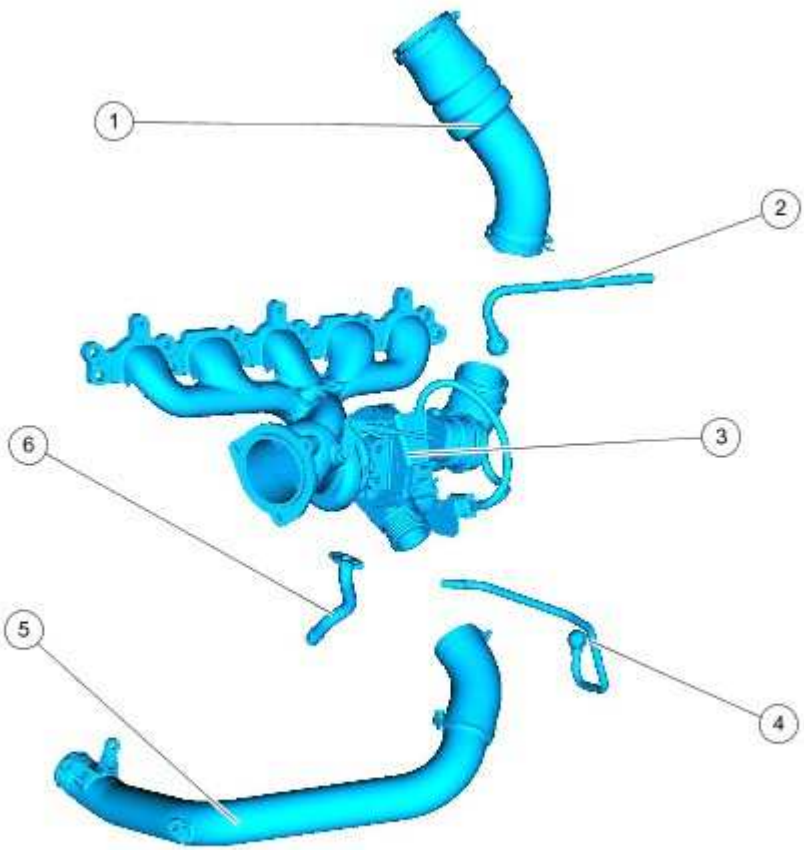
Description and Operation

Turbocharger



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Item	Part Number	Description
1	-	Turbocharger intake pipe
2	-	Turbocharger outlet cooling pipe
3	-	Turbocharger
4	-	Turbocharger intake cooling pipe
5	-	Charge air cooler intake pipe
6	-	Turbocharger oil return pipe

The turbocharger consists of two elements, a turbine and a compressor both installed on a single shaft and are contained within a turbocharger housing. The turbocharger and exhaust manifold are a combined assembly and are not supplied separately.

The turbocharger bearings are supplied, cooled and lubricated by oil from the engine through the oil supply tube. Oil is returned to the oil pan through the oil return pipe. In addition the turbocharger is also cooled by engine coolant which is supplied from the engine and cooled down by the radiator.

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The turbine element of the turbocharger uses the energy of the exhaust gas to drive the compressor. The compressor draws in air from the air cleaner, through the turbocharger which increases pressure and flow of air. Turbocharged air is then forced through the charge air cooler where air temperature is cooled before it reaches the intake manifold.

The turbocharger boost pressure is governed by means of a wastegate control valve. The wastegate redirects some of the exhaust gas past the turbine so over boosting does not occur. The wastegate control valve is controlled by a wastegate control solenoid which is preset during manufacture and must not be tampered with.

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Diagnosis and Testing

Special Tool(s)

	Boost Pressure Gauge 310-020 (23-021)
	Hand Vacuum/Pressure Pump 416-D001 (23-036A)

General Equipment

Ford diagnostic equipment

Principles of Operation

The turbocharger is governed by a wastegate control valve. The wastegate control valve redirects some of the exhaust gas past the turbine and therefore acts as a governor. The wastegate control valve is preset during manufacture and must not be tampered with.

The intake air system is fitted with a turbocharger pressure release valve. This vents the intake air system when the throttle is closed and recirculates the air back into the intake air system. It also releases pressure on the turbocharger which will reduce turbo lag and will improve acceleration and increase engine performance.

The turbocharger is equipped with a boost control system. The powertrain control module (PCM) detects 1st or 2nd gear using the engine speed and vehicle speed signals. This information is then used to adjust the pressures applied to the wastegate control valve allowing it to open at a lower boost pressure. This prevents the turbocharger developing maximum boost in 1st and 2nd gears.

Inspection and Verification

NOTE: It is normal for a small amount of combustion gas to pass into the crankcase. This gas is scavenged into the air intake system through the positive crankcase ventilation (PCV) system, which incorporates an crankcase vent oil separator. Some engine oil, in the form of a vapor is carried into the air intake system with the blow-by gases (this engine oil also contributes to valve seat durability). This means that oil will collect inside the air intake components and the turbocharger. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy or seize. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the oil supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.

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

Visual Inspection Chart

Mechanical	Electrical
• Oil leak(s) • Coolant leak(s)	• Wiring harness(es) • Electrical connector(s)

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• Wastegate control valve • Wastegate control valve vacuum hose(s) • Turbocharger housing • Air cleaner element • Air cleaner outlet pipe • Air cleaner intake pipe • Turbocharger intake tube • Charge air cooler • Charge air cooler intake pipe and hoses • Charge air cooler outlet pipe and hoses • Charge air cooler radiator • Valve cover oil separator • Turbocharger oil supply tube • Turbocharger oil return tube	• Charge air cooler cooling fan • Charge air cooler cooling fan switch • Charge air cooler water pump • Boost control solenoid valve • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the concern is not visually evident, verify the symptom and refer to the Diagnostic Trouble Code (DTC) Index.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0236	Turbocharger boost pressure sensor circuit range/performance concern	Turbocharger boost pressure sensor	REFER to engine management guided diagnostics within the Ford diagnostic equipment.
P0237	Turbocharger boost pressure sensor circuit low input	Turbocharger boost pressure sensor circuit	REFER to engine management guided diagnostics within the Ford diagnostic equipment.
P0238	Turbocharger boost pressure sensor circuit high input	Turbocharger boost pressure sensor circuit	REFER to engine management guided diagnostics within the Ford diagnostic equipment.
P0243	Turbocharger boost control solenoid concern	Turbocharger boost control solenoid	REFER to engine management diagnostics within the Ford diagnostic equipment.

Symptom Chart

NOTE: The wastegate control valve unit is a fixed part of the turbocharger and cannot be adjusted or renewed.

Symptom	Possible Sources	Action
Blue smoke with excessive turbocharger noise	* Turbocharger compressor rubbing on housing walls. * Turbocharger turbine rubbing on housing walls. * Turbocharger bearings and oil seal (s). * Turbocharger oil supply tube blocked or damaged.	* GO to Pinpoint Test A.
Blue smoke without excessive turbocharger noise	* Blocked or damaged valve cover oil separator.	* REFER to: Engine Emission Control (303-08B Engine Emission Control - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing).
	* Turbocharger oil return tube blocked or damaged.	* GO to Pinpoint Test B.

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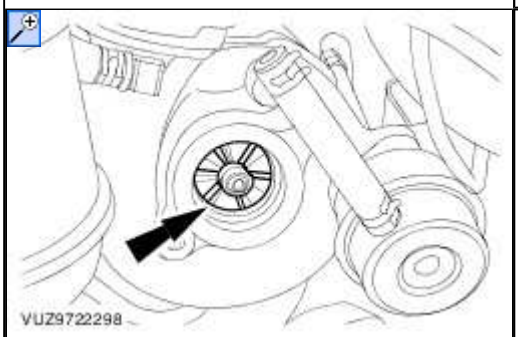
Poor engine performance	* Wastegate control valve actuator rod. * Vacuum line(s).	* GO to Pinpoint Test C.
	* Charge air cooler pipes * Charge air cooler radiator * Charge air cooler water pump * Charge air cooler	* REFER to in this section.
	* Air cleaner intake pipe	* CHECK the air cleaner intake pipe for obstruction. REPAIR as necessary.
	* Turbocharger boost pressure	* GO to Pinpoint Test C.
	* Unauthorized adjustment of the wastegate control valve actuator rod.	* The turbocharger boost pressure is factory set and must not be adjusted. CHECK the paint seal on the wastegate control valve unit actuator rod has not been broken. If the paint seal has been broken, INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	* Ignition system.	* CHECK the ignition system. REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing).
	* Fuel charging system.	* CHECK the fuel charging system. REFER to: Fuel Charging and Controls (303-04C Fuel Charging and Controls - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing).

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE	
	1 Remove the air cleaner. REFER to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
	2 Inspect the turbocharger rotor vanes for damage.
	Is there visible damage to the rotor vanes? **Yes** GO to A2. **No** GO to A3.
A2: CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS	
	1 Check the intake air system components for signs

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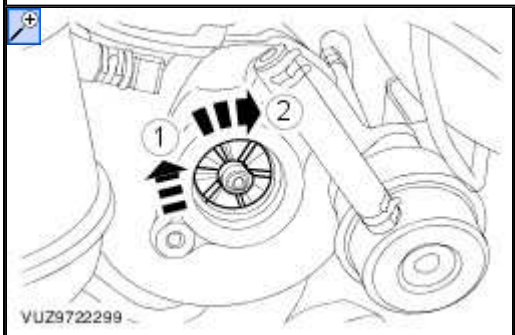
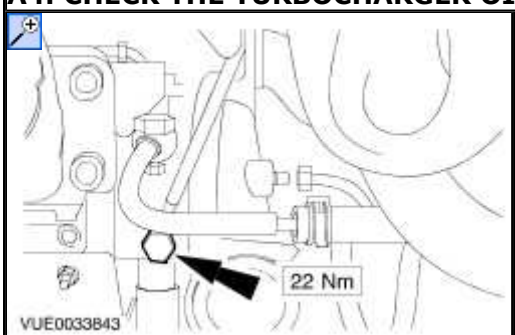
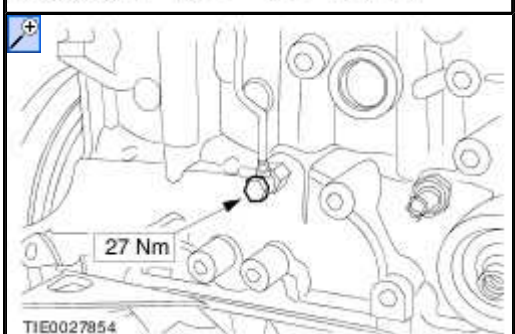
	of foreign material.
	Are there any signs of foreign material? **Yes** CLEAN the intake air system components. INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation. **No** GO to A3.
A3: CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT	
NOTE: A small amount of movement in the bearings is normal.	
	1 Make sure the turbocharger rotor spins freely within the housing. • 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings). • 2. Make sure the rotor spins freely within the housing.
	Does the rotor spin freely within the housing without excessive movement? **Yes** GO to A4. **No** INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation.
A4: CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE	
	NOTE: Discard the copper washers. 1 Disconnect the oil supply tube from the turbocharger (exhaust manifold heatshield and charge air cooler intake pipe shown removed for clarity).
	NOTE: Discard the copper washers. 2 Disconnect the oil supply tube from the engine and remove the oil supply tube.
	3 Using workshop compressed air and a compressed air nozzle check the oil supply tube for blockage.
	Is the oil supply tube free from blockage? **Yes**

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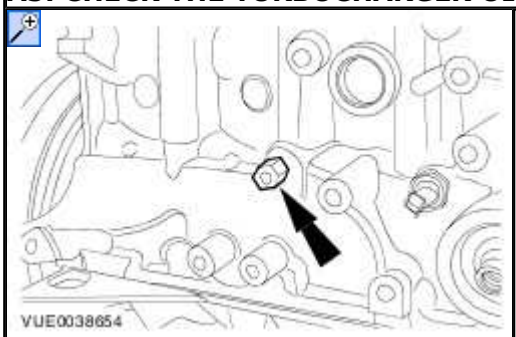
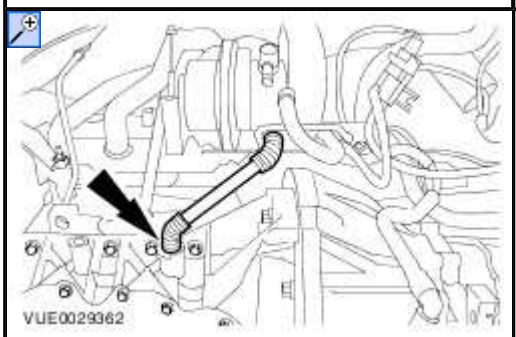
	GO to A5. **No** INSTALL a new oil supply tube. INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation.
A5: CHECK THE TURBOCHARGER OIL SUPPLY TUBE OIL GALLERY	
 VUE0038654	1 Using some suitable welding rod check the oil supply tube oil gallery for blockage.
	Is the oil supply tube oil gallery free from blockage? **Yes** INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation. **No** REMOVE the blockage. INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE TURBOCHARGER OIL RETURN PIPE	
 VUE0029361	NOTE: Discard the gasket. 1 Disconnect the turbocharger oil return tube from the turbocharger (turbocharger heatshield and catalytic converter shown removed for clarity).
 VUE0029362	NOTE: Discard the O-ring seal. 2 Remove the turbocharger oil return tube (turbocharger heatshield and catalytic converter shown removed for clarity).

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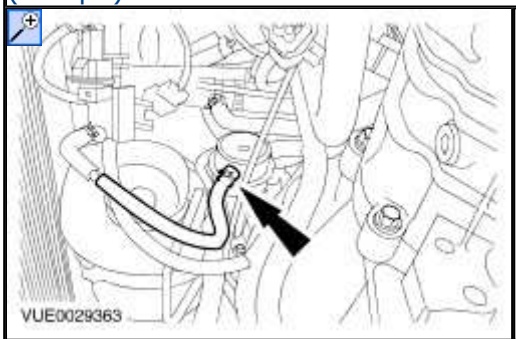
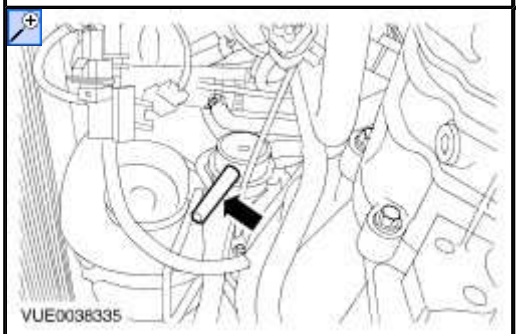
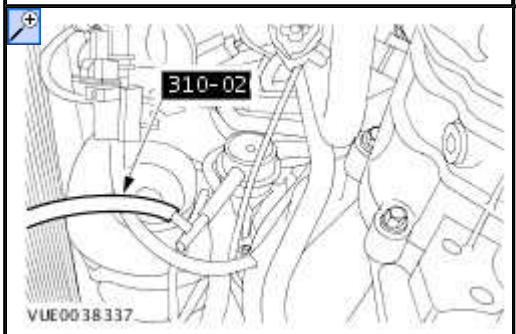
	3 Check the turbocharger oil return tube for blockage or signs of damage.
	Is the turbocharger oil return tube free from foreign material and signs of damage? **Yes** GO to Engine for further diagnostics. REFER to: Engine (303-01D Engine - 2.5L Duratec (162kW/220PS) - VI5, Diagnosis and Testing). **No** INSTALL a new turbocharger oil return pipe, gasket and O-ring seal. TEST the system for normal operation.

PINPOINT TEST C : POOR ENGINE PERFORMANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BOOST PRESSURE	
NOTE: The boost pressure is factory set and must not be adjusted. This test must be carried out on a length of road with a minimum speed limit of 100kmh (60mph).	
	1 Disconnect the wastegate control valve actuator control pipe from the wastegate control valve actuator.
	2 Connect a suitable length of pipe to the wastegate control valve actuator.
	3 Using the boost pressure gauge and T connector, connect the gauge to the length of pipe.
	4 Connect the wastegate control valve actuator control pipe to the T connector.

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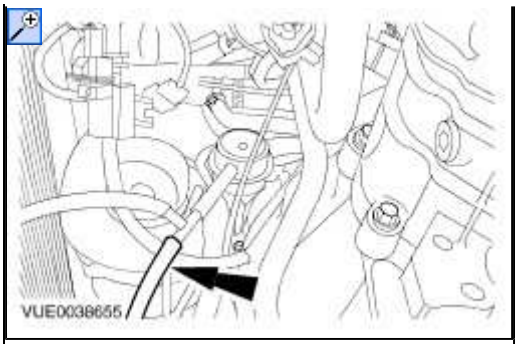


NOTE: Make sure the boost pressure gauge pipe does not become kinked or trapped.

5 Route the boost pressure gauge and pipe into the vehicle through the passenger window.

6 With the aid of another technician carry out a roadtest.

7 Raise the vehicle speed to 60kmh (40mph).

8 Select third gear.

NOTE: Do not exceed the road speed limit.

9 Apply wide open throttle until a speed of 100kmh (60mph) is reached.

Is a boost pressure reading of 201 KPa displayed?

Yes

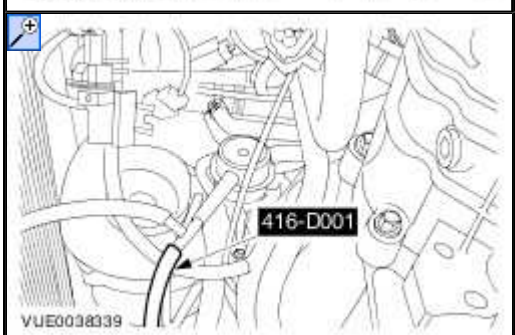
REFER to in this section.

No

GO to C2.

C2: CHECK THE OPERATION OF THE WASTEGATE CONTROL VALVE

1 Disconnect the wastegate control valve actuator control pipe from the T connector.



2 Connect the hand vacuum/pressure pump to the T connector.

3 Operate the hand vacuum/pressure pump until a reading of 75 ± 4 KPa is shown on the boost pressure gauge.

4 Measure the movement of the wastegate control valve actuator rod.

Does the wastegate control valve actuator rod move 10mm and then return to the rest position when the pressure is released?

Yes

REFER to the Ford diagnostic equipment.

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	No INSTALL a new turbocharger. REFER to: Turbocharger (303-04H Fuel Charging and Controls - Turbocharger - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation). TEST the system for normal operation.

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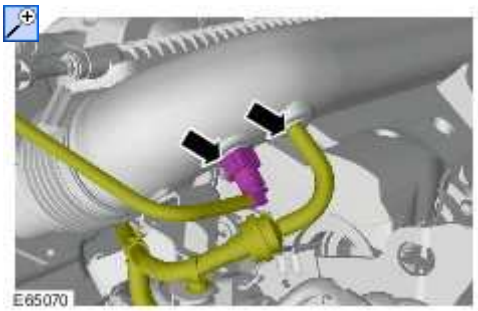
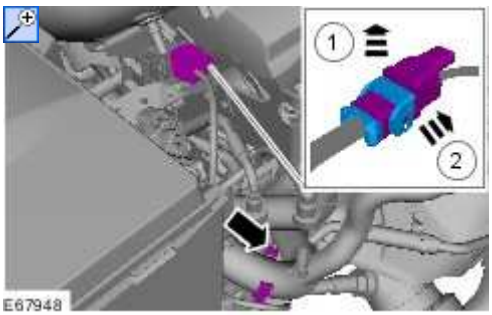
Removal and Installation

Removal

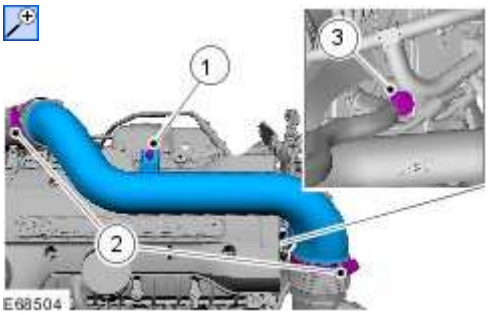
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



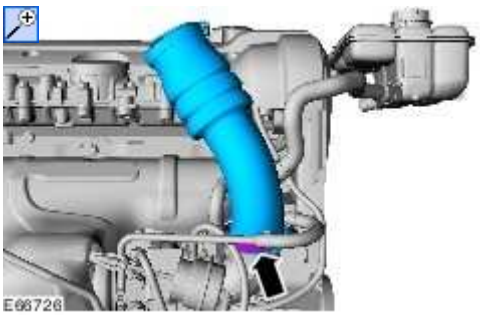
2. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.



3.



4. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   1. *Torque:* 10 Nm
   2. *Torque:* 4 Nm



5. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

6. Refer to: Cooling System Draining, Filling and Bleeding (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
7. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
8. *Torque:* 17 Nm

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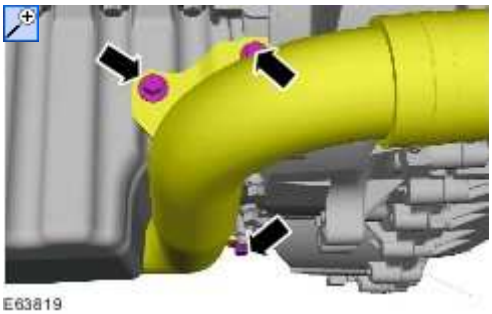
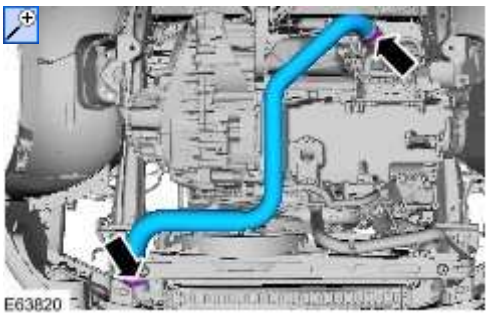
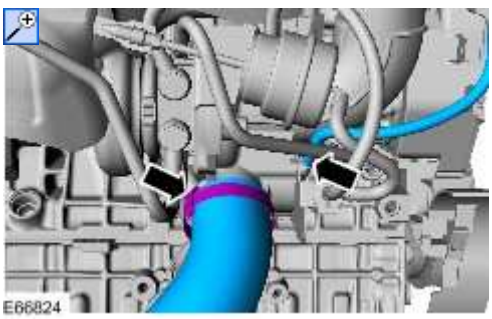
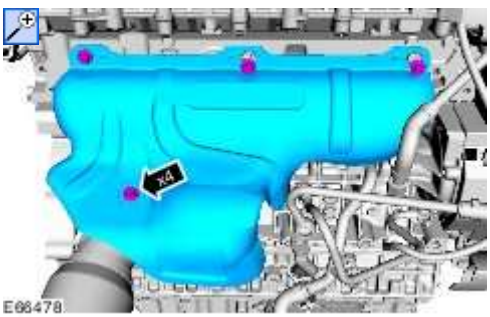




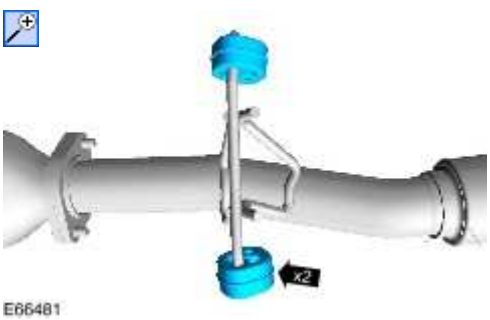
9. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
Torque: 4 Nm



10. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
Torque: 4 Nm



11. NOTE: Note the position of the spring washers to aid installation.
Torque: 20 Nm



12.

13. *Torque:* 28 Nm

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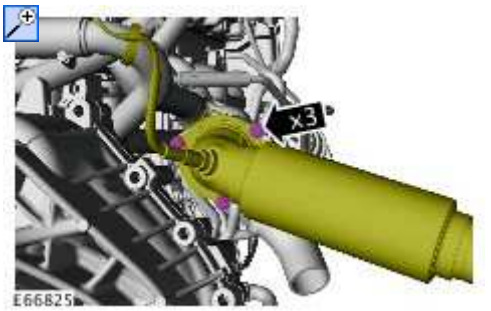
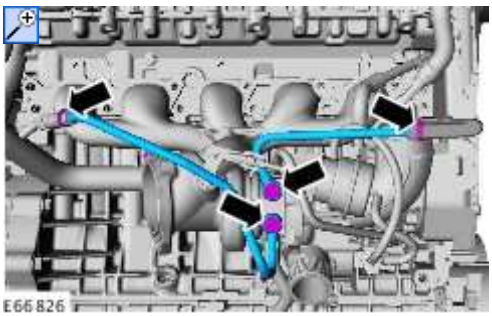
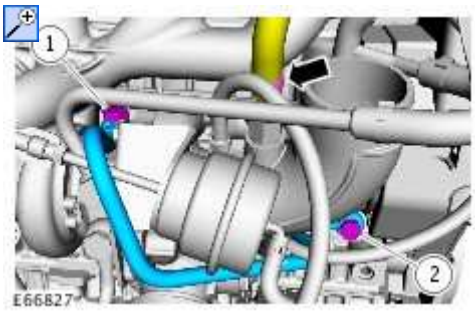
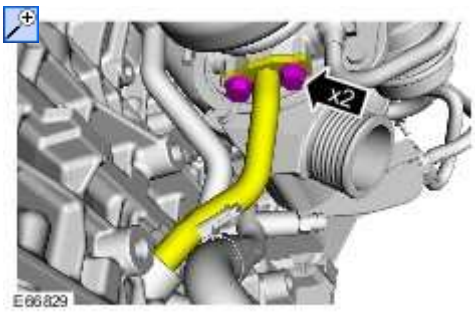




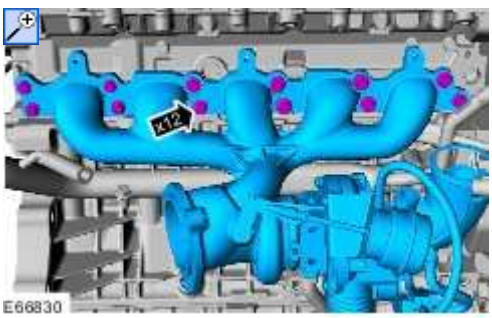
14. *Torque:* 38 Nm



15.
    1. *Torque:* 26 Nm
    2. *Torque:* 38 Nm



16. *Torque:* 12 Nm



17. *Torque:* 24 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Torque Specifications

Description	Nm	lb-ft	lb-in
Engine roll restrictor bolt	48	35	–
Oil supply tube union – vehicles without common rail fuel injection	10	–	89
Oil supply tube union – vehicles with common rail fuel injection	12	9	–
Oil return tube retaining bolts – vehicles without common rail fuel injection	10	–	89
Oil return tube retaining bolts – vehicles with common rail fuel injection	12	9	–
Exhaust gas recirculation cooler clamp bolt	9	–	80
Exhaust manifold to EGR valve tube bolts	24	18	-
EGR tube clamp bolt	9	–	80
EGR tube to EGR valve bolts	20	15	–
EGR cooler to cylinder block retaining bolts	23	17	–
EGR cooler to exhaust manifold retaining bolts	26	19	–
Exhaust manifold retaining nuts and bolts	25	18	–
Catalytic converter support bracket retaining bolts	22	16	–
Charge air cooler intake pipe nut	9	–	80

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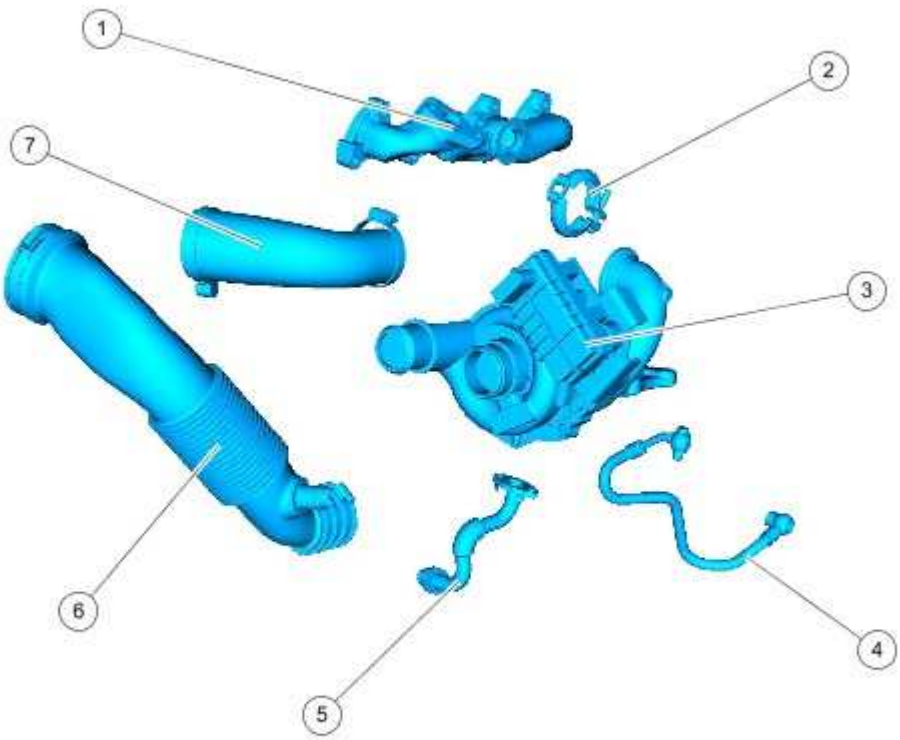
Description and Operation

Turbocharger - General Overveiw



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Item	Part Number	Description
1	-	Exhaust manifold
2	-	Turbocharger retaining clamp
3	-	Turbocharger
4	-	Turbocharger oil supply pipe
5	-	Turbocharger oil return pipe
6	-	Turbocharger inlet hose
7	-	Charge air cooler inlet pipe

Variable Vane Turbocharger

The engine is fitted with an electronically controlled variable vane turbocharger. The turbocharger is fixed to the exhaust manifold by a retaining clamp. The turbocharger consists of two elements, a turbine and a compressor both installed on a single shaft.

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The turbocharger bearings are supplied with oil from the engine.

The turbine uses the flow of the exhaust gas to drive the compressor. The compressor draws air through the air cleaner and forces it into the intake manifold.

The turbocharger is designed to improve engine induction and engine performance. The list below details the possible concerns relating to turbocharger performance.

- High engine speed produces excessive turbine speed and therefore creates excessive turbocharger boost pressure.
- Low engine speed does not produce sufficient turbine speed and therefore not enough turbocharger boost pressure is achieved.

The turbocharger does not have a wastegate control valve. Instead, it has variable turbocharger vanes which are located in the turbocharger turbine housing and these direct the exhaust gas flow into the turbocharger turbine. The turbocharger vanes act as the control for the turbocharger boost pressure.

The turbocharger produces its full turbocharger boost pressure over the entire engine speed range, not just at high engine speed. This is achieved through the adjustment of the vanes and the resulting change in the flow of the exhaust gas.

The speed of the exhaust gas flow within the turbocharger is increased independent of engine speed by varying the intake cross section in front of the turbocharger turbine. This is achieved by adjusting the angle of the vanes controlling the exhaust gas flow into the turbocharger turbine and this drives the turbocharger turbine faster. The higher turbocharger speed produces a high turbocharger boost pressure at all engine speeds.

The powertrain control module (PCM) controls the turbocharger vanes by means of an electronic vane adjustment solenoid attached to the turbocharger.

Regulation at Low Engine Speed

At low engine speeds the PCM operates the vane adjustment solenoid. The vane adjustment solenoid moves the adjusting ring so that the vanes are set at a shallow angle. The shallow intake cross section this creates for the stream of exhaust gas allows the turbocharger boost pressure to build up rapidly and easily at low engine speeds.

Regulation at Moderate Engine Speed

As the engine speed increases and the quantity of exhaust gas increases, the vane adjustment solenoid moves the adjusting ring so that the vanes are set at a steeper angle. The steeper angle opens the intake cross section effectively reducing the gas flow and turbine speed, while maintaining constant turbocharger boost pressure.

Regulation at Maximum Engine Speed

As the engine speed increases the intake cross section in front of the turbocharger turbine is continuously enlarged. The turbine speed and hence the quantity of the air supplied to the engine, is adjusted to suit the engine speed. This means that the turbocharger boost pressure remains optimized over all engine speeds.

The maximum position of the turbocharger vanes (maximum opening cross section) is also an emergency position, in the event of an electrical concern. This lowers the chance of engine damage due to excessive boost in the event of a turbocharger control concern.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

NOTE: It is normal for a small amount of combustion gas to pass into the crankcase. This gas is scavenged into the air intake system through the positive crankcase ventilation (PCV) system, which incorporates an oil separator. Some engine oil, in the form of a vapor is carried into the air intake system with the blow-by gases (this engine oil also contributes to valve seat durability). This means that oil will collect inside the air intake components and the turbocharger. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy or seize. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the oil supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Oil leak(s) • Air cleaner element • Air cleaner outlet pipe • Air cleaner intake pipe • Turbocharger oil supply pipe • Turbocharger oil return tube • Turbocharger intake pipe • Turbocharger housing • Charge air cooler • Charge air cooler intake pipe and hose(s) • Charge air cooler outlet pipe and hose(s)	• Wiring harness • Turbocharger electronic actuator • PCM

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
Blue smoke with excessive turbocharger noise	* Turbocharger compressor rubbing on housing walls. * Turbocharger turbine rubbing on housing	* GO to Pinpoint Test A.

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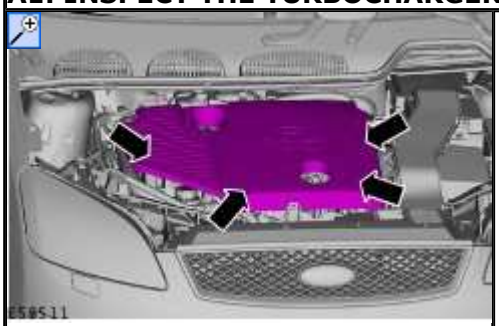
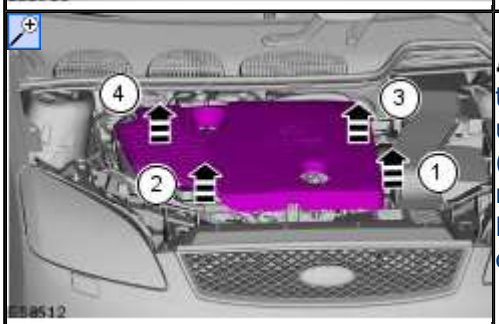
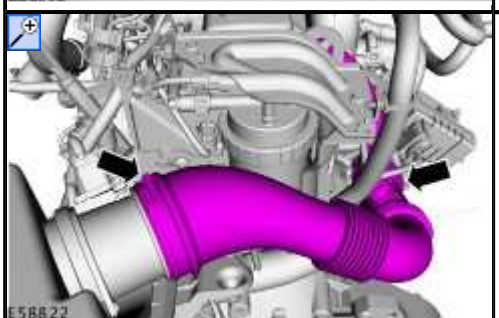
	walls. * Turbocharger bearings and oil seal(s). * Turbocharger oil supply tube blocked or damaged.	
Blue smoke without excessive turbocharger noise	* Turbocharger oil return tube blocked or damaged.	* GO to Pinpoint Test B.
Poor engine performance	* Charge air cooler system.	* CHECK the charge air cooler, charge air cooler pipes and charge air cooler hoses for leaks and obstructions. REPAIR as necessary.
	* Air cleaner intake pipe.	* CHECK the air cleaner intake pipe for obstruction. REPAIR the necessary.
	* Turbocharger electronic actuator.	* REFER to WDS.

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE	
	1 Location of the engine upper cover retaining clips.
	CAUTION: Care must be taken when releasing the fourth retaining clip and maneuvering the engine upper cover past the manifold absolute pressure (MAP) sensor. Failure to follow this instruction may result in damage to the MAP sensor. NOTE: Only remove and install the engine upper cover in the sequence shown. 2 Remove the engine upper cover.
	3 Detach the turbocharger intake pipe and position it to one side.
	4 Inspect the turbocharger rotor vanes for damage.

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Is there visible damage to the rotor vanes?

Yes

GO to A2.

No

GO to A3.

A2: CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

1 Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes

CLEAN the intake air system components. INSTALL a new turbocharger.
REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
TEST the system for normal operation.

No

GO to A4.

A3: CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: A small amount of movement in the bearings is normal.

1 Make sure the turbocharger rotor spins freely within the housing.

- 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
- 2. Make sure the rotor spins freely within the housing.

Does the rotor spin freely within the housing with no excessive movement?

Yes

GO to A4.

No

INSTALL a new turbocharger.
REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
TEST the system for normal operation.

A4: CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

1 Remove the turbocharger.
REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

2 Using workshop compressed air and a compressed

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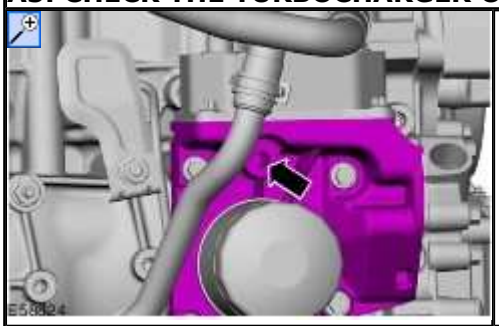
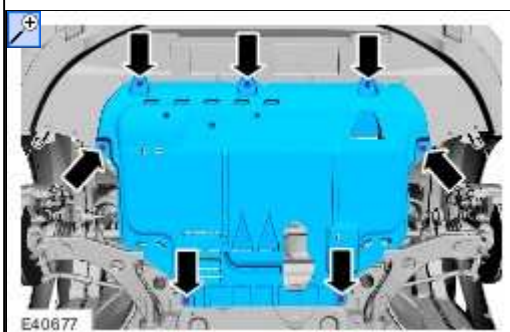
	air nozzle, check the oil supply tube for blockage.
	Is the oil supply tube free from blockage? **Yes** GO to A5. **No** INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). TEST the system for normal operation.
A5: CHECK THE TURBOCHARGER OIL SUPPLY TUBE OIL GALLERY FOR BLOCKAGE	
	1 Visually inspect the oil supply tube oil gallery for blockage.
	Is the oil supply tube oil gallery free from blockage? **Yes** INSTALL a new turbocharger and oil supply pipe. REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). TEST the system for normal operation. **No** REMOVE the blockage. INSTALL a new turbocharger. REFER to: Turbocharger (303-04I Fuel Charging and Controls - Turbocharger - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE TURBOCHARGER OIL RETURN PIPE	
	1 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
	2 Remove the engine undershield.
	NOTE: Discard the gasket(s). 3 Remove the turbocharger oil return pipe.

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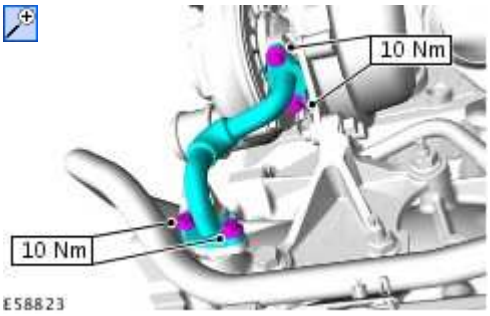

	4 Check the turbocharger oil return pipe for blockage or signs of damage.
	Is the turbocharger oil return pipe free from blockage and signs of damage? **Yes** GO to Fuel Charging and Controls for further diagnostics. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). **No** INSTALL a new turbocharger oil return pipe. TEST the system for normal operation.

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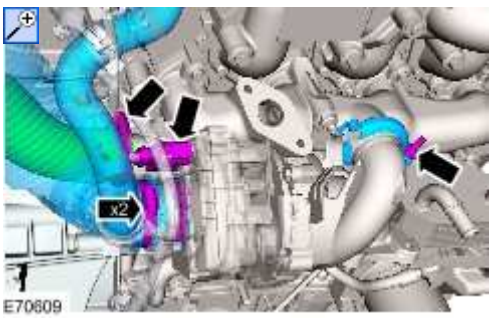
Removal and Installation

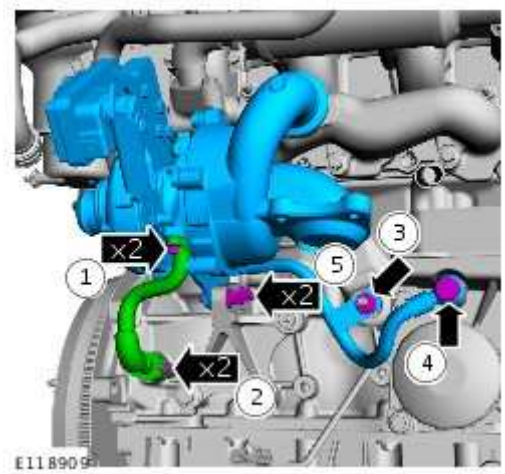
Removal

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

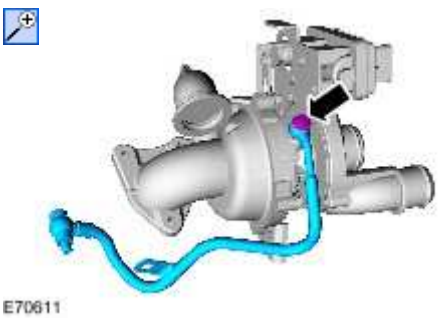
1. Remove the following items:
   - Refer to: Catalytic Converter (309-00D Exhaus System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lyn Removal and Installation).
   Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installatic



2. NOTE: Note the position of the component before removal.
   Discard the clamp.



3.
   3. Discard the nut.



4. Discard the oil supply tube.

Installation

1. NOTE: Make sure that a new component is installe
   Torque: 35 Nm

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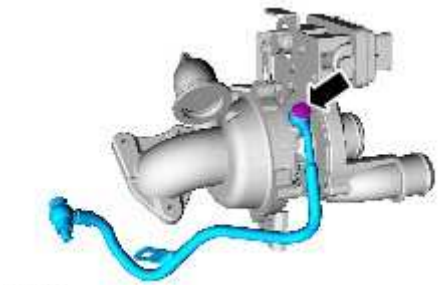
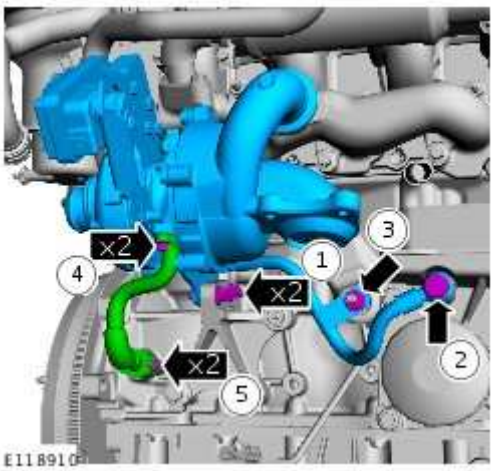
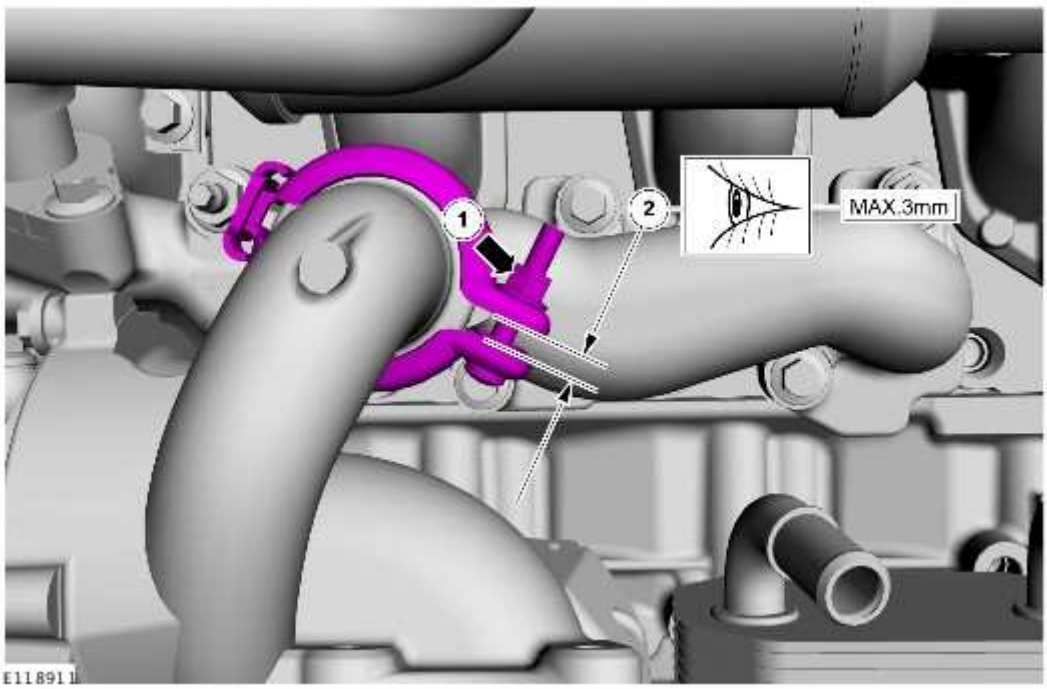




2. NOTE: Only tighten the nuts and bolts finger tight this stage.



3. NOTE:
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4.
1. *Torque:* 25 Nm
2. *Torque:* 35 Nm
3. *Torque:* 23 Nm
4. *Torque:* 10 Nm
5. *Torque:* 10 Nm

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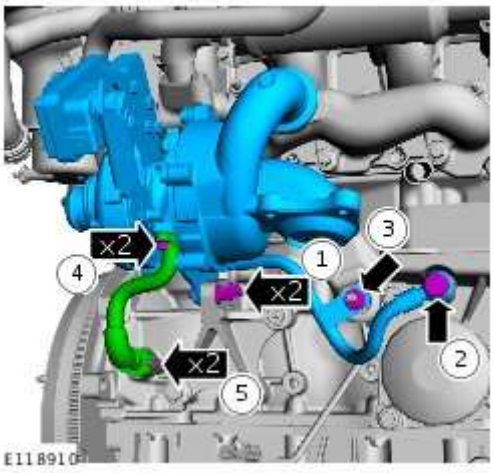

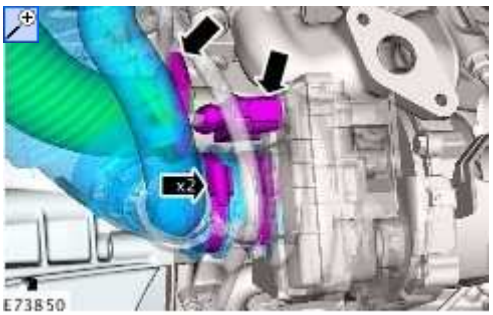

5. CAUTION: Make sure that the inside of the pip ends are clean and free of oil residue.

6. Install the following items:
   - Refer to: Catalytic Converter (309-00D Exhaus System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lyn Removal and Installation).
     Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installatic

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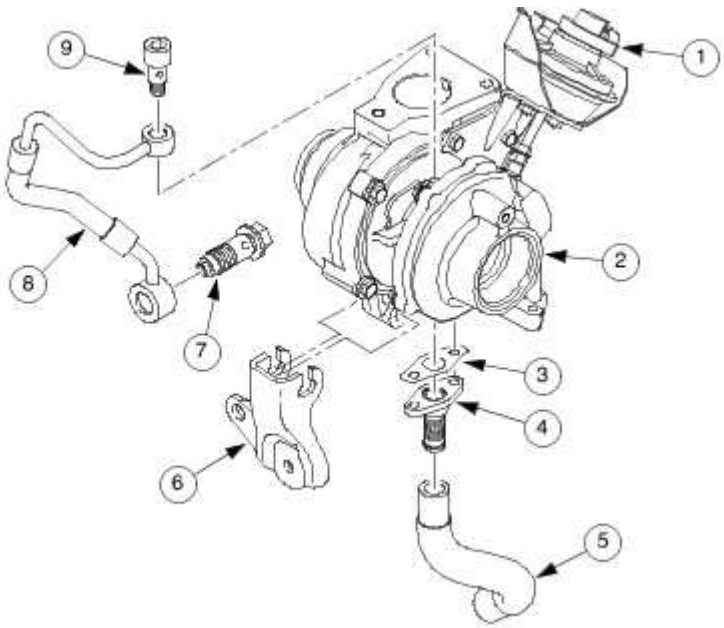
Description and Operation

Turbocharger with variable turbine geometry



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Item	Part Number	Description
1	-	Turbocharger position sensor
2	-	Turbocharger housing
3	-	Seal
4	-	Connector
5	-	Connecting hose - oil return
6	-	Bracket
7	-	Banjo bolt
8	-	Oil line
9	-	Banjo bolt

To ensure an optimum torque curve, a Garrett turbocharger with variable turbine geometry is used.

The movable guide vanes on the turbine wheel are adjusted by the turbocharger vacuum canister by means of a connecting rod.

A position sensor is located centrally on the turbocharger vacuum canister; this forwards the position of the guide vanes to the powertrain control module (PCM) as an input variable.

The vacuum to the turbocharger vacuum canister is metered by the boost control solenoid valve. The boost control solenoid valve is controlled by the PCM .

The bearings of the turbocharger are lubricated by the engine's oil circuit via a rigid oil pipe.

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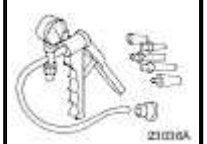
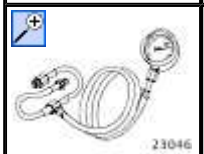
Diagnosis and Testing

Special Tool(s)

	Hand Vacuum/Pressure Pump 416 - D001 (23 - 036A)
	Fuel Pressure Gauge 310-053 (23-046)

General Equipment

Worldwide Diagnostic System (WDS) (418-F224)

Inspection and Verification

NOTE: It is normal for a small amount of combustion gas to pass into the crankcase. This gas is scavenged into the air intake system through the positive crankcase ventilation (PCV) system, which incorporates an oil separator. Some engine oil, in the form of a vapor is carried into the air intake system with the blow-by gases (this engine oil also contributes to valve seat durability). This means that oil will collect inside the air intake components and the turbocharger. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy or seize. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the oil supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Oil leak(s) • Air cleaner element • Air cleaner outlet pipe • Air cleaner intake pipe • Turbocharger oil supply or oil return tube • Turbocharger intake pipe • Turbocharger vacuum diaphragm unit • Turbocharger housing • Charge air cooler • Charge air cooler intake pipe and hose(s) • Charge air cooler outlet pipe and hose(s)	• Wiring harness • Vane adjustment solenoid valve • PCM

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause

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(if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom Chart

NOTE: The vacuum diaphragm unit is a fixed part of the turbocharger and cannot be adjusted or renewed.

Symptom	Possible Sources	Action
Blue smoke with excessive turbocharger noise	* Turbocharger compressor rubbing on housing walls. * Turbocharger turbine rubbing on housing walls. * Turbocharger bearings and oil seal (s). * Turbocharger oil supply tube blocked or damaged.	* GO to Pinpoint Test A.
Blue smoke without excessive turbocharger noise	* Turbocharger oil return tube blocked or damaged.	* GO to Pinpoint Test B.
Poor engine performance	* Vacuum diaphragm unit vacuum line(s).	* CHECK all vacuum line(s) are installed and no signs of air leaks are present. REPAIR as necessary.
	* Charge air cooler system.	* CHECK the charge air cooler, charge air cooler pipes and charge air cooler hoses for leaks and obstructions. REPAIR as necessary.
	* Air cleaner intake pipe.	* CHECK the air cleaner intake pipe for obstruction. REPAIR the necessary.
	* Unauthorized adjustment of the vacuum diaphragm unit actuator rod.	* The turbocharger boost pressure is factory set and must not be adjusted. CHECK the paint seal on the vacuum diaphragm unit actuator rod has not been broken. If the paint seal has been broken, INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Vacuum diaphragm unit actuator rod.	* CHECK the vacuum diaphragm unit actuator rod moves freely, If the vacuum diaphragm unit actuator rod does not move freely. CHECK for signs of damage or signs of foreign material. REPAIR as necessary.
	* Turbocharger boost pressure.	* GO to Pinpoint Test C.

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE	

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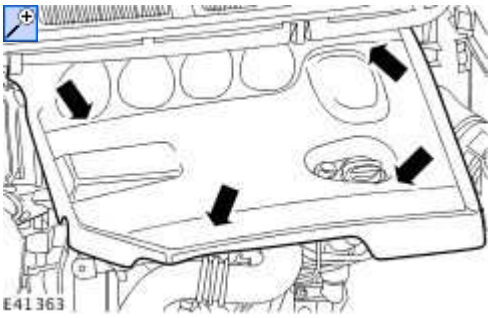
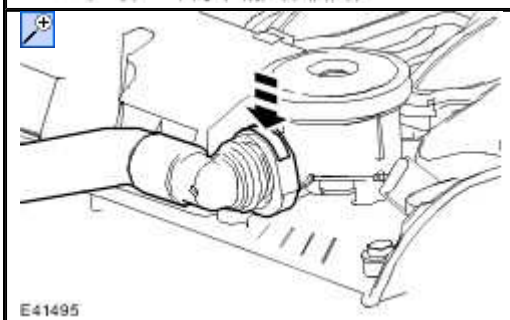
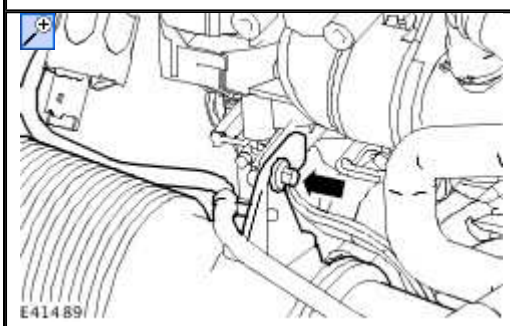
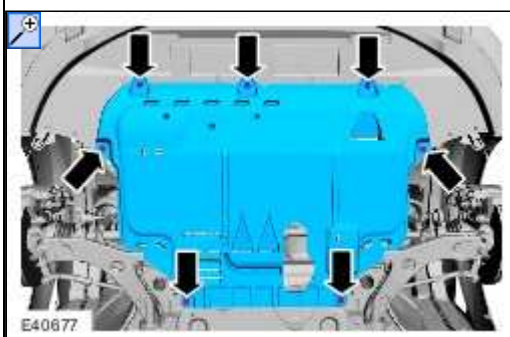
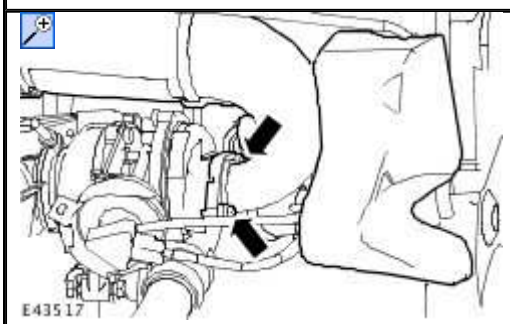
	1 Remove the engine upper cover.
	2 Disconnect the positive crankcase ventilation (PCV) breather hose from the intake manifold PCV valve. • Press in the release clip.
	3 Remove the turbocharger intake pipe support bracket retaining bolt.
	4 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
	5 Remove the engine undershield. • Rotate the locking tangs counterclockwise.
	6 Detach the turbocharger intake pipe.
	7 Inspect the turbocharger rotor vanes for damage.

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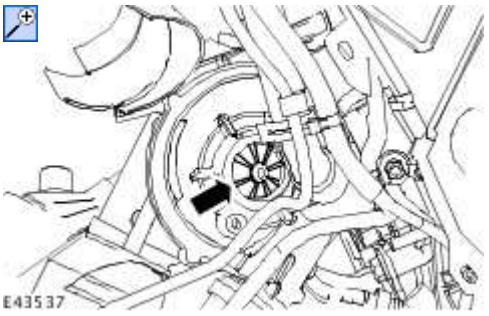


Is there visible damage to the rotor vanes?

Yes

GO to A2.

No

GO to A3.

A2: CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

1 Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes

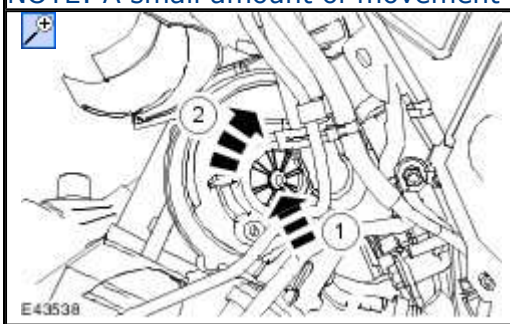
CLEAN the intake air system components. INSTALL a new turbocharger.
REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
TEST the system for normal operation.

No

GO to A4.

A3: CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: A small amount of movement in the bearings is normal.



1 Make sure the turbocharger rotor spins freely within the housing.

- 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
- 2. Make sure the rotor spins freely within the housing.

Does the rotor spin freely within the housing with no excessive movement?

Yes

GO to A4.

No

INSTALL a new turbocharger.
REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
TEST the system for normal operation.

A4: CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

NOTE: Discard the copper washers.

1 Remove the turbocharger oil supply tube.

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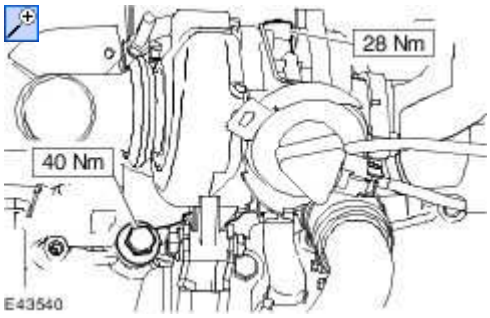
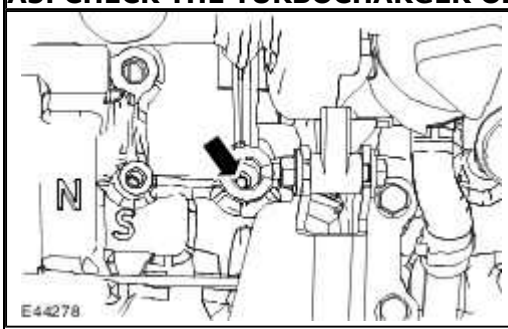


	2 Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.
	Is the oil supply tube free from blockage? **Yes** GO to A5. **No** INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
A5: CHECK THE TURBOCHARGER OIL SUPPLY TUBE OIL GALLERY FOR BLOCKAGE	
	1 Using a suitable welding filler rod, check the oil supply tube oil gallery for blockage.
	Is the oil supply tube oil gallery free from blockage? **Yes** GO to A6. **No** REMOVE the blockage. INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
A6: CHECK THE TURBOCHARGER OIL SUPPLY TUBE NON RETURN VALVE FOR CORRECT OPERATION AND BLOCKAGE	
	1 Remove the turbocharger oil supply pipe union non return valve.

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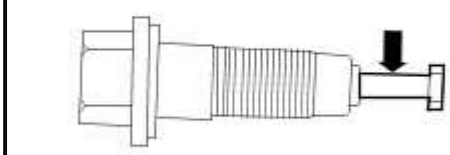
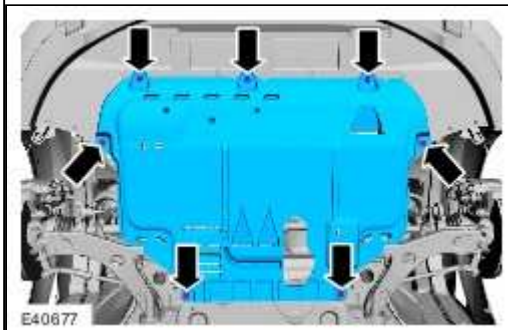
 E43065	
	2 Inspect the turbocharger oil supply pipe union for blockage.
	Is the oil supply pipe union non return valve free to move and the union free from blockage? **Yes** INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation. **No** INSTALL a new turbocharger and oil supply pipe non return valve. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE TURBOCHARGER OIL RETURN PIPE	
	1 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
 E40677	2 Remove the engine undershield. • Rotate the locking tangs counterclockwise.
	NOTE: Discard the gasket. 3 Remove the turbocharger oil return pipe.

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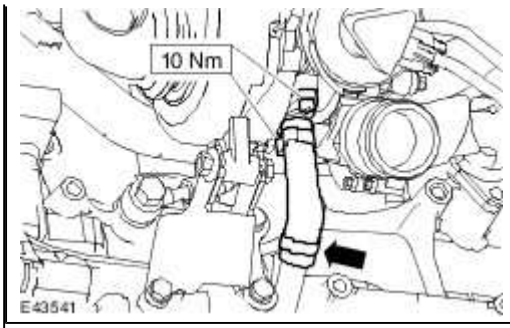
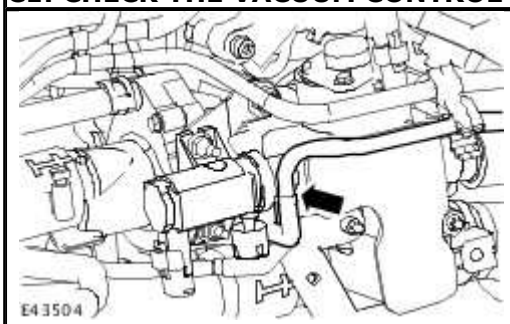
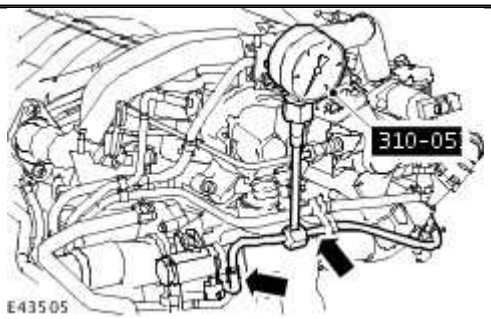


	4 Check the turbocharger oil return pipe for a blockage or signs of damage.
	Is the turbocharger oil return pipe free from blockage and signs of damage? **Yes** GO to Fuel Charging and Controls for further diagnostics. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing). **No** INSTALL a new turbocharger oil return pipe. TEST the system for normal operation.

PINPOINT TEST C : POOR ENGINE PERFORMANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE VACUUM CONTROL CIRCUIT FOR VACUUM	
	1 Disconnect the vacuum line from the turbocharger vacuum control solenoid.
	2 Install the special tool between the turbocharger vacuum control solenoid and vacuum line.
	3 Start and run the engine.
	With the engine at idle does the special tool indicate a vacuum of 0.325 bar or above? **Yes** GO to C2. **No** GO to C4.
C2: CHECK THE VACUUM DIAPHRAGM UNIT ACTUATOR ROD MOVEMENT	
	1 Ignition switch in position 0.

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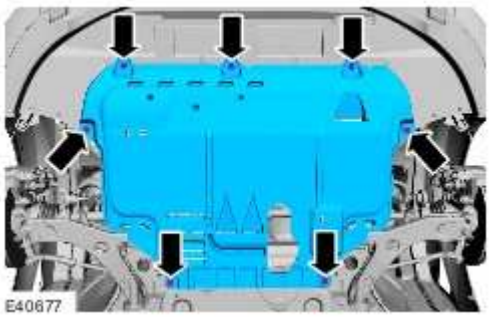
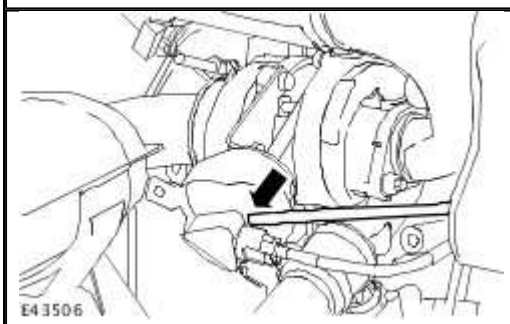
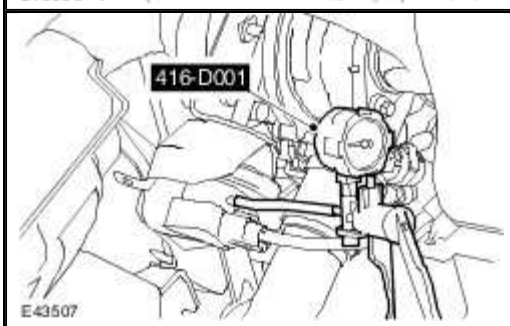
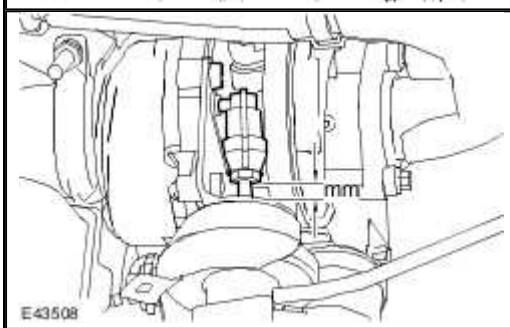
	2 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
	**3** Remove the engine undershield. • Rotate the locking tangs counterclockwise.
	**4** Disconnect the vacuum line from the vane adjustment diaphragm unit.
	**5** Install the special tool to the vane adjustment diaphragm unit.
	**6** Operate the special tool until a vacuum of 35 Kpa is achieved. Measure the distance travelled by the vane adjustment diaphragm unit actuator rod.
	Does the vane adjustment diaphragm unit actuator rod move between 9 and 11 mm? **Yes** GO to C3. **No** CHECK for signs of damage or signs of foreign material in the turbocharger vanes. INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

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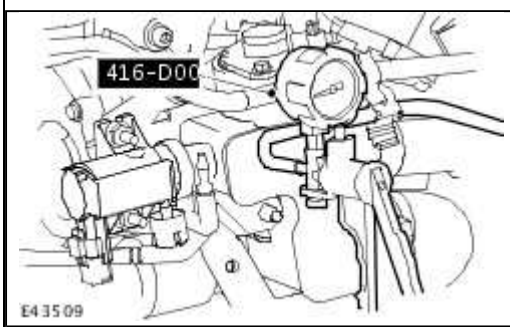
C3: CHECK THE TURBOCHARGER BOOST PRESSURE	
	1 Remove special tool 416-D001.
	2 Connect the vacuum line to the vane adjustment diaphragm unit.
	3 Lower the vehicle.
	4 Connect WDS to the vehicle data link connector (DLC).
	5 Select the dataloger function.
	6 Configure dataloger to read the intake manifold pressure via the manifold absolute pressure (MAP) sensor.
	7 Start and run the engine.
	8 With the aid of another Technician, raise the engine speed to 2000 rpm.
	9 Observe the readings of special tool 310-053 and the WDS manifold pressure display.
	Is a vacuum of 0.325 bar on the special tool and boost pressure of 1.5 bar on the WDS manifold pressure display indicated? **Yes** Continue the diagnostic of the engine management system using WDS. **No** INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
C4: CHECK THE VACUUM DIAPHRAGM UNIT VACUUM LINE FOR LEAKS	
	1 Ignition switch in position 0.
	2 Remove the special tool 310-053.
	3 Install the special tool to the vacuum diaphragm unit vacuum line.
	4 Operate the special tool and observe the reading.
	Does the special tool hold vacuum? **Yes** GO to C5. **No** GO to C6.
C5: CHECK THE TURBOCHARGER VANE ADJUSTMENT SOLENOID VALVE DUTY CYCLE	
	1 Disconnect Turbocharger vain adjustment solenoid C585.
	2 Start and run the engine.
	3 Measure the voltage between C585 pin 1, circuit 15S-RL50 (GN/BU) harness side and C585 pin 2, circuit 91S-RL50 (BK/BU) harness side.

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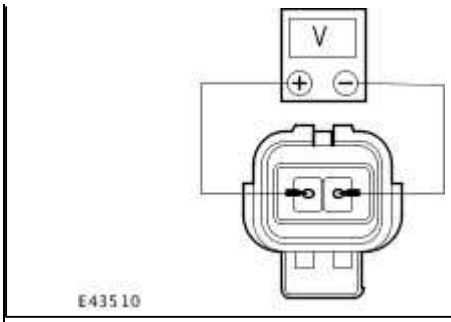


With the engine at idle, is the voltage greater than 10 volts?

Yes

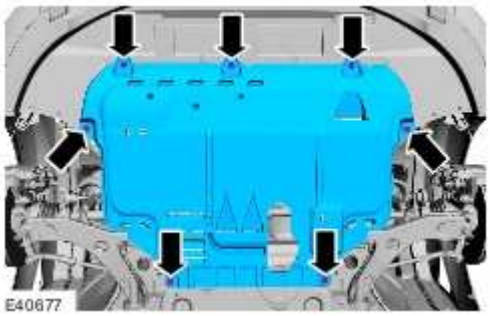
INSTALL a new turbocharger vacuum control solenoid. TEST the system for normal operation.

No

Continue the diagnostic of the engine management system using WDS.

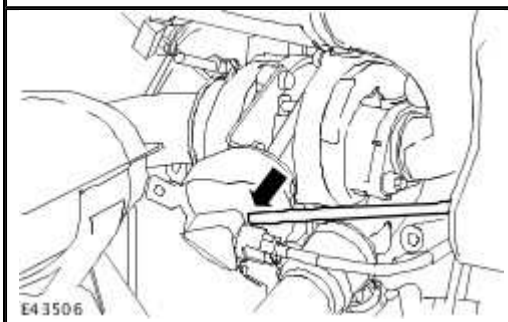
C6: CHECK THE VACUUM DIAPHRAGM UNIT FOR LEAKS

1 Raise and support the vehicle. For additional information,
REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).

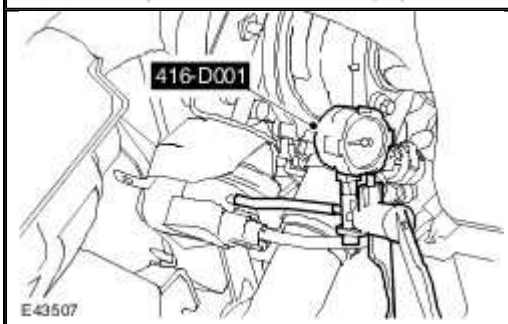


2 Remove the engine undershield.

- Rotate the locking tangs counterclockwise.



3 Disconnect the vacuum line from the vacuum diaphragm unit.



4 Install the special tool to the vane adjustment diaphragm unit.

5 Operate the special tool and observe the reading.

Does the special tool hold vacuum?

Yes

INSTALL a new vacuum line. TEST the system for normal operation.

No

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	INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

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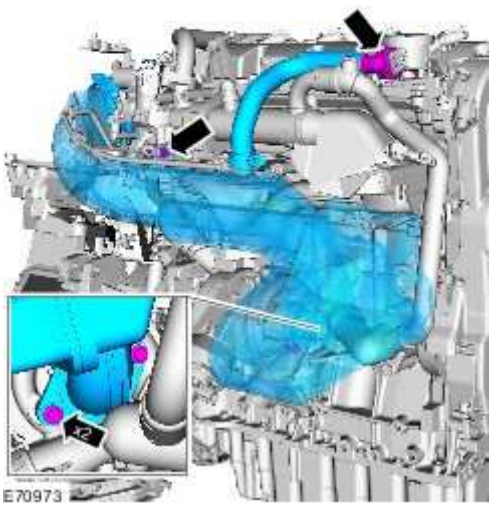
Removal and Installation

Removal

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

1. Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
2. Lower the vehicle.
3. *Torque:* 9 Nm



4. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

5. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   3. *Torque:* 3 Nm
   4. *Torque:* 10 Nm
   5. *Torque:* 15 Nm
   6. *Torque:* 15 Nm

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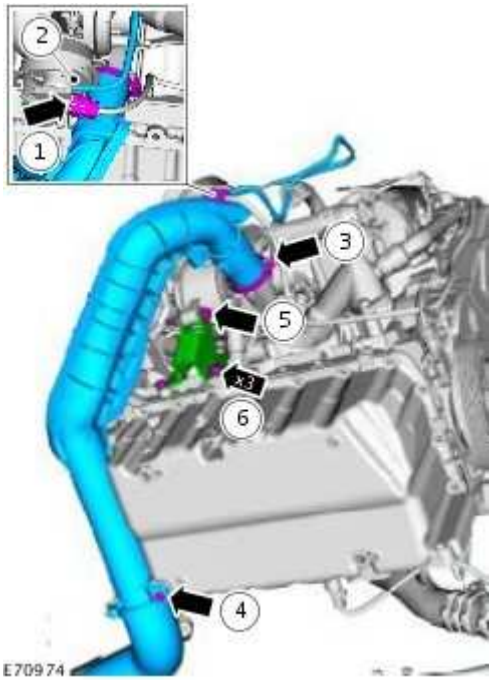
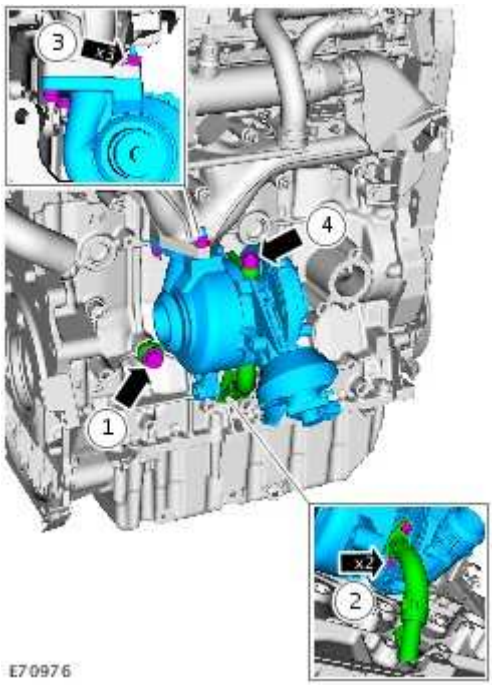
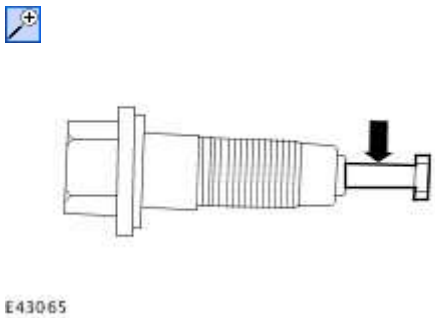




6.
1. *Torque:* 40 Nm
2. *Torque:* 10 Nm
3. *Torque:* 25 Nm
4. *Torque:* 28 Nm

Installation



1. NOTE: Make sure that a new component is installed.
   Install the filter into the turbocharger oil supply tube banjo bolt.
2. To install, reverse the removal procedure.

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Diagnosis and Testing

Special Tool(s)

	Hand Vacuum/Pressure Pump 416 - D001 (23 - 036A)
	Fuel Pressure Gauge 310-053 (23-046)

General Equipment

Worldwide Diagnostic System (WDS) (418-F224)

Inspection and Verification

NOTE: It is normal for a small amount of combustion gas to pass into the crankcase. This gas is scavenged into the air intake system through the positive crankcase ventilation (PCV) system, which incorporates an oil separator. Some engine oil, in the form of a vapor is carried into the air intake system with the blow-by gases (this engine oil also contributes to valve seat durability). This means that oil will collect inside the air intake components and the turbocharger. This is not an indication that the turbocharger oil seal has failed. The turbocharger oil seal will not fail unless the bearings fail first, which will cause the turbocharger to become noisy or seize. Do not install a new turbocharger due to oil inside the turbocharger or the air intake components. If a leak is detected in the oil supply or return tubes or connections, locate and rectify the source. Do not install a new turbocharger due to an oil leak.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Oil leak(s) • Air cleaner element • Air cleaner outlet pipe • Air cleaner intake pipe • Turbocharger oil supply or oil return tube • Turbocharger intake pipe • Turbocharger vacuum diaphragm unit • Turbocharger housing • Charge air cooler • Charge air cooler intake pipe and hose(s) • Charge air cooler outlet pipe and hose(s)	• Wiring harness • Vane adjustment solenoid valve • PCM

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom

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Chart.

Symptom Chart

Symptom Chart

NOTE: The vacuum diaphragm unit is a fixed part of the turbocharger and cannot be adjusted or renewed.

Symptom	Possible Sources	Action
Blue smoke with excessive turbocharger noise	* Turbocharger compressor rubbing on housing walls. * Turbocharger turbine rubbing on housing walls. * Turbocharger bearings and oil seal (s). * Turbocharger oil supply tube blocked or damaged.	* GO to Pinpoint Test A.
Blue smoke without excessive turbocharger noise	* Turbocharger oil return tube blocked or damaged.	* GO to Pinpoint Test B.
Poor engine performance	* Vacuum diaphragm unit vacuum line(s).	* CHECK all vacuum line(s) are installed and no signs of air leaks are present. REPAIR as necessary.
	* Charge air cooler system.	* CHECK the charge air cooler, charge air cooler pipes and charge air cooler hoses for leaks and obstructions. REPAIR as necessary.
	* Air cleaner intake pipe.	* CHECK the air cleaner intake pipe for obstruction. REPAIR the necessary.
	* Unauthorized adjustment of the vacuum diaphragm unit actuator rod.	* The turbocharger boost pressure is factory set and must not be adjusted. CHECK the paint seal on the vacuum diaphragm unit actuator rod has not been broken. If the paint seal has been broken, INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Vacuum diaphragm unit actuator rod.	* CHECK the vacuum diaphragm unit actuator rod moves freely, If the vacuum diaphragm unit actuator rod does not move freely. CHECK for signs of damage or signs of foreign material. REPAIR as necessary.
	* Turbocharger boost pressure.	* GO to Pinpoint Test C.

Pinpoint Tests

PINPOINT TEST A : BLUE SMOKE WITH EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: INSPECT THE TURBOCHARGER ROTOR VANES FOR DAMAGE	
	1 Remove the engine upper cover.

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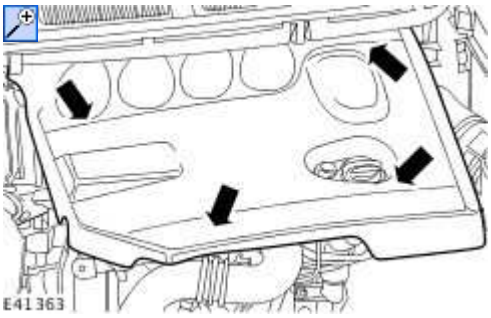
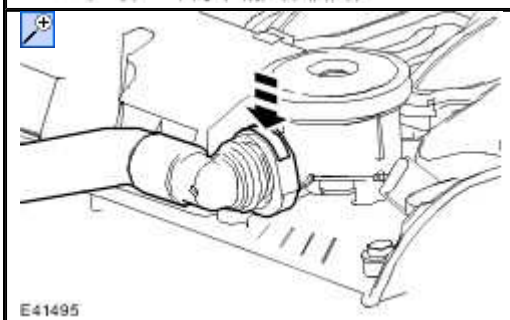
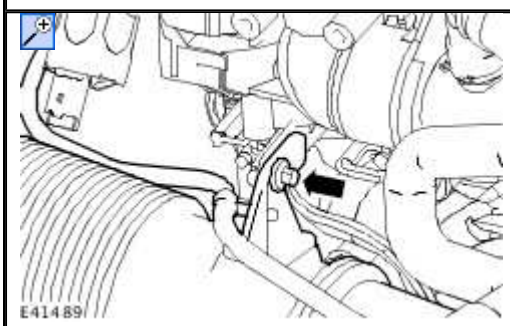
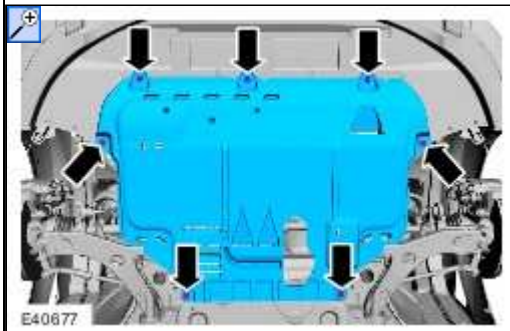
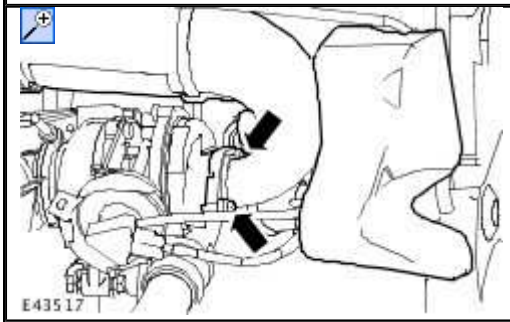
 E41363	
 E41495	2 Disconnect the positive crankcase ventilation (PCV) breather hose from the intake manifold PCV valve. • Press in the release clip.
 E41489	3 Remove the turbocharger intake pipe support bracket retaining bolt.
	4 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
 E40677	5 Remove the engine undershield. • Rotate the locking tangs counterclockwise.
 E43517	6 Detach the turbocharger intake pipe.
	7 Inspect the turbocharger rotor vanes for damage.

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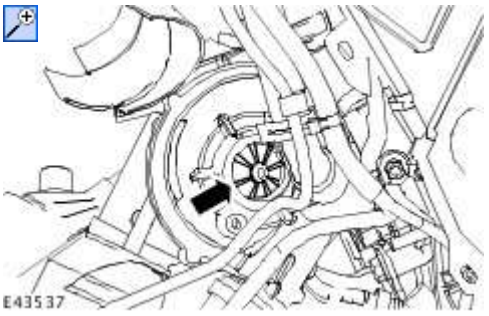


Is there visible damage to the rotor vanes?

Yes

GO to A2.

No

GO to A3.

A2: CHECK FOR FOREIGN MATERIAL IN THE INTAKE AIR SYSTEM COMPONENTS

1 Check the intake air system components for signs of foreign material.

Are there any signs of foreign material?

Yes

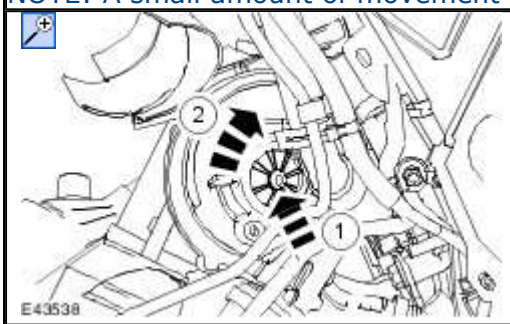
CLEAN the intake air system components. INSTALL a new turbocharger.
REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
TEST the system for normal operation.

No

GO to A4.

A3: CHECK THE TURBOCHARGER BEARINGS FOR EXCESSIVE MOVEMENT

NOTE: A small amount of movement in the bearings is normal.



1 Make sure the turbocharger rotor spins freely within the housing.

- 1. With the turbocharger stationary, gently lift the shaft (the shaft will naturally lay in the bottom of the bearings).
- 2. Make sure the rotor spins freely within the housing.

Does the rotor spin freely within the housing with no excessive movement?

Yes

GO to A4.

No

INSTALL a new turbocharger.
REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
TEST the system for normal operation.

A4: CHECK THE TURBOCHARGER OIL SUPPLY TUBE FOR BLOCKAGE

NOTE: Discard the copper washers.

1 Remove the turbocharger oil supply tube.

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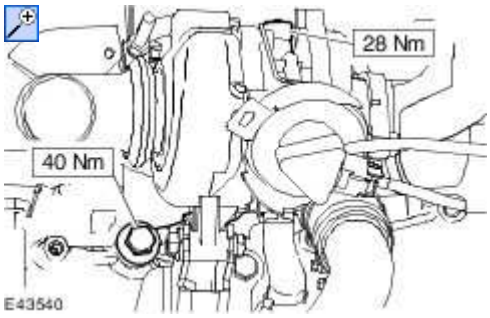
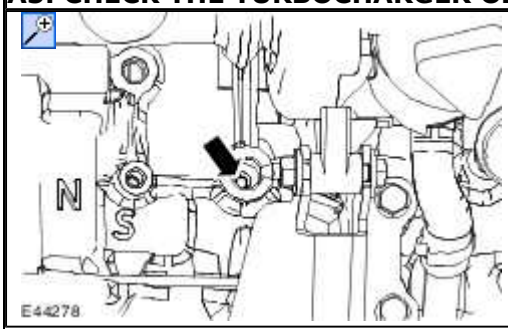


	2 Using workshop compressed air and a compressed air nozzle, check the oil supply tube for blockage.
	Is the oil supply tube free from blockage? **Yes** GO to A5. **No** INSTALL a new turbocharger and turbocharger oil supply tube. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
A5: CHECK THE TURBOCHARGER OIL SUPPLY TUBE OIL GALLERY FOR BLOCKAGE	
	1 Using a suitable welding filler rod, check the oil supply tube oil gallery for blockage.
	Is the oil supply tube oil gallery free from blockage? **Yes** GO to A6. **No** REMOVE the blockage. INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
A6: CHECK THE TURBOCHARGER OIL SUPPLY TUBE NON RETURN VALVE FOR CORRECT OPERATION AND BLOCKAGE	
	1 Remove the turbocharger oil supply pipe union non return valve.

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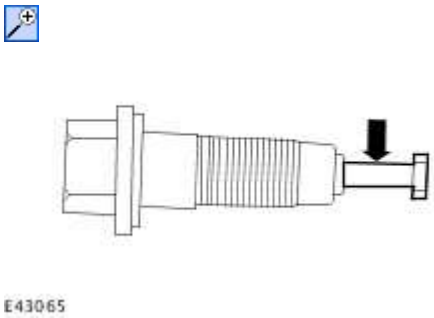
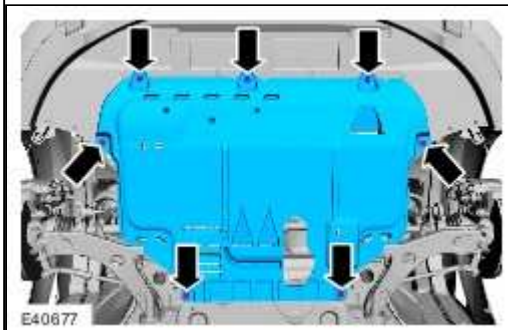
 E43065	
	2 Inspect the turbocharger oil supply pipe union for blockage.
	Is the oil supply pipe union non return valve free to move and the union free from blockage? **Yes** INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation. **No** INSTALL a new turbocharger and oil supply pipe non return valve. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : BLUE SMOKE WITHOUT EXCESSIVE TURBOCHARGER NOISE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE TURBOCHARGER OIL RETURN PIPE	
	1 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
 E40677	2 Remove the engine undershield. • Rotate the locking tangs counterclockwise.
	NOTE: Discard the gasket. 3 Remove the turbocharger oil return pipe.

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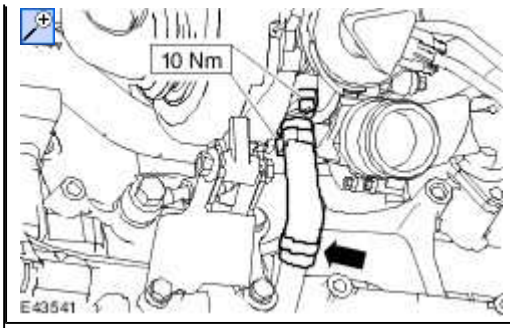
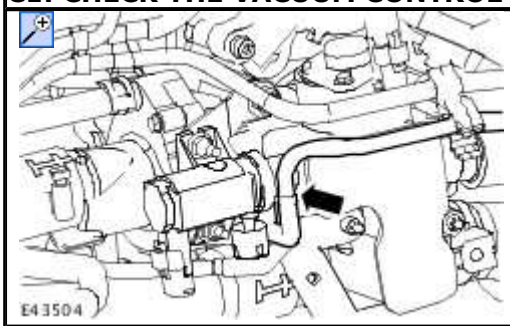
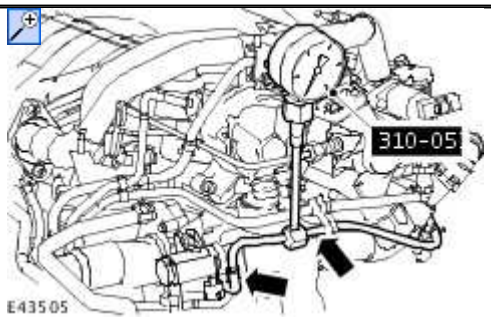


	4 Check the turbocharger oil return pipe for a blockage or signs of damage.
	Is the turbocharger oil return pipe free from blockage and signs of damage? **Yes** GO to Fuel Charging and Controls for further diagnostics. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing). **No** INSTALL a new turbocharger oil return pipe. TEST the system for normal operation.

PINPOINT TEST C : POOR ENGINE PERFORMANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE VACUUM CONTROL CIRCUIT FOR VACUUM	
	1 Disconnect the vacuum line from the turbocharger vacuum control solenoid.
	2 Install the special tool between the turbocharger vacuum control solenoid and vacuum line.
	3 Start and run the engine.
	With the engine at idle does the special tool indicate a vacuum of 0.325 bar or above? **Yes** GO to C2. **No** GO to C4.
C2: CHECK THE VACUUM DIAPHRAGM UNIT ACTUATOR ROD MOVEMENT	
	1 Ignition switch in position 0.

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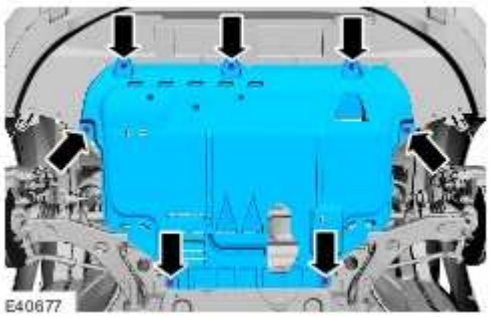
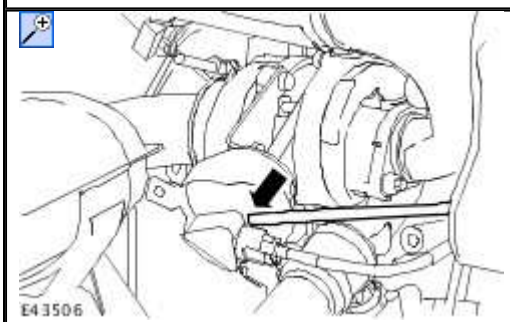
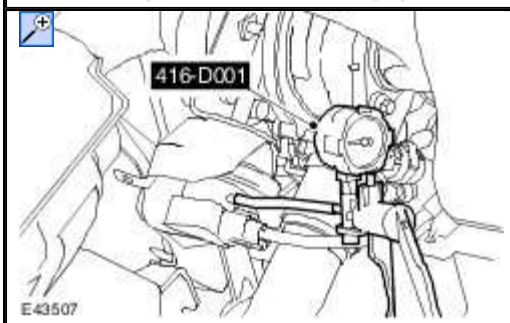
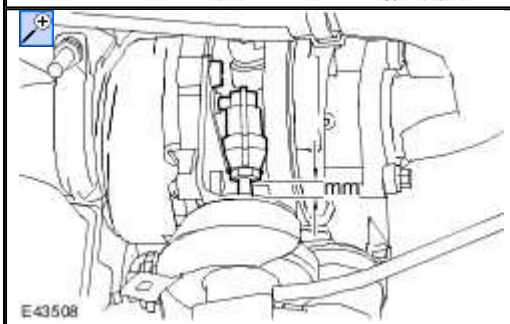
	2 Raise and support the vehicle. For additional information, REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).
	**3** Remove the engine undershield. • Rotate the locking tangs counterclockwise.
	**4** Disconnect the vacuum line from the vane adjustment diaphragm unit.
	**5** Install the special tool to the vane adjustment diaphragm unit.
	**6** Operate the special tool until a vacuum of 35 Kpa is achieved. Measure the distance travelled by the vane adjustment diaphragm unit actuator rod.
	Does the vane adjustment diaphragm unit actuator rod move between 9 and 11 mm? **Yes** GO to C3. **No** CHECK for signs of damage or signs of foreign material in the turbocharger vanes. INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

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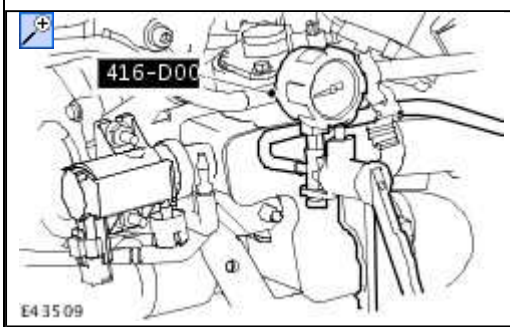
C3: CHECK THE TURBOCHARGER BOOST PRESSURE	
	1 Remove special tool 416-D001.
	2 Connect the vacuum line to the vane adjustment diaphragm unit.
	3 Lower the vehicle.
	4 Connect WDS to the vehicle data link connector (DLC).
	5 Select the dataloger function.
	6 Configure dataloger to read the intake manifold pressure via the manifold absolute pressure (MAP) sensor.
	7 Start and run the engine.
	8 With the aid of another Technician, raise the engine speed to 2000 rpm.
	9 Observe the readings of special tool 310-053 and the WDS manifold pressure display.
	Is a vacuum of 0.325 bar on the special tool and boost pressure of 1.5 bar on the WDS manifold pressure display indicated? **Yes** Continue the diagnostic of the engine management system using WDS. **No** INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
C4: CHECK THE VACUUM DIAPHRAGM UNIT VACUUM LINE FOR LEAKS	
	1 Ignition switch in position 0.
	2 Remove the special tool 310-053.
	3 Install the special tool to the vacuum diaphragm unit vacuum line.
	4 Operate the special tool and observe the reading.
	Does the special tool hold vacuum? **Yes** GO to C5. **No** GO to C6.
C5: CHECK THE TURBOCHARGER VANE ADJUSTMENT SOLENOID VALVE DUTY CYCLE	
	1 Disconnect Turbocharger vain adjustment solenoid C585.
	2 Start and run the engine.
	3 Measure the voltage between C585 pin 1, circuit 15S-RL50 (GN/BU) harness side and C585 pin 2, circuit 91S-RL50 (BK/BU) harness side.

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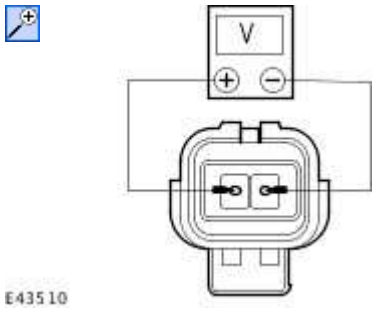


With the engine at idle, is the voltage greater than 10 volts?

Yes

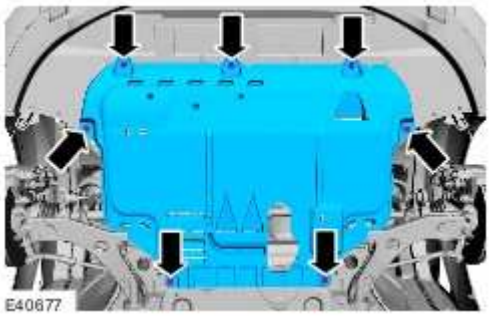
INSTALL a new turbocharger vacuum control solenoid. TEST the system for normal operation.

No

Continue the diagnostic of the engine management system using WDS.

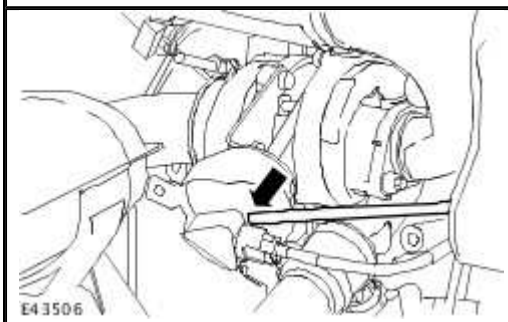
C6: CHECK THE VACUUM DIAPHRAGM UNIT FOR LEAKS

1 Raise and support the vehicle. For additional information,
REFER to: Lifting (100-02 Jacking and Lifting, Description and Operation).

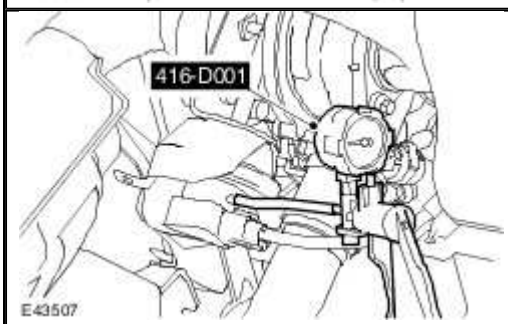


2 Remove the engine undershield.

- Rotate the locking tangs counterclockwise.



3 Disconnect the vacuum line from the vacuum diaphragm unit.



4 Install the special tool to the vane adjustment diaphragm unit.

5 Operate the special tool and observe the reading.

Does the special tool hold vacuum?

Yes

INSTALL a new vacuum line. TEST the system for normal operation.

No

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	INSTALL a new turbocharger. REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

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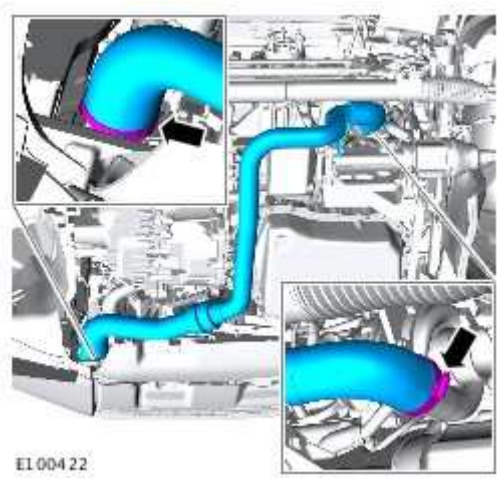
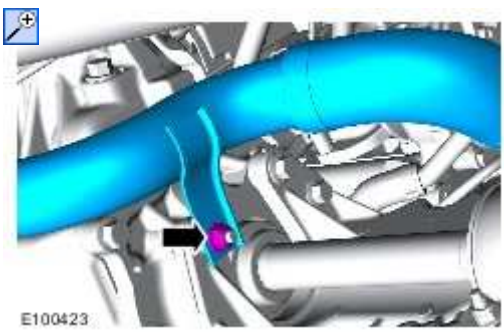
Removal and Installation

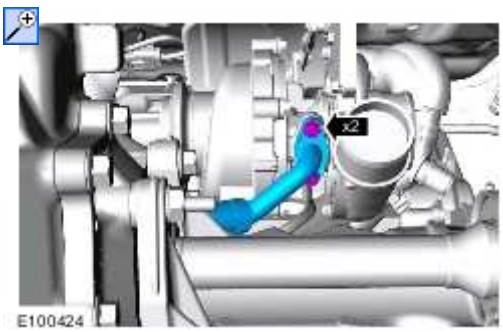
Materials

Name	Specification
Brake Cleaner	3U7J-2C410-AA

Removal

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Refer to: Catalytic Converter (309-00F Exhaust System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
3. 

4. 

5. 

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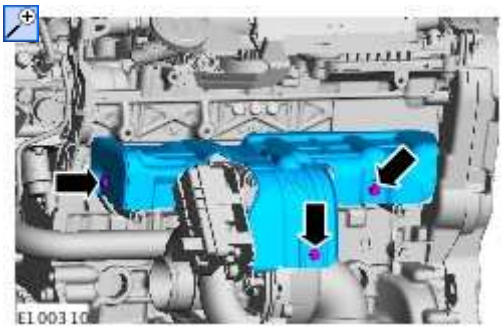

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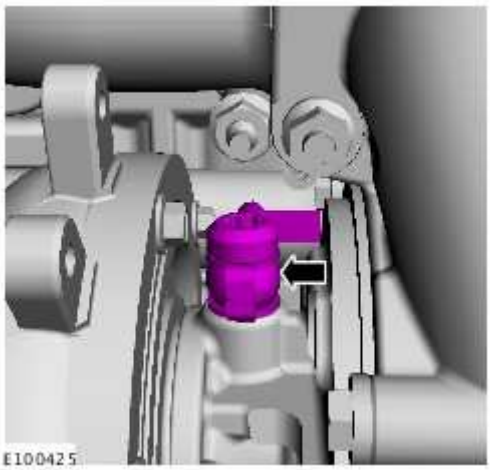

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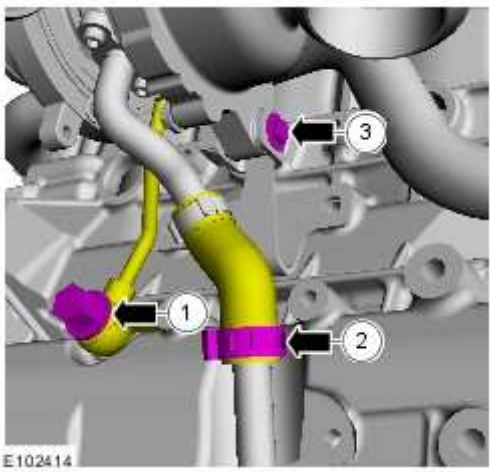

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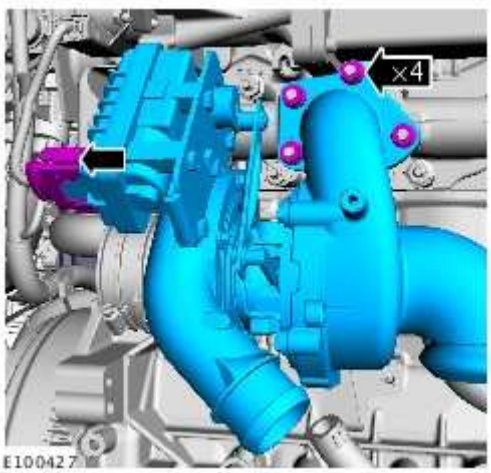

9.

10. If BA level, install latest level.

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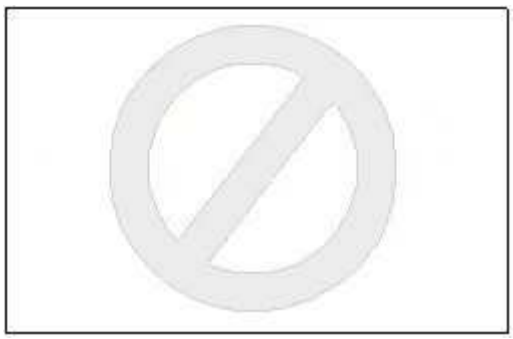
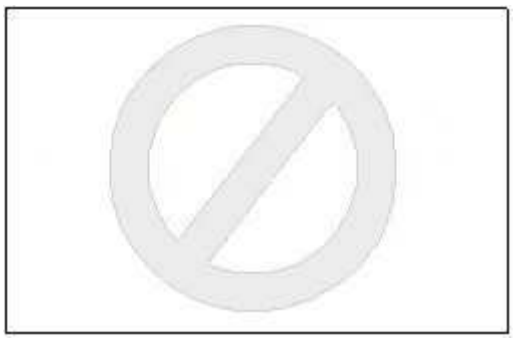
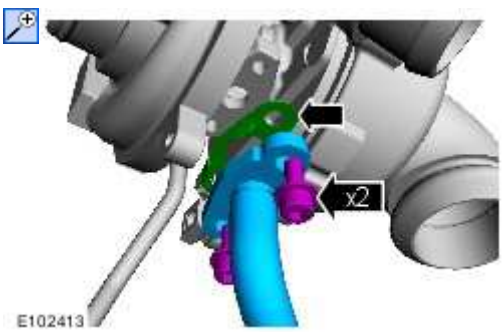


Refer to: Exhaust Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

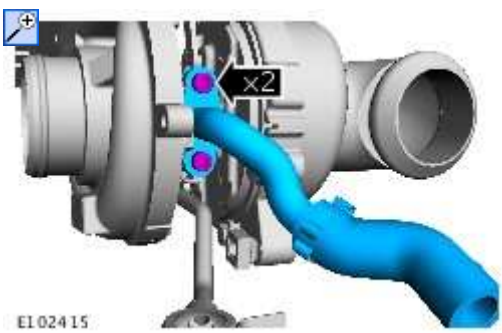


11.

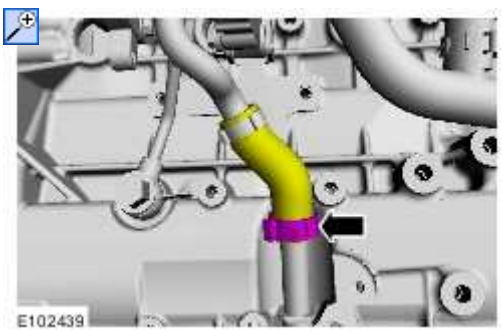
Installation



1. NOTE: Use a new seal.
   NOTE: Only tighten the bolts finger tight at this stage.



2. *Torque:* 10 Nm



3. CAUTION: Make sure that the component is not bent.
   Do not remove the clip at this stage.

4. *Torque:* 26 Nm

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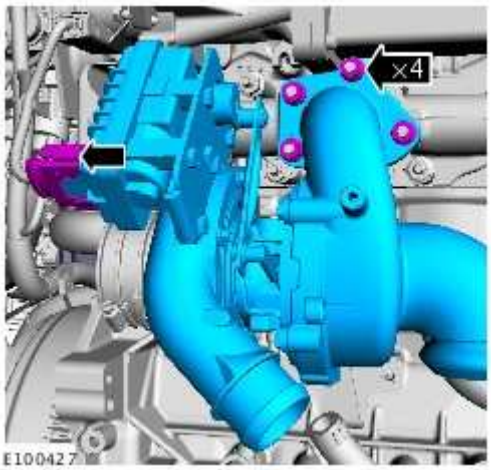
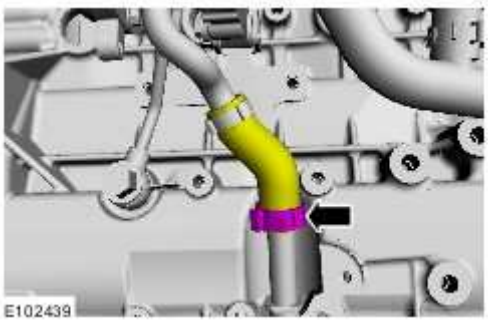
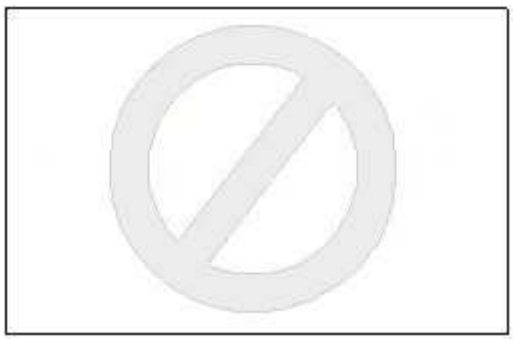
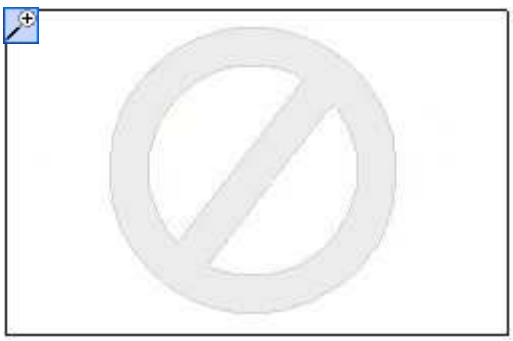




5. CAUTION: Make sure that the component is not bent.
Remove the clip.



6. NOTE: Make sure that a new component is installed.



7. Clean the filter.

Material: Brake Cleaner (3U7J-2C410-AA)

8. CAUTION: Make sure that the component is not bent.
NOTE: Make sure that a new component is installed.
NOTE: Use new seals.
NOTE: Only tighten the bolt finger tight at this stage.

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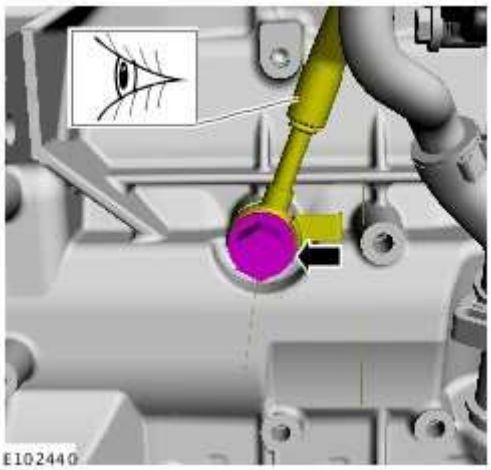
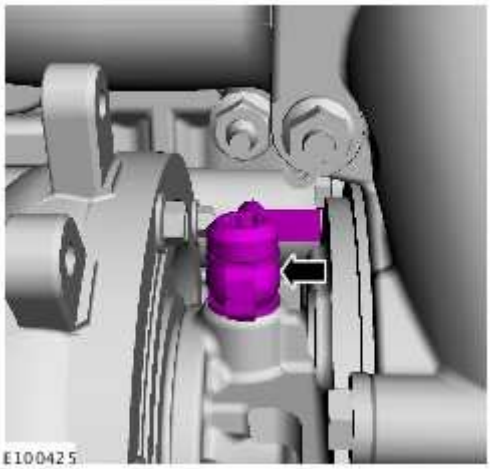
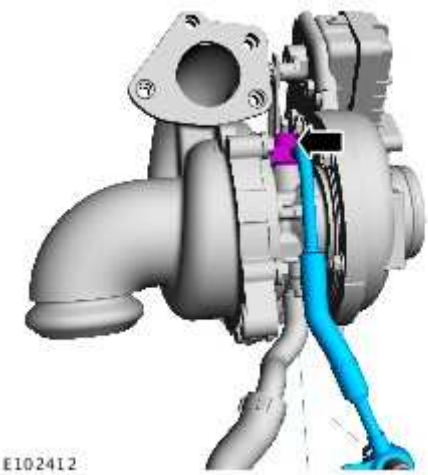




9. CAUTION: Make sure that the component is not bent.
NOTE: Make sure that a new component is installed.
NOTE: Only tighten the bolt finger tight at this stage.



10. CAUTION: Make sure that the component is not bent.
Torque: 5 Nm

11. CAUTION: Make sure that the component is not bent.
Torque: 40 Nm

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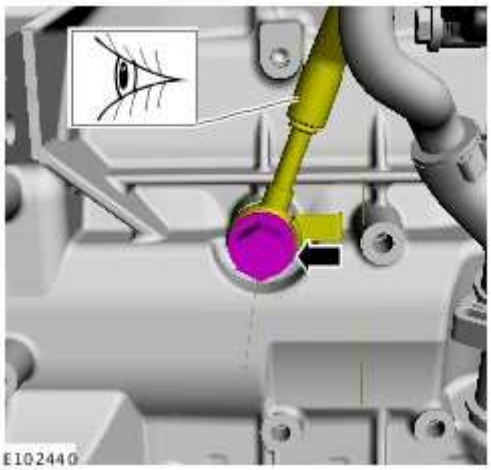
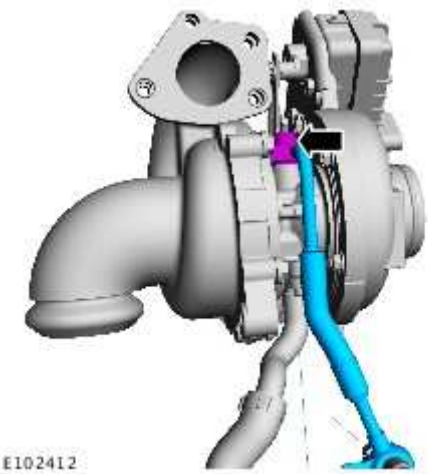
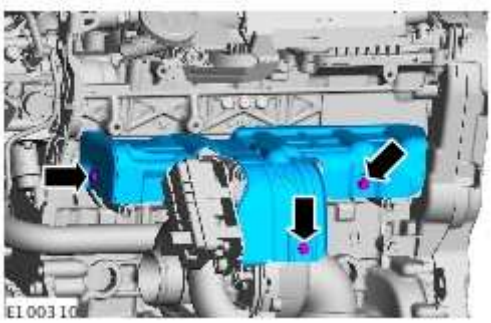


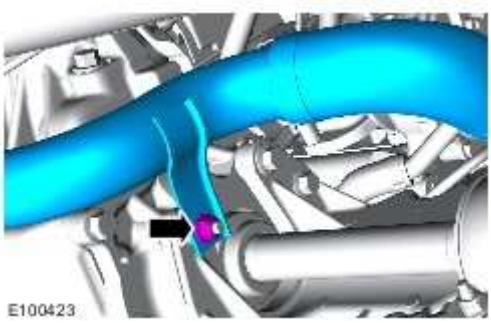
12. *Torque:* 17 Nm



13. *Torque:* 10 Nm



14. *Torque:* 10 Nm



15. *Torque:* 8 Nm

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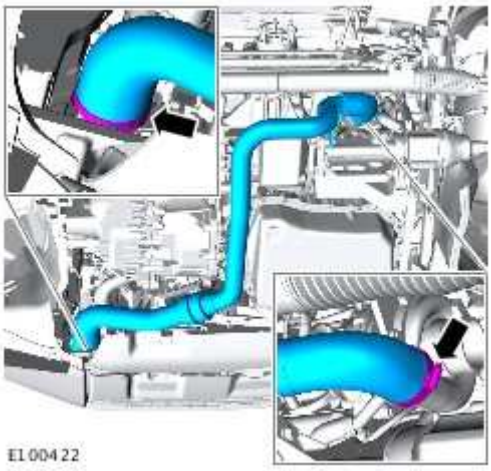

16. Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
Refer to: Catalytic Converter (309-00F Exhaust System - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 - Accessory Drive	S-MAX/Galaxy 2006.5 (02/2006-)

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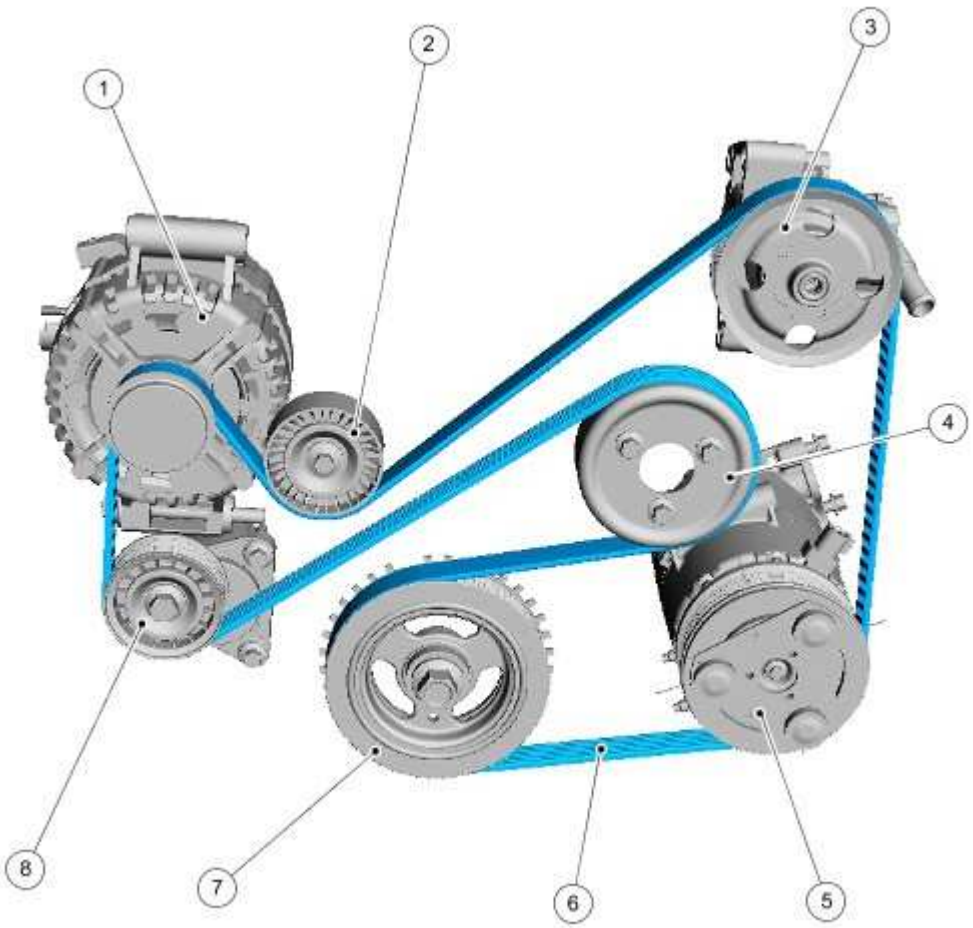
Description and Operation



E64007

Item	Part Number	Description
1	-	Generator
2	-	Accessory drive belt idler pulley
3	-	Power steering pump pulley
4	-	Coolant pump pulley
5	-	Air conditioning (A/C) compressor
6	-	Accessory drive belt
7	-	Crankshaft pulley
8	-	Accessory drive belt tensioner pulley

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Diagnosis and Testing

Inspection and Verification

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

Visual Inspection Chart

Mechanical
• Damaged or contaminated accessory drive belt • Damaged or contaminated pulley(s) • Incorrect accessory drive belt • Incorrect fitment of the accessory drive belt • Accessory drive belt tensioner • Accessory drive belt idler pulley • Generator • Power steering pump • Power steering pump leakage • Air conditioning (A/C) compressor • Pulley(s) • Loose hardware

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. **1.** Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),

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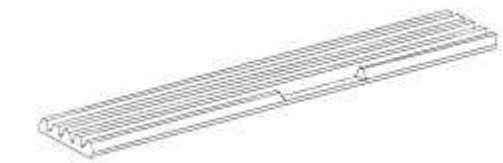
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Chunking

Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



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2. **2.** Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Pilling

Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.

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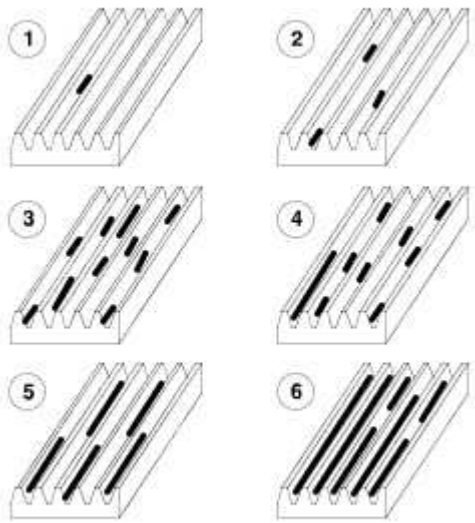

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3. **3.** Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE

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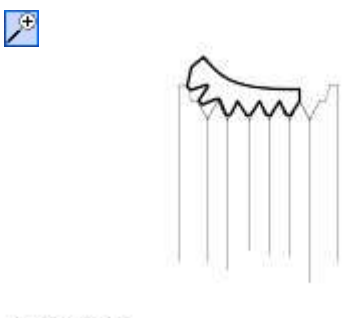
(107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Incorrect fitment

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Accessory drive belt noise	* Accessory drive system	* CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of the noise. INSTALL new components as necessary.

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		TEST the system for normal operation.
	* Accessory drive belt incorrectly installed.	* CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
	* Pulley(s).	* CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	* Lubricant or other contamination.	* CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
NOTE: Squeal is defined as a continuous shriek,	* Accessory drive belt tensioner worn, damaged	* CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner

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most noticeable when the engine is being accelerated or with electrical load. Accessory drive belt squeal	or contaminated with oil.	Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
NOTE: Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys. Accessory drive belt whine	* Poor surface finish on accessory drive belt idler pulley flat surface(s).	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	* Accessory drive belt idler pulley bearing failure.	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
NOTE: Chirp is	* Pulley	* CHECK that the accessory drive belt is running

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defined as a twittering noise, often intermittent Accessory drive belt chirp	misalignment (usually evident at idle).	centrally on the flat pulleys. TEST the system for normal operation. * CHECK the pulleys for excessive end float and bent flanges. * With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
NOTE: Rattle is defined as a metallic knocking noise Accessory drive belt rattle	* Accessory drive belt tensioner hitting the end stops.	* CHECK the accessory drive belt tensioner for correct operation or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
	* Loose components or hardware.	* CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.
Accessory drive belt fraying	* Accessory drive belt. * Pulley(s).	* CHECK the extent of the fraying by referring to the illustrations shown in the Visual Inspection section. Only INSTALL a new accessory drive belt if the fraying is within the criteria quoted in the Visual Inspection section. TEST the system for normal operation. * CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. **1.** Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. NOTE: The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.
   3. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. **4.** Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

5. **5.** If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner. TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

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The accessory drive belt tensioner may be checked dynamically as follows:

1. **1.** With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

   TEST the system for normal operation.

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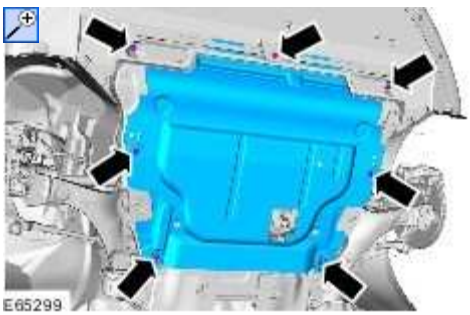
Removal and Installation

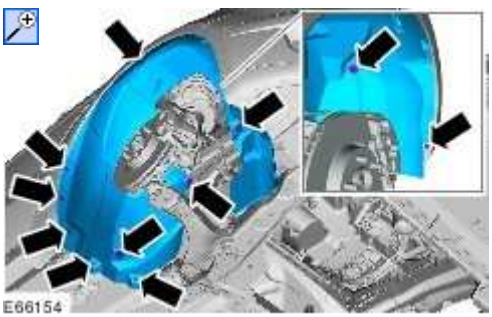
Removal

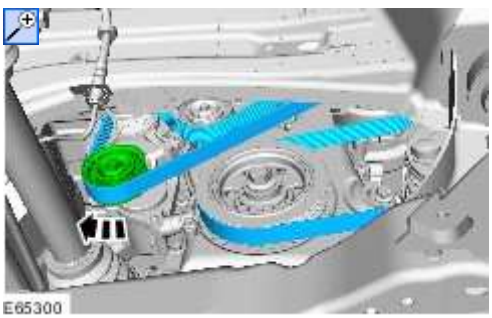
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the right-hand front wheel and tire.

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

2. 

3. 

4. 

Installation

1. To install, reverse the removal procedure.

   Refer to: Accessory Drive (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Description and Operation).

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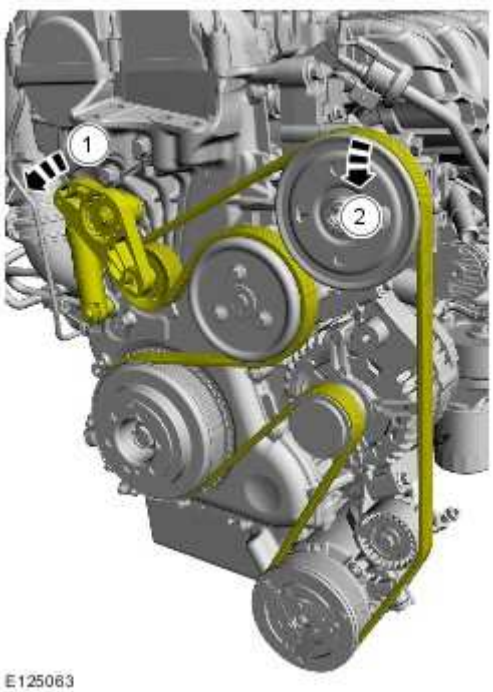
Removal and Installation

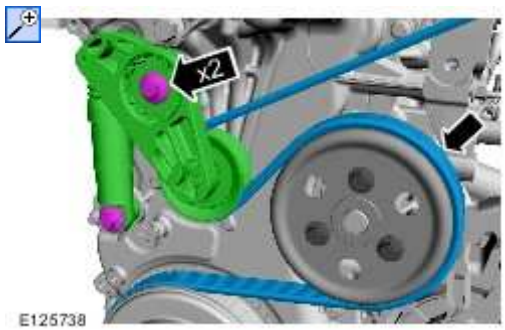
Removal

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

1.



2. WARNING: Take extra care when handling the compressed spring.



3. *Torque:* 24 Nm

Installation

1. To install, reverse the removal procedure.
2. WARNING: Take extra care when handling the compressed spring.

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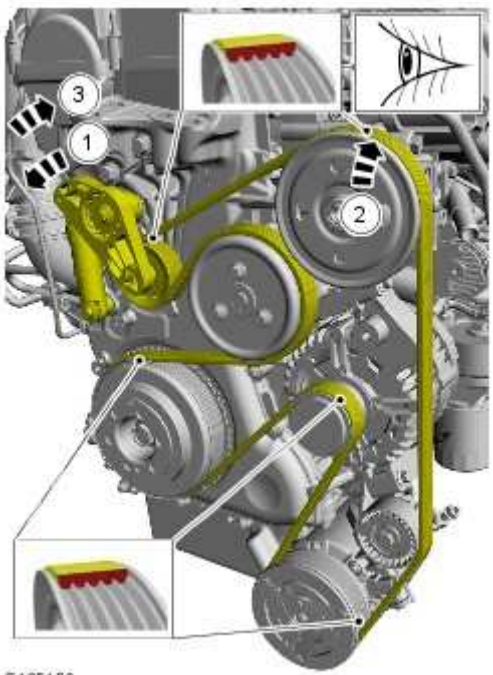

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Accessory Drive - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 - Accessory Drive Belt Tensioner	S-MAX/Galaxy 2006.5 (02/2006-)

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Removal and Installation

Removal and Installation

1. Refer to: Accessory Drive Belt (303-05B Accessory Drive - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).

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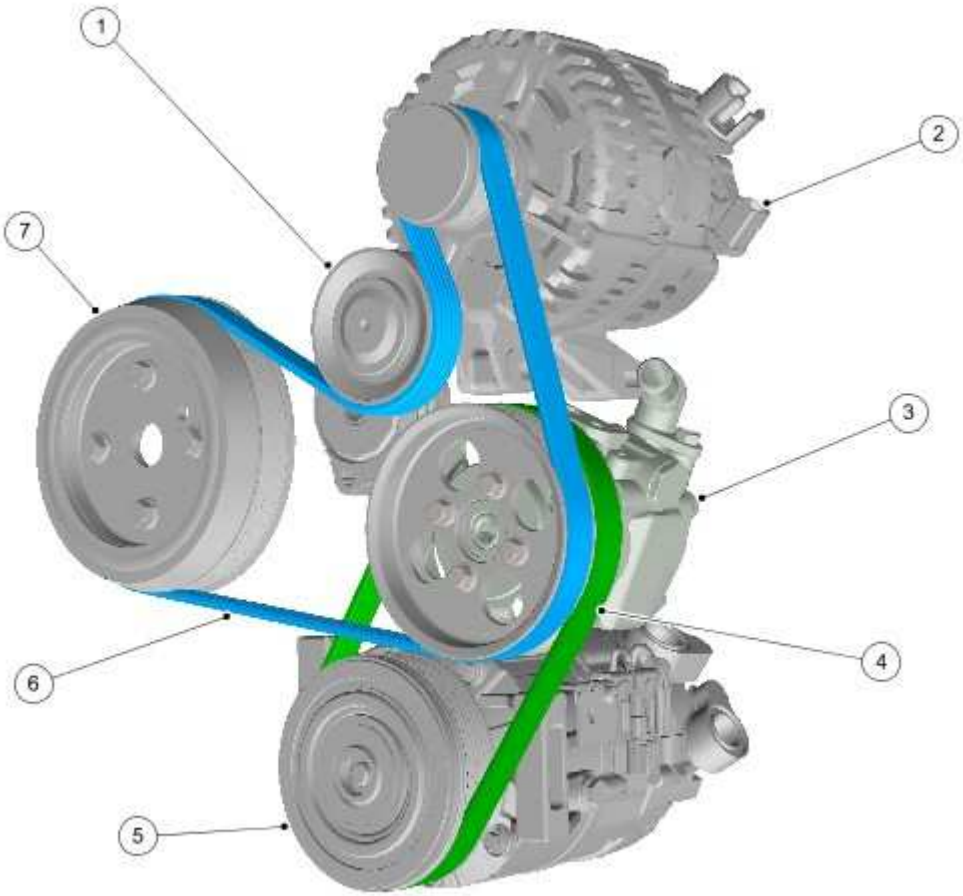
Description and Operation



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Item	Part Number	Description
1	-	Accessory drive belt tensioner
2	-	Generator
3	-	Power steering pump
4	-	Air conditioning (A/C) compressor belt
5	-	A/C compressor
6	-	Accessory drive belt
7	-	Crankshaft pulley

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Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Damaged or contaminated accessory drive belt • Damaged or contaminated pulley(s) • Incorrect accessory drive belt • Incorrect fitment of the accessory drive belt • Accessory drive belt tensioner • Accessory drive belt idler pulley • Generator • Power steering pump • Power steering pump leakage • Air conditioning (A/C) compressor • Pulley(s) • Loose hardware

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. **1.** Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi

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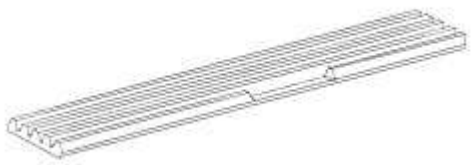
(129kW/175PS) - DW, Removal and Installation).

Chunking

Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



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2. **2.** Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Pilling

Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.

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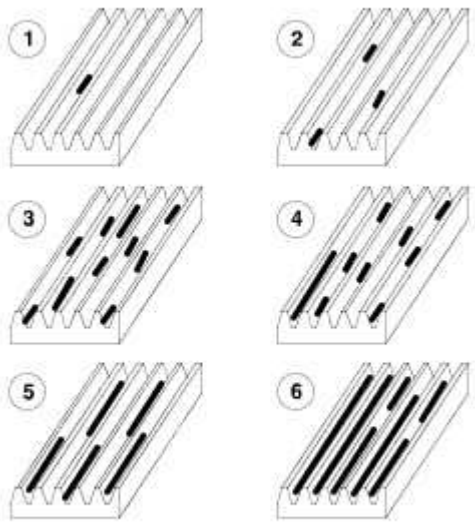

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3. **3.** Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE

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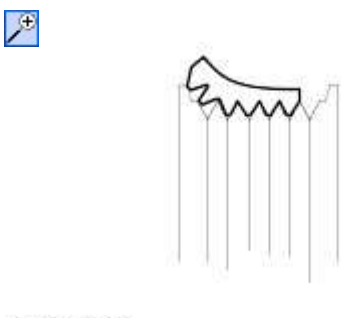
(107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Incorrect fitment

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Accessory drive belt noise	* Accessory drive system	* CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of the noise. INSTALL new components as necessary.

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		TEST the system for normal operation.
	* Accessory drive belt incorrectly installed.	* CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
	* Pulley(s).	* CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	* Lubricant or other contamination.	* CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
NOTE: Squeal is defined as a continuous shriek,	* Accessory drive belt tensioner worn, damaged	* CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner

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most noticeable when the engine is being accelerated or with electrical load. Accessory drive belt squeal	or contaminated with oil.	Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
NOTE: Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys. Accessory drive belt whine	* Poor surface finish on accessory drive belt idler pulley flat surface(s).	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	* Accessory drive belt idler pulley bearing failure.	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
NOTE: Chirp is	* Pulley	* CHECK that the accessory drive belt is running

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defined as a twittering noise, often intermittent Accessory drive belt chirp	misalignment (usually evident at idle).	centrally on the flat pulleys. TEST the system for normal operation. * CHECK the pulleys for excessive end float and bent flanges. * With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
NOTE: Rattle is defined as a metallic knocking noise Accessory drive belt rattle	* Accessory drive belt tensioner hitting the end stops.	* CHECK the accessory drive belt tensioner for correct operation or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
	* Loose components or hardware.	* CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.
Accessory drive belt fraying	* Accessory drive belt. * Pulley(s).	* CHECK the extent of the fraying by referring to the illustrations shown in the Visual Inspection section. Only INSTALL a new accessory drive belt if the fraying is within the criteria quoted in the Visual Inspection section. TEST the system for normal operation. * CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. **1.** Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. NOTE: The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.
   3. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. **4.** Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

5. **5.** If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner. TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

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The accessory drive belt tensioner may be checked dynamically as follows:

1. **1.** With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

   TEST the system for normal operation.

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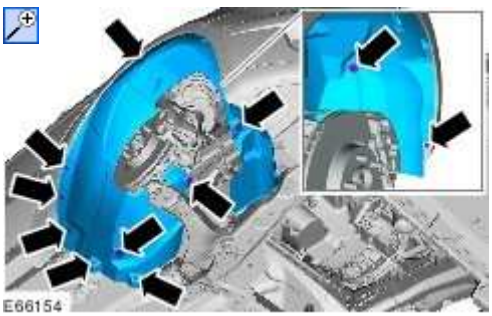
Removal and Installation

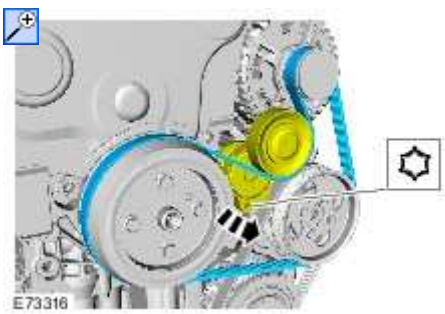
Removal

1. Remove the right-hand front wheel and tire.

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



2.



3.

Installation

1. To install, reverse the removal procedure.

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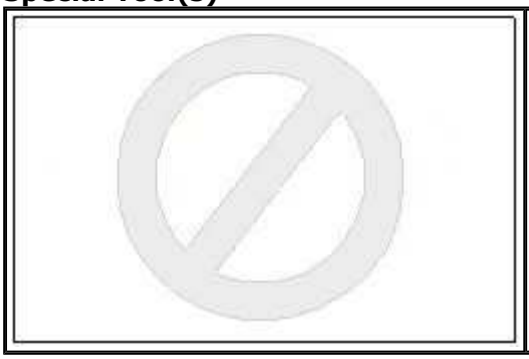
Removal and Installation

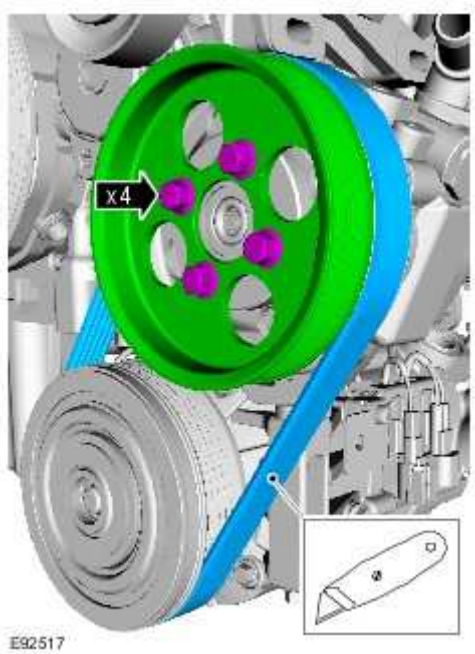
Special Tool(s)

	303-1288 Installer, Stretchy Belt

General Equipment

Knife

Removal



1. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
2. *General Equipment:* Knife

Installation

1.
    1. *Install the Special Tool(s):* 303-1288
    2. *Install the Special Tool(s):* 303-1288
2. *Remove the Special Tool(s):* 303-1288

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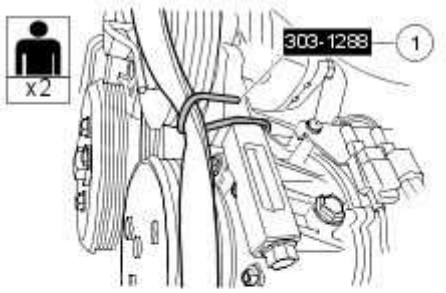
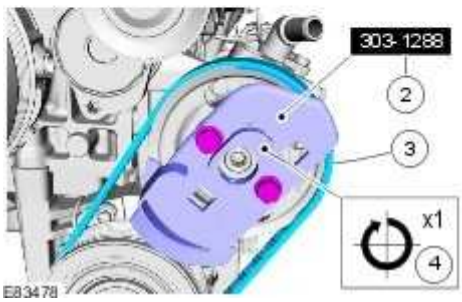
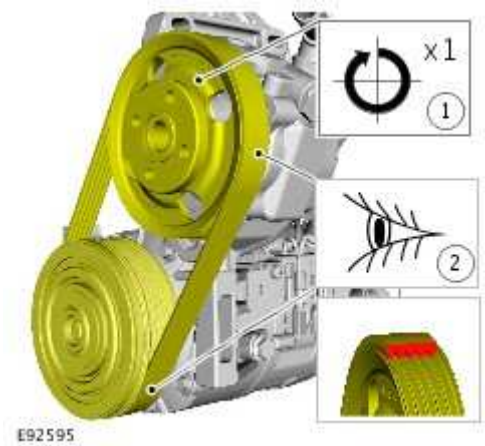
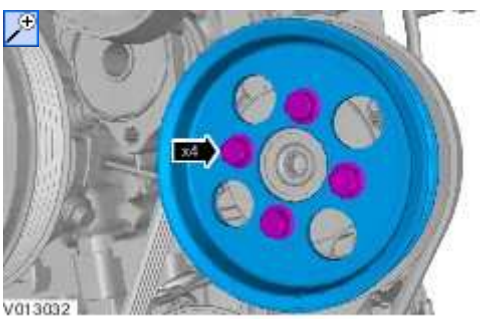




3.





4. *Torque:* 25 Nm

5. Refer to: Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

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Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Accessory Drive	S-MAX/Galaxy 2006.5 (02/2006-)

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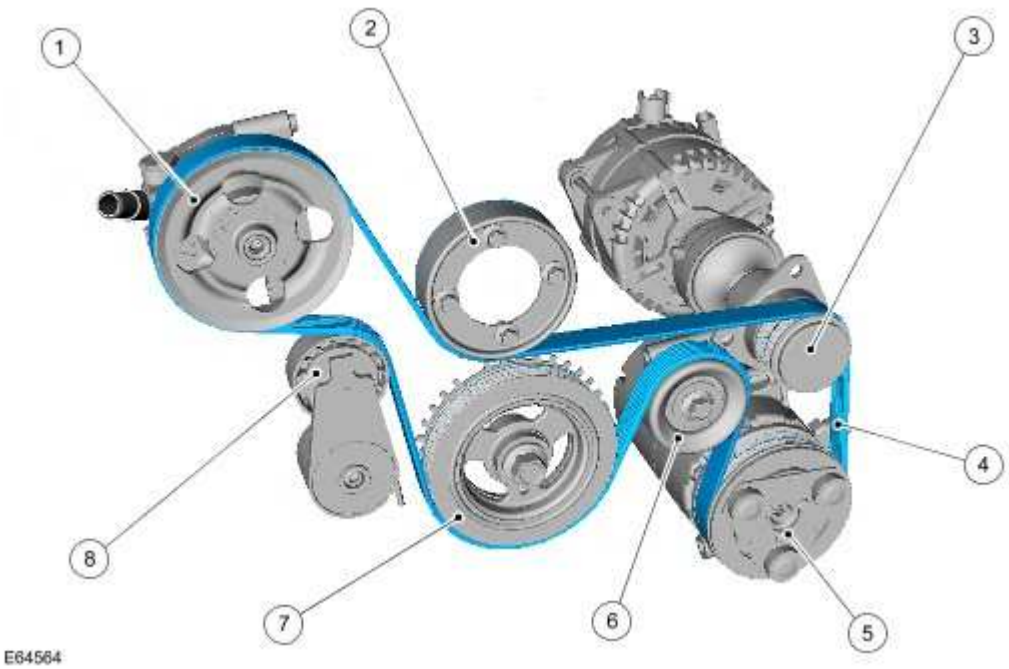
Description and Operation



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Item	Part Number	Description
1	-	Power steering pump pulley
2	-	Coolant pump pulley
3	-	Generator decoupler pulley
4	-	Accessory drive belt
5	-	Air conditioning (A/C) compressor
6	-	Accessory drive belt idler pulley
7	-	Crankshaft pulley
8	-	Accessory drive belt tensioner pulley

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Diagnosis and Testing

Inspection and Verification

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

Visual Inspection Chart

Mechanical
• Damaged or contaminated accessory drive belt • Damaged or contaminated pulley(s) • Incorrect accessory drive belt • Incorrect fitment of the accessory drive belt • Accessory drive belt tensioner • Accessory drive belt idler pulley • Generator • Power steering pump • Power steering pump leakage • Air conditioning (A/C) compressor • Pulley(s) • Loose hardware

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. **1.** Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS)

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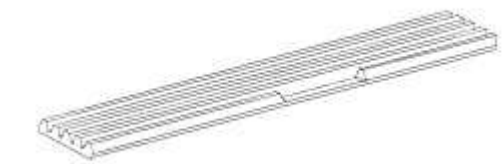
- Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Chunking

Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



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2. **2.** Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Pilling

Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.

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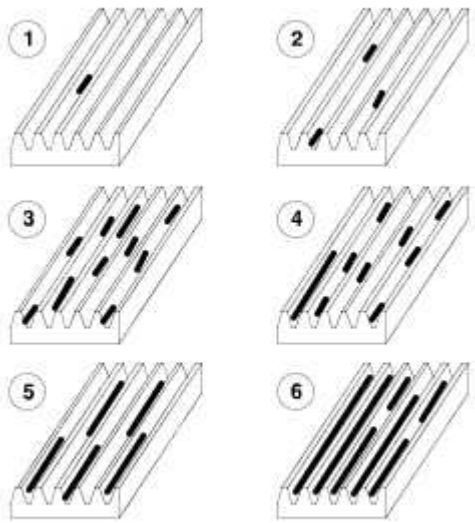

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3. **3.** Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE

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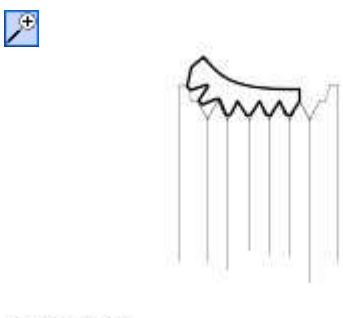
(107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Incorrect fitment

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Accessory drive belt noise	* Accessory drive system	* CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of the noise. INSTALL new components as necessary.

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		TEST the system for normal operation.
	* Accessory drive belt incorrectly installed.	* CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
	* Pulley(s).	* CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	* Lubricant or other contamination.	* CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
NOTE: Squeal is defined as a continuous shriek,	* Accessory drive belt tensioner worn, damaged	* CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner

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most noticeable when the engine is being accelerated or with electrical load. Accessory drive belt squeal	or contaminated with oil.	Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
NOTE: Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys. Accessory drive belt whine	* Poor surface finish on accessory drive belt idler pulley flat surface(s).	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	* Accessory drive belt idler pulley bearing failure.	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
NOTE: Chirp is	* Pulley	* CHECK that the accessory drive belt is running

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defined as a twittering noise, often intermittent Accessory drive belt chirp	misalignment (usually evident at idle).	centrally on the flat pulleys. TEST the system for normal operation. * CHECK the pulleys for excessive end float and bent flanges. * With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
NOTE: Rattle is defined as a metallic knocking noise Accessory drive belt rattle	* Accessory drive belt tensioner hitting the end stops.	* CHECK the accessory drive belt tensioner for correct operation or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
	* Loose components or hardware.	* CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.
Accessory drive belt fraying	* Accessory drive belt. * Pulley(s).	* CHECK the extent of the fraying by referring to the illustrations shown in the Visual Inspection section. Only INSTALL a new accessory drive belt if the fraying is within the criteria quoted in the Visual Inspection section. TEST the system for normal operation. * CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. **1.** Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. NOTE: The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.
   3. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. **4.** Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

5. **5.** If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner. TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

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The accessory drive belt tensioner may be checked dynamically as follows:

1. **1.** With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

   TEST the system for normal operation.

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Removal and Installation

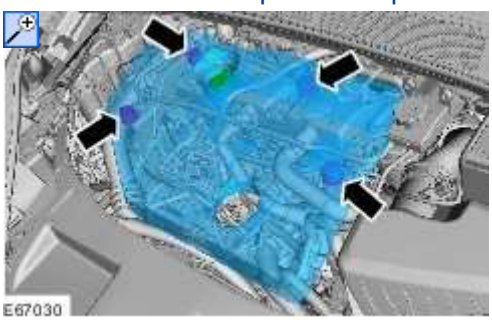
General Equipment

Dowel with a diameter of 4 mm

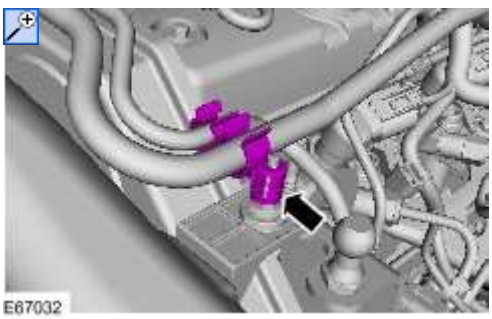
Removal

WARNING: Make sure that the ignition key is removed.

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



1.



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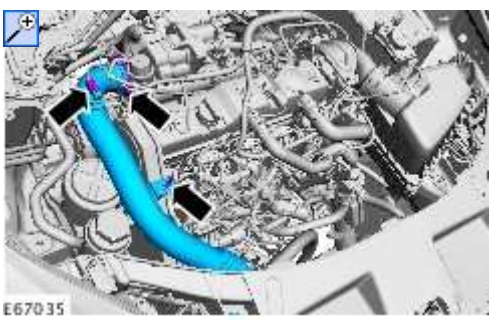

3. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   NOTE: Note the orientation of the clamp to aid installation.

4. Remove the front right wheel.

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

5.

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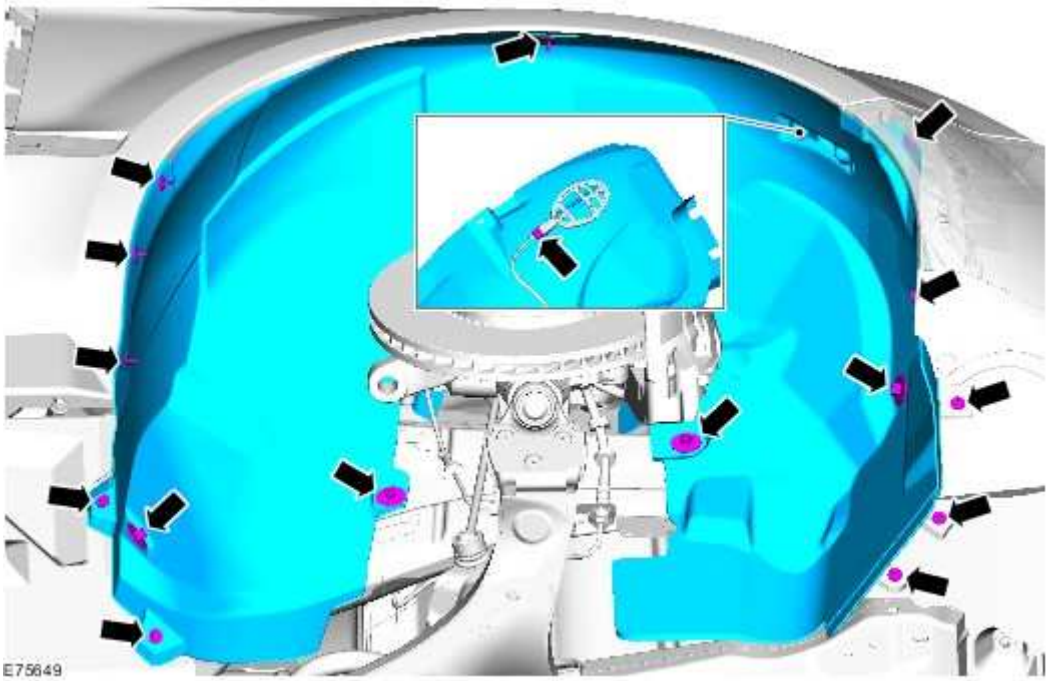

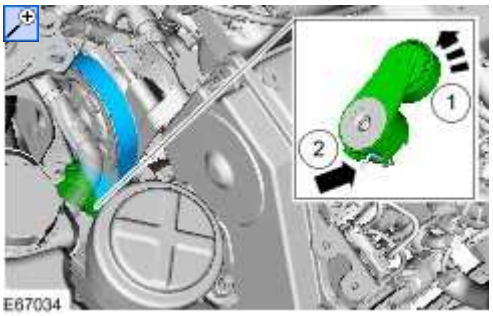

6.

2. *General Equipment:* Dowel with a diameter of 4 mm

Installation

1. NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   To install, reverse the removal procedure.
2. For accessory drive belt routing.

   Refer to: Accessory Drive (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Description and Operation).

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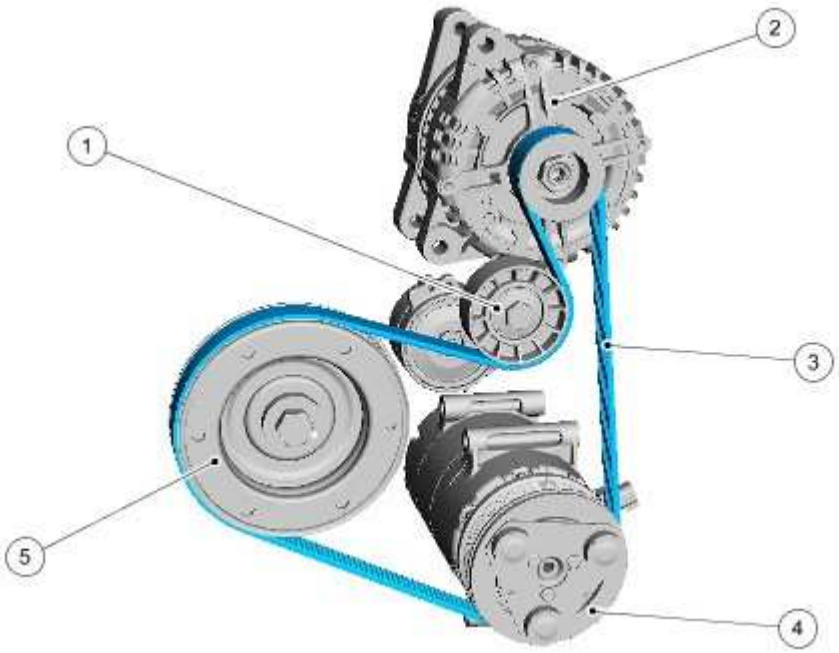
Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV - Accessory Drive	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Description and Operation



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Item	Part Number	Description
1	-	Accessory drive belt tensioner pulley
2	-	Generator
3	-	Accessory drive belt
4	-	Air conditioning (A/C) compressor
5	-	Crankshaft pulley

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Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Damaged or contaminated accessory drive belt • Damaged or contaminated pulley(s) • Incorrect accessory drive belt • Incorrect fitment of the accessory drive belt • Accessory drive belt tensioner • Accessory drive belt idler pulley • Generator • Power steering pump • Power steering pump leakage • Air conditioning (A/C) compressor • Pulley(s) • Loose hardware

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. **1.** Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),

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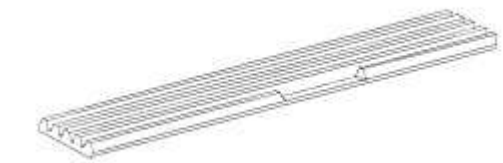
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Chunking

Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



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2. **2.** Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Pilling

Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.

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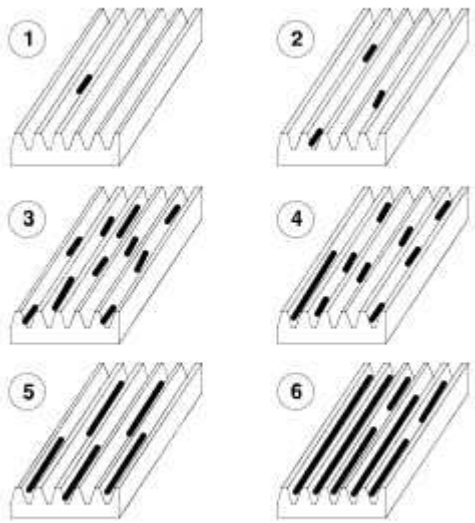

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3. **3.** Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE

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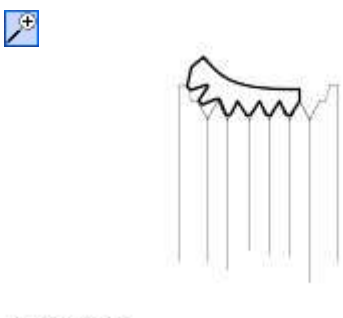
(107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Incorrect fitment

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Accessory drive belt noise	* Accessory drive system	* CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of the noise. INSTALL new components as necessary.

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		TEST the system for normal operation.
	* Accessory drive belt incorrectly installed.	* CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
	* Pulley(s).	* CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	* Lubricant or other contamination.	* CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
NOTE: Squeal is defined as a continuous shriek,	* Accessory drive belt tensioner worn, damaged	* CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner

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most noticeable when the engine is being accelerated or with electrical load. Accessory drive belt squeal	or contaminated with oil.	Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
NOTE: Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys. Accessory drive belt whine	* Poor surface finish on accessory drive belt idler pulley flat surface(s).	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	* Accessory drive belt idler pulley bearing failure.	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
NOTE: Chirp is	* Pulley	* CHECK that the accessory drive belt is running

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defined as a twittering noise, often intermittent Accessory drive belt chirp	misalignment (usually evident at idle).	centrally on the flat pulleys. TEST the system for normal operation. * CHECK the pulleys for excessive end float and bent flanges. * With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
NOTE: Rattle is defined as a metallic knocking noise Accessory drive belt rattle	* Accessory drive belt tensioner hitting the end stops.	* CHECK the accessory drive belt tensioner for correct operation or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
	* Loose components or hardware.	* CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.
Accessory drive belt fraying	* Accessory drive belt. * Pulley(s).	* CHECK the extent of the fraying by referring to the illustrations shown in the Visual Inspection section. Only INSTALL a new accessory drive belt if the fraying is within the criteria quoted in the Visual Inspection section. TEST the system for normal operation. * CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. **1.** Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. NOTE: The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.
   3. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. **4.** Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

5. **5.** If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner. TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

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The accessory drive belt tensioner may be checked dynamically as follows:

1. **1.** With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

   TEST the system for normal operation.

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Removal and Installation

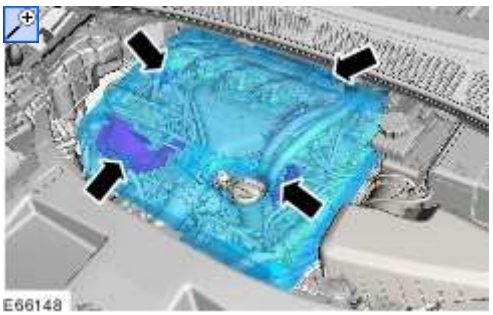
General Equipment

Dowel with a diameter of 4 mm

Removal

WARNING: Make sure that the ignition key is removed.

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



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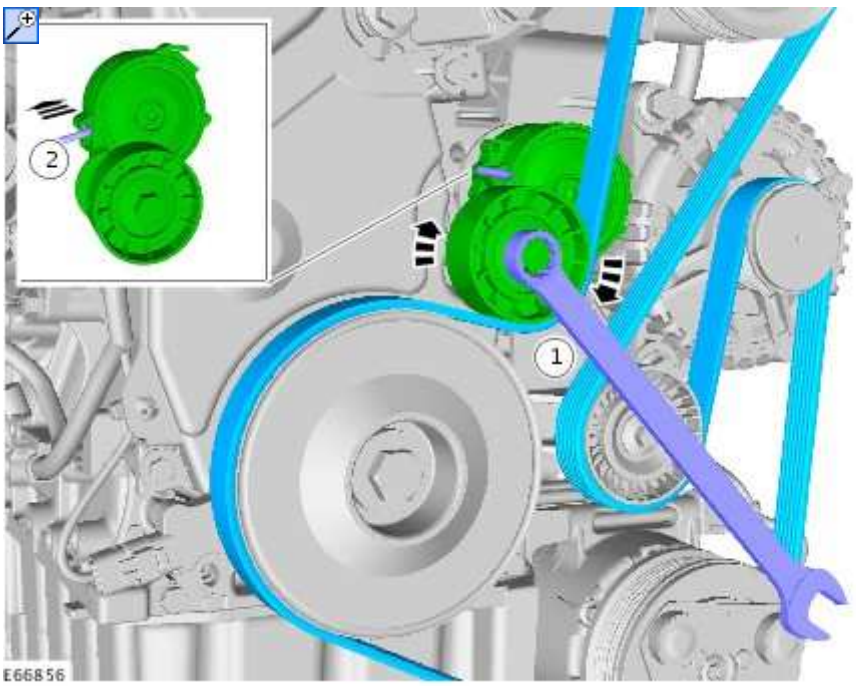

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Installation

1. To install, reverse the removal procedure.
2. For accessory drive belt routing.

   Refer to: Accessory Drive (303-05D Accessory Drive
   Duratorq-TDCi (DW) Diesel, Description and Operati

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Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical
• Damaged or contaminated accessory drive belt • Damaged or contaminated pulley(s) • Incorrect accessory drive belt • Incorrect fitment of the accessory drive belt • Accessory drive belt tensioner • Accessory drive belt idler pulley • Generator • Power steering pump • Power steering pump leakage • Air conditioning (A/C) compressor • Pulley(s) • Loose hardware

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Accessory Drive Belt Concerns

CAUTION: Do not lubricate the accessory drive belt, accessory drive belt tensioner or idler pulley(s) as potential damage to the accessory drive belt material construction, accessory drive belt tensioner damping mechanism, accessory drive belt tensioner pulley bearing and idler pulley(s) bearing may occur.

Cracking

Accessory drive belts are made from rubber which hardens with time and can develop cracks. As the accessory drive belt runs on the back of some of the pulleys, the cracks are opened up. Small cracks are not considered to be a failure of the accessory drive belt. Only if the crack is deep enough to reach the bottom of the groove to expose the cord or any chunks are found to be missing from the accessory drive belt, is the accessory drive belt condition considered to be unacceptable.

1. **1.** Check the accessory drive belt for cracks. If the damage exceeds the acceptable limit, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi

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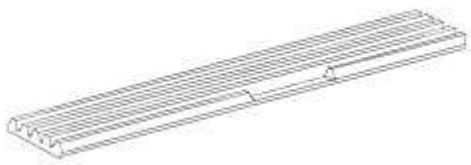
(129kW/175PS) - DW, Removal and Installation).

Chunking

Chunking describes the condition where long lengths of rubber become detached from the ribs of the accessory drive belt. This is considered to be a failure of the accessory drive belt.



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2. **2.** Check the accessory drive belt for damage. If any chunks are found to be missing, install a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Pilling

Pilling is dust that forms in between the ribs of the accessory drive belt from rubber that is worn off the accessory drive belt when it is new. There may also be loose particles left on the accessory drive belt during the manufacturing process. These are worn off and form into small balls of rubber that then get trapped in the grooves of the accessory drive belt. This condition will usually clear itself within 4800 km - 8000 km (3000 miles - 5000 miles) of normal driving.

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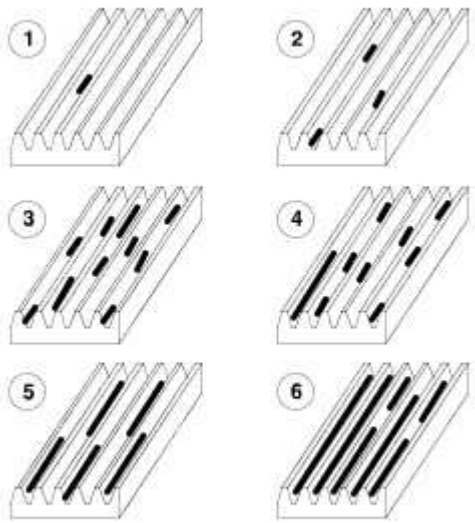

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3. **3.** Check the accessory drive belt for pilling. The condition of the accessory drive belt should be compared against the illustration.
    1. Small scattered pills. Not considered a concern. No action required.
    2. Small scattered pills. Not considered a concern. No action required.
    3. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    4. Longer pills up to 50% of the rib height. Possible noise concern. INSTALL a new accessory drive belt if noise is apparent. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
        Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
        Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
        Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
    5. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
        Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE

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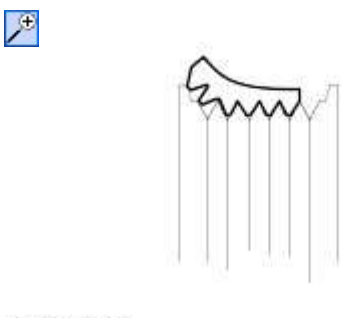
(107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

6. Heavy deposits in the grooves. Possible noise and stability concern. INSTALL a new accessory drive belt. REFER to:
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Incorrect fitment

Accessory drive belt noise can be generated by the accessory drive belt being incorrectly fitted on the pulley as shown in the following illustration. Make sure that all the V grooves on the accessory drive belt contact correctly with the pulley.



4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Accessory drive belt noise	* Accessory drive system	* CHECK the system with the engine running and the accessory drive belt removed (only run the engine for a very short period). If a noise is apparent, the cause is not the accessory drive system. If a noise is not apparent, the cause is the accessory drive system. CHECK where the noise is coming from. Use a stethoscope or other listening device to determine the source of the noise. INSTALL new components as necessary.

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		TEST the system for normal operation.
	* Accessory drive belt incorrectly installed.	* CHECK the accessory drive belt is correctly installed in the pulley grooves. INSTALL a new accessory drive belt as necessary. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
	* Pulley(s).	* CHECK the pulley(s) for damage, freedom of rotation, stone entrapment and alignment. INSTALL new components as necessary. TEST the system for normal operation.
	* Lubricant or other contamination.	* CHECK the accessory drive belt for contamination or damage. RECTIFY the source of the leak and INSTALL a new accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
NOTE: Squeal is defined as a continuous shriek,	* Accessory drive belt tensioner worn, damaged	* CHECK the accessory drive belt tensioner for correct operation, damage or contamination. REFER to the Accessory Drive Belt Tensioner

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most noticeable when the engine is being accelerated or with electrical load. Accessory drive belt squeal	or contaminated with oil.	Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
NOTE: Whine is defined as a continuous noise at the same frequency, generally associated with plastic pulleys. Accessory drive belt whine	* Poor surface finish on accessory drive belt idler pulley flat surface(s).	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for surface finish. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
	* Accessory drive belt idler pulley bearing failure.	* REMOVE the accessory drive belt. REFER to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation), Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation), Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation), Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). INSPECT the idler pulley(s) for smooth rotation. INSTALL a new idler pulley(s) as necessary. TEST the system for normal operation.
NOTE: Chirp is	* Pulley	* CHECK that the accessory drive belt is running

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defined as a twittering noise, often intermittent Accessory drive belt chirp	misalignment (usually evident at idle).	centrally on the flat pulleys. TEST the system for normal operation. * CHECK the pulleys for excessive end float and bent flanges. * With the engine running at idle, use a stethoscope to identify the source of the noise. INSTALL new components as necessary. TEST the system for normal operation.
NOTE: Rattle is defined as a metallic knocking noise Accessory drive belt rattle	* Accessory drive belt tensioner hitting the end stops.	* CHECK the accessory drive belt tensioner for correct operation or damage. REFER to the Accessory Drive Belt Tensioner Component Test in this procedure. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.
	* Loose components or hardware.	* CHECK the components or hardware for correct installation and tighten as necessary. TEST the system for normal operation.
Accessory drive belt fraying	* Accessory drive belt. * Pulley(s).	* CHECK the extent of the fraying by referring to the illustrations shown in the Visual Inspection section. Only INSTALL a new accessory drive belt if the fraying is within the criteria quoted in the Visual Inspection section. TEST the system for normal operation. * CHECK the pulley(s) for damage, freedom of rotation and alignment. INSTALL new components as necessary. TEST the system for normal operation.

Component Tests

Accessory Drive Belt Tensioner - Static Check

The accessory drive belt tensioner may be checked statically as follows:

1. **1.** Inspect the area surrounding the accessory drive belt tensioner for lubricant or other contamination. Rectify any leaks before installing a new accessory drive belt tensioner. If the accessory drive belt tensioner is contaminated, do not attempt to clean it as the damping mechanism inside may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Detach the accessory drive belt in the area of the accessory drive belt tensioner.

3. NOTE: The accessory drive belt tensioner has a damping feature, which is usually a friction device, therefore some friction within the system is normal.
   3. Using the correct tool, move the accessory drive belt tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no excessive stick, grab or bind, and to make sure there is tension on the accessory drive belt tensioner spring.

4. **4.** Rotate the accessory drive belt tensioner pulley and check for damage, freedom of rotation and alignment. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

5. **5.** If the accessory drive belt tensioner meets the above criteria, proceed to test the accessory drive belt tensioner dynamically. If the accessory drive belt tensioner does not meet the above criteria, INSTALL a new accessory drive belt tensioner. TEST the system for normal operation.

Accessory Drive Belt Tensioner - Dynamic Check

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The accessory drive belt tensioner may be checked dynamically as follows:

1. **1.** With the engine running, observe the accessory drive belt tensioner movement. The accessory drive belt tensioner should move (respond) when the engine is accelerated rapidly or when the A/C clutch cycles ON and OFF (the degree of movement can be up to 4 mm). If the accessory drive belt tensioner movement is not constant without engine acceleration or A/C clutch cycling, a pulley or shaft is possibly bent, out of round, or the damping mechanism inside the accessory drive belt tensioner may be damaged. INSTALL a new accessory drive belt tensioner as necessary. TEST the system for normal operation.

2. **2.** Excessive accessory drive belt rideout (uneven depth of grooves in the accessory drive belt) may cause excessive accessory drive belt tensioner movement. Check the condition by installing a new accessory drive belt. REFER to:

   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation),
   Accessory Drive Belt (303-05C Accessory Drive - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation),
   Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation),
   Accessory Drive Belt (303-05F Accessory Drive - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

   TEST the system for normal operation.

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Removal and Installation

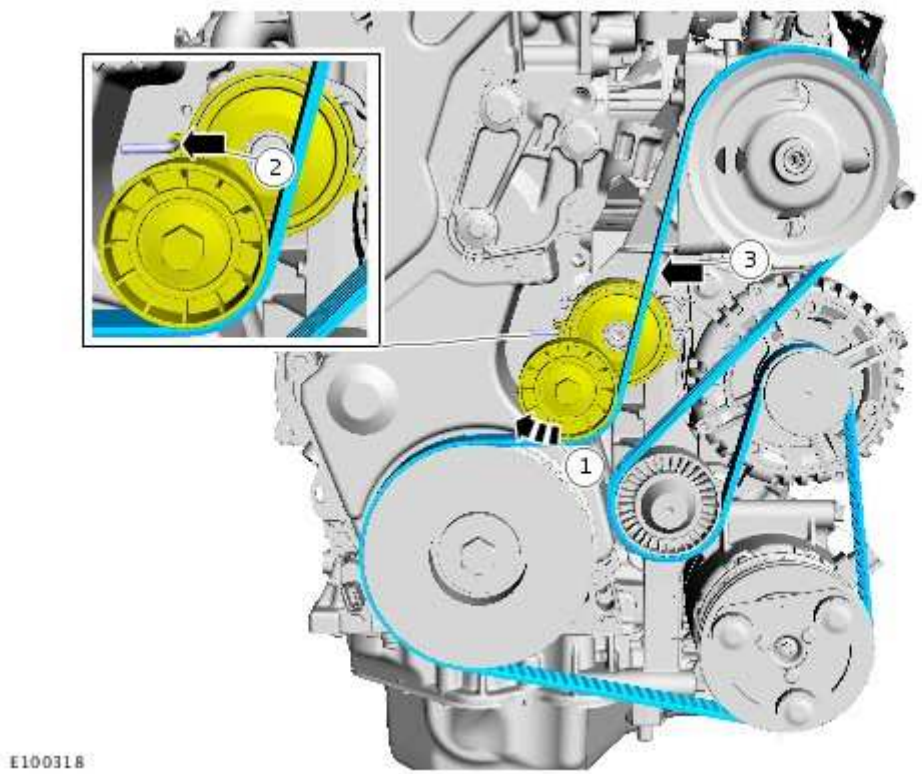
General Equipment

Dowel with a diameter of 4 mm

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).



2.

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Installation

1. To install, reverse the removal procedure.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

The starter motor function is controlled by a starter relay. The starter relay is operated by the ignition switch.

Battery voltage is supplied to the ignition switch from battery junction box (BJB) fuse F17. When the ignition switch is turned to position III, battery voltage is supplied to the starter relay coil. The starter relay coil circuit is completed by a ground circuit through the powertrain control module (PCM). The ground circuit will only be available when the PCM receives the correct signal from the passive anti-theft system (PATS).

When the starter relay coil is energized, the starter relay contacts close and battery voltage is supplied to the starter motor solenoid circuit from BJB fuse F15. The starter motor solenoid circuit is completed by a ground circuit through the starter motor casing.

The starter motor solenoid has two functions. The first is to supply the starter motor with a high energy switch between the battery positive terminal and the starter motor windings. The second is to act as a mechanical clutch between the starter motor drive gear and the flywheel ring gear.

Battery voltage is supplied to the starter motor solenoid contact through a fused wire. The ground circuit is completed using the starter motor casing and the engine/transmission ground wire.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Starter motor	• Fuse(s) • Wiring harness(es) • Electrical connector(s) • Relay(s) • Switch(es) • Battery

Symptom Chart

Symptom	Possible Sources	Action
The engine does	* Battery	* REFER to: Charging System (414-00, Diagnosis and

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not crank and the relay does not click		Testing).
	* Circuit(s) * Starter relay * Ignition switch * PCM * BJB	* GO to Pinpoint Test A.
	* PATS	* REFER to: Anti-Theft - Passive (419-01B, Diagnosis and Testing).
The engine does not crank but the relay clicks	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Circuit(s) * Starter relay * Starter motor	* GO to Pinpoint Test B.
The engine cranks slowly	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Battery cable * Starter motor	* GO to Pinpoint Test C.
Unusual starter motor noise	* Starter motor	* INSPECT the starter motor for alignment or cracked casing. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* CHECK the flywheel ring gear. INSTALL a new flywheel ring gear as necessary.
The starter motor spins but the engine does not crank	* Starter motor	* REMOVE the starter motor. INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* INSPECT the flywheel ring gear for missing teeth. CHECK the starter motor for correct mounting. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE

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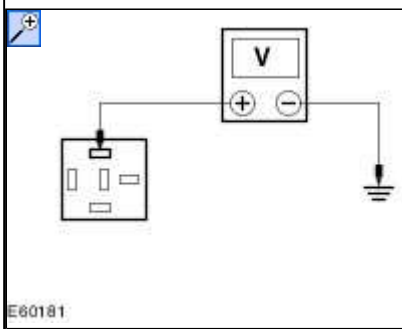
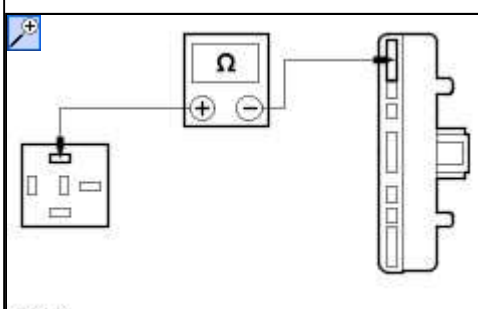
		(118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE STARTER RELAY COIL FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Ignition switch in position III.
 E60181	3 Measure the voltage between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** GO to A2.
A2: CHECK CIRCUIT CDC35D (BU/WH) AND CDC35F (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Ignition Switch C2DC32.
 E75332	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and the ignition switch C2DC32 pin 7, circuit CDC35F (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new ignition switch. TEST the system for correct operation. **No** REPAIR circuit CDC35D (BU/WH) or circuit CDC35F (BU/WH) as necessary. TEST the system for normal operation.
A3: CHECK THE STARTER RELAY COIL FOR GROUND	
	1 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), and ground.

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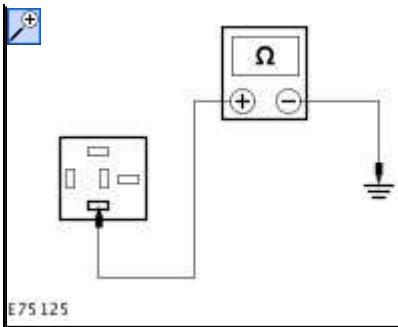


Is the resistance less than 1 ohm?

Yes

INSTALL a new starter relay. TEST the system for normal operation.

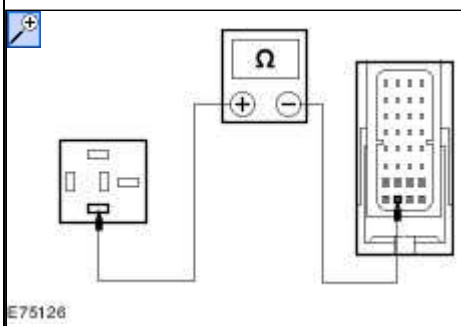
No

For vehicles with 1.8L Duratorq TDCi (Kent) Diesel and 2.0L Duratorq TDCi (DW) Diesel, GO to A4.
For vehicles with 2.0L Duratec HE (MI4), GO to A5.
For vehicles with 2.5L Duratec ST (VI5), GO to A6.

A4: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E108-K.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE) and the PCM C1E108-K pin K2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation.

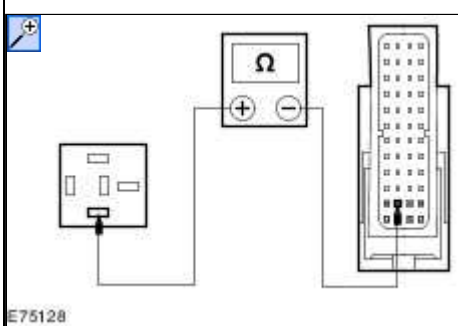
No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

A5: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E104-E.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A and the PCM C1E104-E pin L2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT

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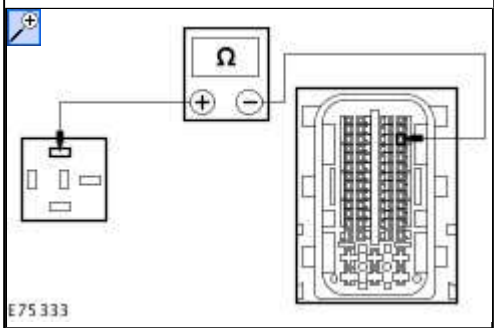
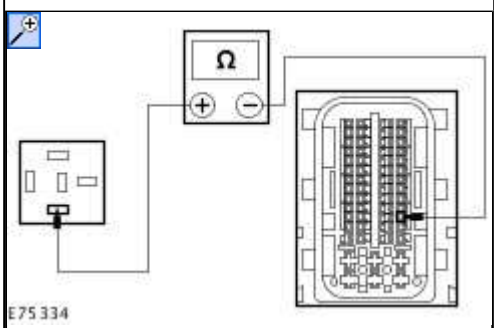
	all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A6: CHECK CIRCUIT CDC35G (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect PCM C1E108-B.
	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35G (BU/WH), harness side and the PCM C1E108-B pin 17, circuit CDC35G (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to A7. **No** REPAIR circuit CDC35G (BU/WH). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A7: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY	
	1 Disconnect BJB C1E108-B.
	2 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), harness side and the PCM C1E108-B pin 9, circuit CDC12A (YE), harness side.
	Is the resistance less than 1 ohm? **Yes** Using the WDS, CHECK for current DTC's. CORRECT all DTC's. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR circuit CDC12A (YE). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

PINPOINT TEST B : THE ENGINE DOES NOT CRANK BUT THE RELAY CLICKS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT CDC35B (GN/RD) FOR VOLTAGE	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor solenoid C1DC35-B-1 circuit CDC35B (GN/RD), component side and ground.

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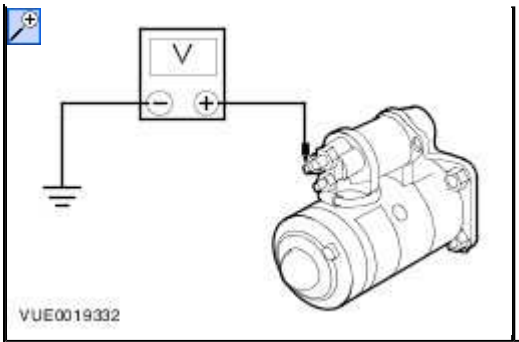
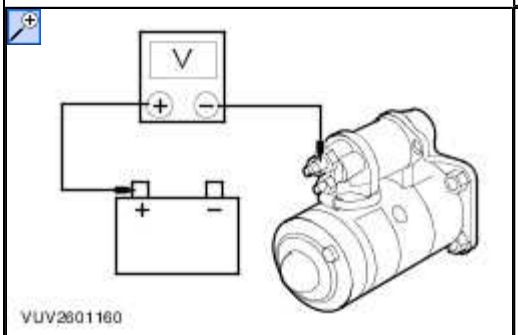
	
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** GO to B3.
B2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.
	Is the voltage less than 2 volts? **Yes** CLEAN and TIGHTEN all battery positive cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
B3: CHECK THE STARTER RELAY CONTACT CIRCUIT FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Measure the voltage between the BJB starter relay R1 connector pin 3 and ground.

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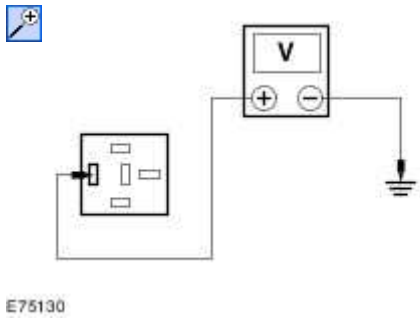
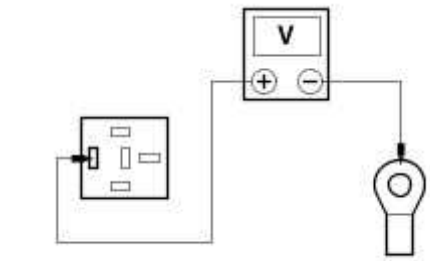
 E75130	
	Is the voltage greater than 10 volts? **Yes** GO to B4. **No** INSTALL a new BJB. TEST the system for normal operation.
B4: CHECK CIRCUIT CDC35 (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
 E75131	2 Measure the resistance between the BJB starter relay R1 connector pin 5 and the starter motor solenoid C1DC35-B pin 1, circuit CDC35B (BU/WH).
	Is the resistance less than 1 ohm? **Yes** INSTALL a new starter relay. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for correct operation. **No** REPAIR circuit CDC35A (BU/WH) or circuit CDC35B (BU/WH) as necessary. TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE CRANKS SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BATTERY VOLTAGE AND CONDITION	
	1 CHECK the battery using a battery tester.
	Is the battery voltage and condition OK? **Yes** GO to C2. **No** CHARGE or install a new battery as required. CHECK the charging system using WDS. TEST the system for normal operation.
C2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.

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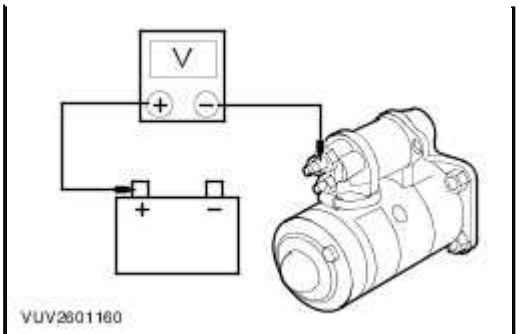
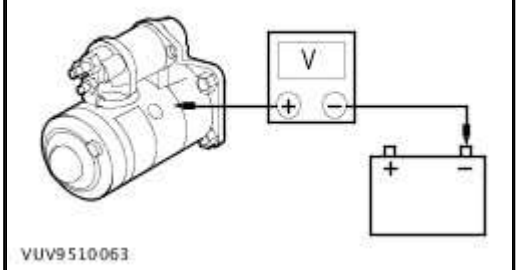
	
	Is the voltage less than 2 volts? **Yes** GO to C3. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
C3: CHECK FOR GROUND CONNECTION	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor housing and the battery negative terminal.
	Is the voltage less than 2 volts? **Yes** INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery negative cable connections and starter motor mountings. TEST the system for normal operation. If the concern persists, INSTALL a new battery negative cable. TEST the system for normal operation.

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Removal and Installation

Removal

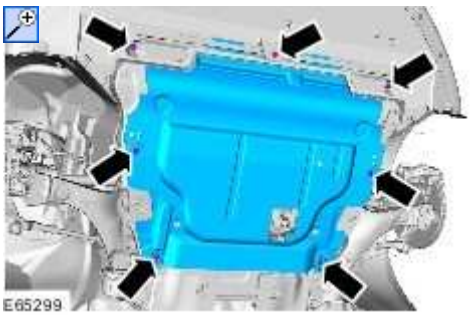
NOTE: Removal steps in this procedure may contain installation details.

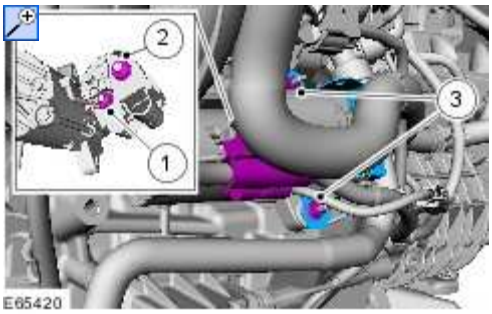
1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

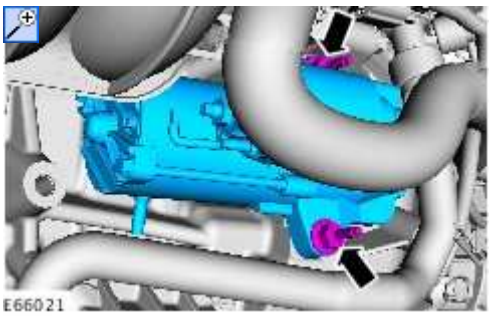
2. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

3. 

4. 

   1. *Torque:* 6 Nm
   2. *Torque:* 12 Nm
   3. *Torque:* 20 Nm

5. 

   1. *Torque:* 40 Nm
   2. Retighten the bolts.

      Torque: 40 Nm

6. Discard the starter motor gasket.

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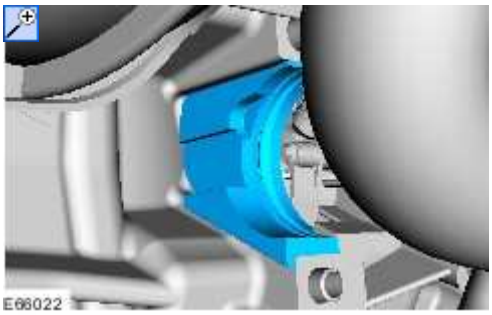

Installation

1. To install, reverse the removal procedure.

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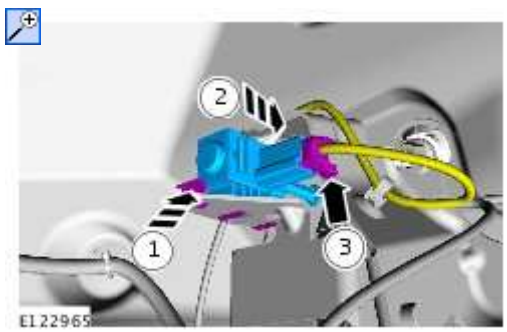
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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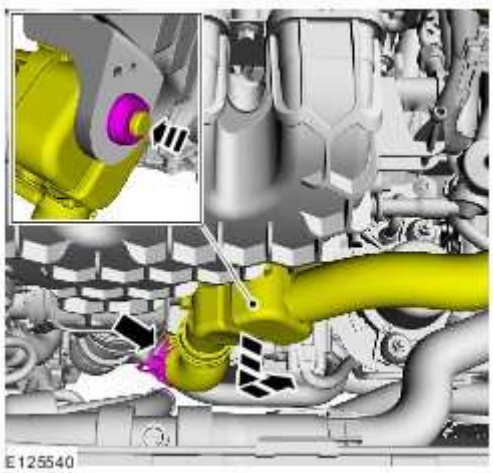
Removal and Installation

Removal

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

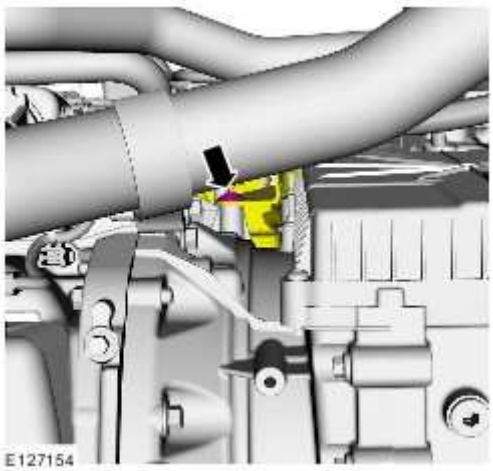
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2.



3.

4. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



5. *Torque:* 12 Nm

6. *Torque:* 12 Nm

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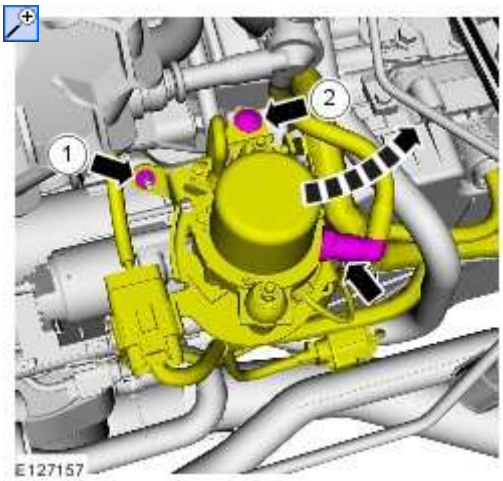
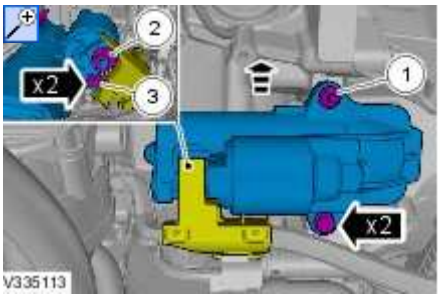
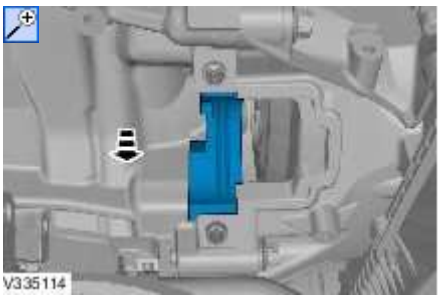




7. *Torque:*
   1 48 Nm
   2 12 Nm
   3 10 Nm



8. NOTE: Make sure that a new component is installed.

Installation

1. To install, reverse the removal procedure.

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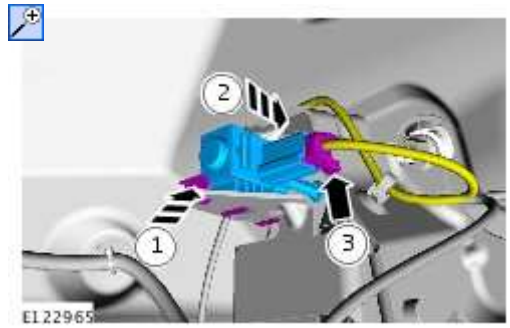
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.

1.



Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

The starter motor function is controlled by a starter relay. The starter relay is operated by the ignition switch.

Battery voltage is supplied to the ignition switch from battery junction box (BJB) fuse F17. When the ignition switch is turned to position III, battery voltage is supplied to the starter relay coil. The starter relay coil circuit is completed by a ground circuit through the powertrain control module (PCM). The ground circuit will only be available when the PCM receives the correct signal from the passive anti-theft system (PATS).

When the starter relay coil is energized, the starter relay contacts close and battery voltage is supplied to the starter motor solenoid circuit from BJB fuse F15. The starter motor solenoid circuit is completed by a ground circuit through the starter motor casing.

The starter motor solenoid has two functions. The first is to supply the starter motor with a high energy switch between the battery positive terminal and the starter motor windings. The second is to act as a mechanical clutch between the starter motor drive gear and the flywheel ring gear.

Battery voltage is supplied to the starter motor solenoid contact through a fused wire. The ground circuit is completed using the starter motor casing and the engine/transmission ground wire.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Starter motor	• Fuse(s) • Wiring harness(es) • Electrical connector(s) • Relay(s) • Switch(es) • Battery

Symptom Chart

Symptom	Possible Sources	Action
The engine does not crank and the relay does not click	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Circuit(s)	* GO to Pinpoint Test A.

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	* Starter relay * Ignition switch * PCM * BJB	
	* PATS	* REFER to: Anti-Theft - Passive (419-01B, Diagnosis and Testing).
The engine does not crank but the relay clicks	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Circuit(s) * Starter relay * Starter motor	* GO to Pinpoint Test B.
The engine cranks slowly	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Battery cable * Starter motor	* GO to Pinpoint Test C.
Unusual starter motor noise	* Starter motor	* INSPECT the starter motor for alignment or cracked casing. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* CHECK the flywheel ring gear. INSTALL a new flywheel ring gear as necessary.
The starter motor spins but the engine does not crank	* Starter motor	* REMOVE the starter motor. INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* INSPECT the flywheel ring gear for missing teeth. CHECK the starter motor for correct mounting. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST

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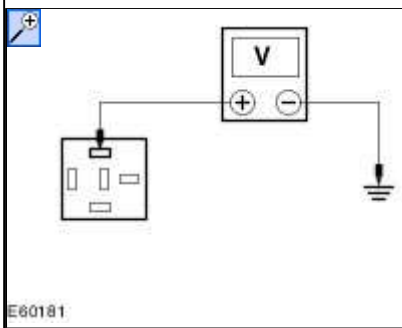
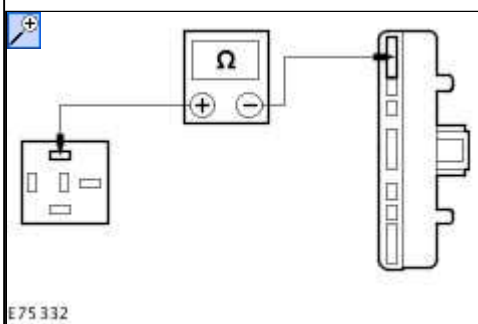
		(VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE STARTER RELAY COIL FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Ignition switch in position III.
 E60181	3 Measure the voltage between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** GO to A2.
A2: CHECK CIRCUIT CDC35D (BU/WH) AND CDC35F (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Ignition Switch C2DC32.
 E75332	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and the ignition switch C2DC32 pin 7, circuit CDC35F (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new ignition switch. TEST the system for correct operation. **No** REPAIR circuit CDC35D (BU/WH) or circuit CDC35F (BU/WH) as necessary. TEST the system for normal operation.
A3: CHECK THE STARTER RELAY COIL FOR GROUND	
	1 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), and ground.

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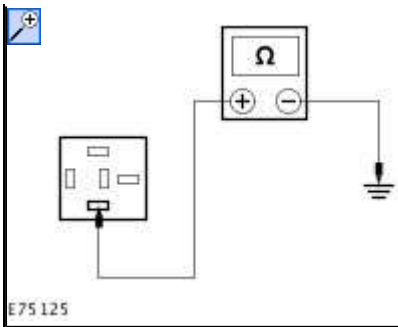


Is the resistance less than 1 ohm?

Yes

INSTALL a new starter relay. TEST the system for normal operation.

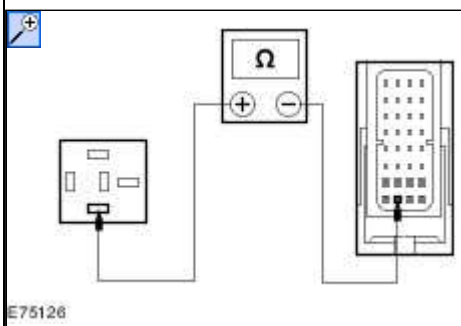
No

For vehicles with 1.8L Duratorq TDCi (Kent) Diesel and 2.0L Duratorq TDCi (DW) Diesel, GO to A4.
For vehicles with 2.0L Duratec HE (MI4), GO to A5.
For vehicles with 2.5L Duratec ST (VI5), GO to A6.

A4: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E108-K.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE) and the PCM C1E108-K pin K2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation.

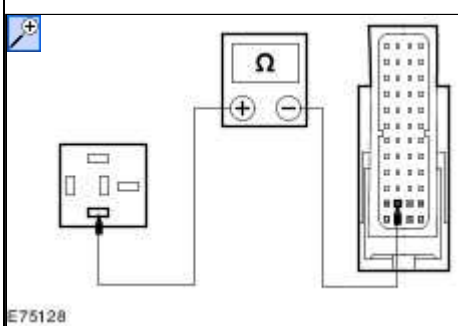
No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

A5: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E104-E.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A and the PCM C1E104-E pin L2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT

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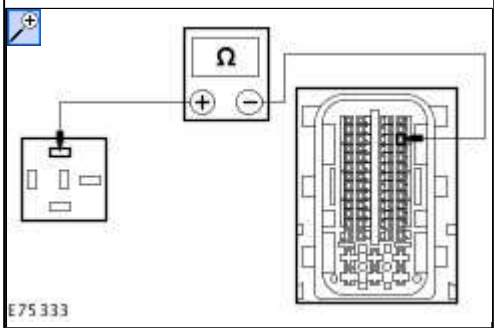
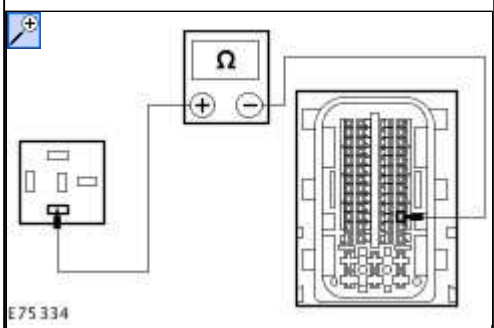
	all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A6: CHECK CIRCUIT CDC35G (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect PCM C1E108-B.
	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35G (BU/WH), harness side and the PCM C1E108-B pin 17, circuit CDC35G (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to A7. **No** REPAIR circuit CDC35G (BU/WH). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A7: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY	
	1 Disconnect BJB C1E108-B.
	2 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), harness side and the PCM C1E108-B pin 9, circuit CDC12A (YE), harness side.
	Is the resistance less than 1 ohm? **Yes** Using the WDS, CHECK for current DTC's. CORRECT all DTC's. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR circuit CDC12A (YE). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

PINPOINT TEST B : THE ENGINE DOES NOT CRANK BUT THE RELAY CLICKS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT CDC35B (GN/RD) FOR VOLTAGE	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor solenoid C1DC35-B-1 circuit CDC35B (GN/RD), component side and ground.

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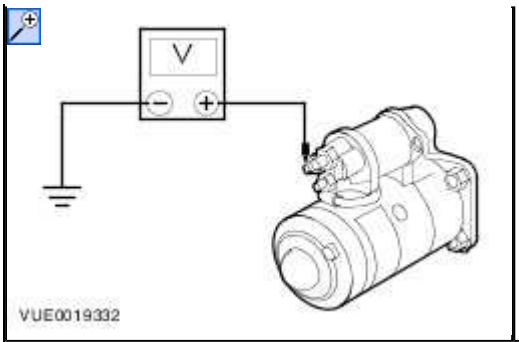
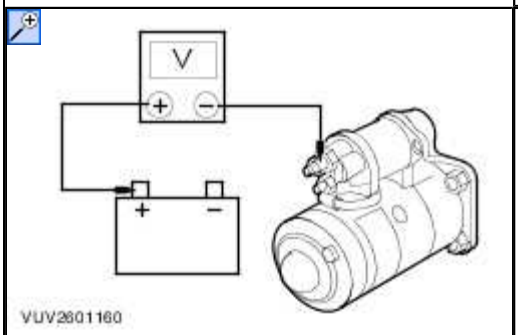
	
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** GO to B3.
B2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.
	Is the voltage less than 2 volts? **Yes** CLEAN and TIGHTEN all battery positive cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
B3: CHECK THE STARTER RELAY CONTACT CIRCUIT FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Measure the voltage between the BJB starter relay R1 connector pin 3 and ground.

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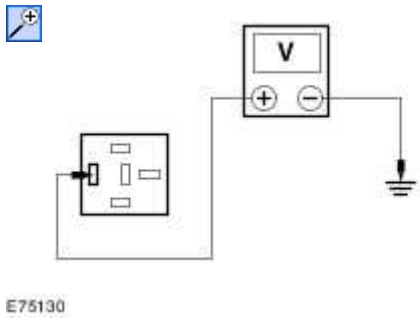
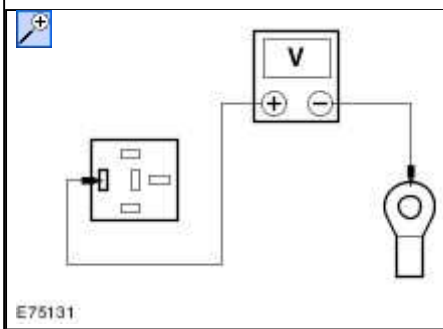
 E75130	
	Is the voltage greater than 10 volts? **Yes** GO to B4. **No** INSTALL a new BJB. TEST the system for normal operation.
B4: CHECK CIRCUIT CDC35 (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
 E75131	2 Measure the resistance between the BJB starter relay R1 connector pin 5 and the starter motor solenoid C1DC35-B pin 1, circuit CDC35B (BU/WH).
	Is the resistance less than 1 ohm? **Yes** INSTALL a new starter relay. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for correct operation. **No** REPAIR circuit CDC35A (BU/WH) or circuit CDC35B (BU/WH) as necessary. TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE CRANKS SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BATTERY VOLTAGE AND CONDITION	
	1 CHECK the battery using a battery tester.
	Is the battery voltage and condition OK? **Yes** GO to C2. **No** CHARGE or install a new battery as required. CHECK the charging system using WDS. TEST the system for normal operation.
C2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.

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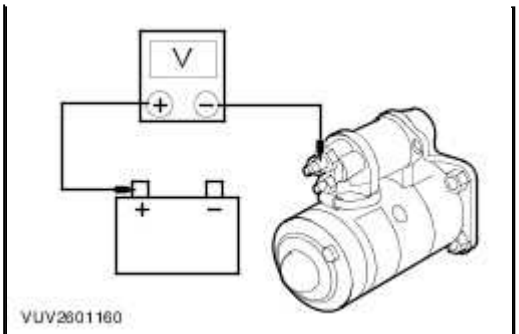
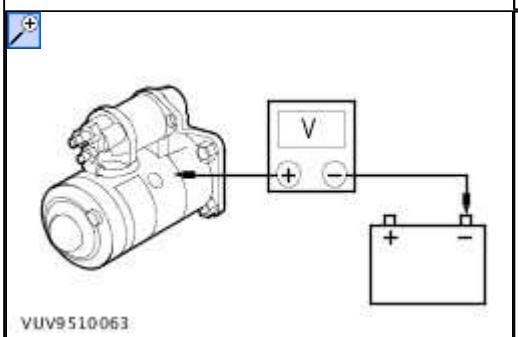
	
	Is the voltage less than 2 volts? **Yes** GO to C3. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
C3: CHECK FOR GROUND CONNECTION	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor housing and the battery negative terminal.
	Is the voltage less than 2 volts? **Yes** INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery negative cable connections and starter motor mountings. TEST the system for normal operation. If the concern persists, INSTALL a new battery negative cable. TEST the system for normal operation.

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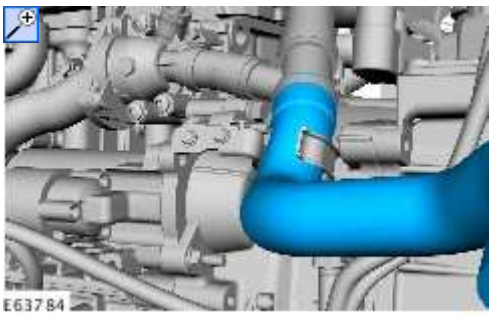
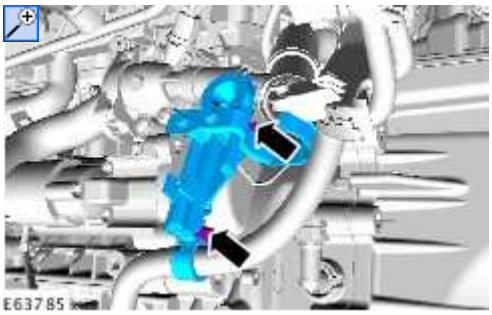
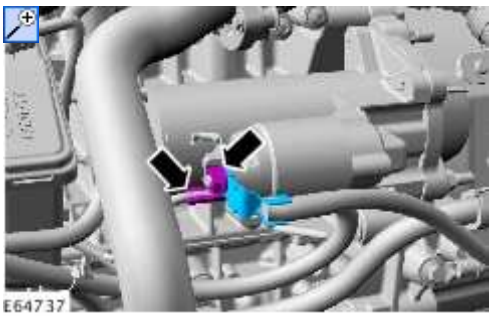
Removal and Installation

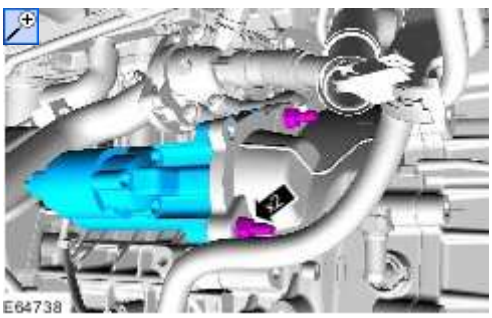
Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. 

4. *Torque:* 10 Nm


5. *Torque:* 12 Nm


6. *Torque:* 50 Nm


Installation

1. To install, reverse the removal procedure.

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2. Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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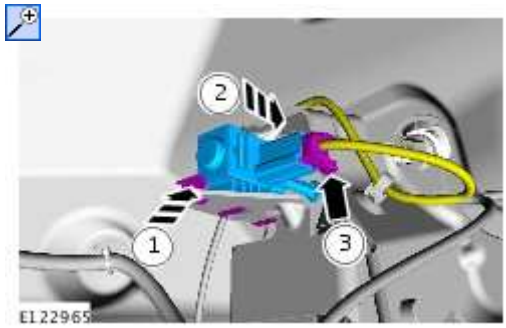
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.

1.



Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

The starter motor function is controlled by a starter relay. The starter relay is operated by the ignition switch.

Battery voltage is supplied to the ignition switch from battery junction box (BJB) fuse F17. When the ignition switch is turned to position III, battery voltage is supplied to the starter relay coil. The starter relay coil circuit is completed by a ground circuit through the powertrain control module (PCM). The ground circuit will only be available when the PCM receives the correct signal from the passive anti-theft system (PATS).

When the starter relay coil is energized, the starter relay contacts close and battery voltage is supplied to the starter motor solenoid circuit from BJB fuse F15. The starter motor solenoid circuit is completed by a ground circuit through the starter motor casing.

The starter motor solenoid has two functions. The first is to supply the starter motor with a high energy switch between the battery positive terminal and the starter motor windings. The second is to act as a mechanical clutch between the starter motor drive gear and the flywheel ring gear.

Battery voltage is supplied to the starter motor solenoid contact through a fused wire. The ground circuit is completed using the starter motor casing and the engine/transmission ground wire.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Starter motor	• Fuse(s) • Wiring harness(es) • Electrical connector(s) • Relay(s) • Switch(es) • Battery

Symptom Chart

Symptom	Possible Sources	Action
The engine does not crank and the	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).

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relay does not click	* Circuit(s) * Starter relay * Ignition switch * PCM * BJB	* GO to Pinpoint Test A.
	* PATS	* REFER to: Anti-Theft - Passive (419-01B, Diagnosis and Testing).
The engine does not crank but the relay clicks	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Circuit(s) * Starter relay * Starter motor	* GO to Pinpoint Test B.
The engine cranks slowly	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Battery cable * Starter motor	* GO to Pinpoint Test C.
Unusual starter motor noise	* Starter motor	* INSPECT the starter motor for alignment or cracked casing. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* CHECK the flywheel ring gear. INSTALL a new flywheel ring gear as necessary.
The starter motor spins but the engine does not crank	* Starter motor	* REMOVE the starter motor. INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* INSPECT the flywheel ring gear for missing teeth. CHECK the starter motor for correct mounting. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) /

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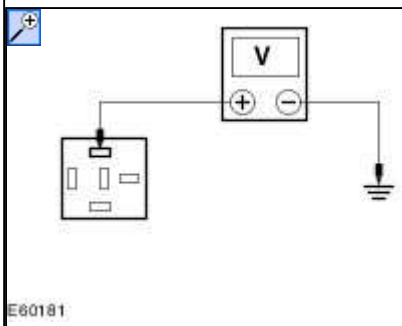
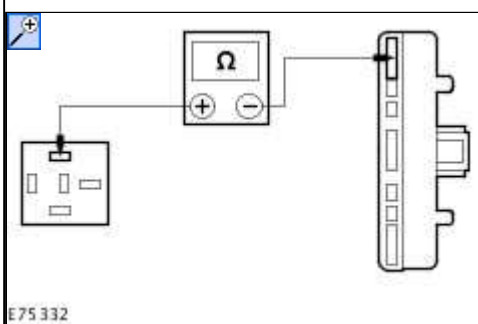
		Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE STARTER RELAY COIL FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Ignition switch in position III.
 E60181	3 Measure the voltage between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** GO to A2.
A2: CHECK CIRCUIT CDC35D (BU/WH) AND CDC35F (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Ignition Switch C2DC32.
 E75332	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and the ignition switch C2DC32 pin 7, circuit CDC35F (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new ignition switch. TEST the system for correct operation. **No** REPAIR circuit CDC35D (BU/WH) or circuit CDC35F (BU/WH) as necessary. TEST the system for normal operation.
A3: CHECK THE STARTER RELAY COIL FOR GROUND	
	1 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), and ground.

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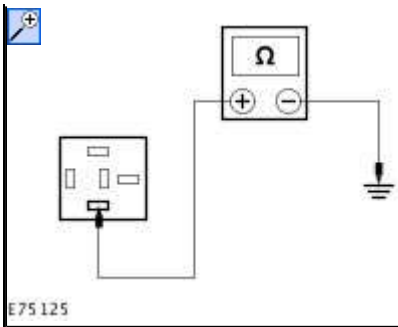


Is the resistance less than 1 ohm?

Yes

INSTALL a new starter relay. TEST the system for normal operation.

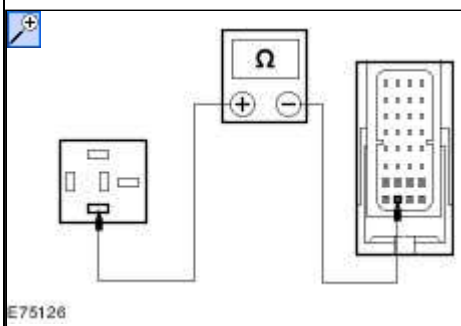
No

For vehicles with 1.8L Duratorq TDCi (Kent) Diesel and 2.0L Duratorq TDCi (DW) Diesel, GO to A4.
For vehicles with 2.0L Duratec HE (MI4), GO to A5.
For vehicles with 2.5L Duratec ST (VI5), GO to A6.

A4: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E108-K.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE) and the PCM C1E108-K pin K2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation.

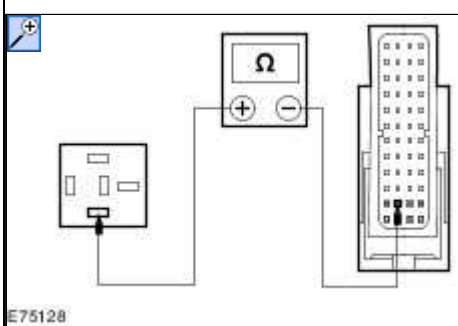
No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

A5: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E104-E.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A and the PCM C1E104-E pin L2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT

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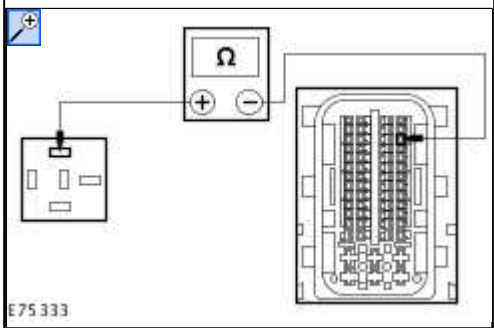
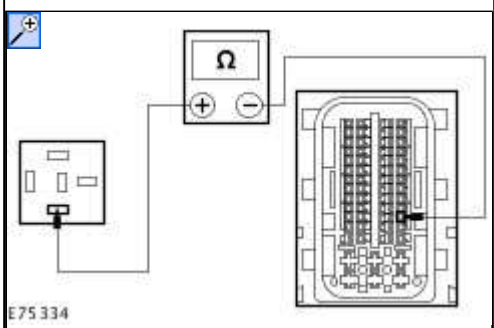
	all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A6: CHECK CIRCUIT CDC35G (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect PCM C1E108-B.
	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35G (BU/WH), harness side and the PCM C1E108-B pin 17, circuit CDC35G (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to A7. **No** REPAIR circuit CDC35G (BU/WH). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A7: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY	
	1 Disconnect BJB C1E108-B.
	2 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), harness side and the PCM C1E108-B pin 9, circuit CDC12A (YE), harness side.
	Is the resistance less than 1 ohm? **Yes** Using the WDS, CHECK for current DTC's. CORRECT all DTC's. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR circuit CDC12A (YE). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

PINPOINT TEST B : THE ENGINE DOES NOT CRANK BUT THE RELAY CLICKS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT CDC35B (GN/RD) FOR VOLTAGE	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor solenoid C1DC35-B-1 circuit CDC35B (GN/RD), component side and ground.

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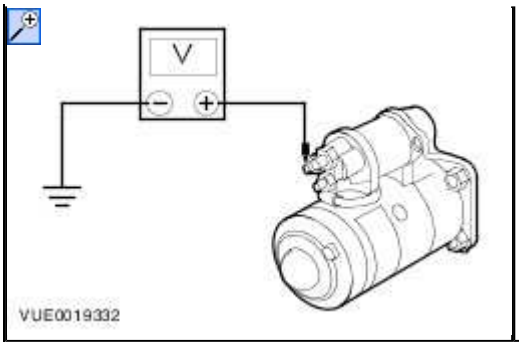
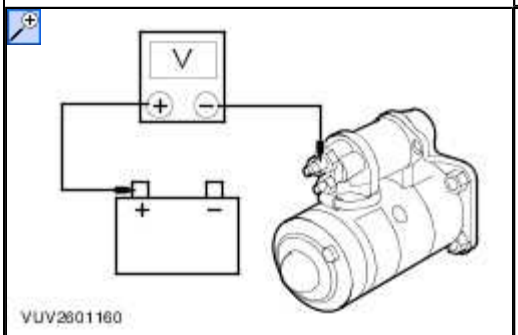
	
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** GO to B3.
B2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.
	Is the voltage less than 2 volts? **Yes** CLEAN and TIGHTEN all battery positive cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
B3: CHECK THE STARTER RELAY CONTACT CIRCUIT FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Measure the voltage between the BJB starter relay R1 connector pin 3 and ground.

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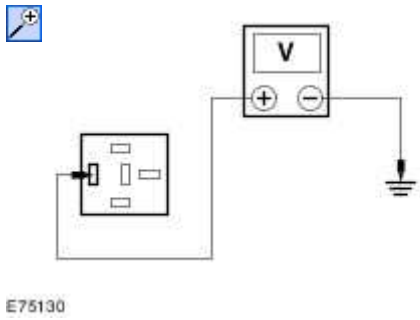
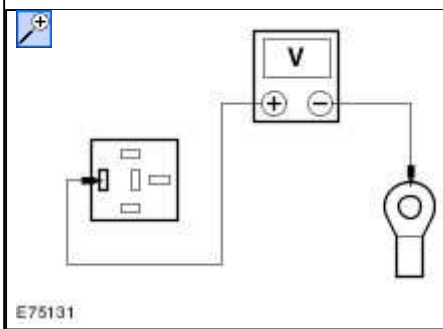
 E75130	
	Is the voltage greater than 10 volts? **Yes** GO to B4. **No** INSTALL a new BJB. TEST the system for normal operation.
B4: CHECK CIRCUIT CDC35 (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
 E75131	2 Measure the resistance between the BJB starter relay R1 connector pin 5 and the starter motor solenoid C1DC35-B pin 1, circuit CDC35B (BU/WH).
	Is the resistance less than 1 ohm? **Yes** INSTALL a new starter relay. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for correct operation. **No** REPAIR circuit CDC35A (BU/WH) or circuit CDC35B (BU/WH) as necessary. TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE CRANKS SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BATTERY VOLTAGE AND CONDITION	
	1 CHECK the battery using a battery tester.
	Is the battery voltage and condition OK? **Yes** GO to C2. **No** CHARGE or install a new battery as required. CHECK the charging system using WDS. TEST the system for normal operation.
C2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.

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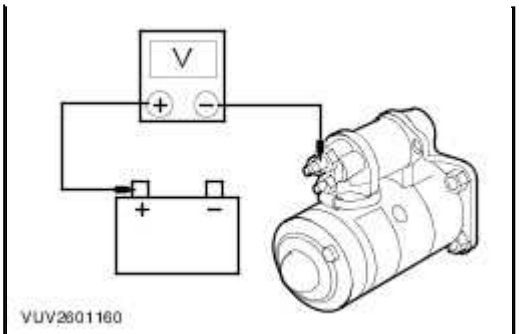
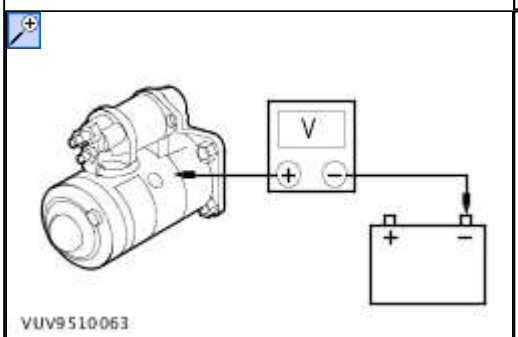
	
	Is the voltage less than 2 volts? **Yes** GO to C3. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
C3: CHECK FOR GROUND CONNECTION	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor housing and the battery negative terminal.
	Is the voltage less than 2 volts? **Yes** INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery negative cable connections and starter motor mountings. TEST the system for normal operation. If the concern persists, INSTALL a new battery negative cable. TEST the system for normal operation.

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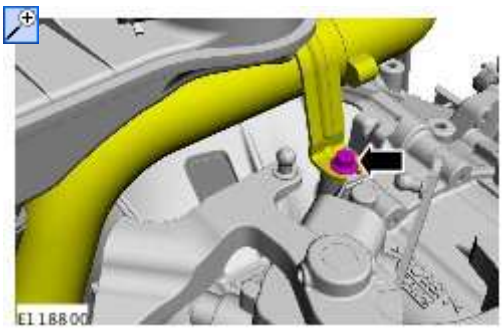
Removal and Installation

Removal

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

1. Disconnect the battery ground cable.

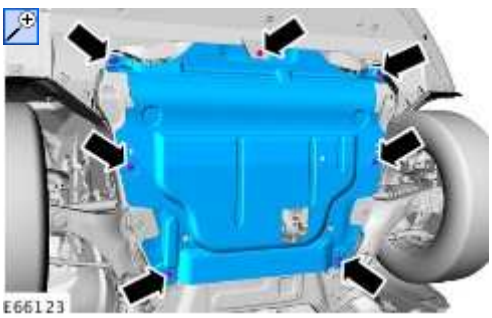
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



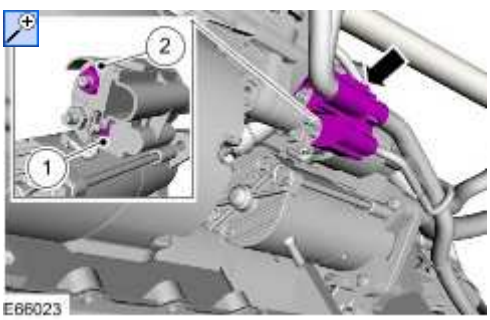
2. *Torque:* 24 Nm

3. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5.
   1. *Torque:* 6 Nm
   2. *Torque:* 12 Nm

6. *Torque:* 24 Nm

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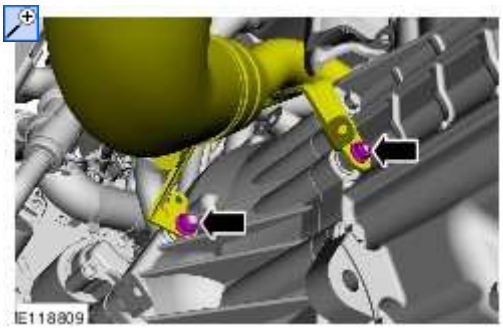

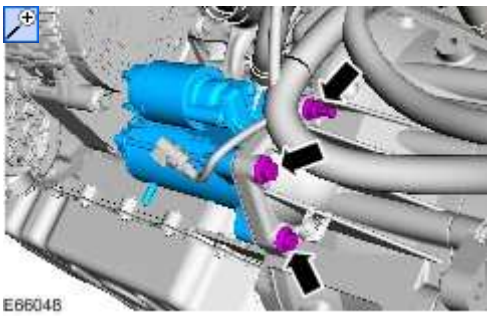

7. *Torque:* 40 Nm

Installation

1. To install, reverse the removal procedure.

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Starting System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Start Inhibit Switch	S-MAX/Galaxy 2006.5 (02/2006-)

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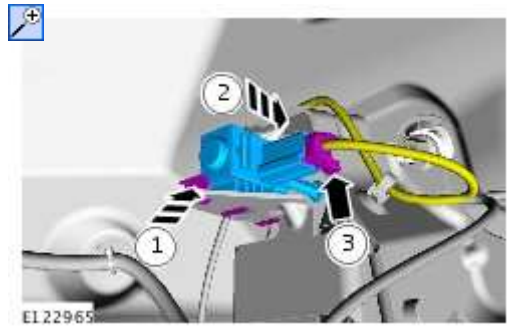
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Principles of Operation

The starter motor function is controlled by a starter relay. The starter relay is operated by the ignition switch.

Battery voltage is supplied to the ignition switch from battery junction box (BJB) fuse F17. When the ignition switch is turned to position III, battery voltage is supplied to the starter relay coil. The starter relay coil circuit is completed by a ground circuit through the powertrain control module (PCM). The ground circuit will only be available when the PCM receives the correct signal from the passive anti-theft system (PATS).

When the starter relay coil is energized, the starter relay contacts close and battery voltage is supplied to the starter motor solenoid circuit from BJB fuse F15. The starter motor solenoid circuit is completed by a ground circuit through the starter motor casing.

The starter motor solenoid has two functions. The first is to supply the starter motor with a high energy switch between the battery positive terminal and the starter motor windings. The second is to act as a mechanical clutch between the starter motor drive gear and the flywheel ring gear.

Battery voltage is supplied to the starter motor solenoid contact through a fused wire. The ground circuit is completed using the starter motor casing and the engine/transmission ground wire.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Starter motor	• Fuse(s) • Wiring harness(es) • Electrical connector(s) • Relay(s) • Switch(es) • Battery

Symptom Chart

Symptom	Possible Sources	Action
The engine does	* Battery	* REFER to: Charging System (414-00, Diagnosis and

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not crank and the relay does not click		Testing).
	* Circuit(s) * Starter relay * Ignition switch * PCM * BJB	* GO to Pinpoint Test A.
	* PATS	* REFER to: Anti-Theft - Passive (419-01B, Diagnosis and Testing).
The engine does not crank but the relay clicks	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Circuit(s) * Starter relay * Starter motor	* GO to Pinpoint Test B.
The engine cranks slowly	* Battery	* REFER to: Charging System (414-00, Diagnosis and Testing).
	* Battery cable * Starter motor	* GO to Pinpoint Test C.
Unusual starter motor noise	* Starter motor	* INSPECT the starter motor for alignment or cracked casing. Make sure the mounting bolts are tightened. If necessary, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* CHECK the flywheel ring gear. INSTALL a new flywheel ring gear as necessary.
The starter motor spins but the engine does not crank	* Starter motor	* REMOVE the starter motor. INSPECT the starter motor gear for damage. INSTALL a new starter motor as necessary. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.
	* Flywheel ring gear	* INSPECT the flywheel ring gear for missing teeth. CHECK the starter motor for correct mounting. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE

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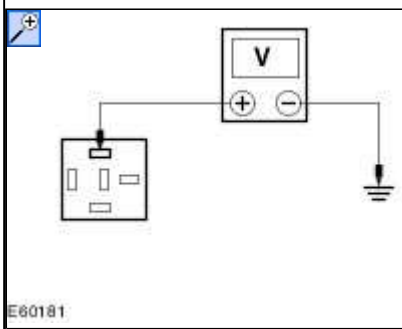
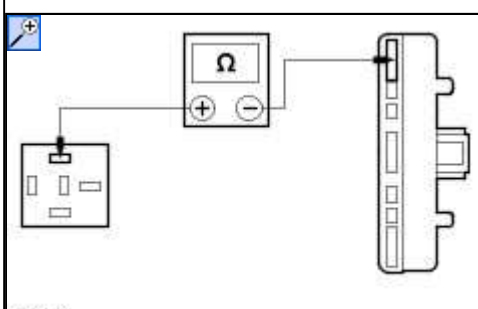
		(118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE ENGINE DOES NOT CRANK AND THE RELAY DOES NOT CLICK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE STARTER RELAY COIL FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Ignition switch in position III.
 E60181	3 Measure the voltage between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** GO to A2.
A2: CHECK CIRCUIT CDC35D (BU/WH) AND CDC35F (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Ignition Switch C2DC32.
 E75332	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35D (BU/WH), harness side and the ignition switch C2DC32 pin 7, circuit CDC35F (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new ignition switch. TEST the system for correct operation. **No** REPAIR circuit CDC35D (BU/WH) or circuit CDC35F (BU/WH) as necessary. TEST the system for normal operation.
A3: CHECK THE STARTER RELAY COIL FOR GROUND	
	1 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), and ground.

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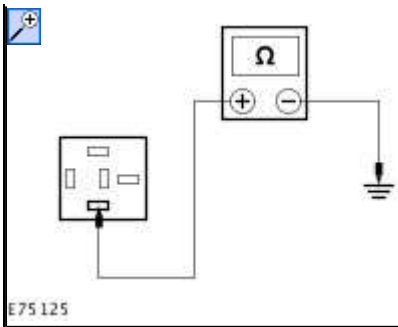


Is the resistance less than 1 ohm?

Yes

INSTALL a new starter relay. TEST the system for normal operation.

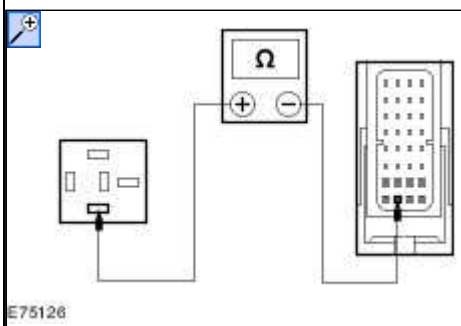
No

For vehicles with 1.8L Duratorq TDCi (Kent) Diesel and 2.0L Duratorq TDCi (DW) Diesel, GO to A4.
For vehicles with 2.0L Duratec HE (MI4), GO to A5.
For vehicles with 2.5L Duratec ST (VI5), GO to A6.

A4: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E108-K.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE) and the PCM C1E108-K pin K2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation.

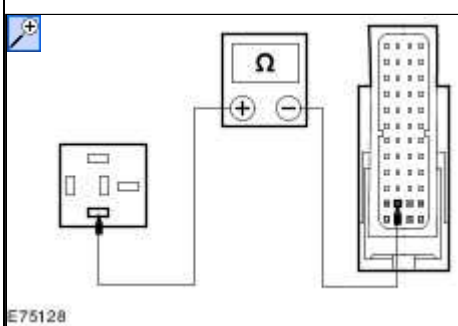
No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

A5: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY

1 Ignition switch in position 0.

2 Disconnect PCM C1E104-E.



3 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A and the PCM C1E104-E pin L2, circuit CDC12A (YE), harness side.

Is the resistance less than 1 ohm?

Yes

Using the WDS, CHECK for current DTCs. CORRECT

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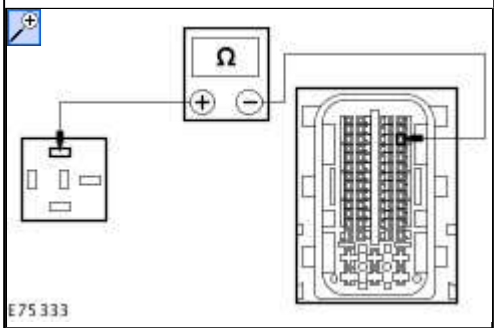
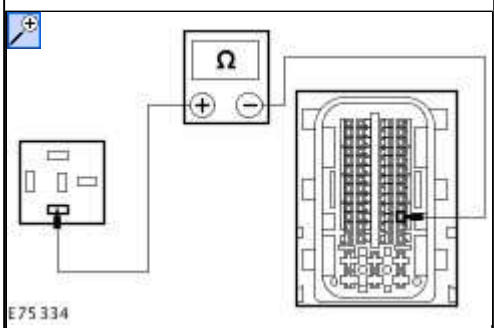
	all DTCs. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A6: CHECK CIRCUIT CDC35G (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect PCM C1E108-B.
	3 Measure the resistance between the BJB starter relay R1 connector pin 1, circuit CDC35G (BU/WH), harness side and the PCM C1E108-B pin 17, circuit CDC35G (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to A7. **No** REPAIR circuit CDC35G (BU/WH). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.
A7: CHECK CIRCUIT CDC12A (YE) FOR CONTINUITY	
	1 Disconnect BJB C1E108-B.
	2 Measure the resistance between the BJB starter relay R1 connector pin 2, circuit CDC12A (YE), harness side and the PCM C1E108-B pin 9, circuit CDC12A (YE), harness side.
	Is the resistance less than 1 ohm? **Yes** Using the WDS, CHECK for current DTC's. CORRECT all DTC's. TEST the system for normal operation. If the concern persists, INSTALL a new PCM. TEST the system for normal operation. **No** REPAIR circuit CDC12A (YE). TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for normal operation.

PINPOINT TEST B : THE ENGINE DOES NOT CRANK BUT THE RELAY CLICKS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT CDC35B (GN/RD) FOR VOLTAGE	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor solenoid C1DC35-B-1 circuit CDC35B (GN/RD), component side and ground.

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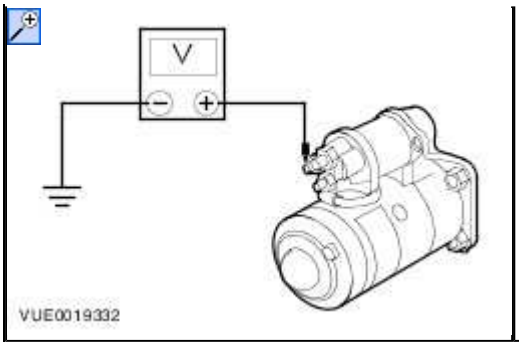
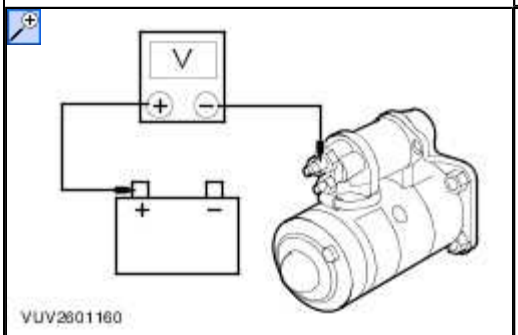
	
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** GO to B3.
B2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.
	Is the voltage less than 2 volts? **Yes** CLEAN and TIGHTEN all battery positive cable connections. TEST the system for normal operation. If the concern persists, INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
B3: CHECK THE STARTER RELAY CONTACT CIRCUIT FOR VOLTAGE	
	1 Disconnect Starter Relay R1.
	2 Measure the voltage between the BJB starter relay R1 connector pin 3 and ground.

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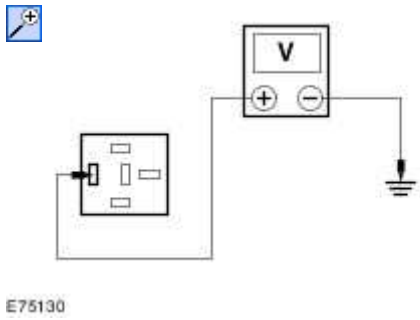
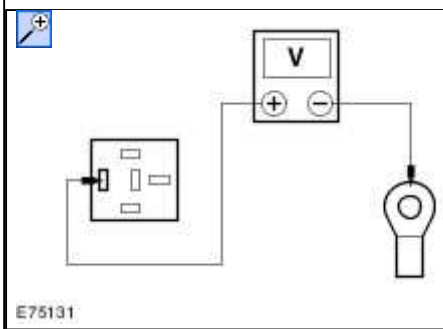
 E75130	
	Is the voltage greater than 10 volts? **Yes** GO to B4. **No** INSTALL a new BJB. TEST the system for normal operation.
B4: CHECK CIRCUIT CDC35 (BU/WH) FOR CONTINUITY	
	1 Ignition switch in position 0.
 E75131	2 Measure the resistance between the BJB starter relay R1 connector pin 5 and the starter motor solenoid C1DC35-B pin 1, circuit CDC35B (BU/WH).
	Is the resistance less than 1 ohm? **Yes** INSTALL a new starter relay. TEST the system for normal operation. If the concern persists, INSTALL a new BJB. TEST the system for correct operation. **No** REPAIR circuit CDC35A (BU/WH) or circuit CDC35B (BU/WH) as necessary. TEST the system for correct operation.

PINPOINT TEST C : THE ENGINE CRANKS SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE BATTERY VOLTAGE AND CONDITION	
	1 CHECK the battery using a battery tester.
	Is the battery voltage and condition OK? **Yes** GO to C2. **No** CHARGE or install a new battery as required. CHECK the charging system using WDS. TEST the system for normal operation.
C2: CHECK CIRCUIT SBF01A (RD) FOR VOLTAGE DROP	
	1 Ignition switch in position III.
	2 Measure the voltage between starter motor solenoid C1DC35-A-1 circuit SBF01A (RD), component side and the battery positive terminal.

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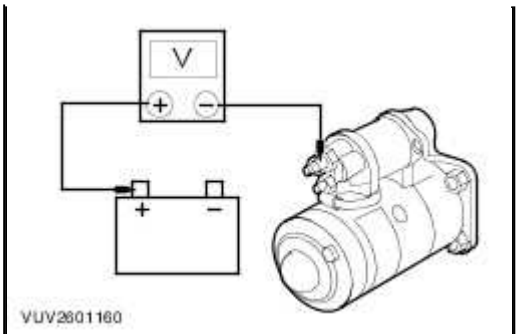
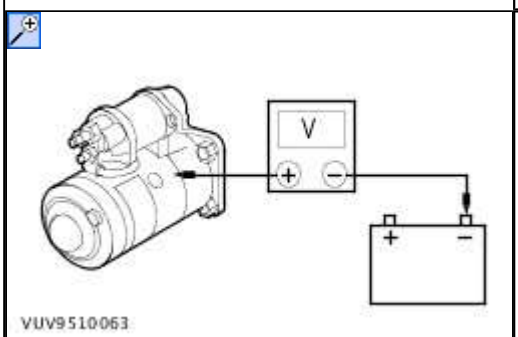
	
	Is the voltage less than 2 volts? **Yes** GO to C3. **No** CLEAN and TIGHTEN all battery positive cables connections. TEST the system for normal operation. If the concern persists, INSTALL a new battery to starter motor solenoid cable. TEST the system for normal operation.
C3: CHECK FOR GROUND CONNECTION	
	1 Ignition switch in position III.
	2 Measure the voltage between the starter motor housing and the battery negative terminal.
	Is the voltage less than 2 volts? **Yes** INSTALL a new starter motor. REFER to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation) / Starter Motor (303-06B Starting System - 2.5L Duratec-ST (VI5), Removal and Installation) / Starter Motor (303-06C Starting System - 1.8L Duratorq-TDCi (Kent) Diesel, Removal and Installation) / Starter Motor (303-06D Starting System - 2.0L Duratorq-TDCi (DW) Diesel, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN all battery negative cable connections and starter motor mountings. TEST the system for normal operation. If the concern persists, INSTALL a new battery negative cable. TEST the system for normal operation.

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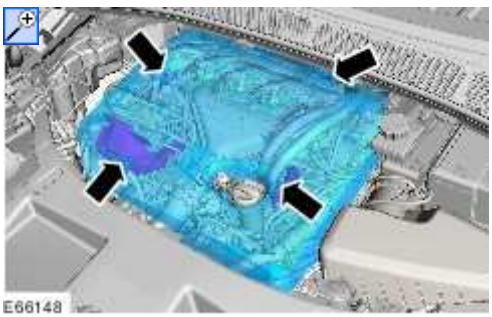
Removal and Installation

Removal

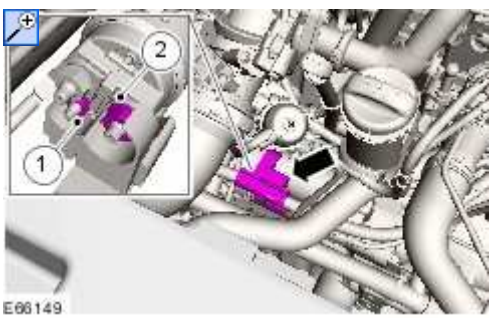
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

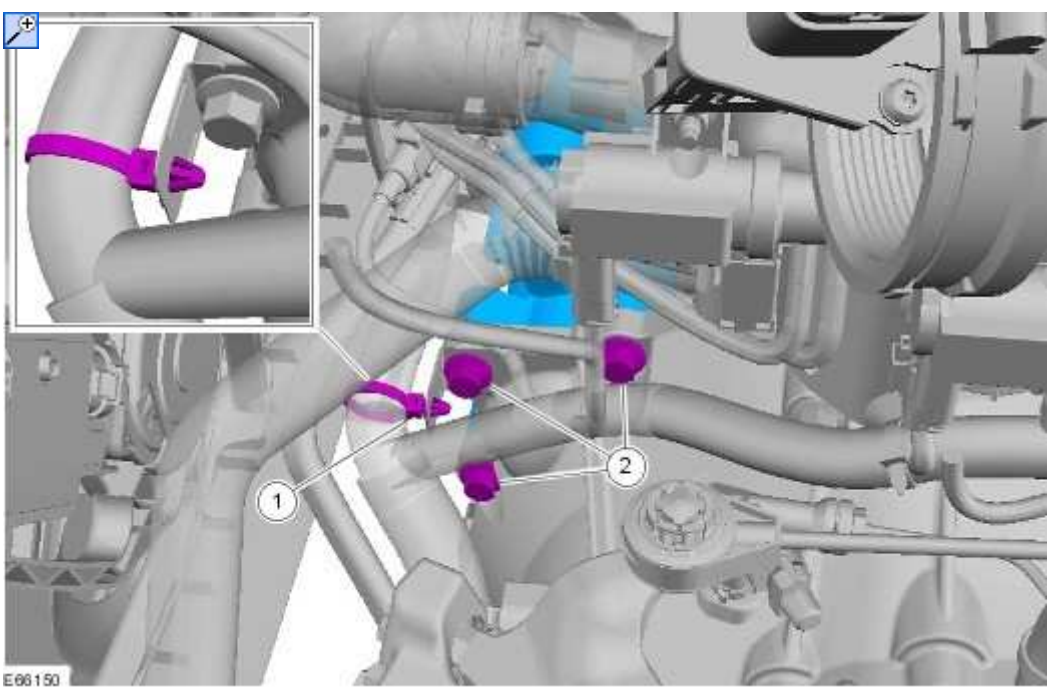
   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



2.



3.
   1. *Torque:* 6 Nm
   2. *Torque:* 12 Nm



4. *Torque:* 40 Nm

Installation

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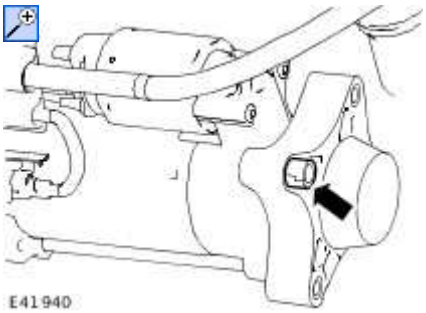

1. CAUTION: Make sure that the component is correctly located on the locating dowels.
2. To install, reverse the removal procedure.

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Starting System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV - Start Inhibit Switch	S-MAX/Galaxy 2006.5 (02/2006-)

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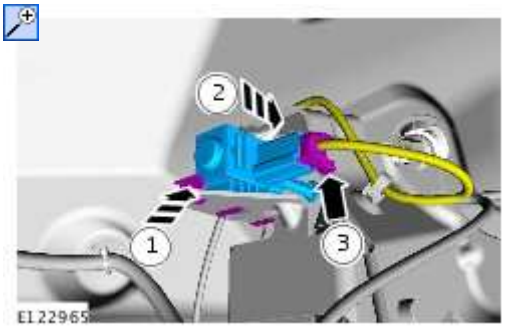
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.

1.



Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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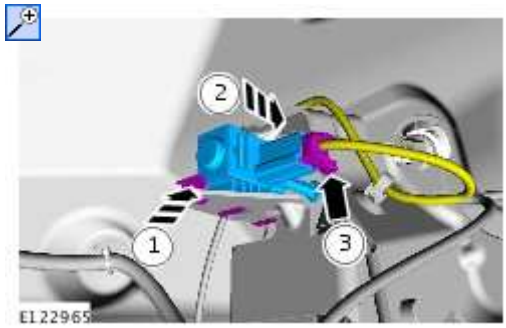
Removal and Installation

Removal

CAUTION: Make sure that the clutch pedal remains in the rest position.

1.



Installation

CAUTION: Make sure that the clutch pedal remains in the rest position.

1. To install, reverse the removal procedure.

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Engine Ignition - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4 - Specifications	S-MAX/Galaxy 2006.5 (02/2006-)

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Torque Specifications

Item	Nm	lb-ft	lb-in
Spark plug(s)	12	10	-

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Spark plugs

Description	mm
Spark plug gap	0.7

Torque Specifications

Item	Nm	lb-ft	lb-in
Spark plug	28		

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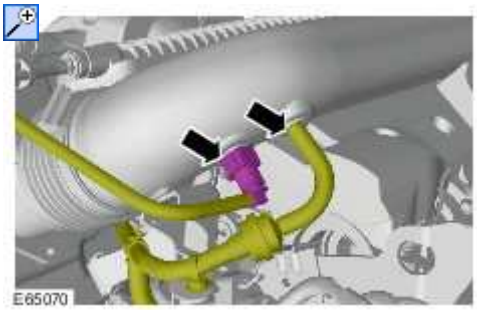
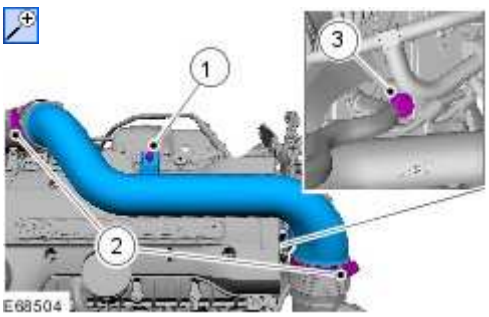
Removal and Installation

Removal

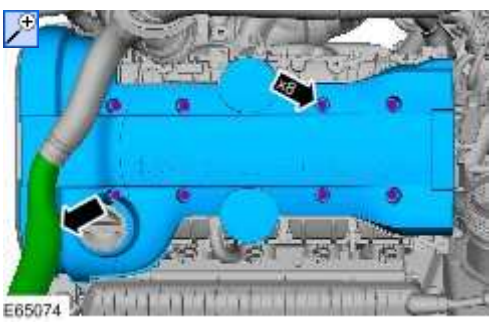
NOTE: Removal steps in this procedure may contain installation details.



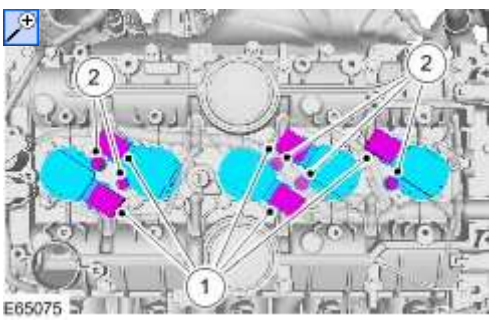
1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.



2. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   1. *Torque:* 10 Nm
   2. *Torque:* 4 Nm
   3. *Torque:* 10 Nm



3. *Torque:* 10 Nm



4.
   2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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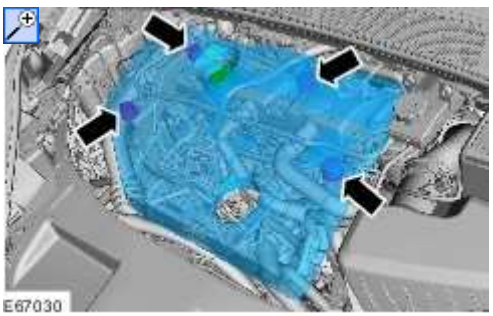
Removal and Installation

Removal

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

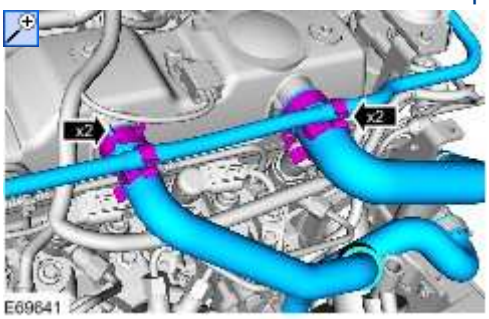
1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

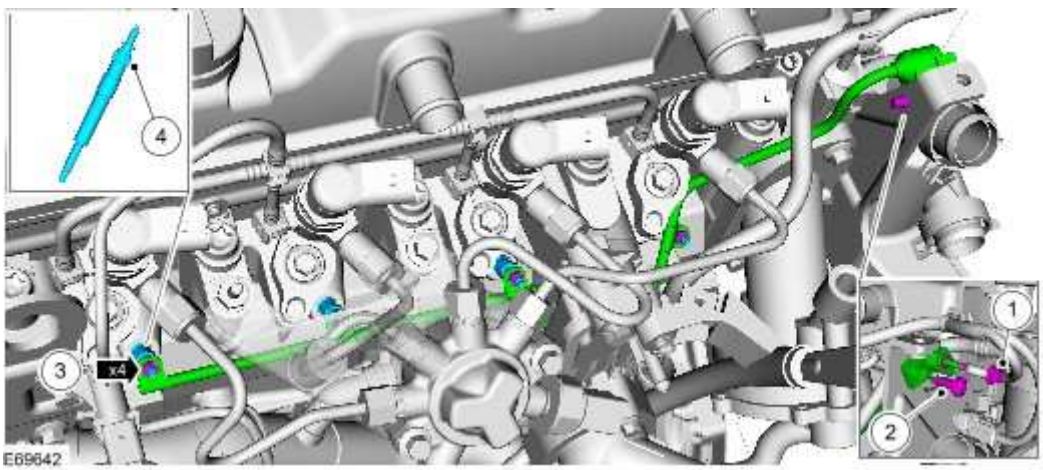


2.

CAUTION: Make sure that all openings are sealed.



3.



4.

1. *Torq* 4 Nn
2. *Torq* 7 Nn
3. *Torq* 2 Nn
4. *Torq* 15 N

Installation

1. To install, reverse the removal procedure.

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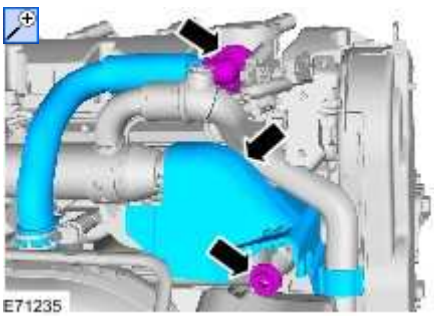
Removal and Installation

Removal

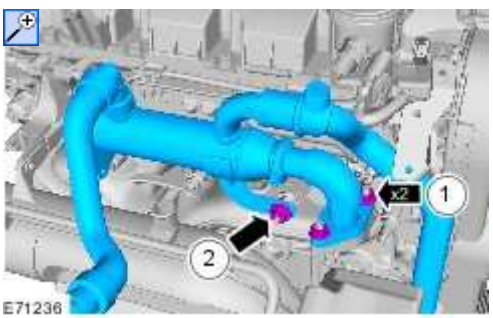
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the exhaust gas recirculation (EGR) valve.

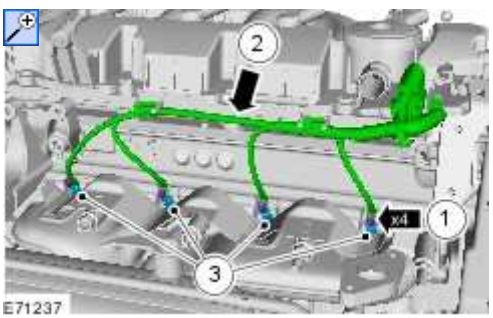
   Refer to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



2. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   Torque: 20 Nm



3.
   1. *Torque:* 10 Nm
   2. *Torque:* 30 Nm



4.
   1. *Torque:* 2 Nm
   3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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Diagnosis and Testing

General Equipment

Ford diagnostic equipment

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Fuse(s) • Relay • Wiring harness • Electrical connector(s) • Glow plug(s) • Glow plug wire • Powertrain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Ford diagnostic equipment to diagnose the system.

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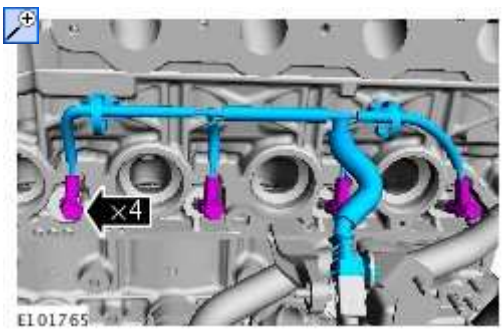
Removal and Installation

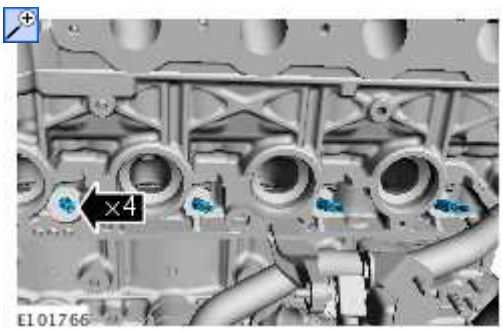
Removal

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

1. Refer to: Intake Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).



2.



3. *Torque:* 8 Nm

Installation

1. To install, reverse the removal procedure.

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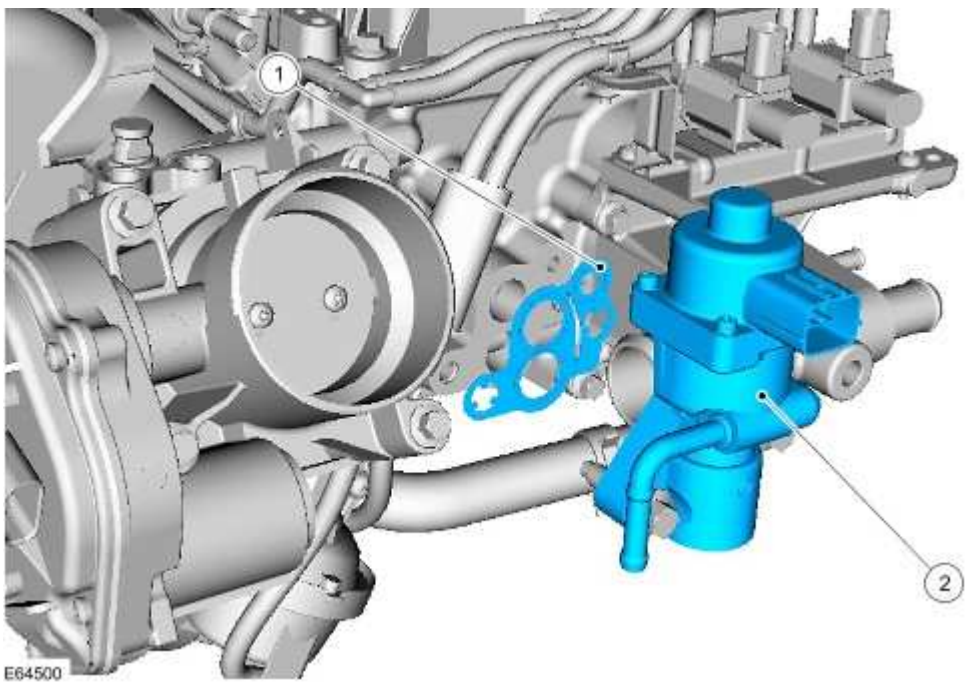
Description and Operation



Item	Part Number	Description
1	-	Exhaust gas recirculation (EGR) valve gasket
2	-	EGR valve

The EGR system allows a measured quantity of exhaust gas to be directed back to the intake manifold. The exhaust gas is introduced to the incoming charge air in the intake manifold, where it mixes with the air/fuel mixture and lowers the peak gas temperature, reducing nitrogen oxide (NOx) exhaust emissions. The EGR valve is electrically operated and is controlled through an input from the powertrain control module (PCM).

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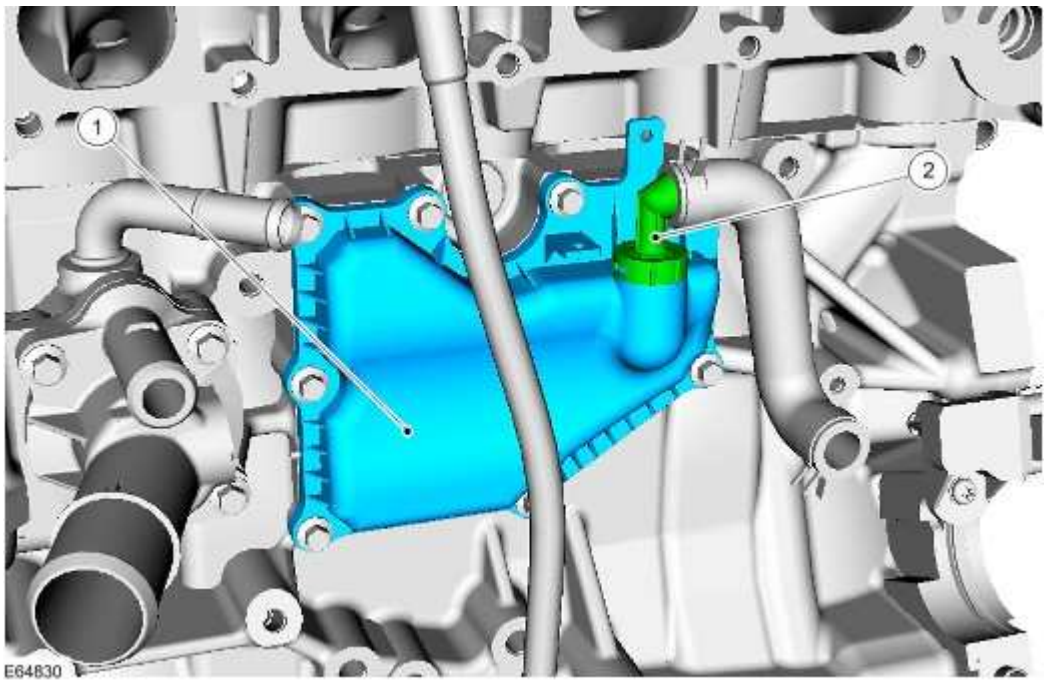
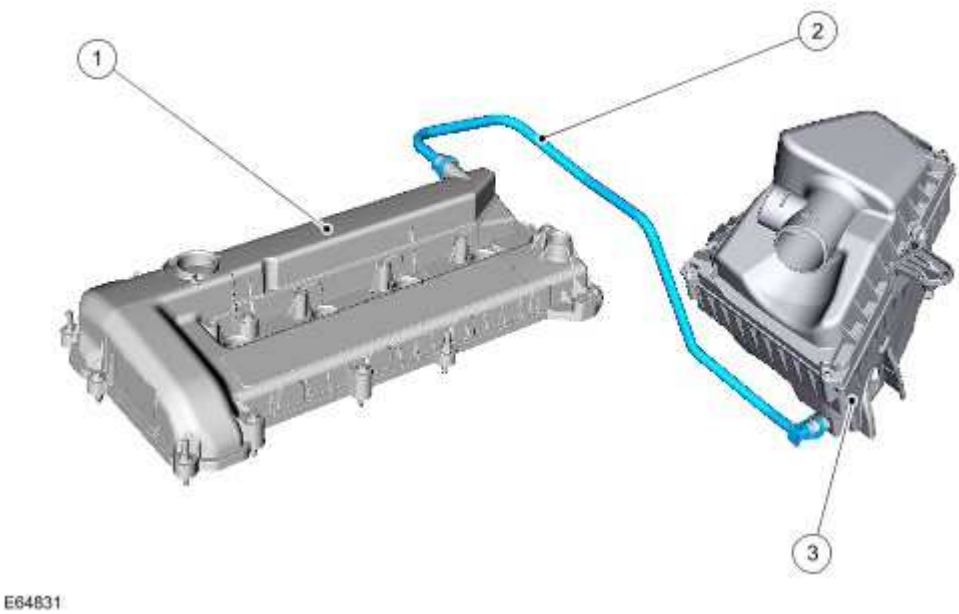


Item	Part Number	Description
1	-	Crankcase vent oil separator
2	-	Positive crankcase ventilation (PCV) valve



Item	Part Number	Description
1	-	Valve cover
2	-	PCV hose
3	-	Air cleaner assembly

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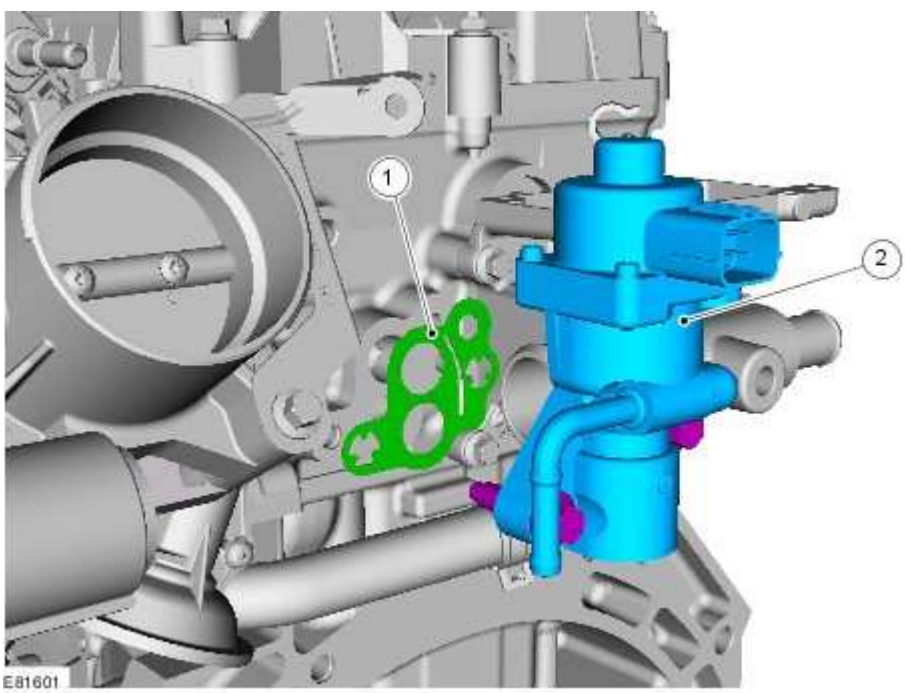
Description and Operation



Item	Part Number	Description
1	-	Exhaust gas recirculation (EGR) valve gasket
2	-	EGR valve

The EGR system allows a measured quantity of exhaust gas to be directed back to the intake manifold. The exhaust gas is introduced to the incoming charge air in the intake manifold, where it mixes with the air/fuel mixture and lowers the peak gas temperature, reducing nitrogen oxide (NOx) exhaust emissions. The EGR valve is electrically operated and is controlled through an input from the powertrain control module (PCM).

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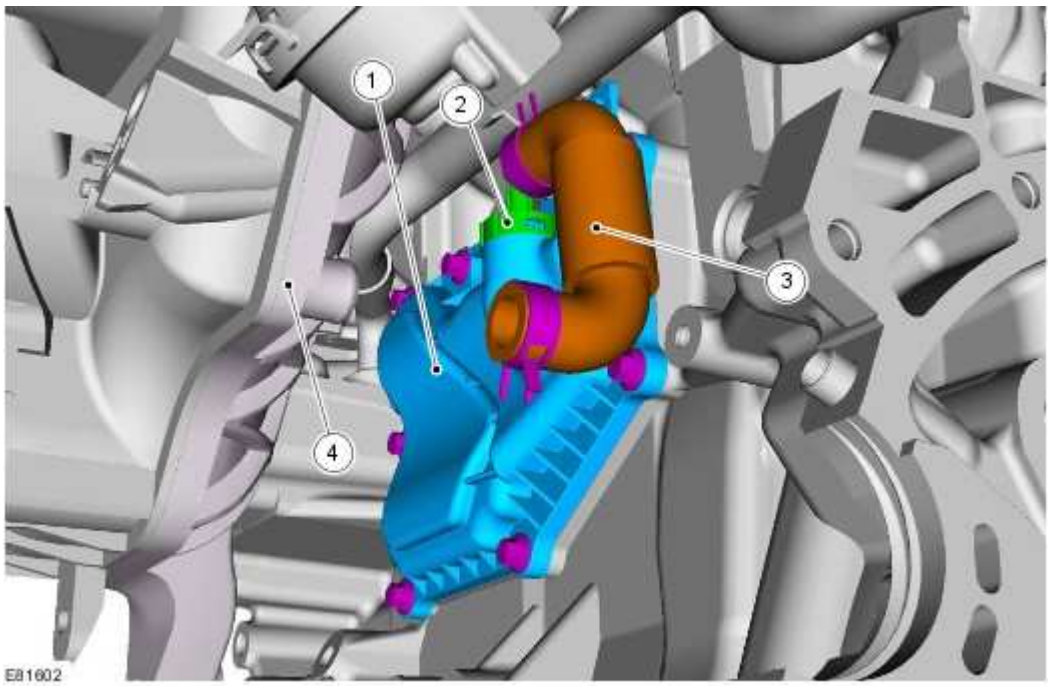
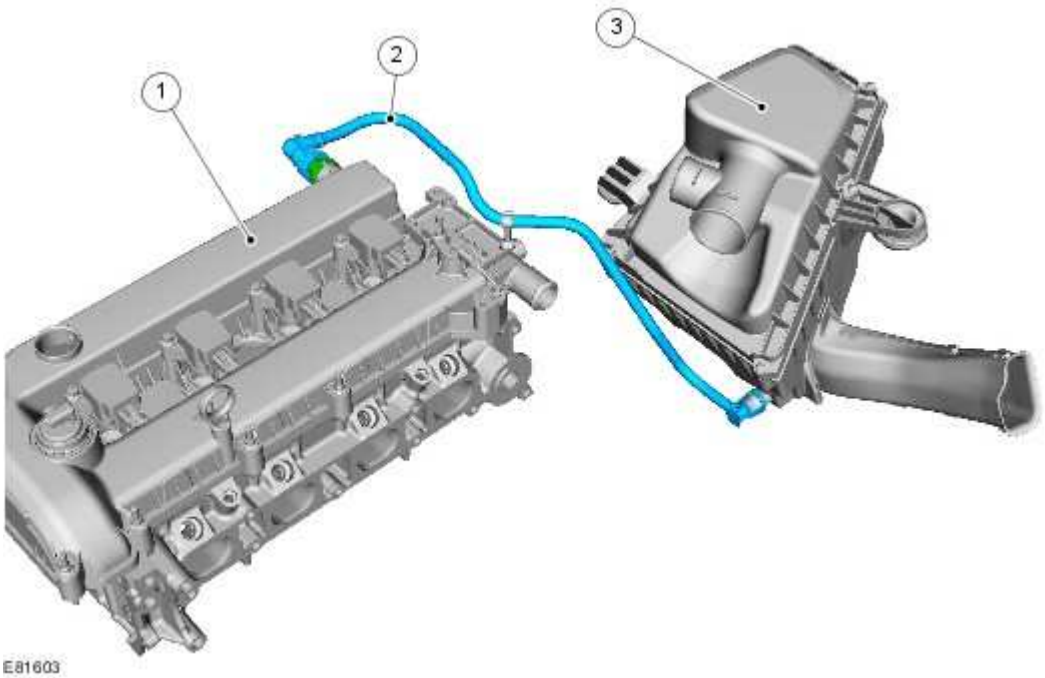


Item	Part Number	Description
1	-	Crankcase vent oil separator
2	-	Positive crankcase ventilation (PCV) valve
3	-	PCV hose
4	-	Intake manifold



Item	Part Number	Description
1	-	Valve cover
2	-	PCV hose
3	-	Air cleaner assembly

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Hose(s)/hose joints • Gasket(s) • Positive crankcase ventilation (PCV) valve • PCV separator • Exhaust gas recirculation (EGR) valve	• Electrical connector(s) • Wiring harness • Fuse(s) • Relay • EGR valve • Powertain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Poor engine performance	* EGR valve.	* Using the WDS, CHECK the EGR Valve Duty Cycle input signal to the EGR vacuum regulator valve. If the result is 0%, REMOVE the EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08A Engine Emission Control - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation). INSPECT the EGR valve and valve seat for damage. Make sure that the EGR valve is in the closed position. If the EGR valve is not closed. INSTALL a new EGR valve. TEST the system for normal operation. If the result is not 0% continue the engine diagnostic using the WDS.
Excessive crankcase pressure	* Blocked or damaged PCV hose(s). * Blocked crankcase vent oil separator.	* CHECK the PCV system components for blockages, CLEAN or INSTALL new components as necessary.
	* Worn or damaged engine components.	* REFER to: Engine (303-01A, Diagnosis and Testing).

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Removal and Installation

General Equipment

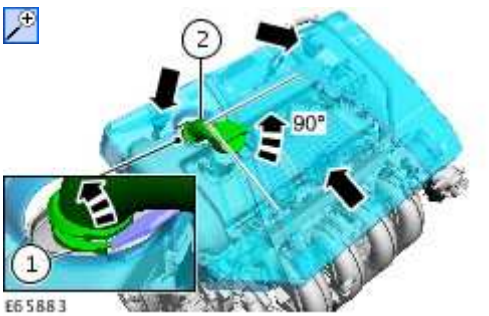
Hose clamp remover/installer

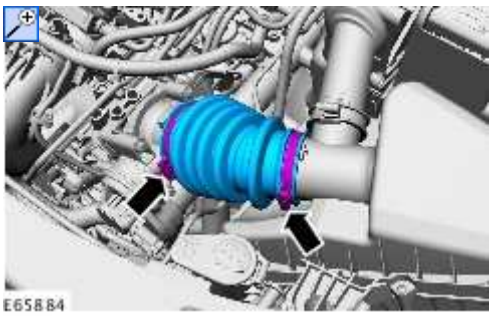
Removal

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

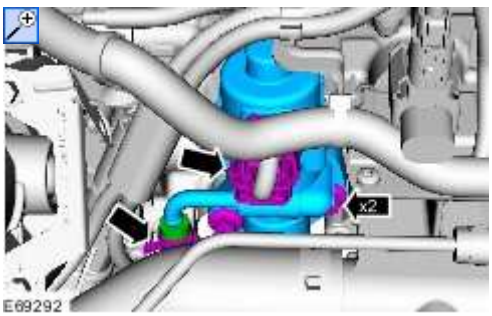
1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

2. 

3. 

4. NOTE: The gasket is to be reused unless damaged.
   General Equipment: Hose clamp remover/installer
   Torque: 25 Nm



Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material.
   To install, reverse the removal procedure.

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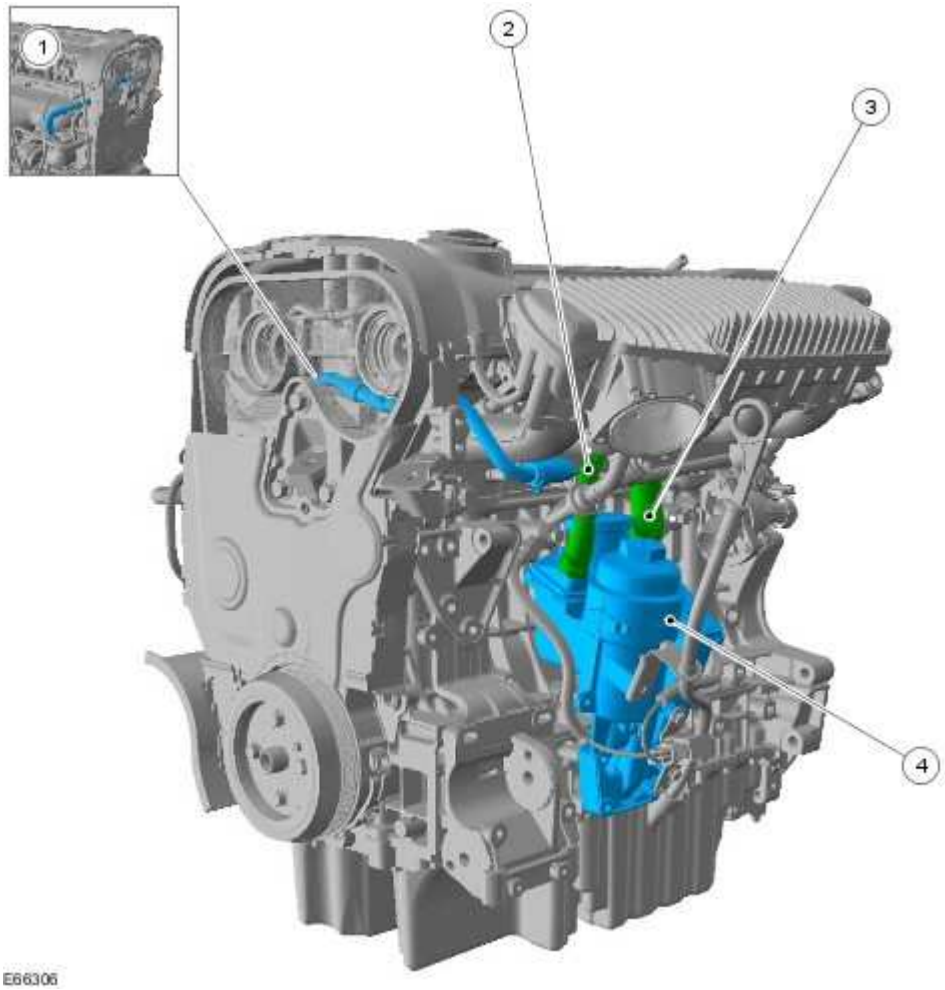
Description and Operation

2.5L Duratec-ST (VI5)

Engine Emission Components



Item	Part Number	Description
1	-	Intake manifold to turbocharger breather hose
2	-	Crankcase vent oil separator to valve cover hose
3	-	Crankcase vent oil separator to intake manifold hose
4	-	Crankcase vent oil separator

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Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical damage.

Visual Inspection Chart

Mechanical	Electrical
• Hose(s)/hose joints • Gasket(s) • Positive crankcase ventilation (PCV) valve • PCV crankcase vent oil separator • Turbocharger	• Electrical connector(s) • Wiring harness • Fuse(s) • Relay • Powertain control module (PCM)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Excessive crankcase pressure	* Blocked PCV crankcase vent oil separator. * Blocked PCV hose.	* CLEAN or INSTALL new PCV components as necessary. TEST the system for normal operation.
	* Worn or damaged engine components.	* REFER to: Engine (303-01B, Diagnosis and Testing).
Oil in the air intake system	* Crankcase vent oil separator.	* CLEAN or INSTALL a new crankcase vent oil separator. TEST the system for normal operation.
	* Turbocharger	* REFER to: Turbocharger (303-04E, Diagnosis and Testing).
	* Worn or damaged engine components.	* REFER to: Engine (303-01B, Diagnosis and Testing).

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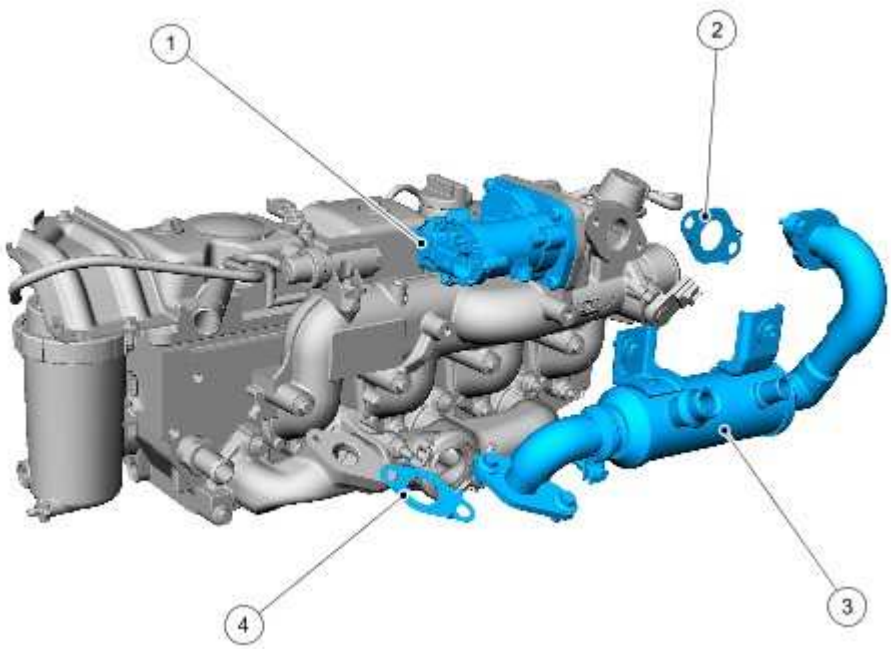
Description and Operation



E64501

Item	Part Number	Description
1	-	EGR valve
2	-	EGR cooler to intake manifold gasket
3	-	EGR cooler
4	-	Exhaust manifold to EGR cooler tube gasket

The EGR system allows a measured quantity of exhaust gas to be directed back to the intake manifold. The exhaust gas is introduced to the incoming charge air in the intake manifold, where it mixes with the air/fuel mixture and lowers the peak gas temperature, reducing nitrogen oxide (NOx) exhaust emissions. The EGR valve is electrically operated and is controlled through an input from the powertrain control module (PCM).

The EGR system is fitted with an EGR cooler. The EGR cooler reduces the temperature of the exhaust gasses being returned to the intake system. By reducing the EGR temperature, the intake air charge density is not adversely affected, so maintaining the optimum fueling characteristics.

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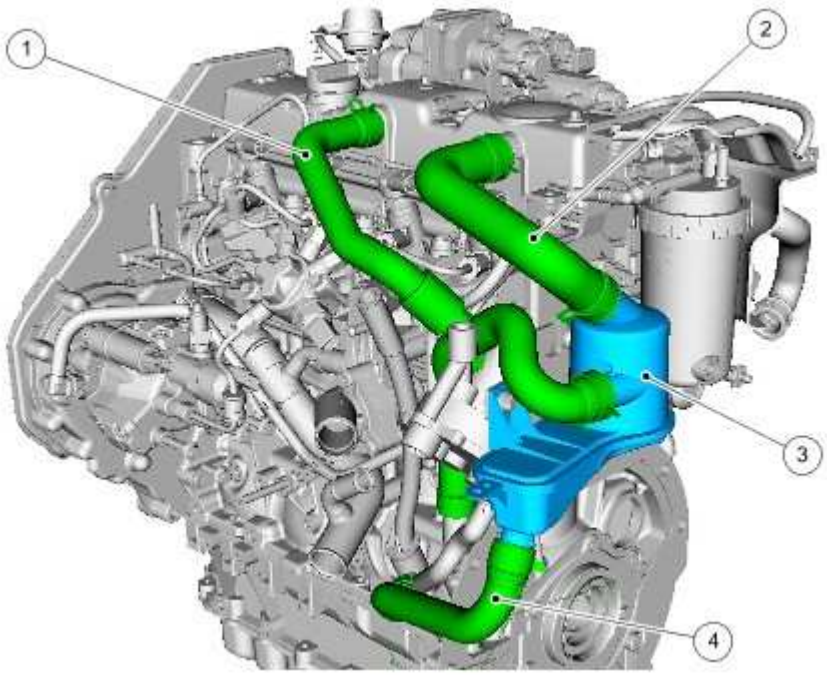
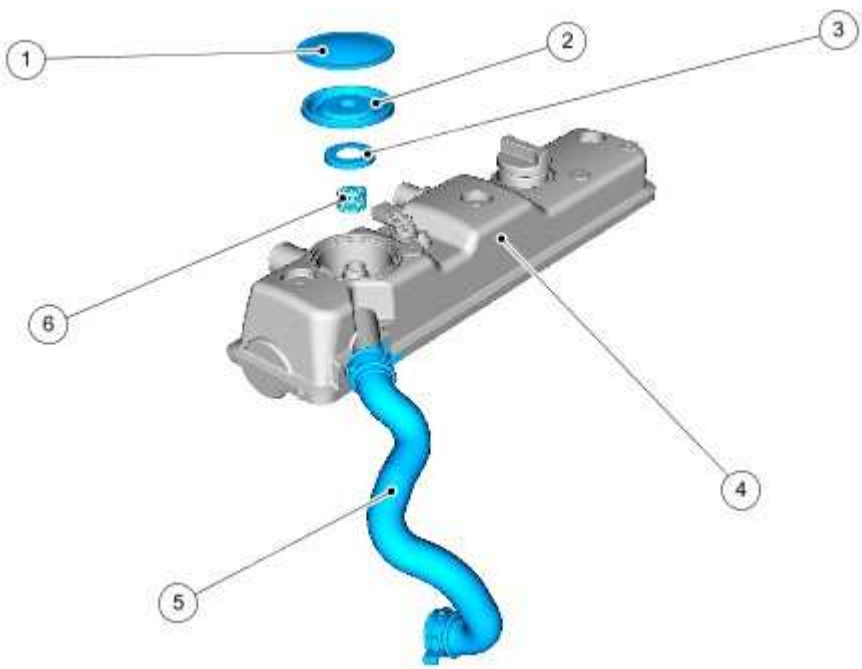


E64834

Item	Part Number	Description
1	-	Valve cover and crankcase to positive crankcase ventilation (PCV) separator PCV hose
2	-	PCV separator to valve cover PCV hose
3	-	PCV separator
4	-	PCV separator to crankcase PCV hose



E64835

Item	Part Number	Description
1	-	PCV valve cover
2	-	PCV valve diaphragm
3	-	PCV valve bush
4	-	Valve cover

-

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5		Valve cover to air intake pipe PCV hose
	6 -	PCV valve spring

The PCV system consists of an oil separator chamber connected to the crankcase and valve cover by hoses.

The crankcase pressure is controlled by a diaphragm operated PCV valve built into the valve cover. As the pressure in the oil separator reduces, the diaphragm valve closes against the force of the PCV valve spring, so closing the PCV valve. As the crankcase pressure rises, the PCV valve is pushed open assisted by the PCV valve spring. This allows the positive crankcase gasses to be scavenged by the air intake system.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS) (418-F224)

Principles of Operation

Exhaust Gas Recirculation (EGR) system

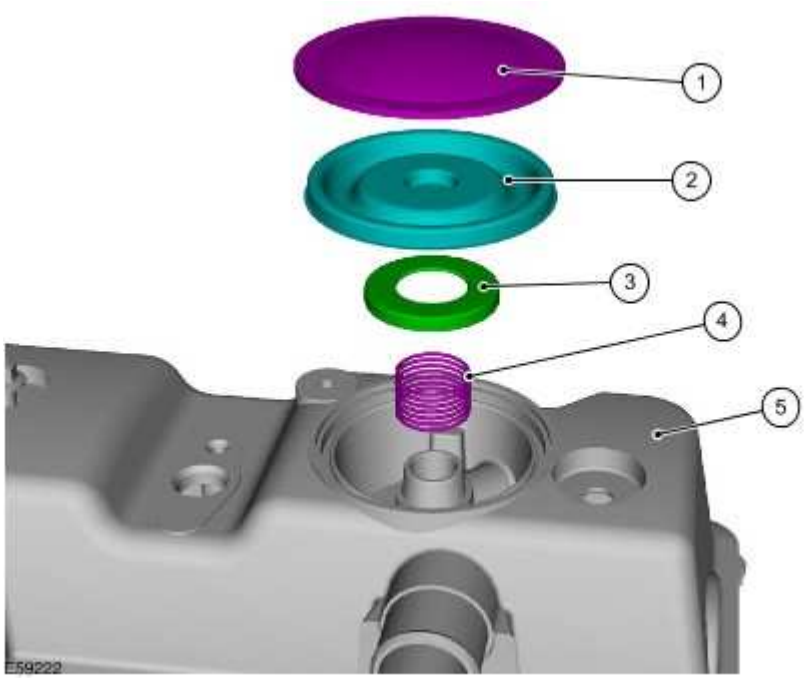
To maintain the standards of low exhaust emission levels required of today's engines, the EGR system on this engine is fully electronically controlled.

The EGR valve is a proportional electric motor controlled directly by a duty-cycle signal from the powertrain control module (PCM). Integrated into the EGR valve is a valve position sensor. The signal from the EGR valve position sensor allows for the precise control of the timing and the quantity of exhaust gas to be recirculated. If the EGR valve becomes inoperative or fails to close completely, the PCM will raise a diagnostic trouble code (DTC) and the instrument cluster malfunction indicator lamp (MIL) will be illuminated.

If a new EGR valve is installed. The base setting (closed position) value must be configured to the PCM. This is initiated using WDS. If the base setting is not configured to the PCM, the setting from the previous EGR valve will be used and the control function of the EGR system will be incorrect.

The EGR system is fitted with an EGR cooler. The EGR cooler reduces the temperature of the exhaust gasses being returned to the intake system. By reducing the EGR temperature, the intake air charge density is not adversely affected, so maintaining the optimum fueling characteristics.

Positive Crankcase Ventilation (PCV) system



Item	Part Number	Description
1	-	PCV valve cover
	-	

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2		PCV valve diaphragm
	3 -	PCV valve bush
4	-	PCV valve spring
5	-	Valve cover

The PCV system is made up of an oil separator chamber connected to the crankcase and valve cover by hoses.

The crankcase pressure is controlled by a diaphragm operated PCV valve built into the valve cover. As the pressure in the oil separator reduces, the diaphragm valve closes against the force of the PCV valve spring, so closing the PCV valve. As the crankcase pressure rises, the PCV valve is pushed open assisted by the PCV valve spring. This allows the positive crankcase gasses to be scavenged by the air intake system.

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Exhaust gas recirculation (EGR) valve • EGR cooler • Gasket • PCV hoses • PCV oil separator	• Electrical connector • Wiring harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. **4.** If the cause is not visually evident, verify the symptom and refer to the diagnostic trouble code (DTC) chart.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description/Condition	Possible Source	Action
P1402	EGR metering orifice restricted	EGR valve stuck closed or leaking	GO to Pinpoint Test A.

1. **1.** If no DTC's are retrieved, verify the symptom and refer to the symptom chart.

Symptom Chart

Symptom	Possible Sources	Action
Excessive exhaust black smoke	* EGR valve.	* GO to Pinpoint Test A.
Excessive crankcase pressure	* Blocked or damaged PCV hose(s). * Blocked PCV oil separator.	* GO to Pinpoint Test B.
	* Worn or damaged engine components.	* REFER to: Engine (303-01C, Diagnosis and Testing).

Pinpoint Tests

PINPOINT TEST A : EXCESSIVE EXHAUST BLACK SMOKE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

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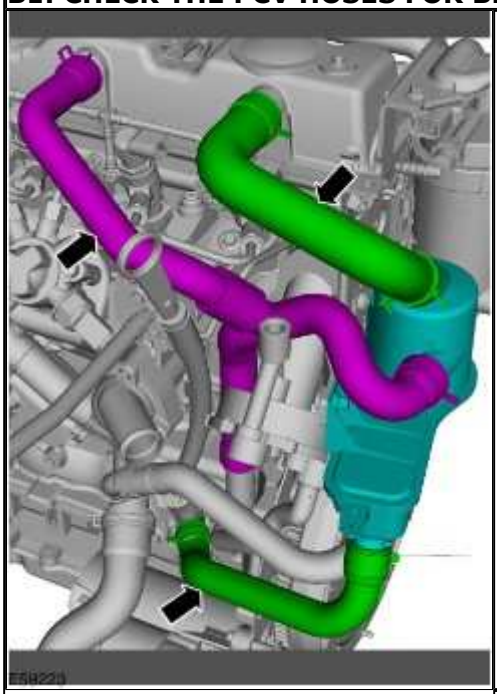
A1: CHECK THE EGR VALVE

	1 Using the WDS, CHECK for DTC P1402.
	Is DTC P1402 retrieved? **Yes** INSTALL a new EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08C, Removal and Installation). TEST the system for normal operation. **No** Continue the diagnostic using the WDS.

PINPOINT TEST B : EXCESSIVE CRANKCASE PRESSURE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

B1: CHECK THE PCV HOSES FOR BLOCKAGE

	1 Remove the PCV hoses.
	2 Inspect the PCV hoses for blockage.
	Are the PCV hoses free from blockage? **Yes** GO to B2. **No** CLEAN or INSTALL new PCV hoses as necessary. TEST the system for normal operation.

B2: CHECK THE PCV VALVE FOR DAMAGE

	1 Inspect the PCV valve for damage or blockage.
	Is the PCV valve spring undamaged and the PCV valve free from blockage? **Yes** TEST the system for normal operation. If the concern persists, REFER to: Engine (303-01C, Diagnosis and Testing).

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	No CLEAN the PCV oil separator and PCV valve assembly or INSTALL a new valve cover as necessary TEST the system for normal operation.

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Removal

CAUTION: The intake manifold and exhaust gas recirculation (EGR) valve must not be separated.
NOTE: Removal steps in this procedure may contain installation details.

Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Exhaust Gas Recirculation (EGR) Valve	S-MAX/Galaxy 2006.5 (02/2006-)

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Removal and Installation

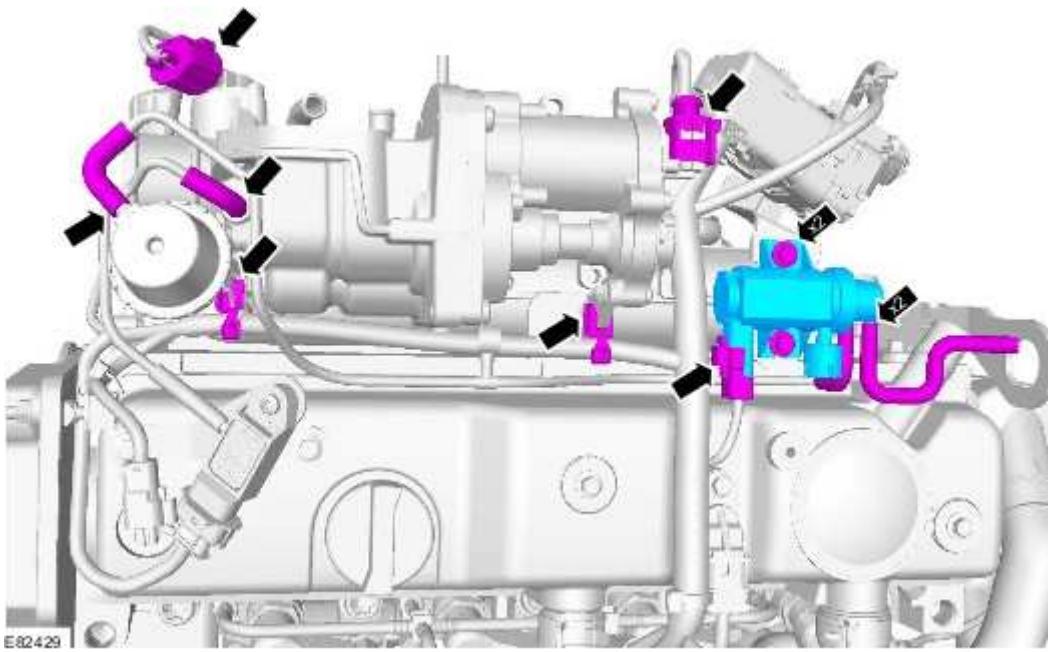
General Equipment

Ford approved diagnostic tool

1. Remove the exhaust manifold.

   Refer to: Exhaust Manifold (303-01E Engine - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
2. Remove the exhaust gas recirculation (EGR) cooler.

   Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08C Engine Emission Control - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
3. *Torque:* 10 Nm



4. NOTE: The gaskets are to be reused unless damaged.
   NOTE: Make sure that new components are installed.
   Discard the nuts.

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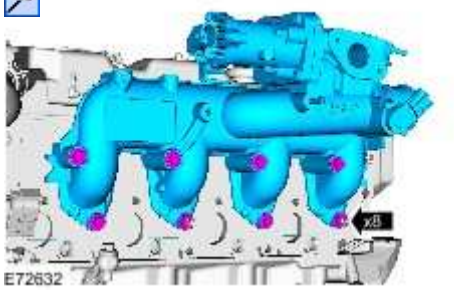

Torque: 24 Nm

Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, select: TOOLBOX/POWERTRAIN/SERVICE FUNCTIONS/RESET KAM, to reset the EGR valve.

   General Equipment: Ford approved diagnostic tool

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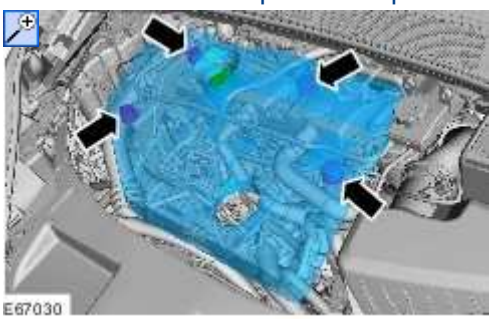
Removal and Installation

General Equipment

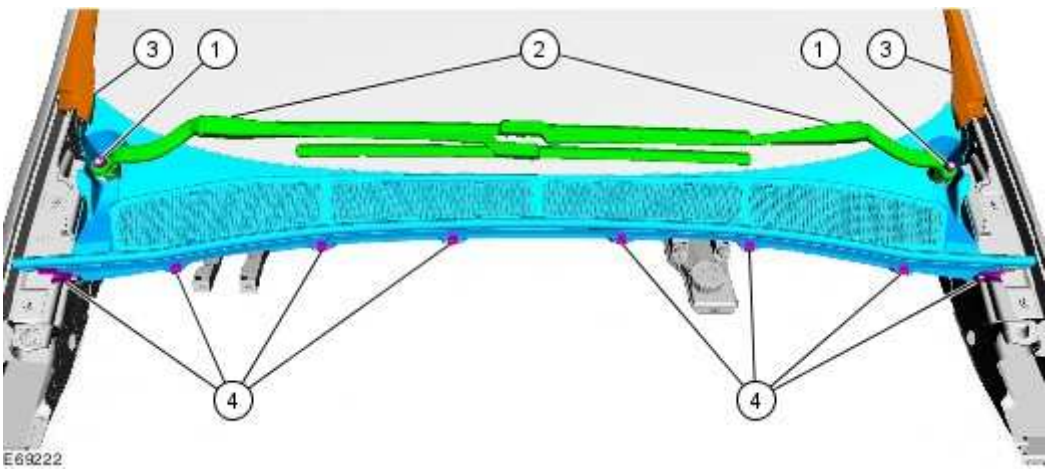
Hose clamp remover/installer

Removal

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

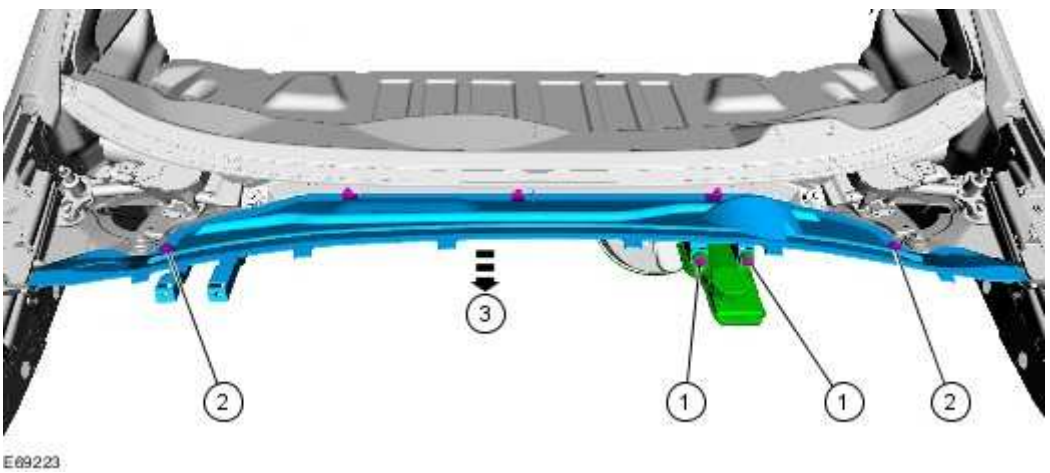


1.



2.

1. *Torq* 22 N
3. Deta the A pillar exte trim pane lowe clips



3.

2. *Torq* 10 N

4.

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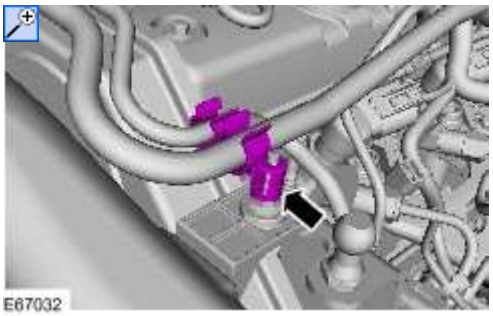
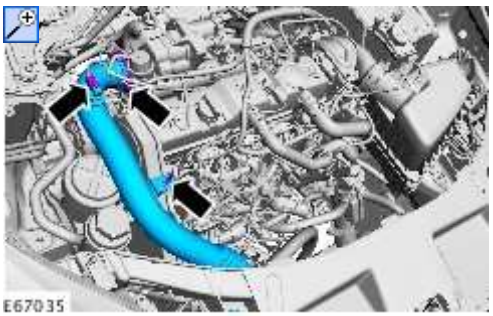
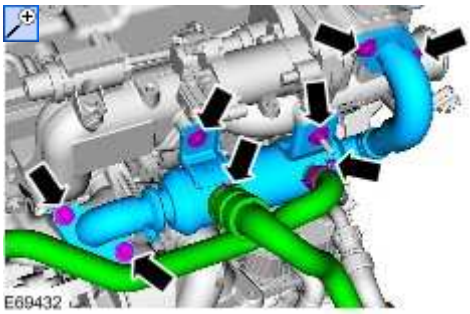


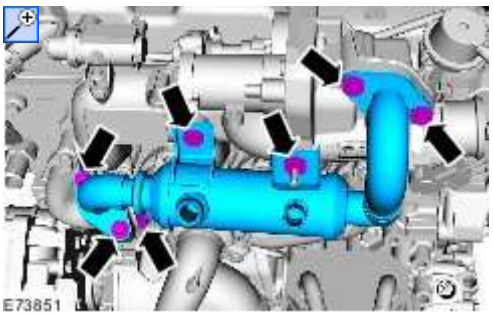


5. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
NOTE: Make a note of the orientation of the charger air cooler clamp.

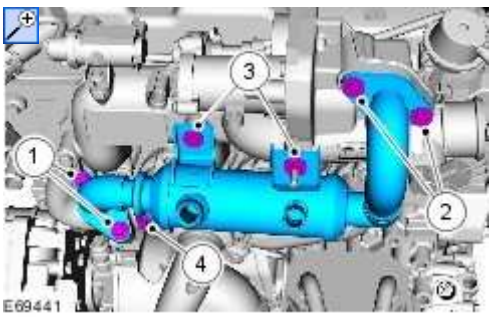


6. NOTE: The gaskets are to be reused unless damaged.
General Equipment: Hose clamp remover/installer

Installation



1. NOTE: Only tighten the nut and bolts finger tight a this stage.



2.
    1. *Torque:* 23 Nm
    2. *Torque:* 10 Nm
    3. *Torque:* 10 Nm
    4. *Torque:* 4 Nm

3. To install, reverse the removal procedure.

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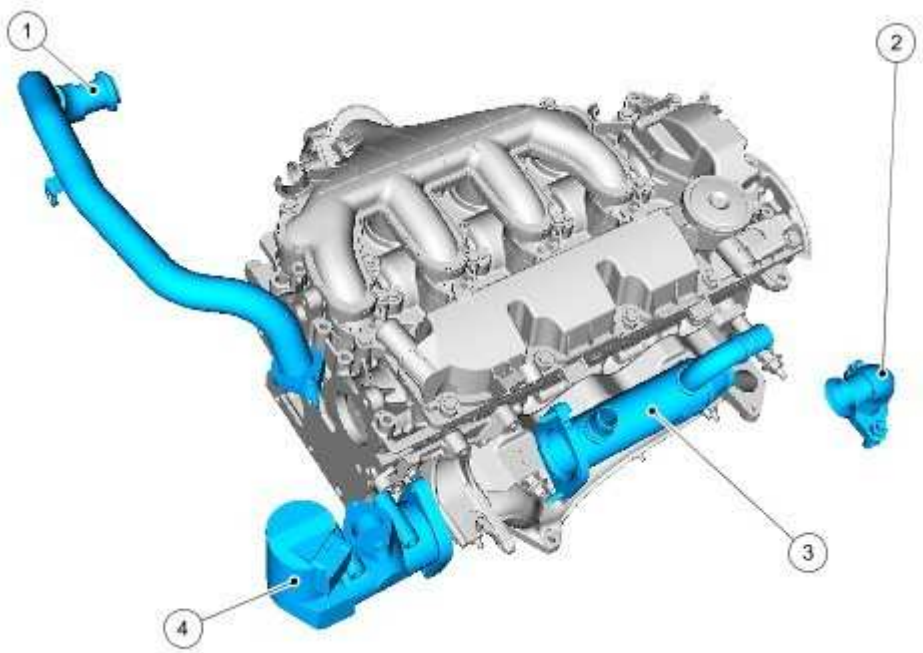
Description and Operation



E64499

Item	Part Number	Description
1	-	Exhaust gas recirculation (EGR) valve outlet tube
2	-	Exhaust manifold to EGR cooler tube
3	-	EGR cooler
4	-	EGR valve

The EGR system allows a measured quantity of exhaust gas to be directed back to the intake manifold. The exhaust gas is introduced to the incoming charge air in the intake manifold, where it mixes with the air/fuel mixture and lowers the peak gas temperature, reducing nitrogen oxide (NOx) exhaust emissions. The EGR valve is electrically operated and is controlled through an input from the powertrain control module (PCM).

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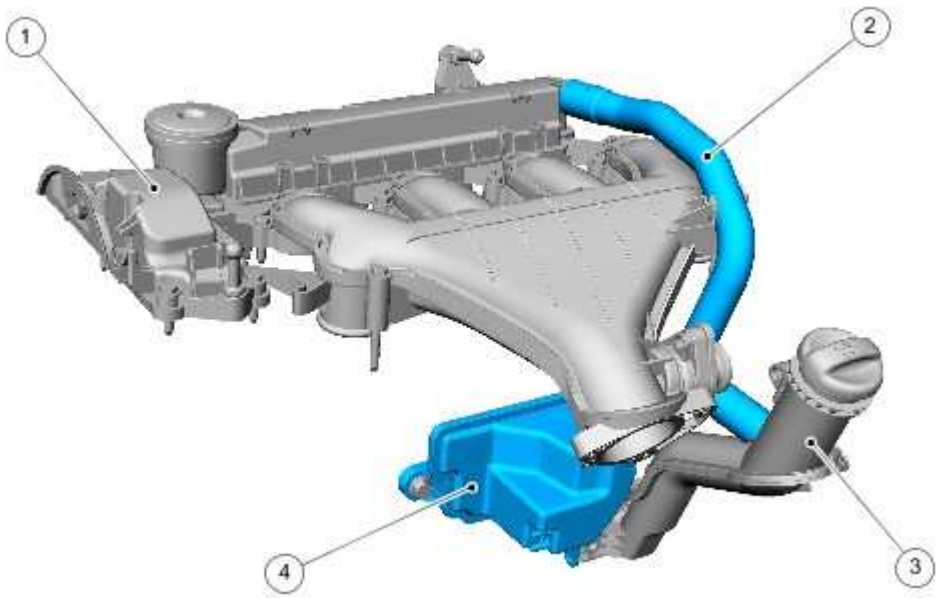

E64924

Item	Part Number	Description
1	-	Intake manifold
2	-	PCV hose
3	-	Oil filler tube
4	-	EGR electronic vacuum regulating valve vacuum reservoir

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS) (418-F224)

Principles of Operation

Exhaust Gas Recirculation (EGR) system

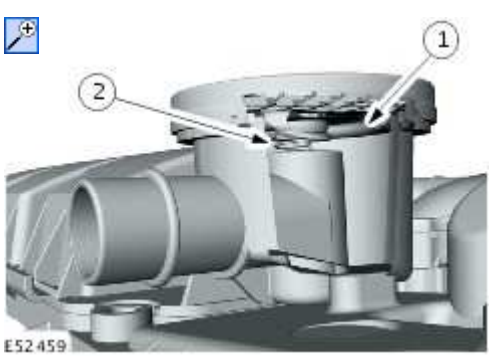
To maintain the standards of low exhaust emission levels required of todays engines, the EGR system on this engine is fully electronically controlled.

The EGR valve is a proportional electric motor controlled directly by a duty-cycle signal from the powertrain control module (PCM). Integrated into the EGR valve is a valve position sensor. The signal from the EGR valve position sensor allows for the precise control of the timing and the quantity of exhaust gas to be recirculated. If the EGR valve becomes inoperative or fails to close completely, the PCM will raise a diagnostic trouble code (DTC) and the instrument cluster malfunction indicator lamp (MIL) will be illuminated. At the end of each drive cycle the PCM drives the EGR valve to the fully open and fully closed positions several times. This assists with cleaning the EGR valve.

If a new EGR valve is installed. The base setting (closed position) value must be configured to the PCM. This is initiated using WDS. If the base setting is not configured to the PCM, the setting from the previous EGR valve will be used and the control function of the EGR system will be incorrect.

The EGR system is fitted with an EGR cooler. The EGR cooler reduces the temperature of the exhaust gasses being returned to the intake system. By reducing the EGR temperature, the intake air charge density is not adversely affected, so maintaining the optimum fueling characteristics.

Positive Crankcase Ventilation (PCV) system



Item	Part Number	Description
1	-	PCV valve diaphragm
2	-	PCV valve

The PCV system is made up of an oil separator chamber connected to the crankcase by a hose. The oil separator chamber is an integral part of the engine intake manifold.

The crankcase pressure is controlled by a diaphragm operated PCV valve built into the oil separator. As the pressure in the oil separator reduces, the diaphragm valve closes against the force of the PCV valve spring, so closing the PCV valve. As the crankcase pressure rises,

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the PCV valve is pushed open assisted by the PCV valve spring. This allows the positive crankcase gasses to be scavenged by the air intake system.

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Exhaust gas recirculation (EGR) valve • EGR tube • EGR cooler • EGR tube clamp • Gasket • PCV hose • PCV oil separator	• Electrical connector • Wiring harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the DTC Index Chart.
5. **5.** If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnosis.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description	Possible Source	Action
P1412	MIL illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart
P0404	MIL illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart
P1335	Powertrain warning indicator illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
Excessive exhaust black smoke	* EGR valve.	* Using the WDS, CHECK the PCM calibration. If necessary UPDATE the PCM calibration to the latest level. Using the WDS, TOOLBOX/POWERTRAIN/SERVICE FUNCTIONS/RESET KAM, RESET the EGR valve. Carry out a road test, if the concern persists GO to Pinpoint Test A.
Excessive crankcase pressure	* Blocked or damaged PCV hose(s). * Blocked PCV oil separator.	* GO to Pinpoint Test B.
	* Worn or damaged engine components.	* REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).

Pinpoint Tests

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PINPOINT TEST A : EXCESSIVE EXHAUST BLACK SMOKE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE EXHAUST GAS RECIRCULATION VALVE POSITION	
NOTE: Allow the engine to idle for a minimum of four minutes before carrying out the system checks using the WDS.	
NOTE: After the engine is switched off, the EGR valve will attempt the cleaning cycle up to a maximum of 18 times. If 18 cycles are seen during the test the EGR valve is suspect and should be changed.	
	1 Ignition switch in position III.
	2 Using the WDS, DATALOGGER, set the parameters DPFEGR, RPM, EGRDC#.
	3 Set DATALOGGER to RECORD.
	4 Ignition switch in position 0.
	Does the DPFEGR 0 to 5 volt parameter change from a minimum approximate value of 0.9 volts to a maximum approximate value of 4.2 volts for a total of 6 cycles? **Yes** GO to A2. **No** RECORD the DTCs and DATALOGGER freeze frame data. INSTALL a new EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.
A2: CHECK THE EXHAUST GAS RECIRCULATION VALVE FOR DAMAGE	
	1 Remove the EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	2 INSPECT the EGR valve and valve seat for damage or excessive carbon build up. REMOVE the plastic cover on the EGR valve and check the EGR valve cam actuator for free movement.
	Is the EGR valve undamaged and in the closed position and the EGR valve cam actuator free to move? **Yes** To continue diagnostics, REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing). **No** INSTALL a new EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : EXCESSIVE CRANKCASE PRESSURE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE PCV HOSE FOR BLOCKAGE	
	1 Remove the PCV hose.

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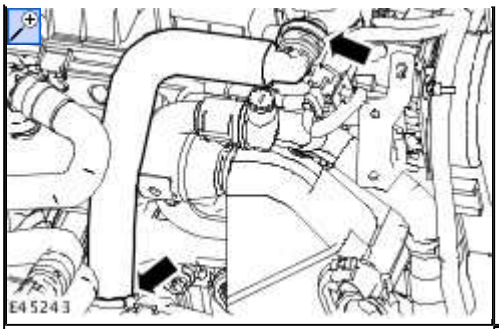
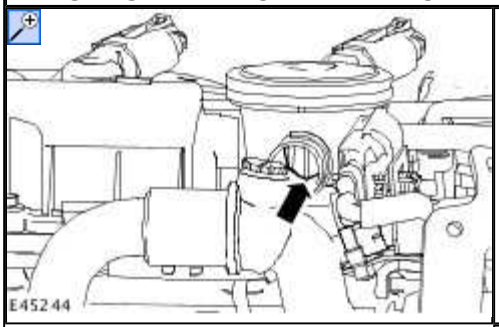


	2 Inspect the PCV hose for blockage.
	Is the PCV hose free from blockage? **Yes** GO to B2. **No** CLEAN or INSTALL a new PCV hose as necessary. TEST the system for normal operation.

B2: CHECK THE PCV VALVE FOR DAMAGE



	1 Inspect the PCV valve for damage or blockage.
	Is the PCV valve spring undamaged and the PCV valve free from blockage? **Yes** TEST the system for normal operation. If the concern persists, REFER to: Engine (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing). **No** CLEAN the PCV oil separator and PCV valve assembly or INSTALL a new intake manifold as necessary. REFER to: Intake Manifold (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation). TEST the system for normal operation.

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Removal and Installation

General Equipment

Worldwide Diagnostic System (WDS)

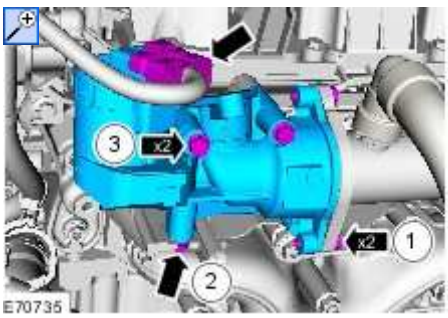
Removal

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

1. Remove the EGR valve tube.

   Refer to: Exhaust Manifold to Exhaust Gas Recirculation (EGR) Valve Tube (303-08D Engine Emission Control - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).



3. NOTE: The gasket is to be reused unless damaged.
   1. *Torque:* 10 Nm
   2. *Torque:* 8 Nm
   3. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.
2. Using the WDS, TOOLBOX/POWERTRAIN/SERVICE FUNCTIONS/RESET KAM, reset the EGR valve.

   General Equipment: Worldwide Diagnostic System (WDS)

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Removal and Installation

General Equipment

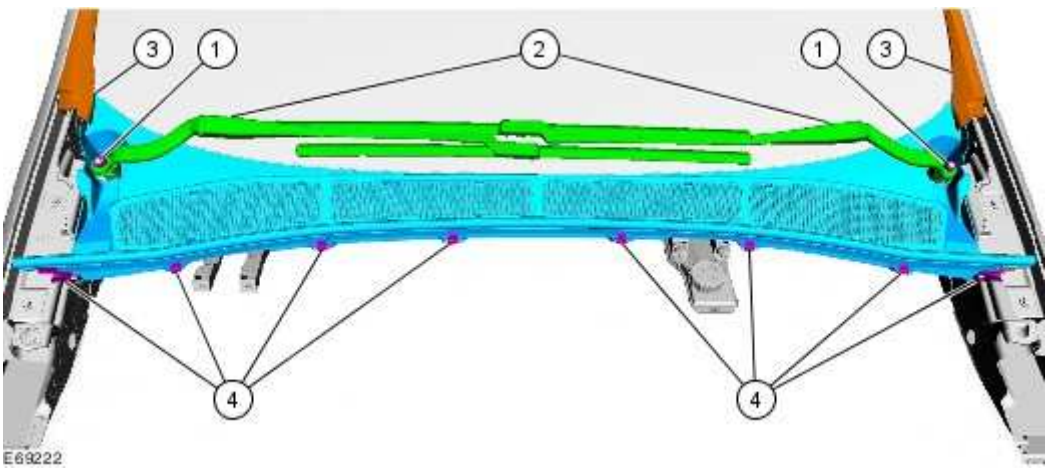
Hose clamp remover/installer

Removal

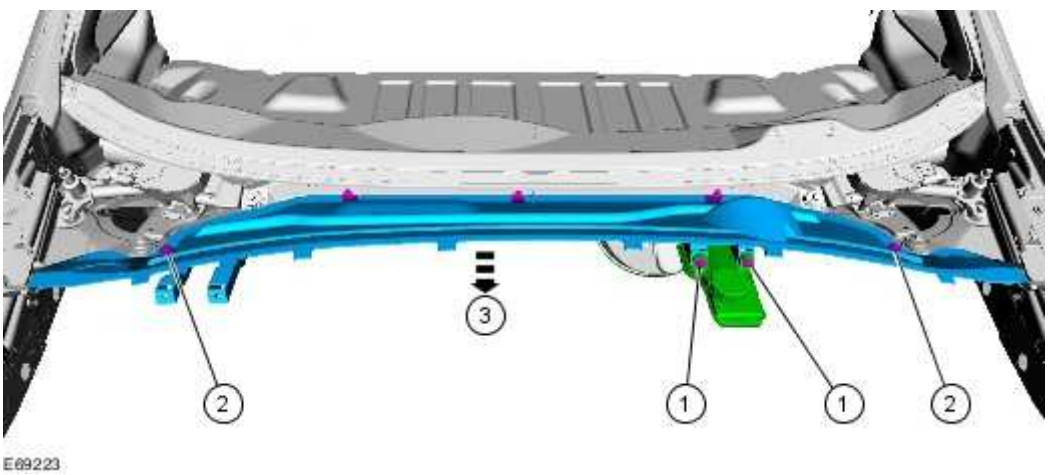
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

   Refer to: Cooling System Draining, Filling and Bleedi (303-03E Engine Cooling - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, General Procedures).



2.
   1. *Torq* 22 N
   3. Deta the A pillar exte trim pane lowe clips



3.
   2. *Torq* 10 N

4. *General Equipment:* Hose clamp remover/installer
   Torque: 10 Nm

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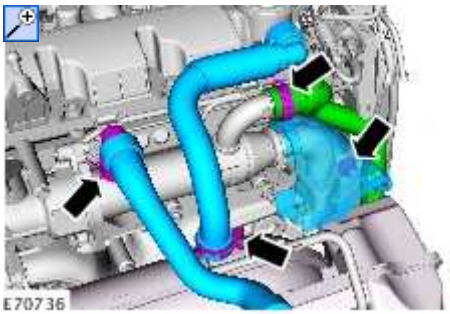

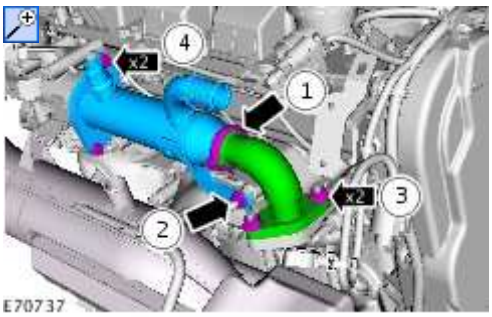

5. NOTE: Note the orientation of the clamp to aid installation.
   NOTE: The gasket is to be reused unless damaged
   1. Discard the clamp.
   2. *Torque:* 30 Nm
   3. *Torque:* 10 Nm
   4. *Torque:* 10 Nm

Installation

1. NOTE: Make sure that a new clamp is installed.
   NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   To install, reverse the removal procedure.

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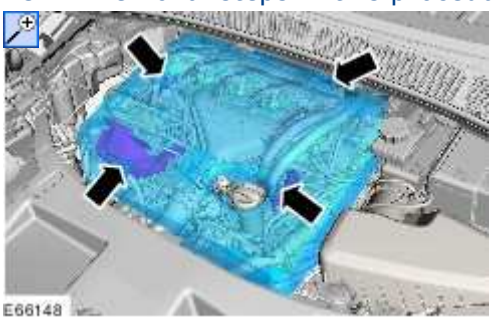
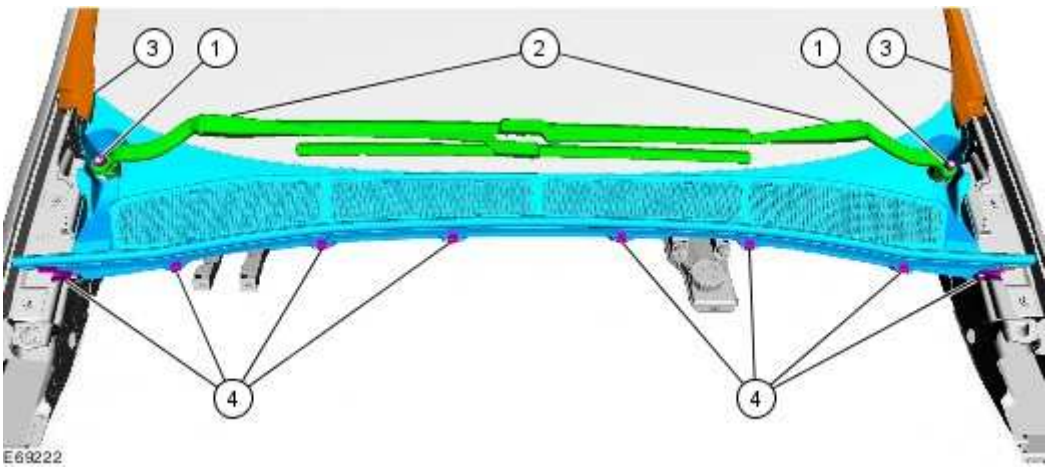
Removal and Installation

Removal

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

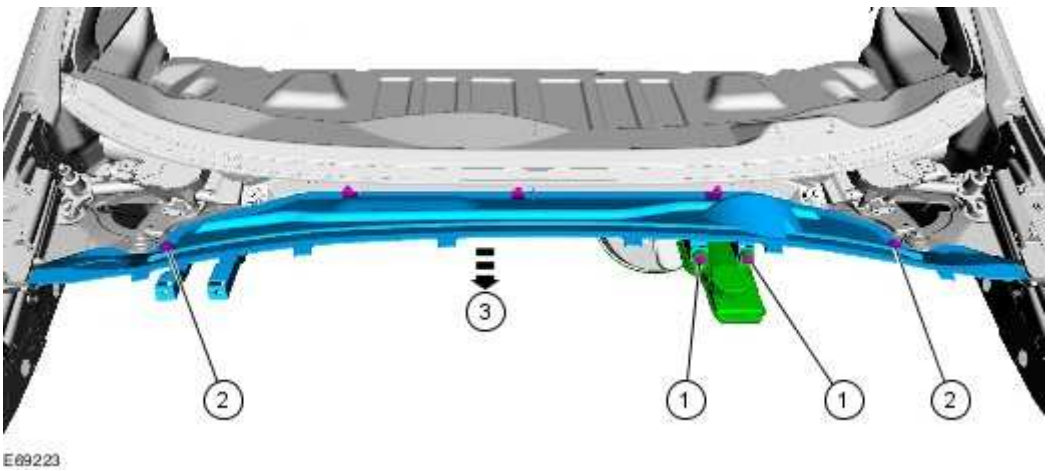


1.



2.

1. *Torq* 22 N
3. Deta the A pillar exte trim pane lowe clips



3.

2. *Torq* 10 N

4. NOTE: Note the orientation of the clamp to aid installation.
   NOTE: The gaskets are to be reused unless damaged.
   1. *Torque:* 5 Nm
   2. *Torque:* 10 Nm
   3. Discard the clamp.

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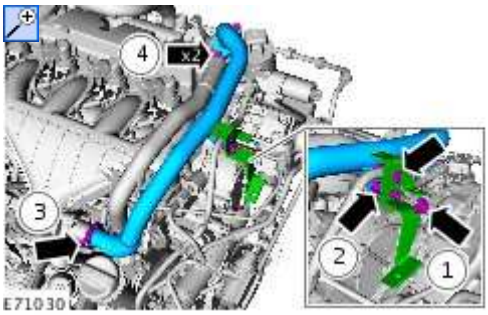

4. *Torque:* 10 Nm

Installation

1. NOTE: Make sure that a new clamp is installed.
   NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   To install, reverse the removal procedure.

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Print

Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Principles of Operation

Exhaust Gas Recirculation (EGR) system

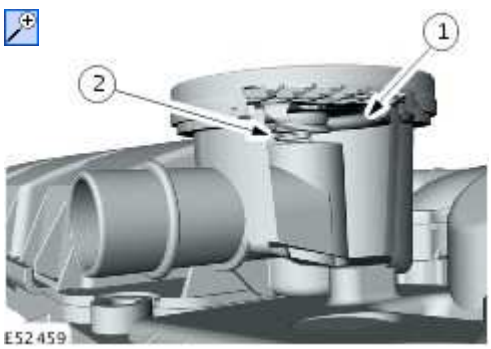
To maintain the standards of low exhaust emission levels required of todays engines, the EGR system on this engine is fully electronically controlled.

The EGR valve is a proportional electric motor controlled directly by a duty-cycle signal from the powertrain control module (PCM). Integrated into the EGR valve is a valve position sensor. The signal from the EGR valve position sensor allows for the precise control of the timing and the quantity of exhaust gas to be recirculated. If the EGR valve becomes inoperative or fails to close completely, the PCM will raise a diagnostic trouble code (DTC) and the instrument cluster malfunction indicator lamp (MIL) will be illuminated. At the end of each drive cycle the PCM drives the EGR valve to the fully open and fully closed positions several times. This assists with cleaning the EGR valve.

If a new EGR valve is installed. The base setting (closed position) value must be configured to the PCM using the Ford approved diagnostic tool. If the base setting is not configured to the PCM, the setting from the previous EGR valve will be used and the control function of the EGR system will be incorrect.

The EGR system is fitted with an EGR cooler. The EGR cooler reduces the temperature of the exhaust gasses being returned to the intake system. By reducing the EGR temperature, the intake air charge density is not adversely affected, so maintaining the optimum fuelling characteristics.

Positive Crankcase Ventilation (PCV) system



Item	Part Number	Description
1	-	PCV valve diaphragm
2	-	PCV valve

The PCV system is made up of a crankcase vent oil separator chamber connected to the crankcase by a hose. The crankcase vent oil separator chamber is an integral part of the intake manifold.

The crankcase pressure is controlled by a diaphragm operated PCV valve built into the crankcase vent oil separator. As the pressure in the crankcase vent oil separator reduces, the diaphragm valve closes against the force of the PCV valve spring, so closing the PCV valve. As the crankcase pressure rises, the PCV valve is pushed open assisted by the PCV valve spring. This allows the positive crankcase gasses to be scavenged by the air intake system.

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Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Exhaust gas recirculation (EGR) valve • EGR tube • EGR cooler • EGR tube clamp • Gasket • PCV hose • Crankcase vent oil separator	• Electrical connector • Wiring harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the DTC Index Chart.
5. **5.** If no DTCs related to the concern are retrieved, proceed to the Symptom Chart to continue diagnosis.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description	Possible Source	Action
P1412	MIL illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart
P0404	MIL illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart
P1335	Powertrain warning indicator illuminated	EGR valve	REFER to Excessive exhaust black smoke in the Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
Excessive exhaust black smoke	* EGR valve.	* Using the Ford approved diagnostic tool, CHECK the PCM calibration. If necessary UPDATE the PCM calibration to the latest level. Using the Ford approved diagnostic tool, TOOLBOX/POWERTRAIN SERVICE FUNCTIONS/COMPONENT OR PARAMETER RESET/EGR RE-CALIBRATION, RESET the EGR valve. Carry out a road test, if the concern persists GO to Pinpoint Test A.
Excessive crankcase pressure	* Blocked or damaged PCV hose(s). * Blocked crankcase vent oil separator.	* GO to Pinpoint Test B.
	* Worn or damaged engine components.	* REFER to: Engine (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).

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Pinpoint Tests

PINPOINT TEST A : EXCESSIVE EXHAUST BLACK SMOKE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE EXHAUST GAS RECIRCULATION VALVE POSITION	
NOTE: Allow the engine to idle for a minimum of four minutes before carrying out the system checks using the Ford approved diagnostic tool.	
NOTE: After the engine is switched off, the EGR valve will attempt the cleaning cycle up to a maximum of 18 times. If 18 cycles are seen during the test the EGR valve is suspect and should be changed.	
	1 Ignition switch in position III.
	2 Using the Ford approved diagnostic tool, DATALOGGER, set the parameters DPFEGR, RPM, EGRDC#.
	3 Set DATALOGGER to RECORD.
	4 Ignition switch in position 0.
	Does the DPFEGR 0 to 5 volt parameter change from a minimum approximate value of 0.9 volts to a maximum approximate value of 4.2 volts for a total of 6 cycles? **Yes** GO to A2. **No** RECORD the DTCs and DATALOGGER freeze frame data. INSTALL a new EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.
A2: CHECK THE EXHAUST GAS RECIRCULATION VALVE FOR DAMAGE	
	1 Remove the EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	2 INSPECT the EGR valve and valve seat for damage or excessive carbon build up. REMOVE the plastic cover on the EGR valve and check the EGR valve cam actuator for free movement.
	Is the EGR valve undamaged and in the closed position and the EGR valve cam actuator free to move? **Yes** To continue diagnostics, REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing). **No** INSTALL a new EGR valve. REFER to: Exhaust Gas Recirculation (EGR) Valve (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : EXCESSIVE CRANKCASE PRESSURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE PCV HOSE FOR BLOCKAGE	
	1 Remove the PCV hose.

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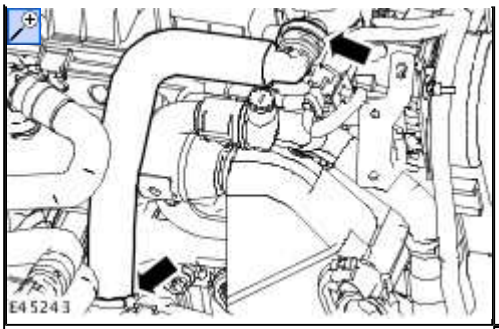
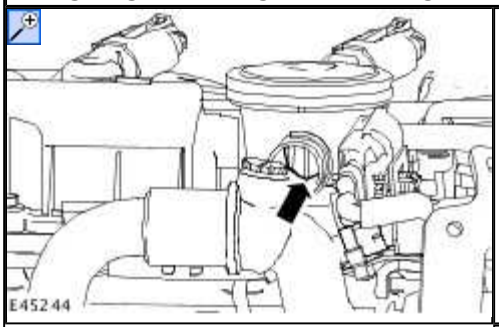


	2 Inspect the PCV hose for blockage.
	Is the PCV hose free from blockage? **Yes** GO to B2. **No** CLEAN or INSTALL a new PCV hose as necessary. TEST the system for normal operation.

B2: CHECK THE PCV VALVE FOR DAMAGE



	1 Inspect the PCV valve for damage or blockage.
	Is the PCV valve spring undamaged and the PCV valve free from blockage? **Yes** TEST the system for normal operation. If the concern persists, REFER to: Engine (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing). **No** CLEAN the crankcase vent oil separator and PCV valve assembly or INSTALL a new intake manifold as necessary. REFER to: Intake Manifold (303-01G Engine - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation). TEST the system for normal operation.

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Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW - Exhaust Gas Recirculation (EGR) Valve	S-MAX/Galaxy 2006.5 (02/2006-)

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Removal and Installation

Removal

1. Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

Installation

1. Refer to: Exhaust Gas Recirculation (EGR) Cooler (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

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Removal and Installation

General Equipment

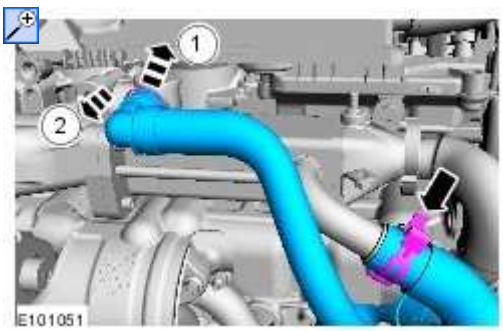
Hose clamp remover/installer

Removal

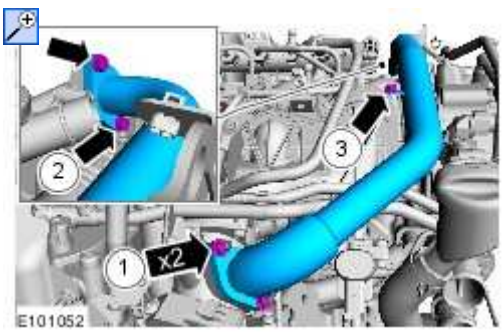
NOTE: Removal steps in this procedure may contain installation details.

1. Drain the cooling system.

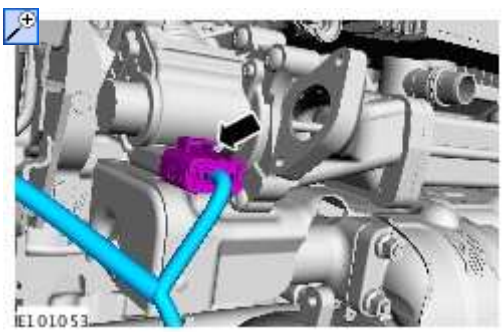
   Refer to: Cooling System Draining, Filling and Bleeding (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



2. *General Equipment:* Hose clamp remover/installer



3. NOTE: Use new seals.
   Torque:
   1 10 Nm
   2 10 Nm
   3 8 Nm



4.

5. *Torque:* 10 Nm

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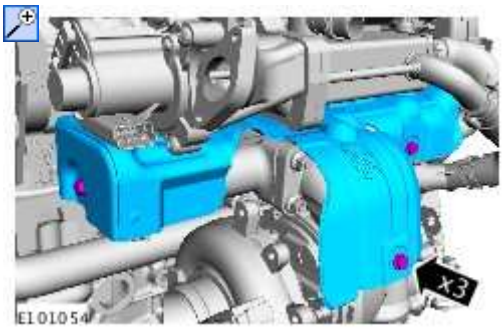
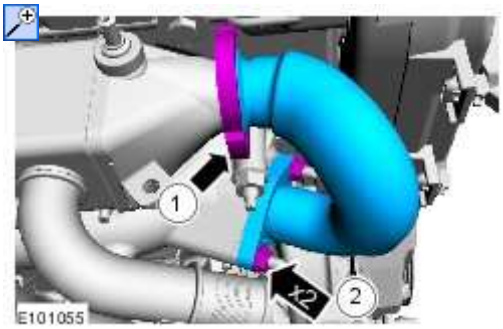
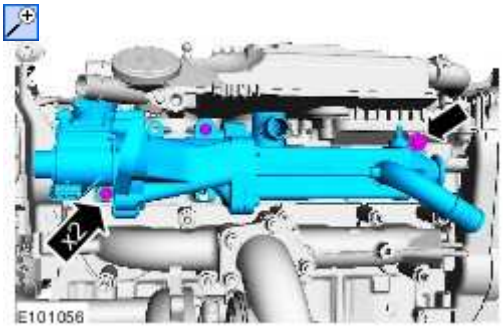
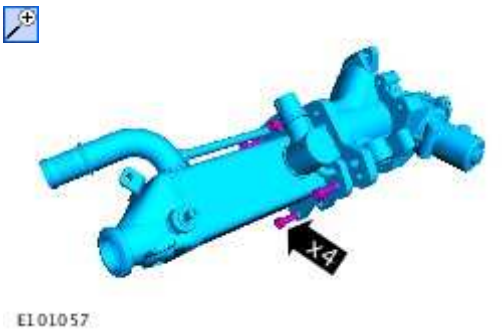




6. NOTE: Use new seals.
   NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   2. *Torque:* 10 Nm



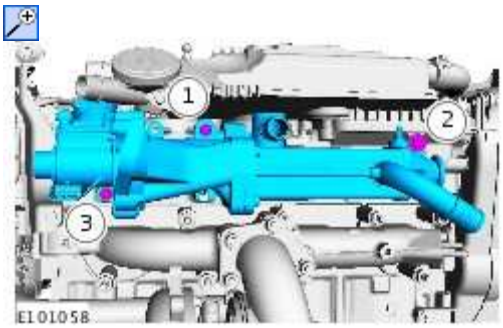
7.



8. NOTE: This step is not necessary when installing a new component.
   Install a new gasket.

   Torque: 10 Nm

Installation



1. To install, reverse the removal procedure.
2.
   1. *Torque:* 10 Nm
   2. *Torque:* 8 Nm
   3. *Torque:* 10 Nm

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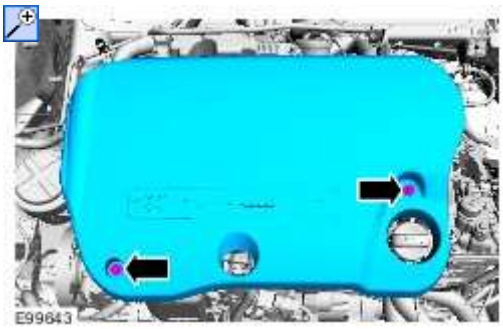
Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW - Exhaust Manifold to Exhaust Gas Recirculation (EGR) Valve Tube	S-MAX/Galaxy 2006.5 (02/2006-)

Print

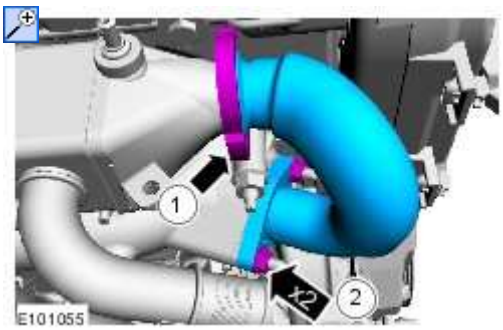
Removal and Installation

Removal

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



1.



2. *Torque:* 10 Nm

Installation

1. NOTE: Make sure that a new clamp is installed.
   NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   To install, reverse the removal procedure.

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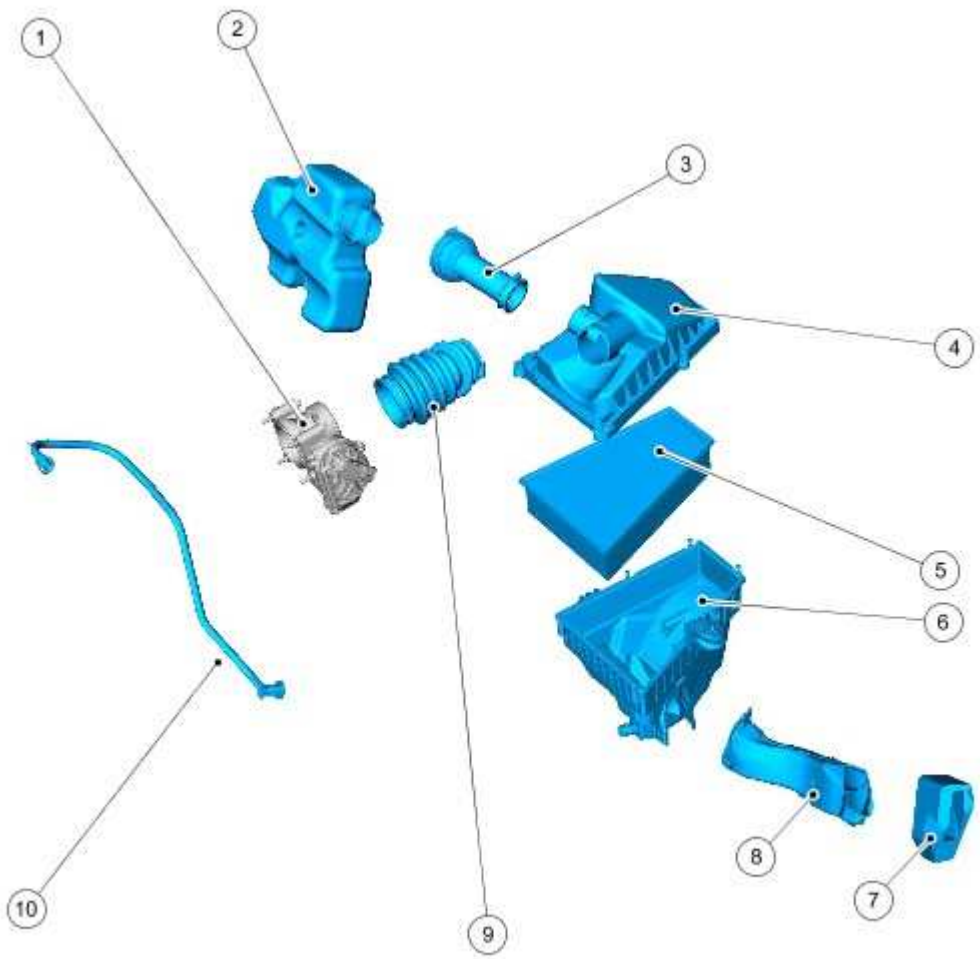
Description and Operation



E64815

Item	Part Number	Description
1	-	Electronic throttle body
2	-	Intake air resonator
3	-	Air cleaner to intake air resonator pipe
4	-	Air cleaner cover
5	-	Air cleaner element
6	-	Air cleaner housing
7	-	Noise, vibration and harshness (NVH) foam
8	-	Air cleaner intake pipe
9	-	Air cleaner outlet pipe
10	-	Positive crankcase ventilation (PCV) hose

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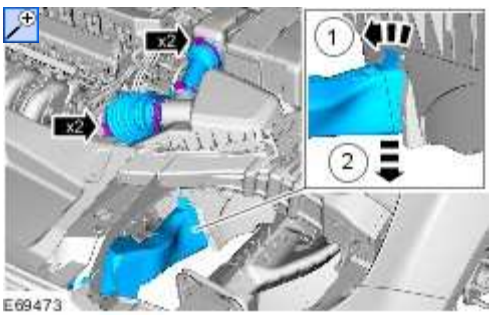
Removal and Installation

Removal

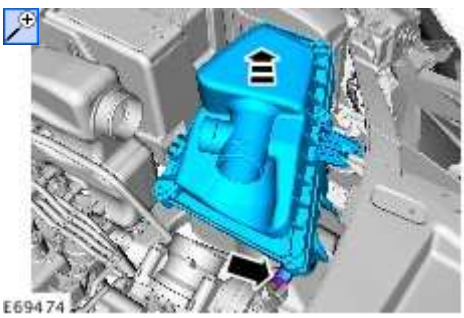
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the left-hand headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



2. *Torque:* 3 Nm



3.

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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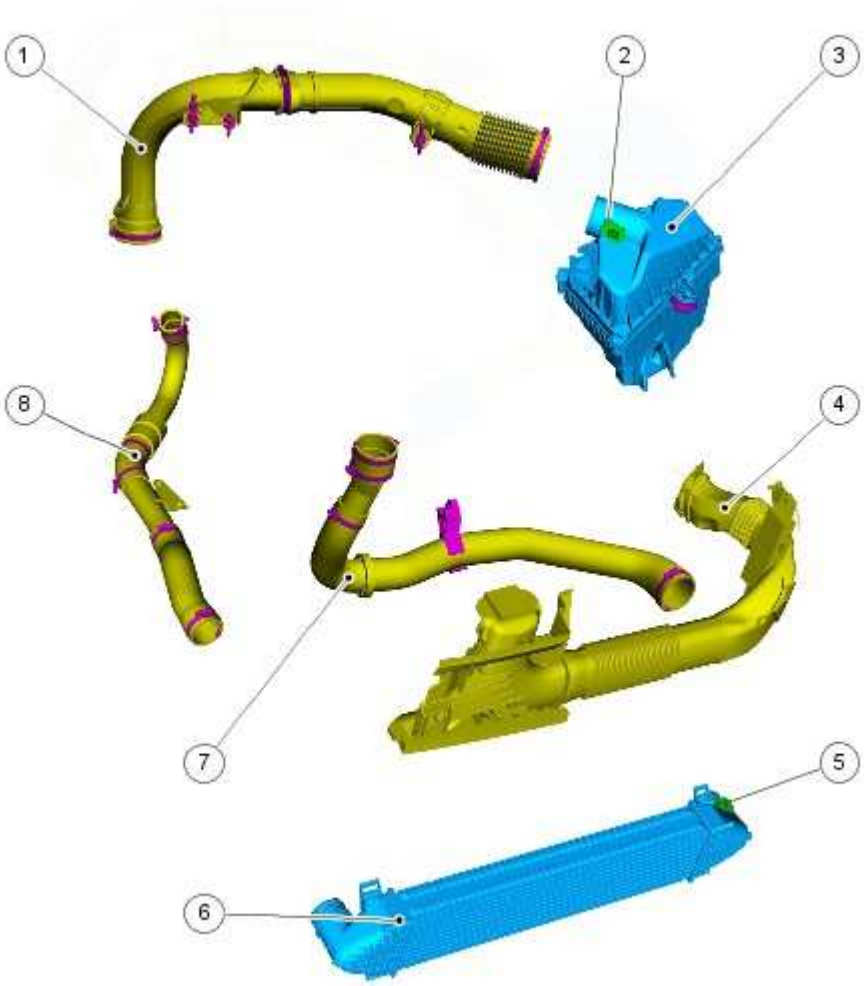
Description and Operation



Item	Description
1	Outlet line, air cleaner
2	The MAF (mass air flow) sensor
3	Air cleaner case
4	Inlet line, air cleaner
5	The MAPT (manifold absolute pressure and temperature) sensor
6	Charge Air Coolers
7	Outlet line, intercooler
8	Inlet line, intercooler

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Removal and Installation

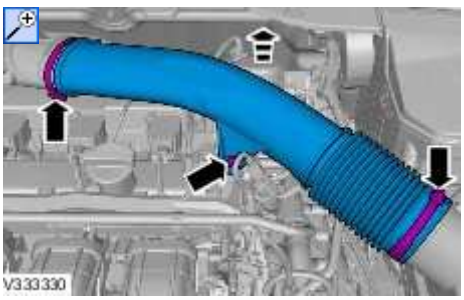
Removal

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

1. Remove the left-hand headlamp assembly.

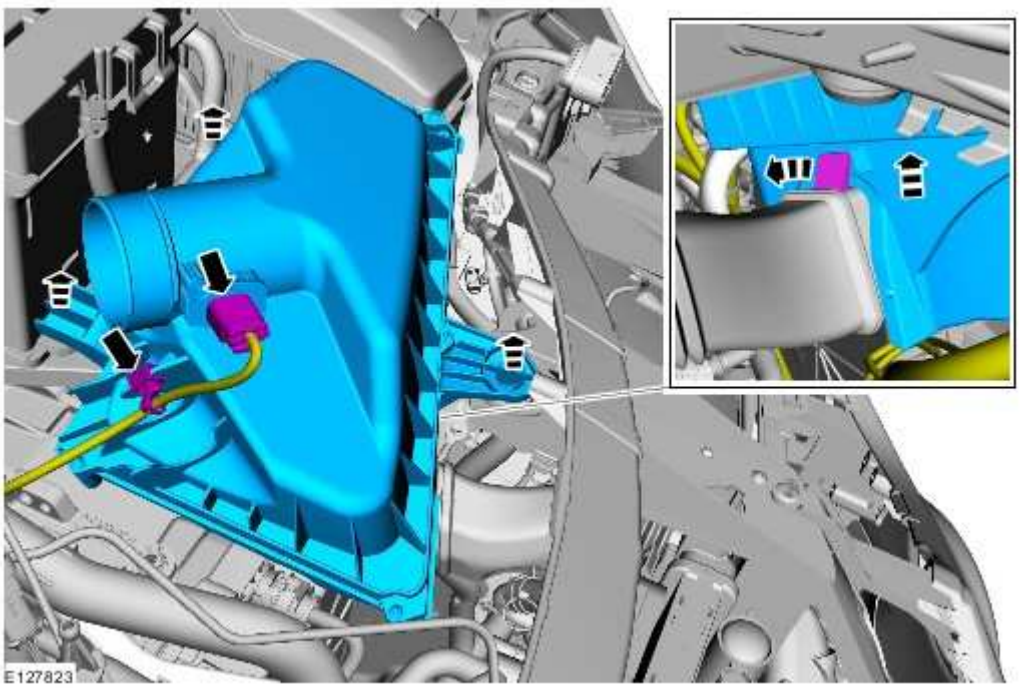
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

2.



3. *Torque:* 10 Nm

4.



Installation

1. To install, reverse the removal procedure.

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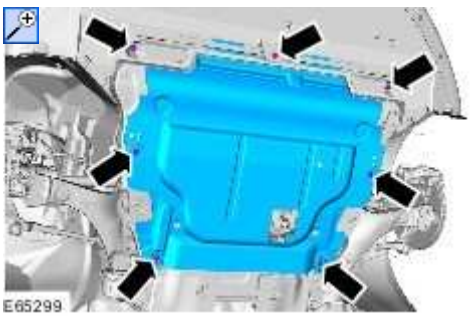
Removal and Installation

Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



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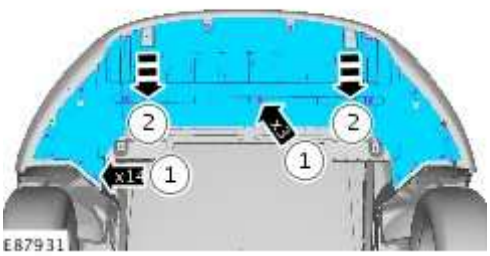

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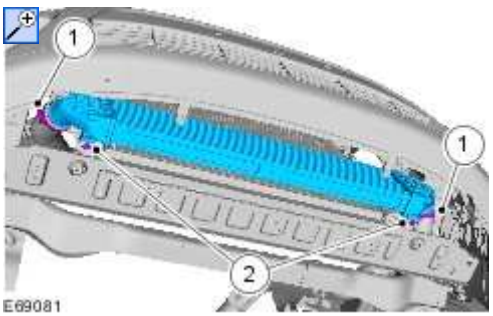

4.
   1. *Torque:* 3 Nm
   2. *Torque:* 5 Nm

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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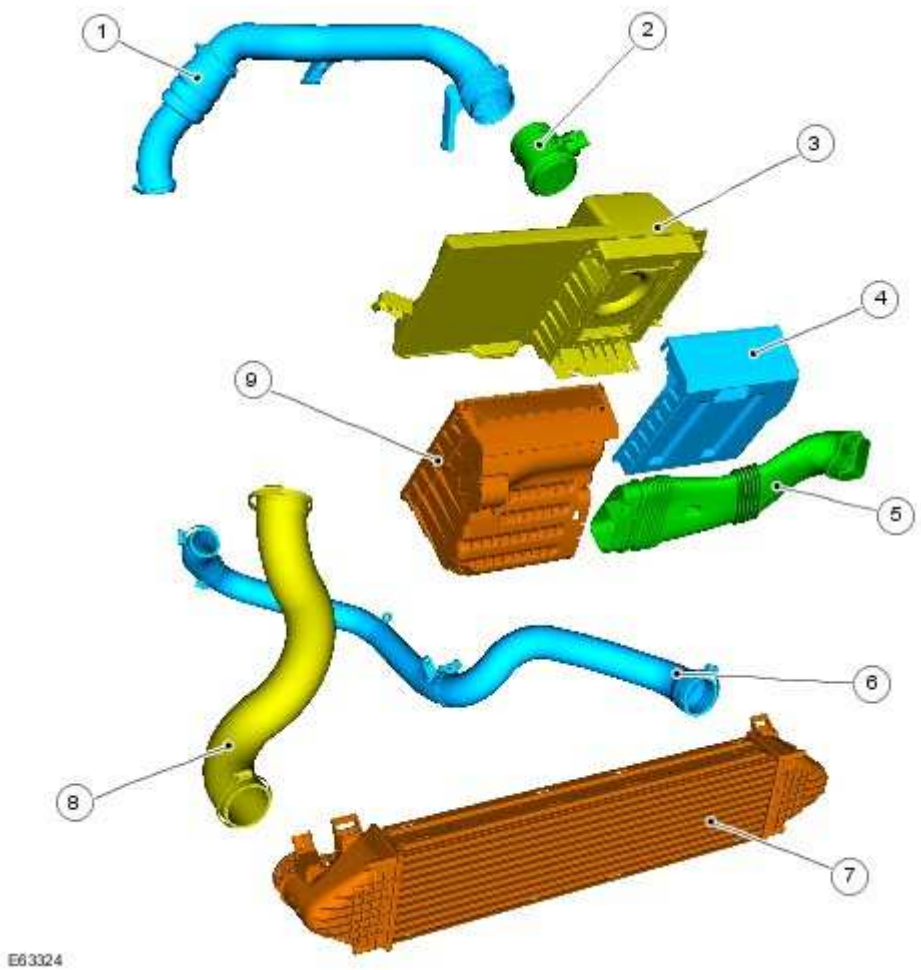
Description and Operation

2.5L Duratec-ST (VI5)



Item	Part Number	Description
1	-	Air cleaner outlet pipe
2	-	Mass air flow (MAF) sensor
3	-	Air cleaner housing
4	-	Powertrain control module (PCM) cover
5	-	Air cleaner intake pipe
6	-	Charge air cooler intake pipe
7	-	Charge air cooler
8	-	Charge air cooler outlet pipe
9	-	Air cleaner element housing

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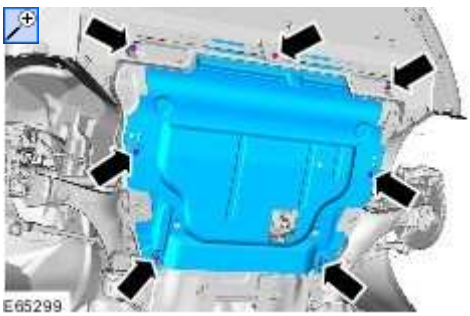
Removal and Installation

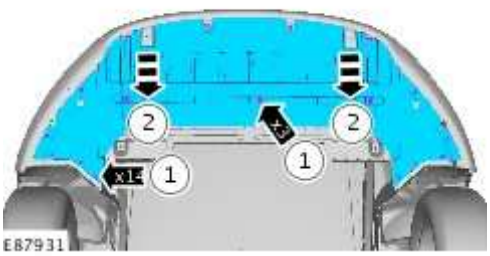
Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2.



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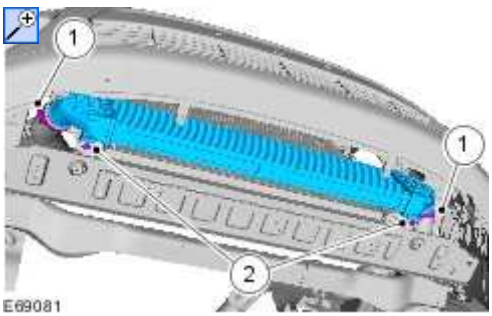

4.
1. *Torque:* 3 Nm
2. *Torque:* 5 Nm

5.

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
To install, reverse the removal procedure.

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Removal and Installation

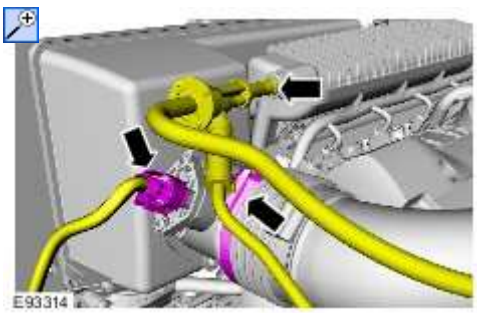
Removal

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

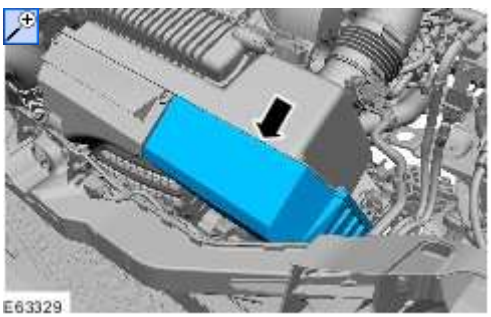
Vehicles built up to 09/2007

1.

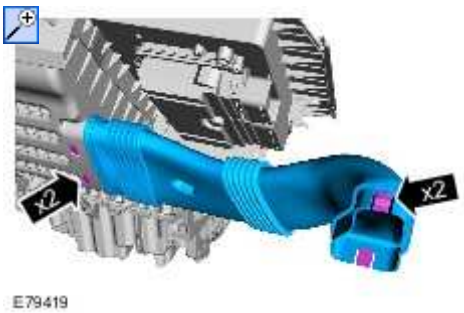
All vehicles



2. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.



3.



4.

Vehicles with PCM security shield

5. *Torque:* 7 Nm

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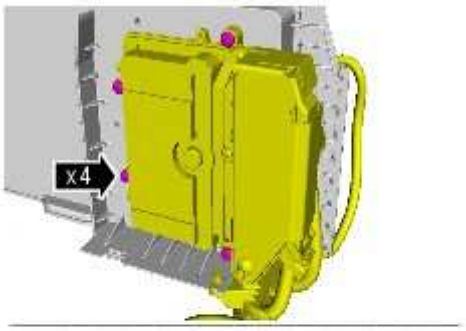
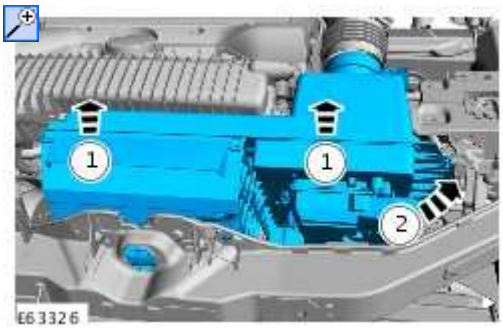
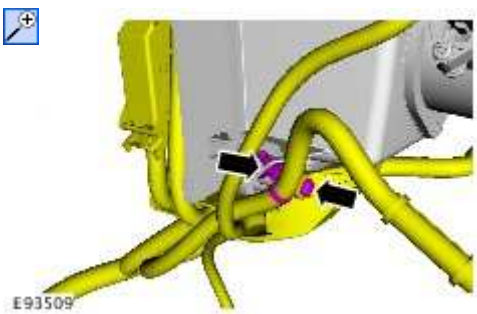


6.

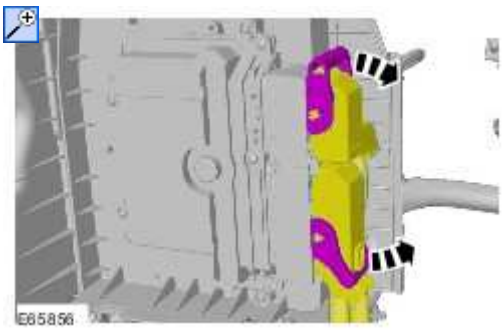


Vehicles without PCM security shield

7.



8.



9.

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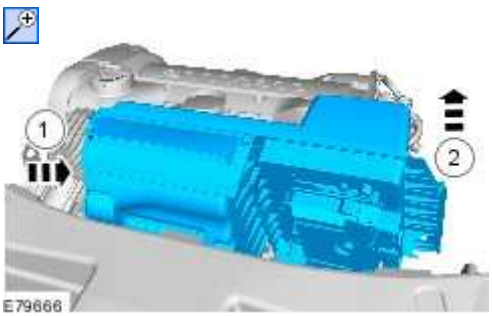

Installation

1. To install, reverse the removal procedure.

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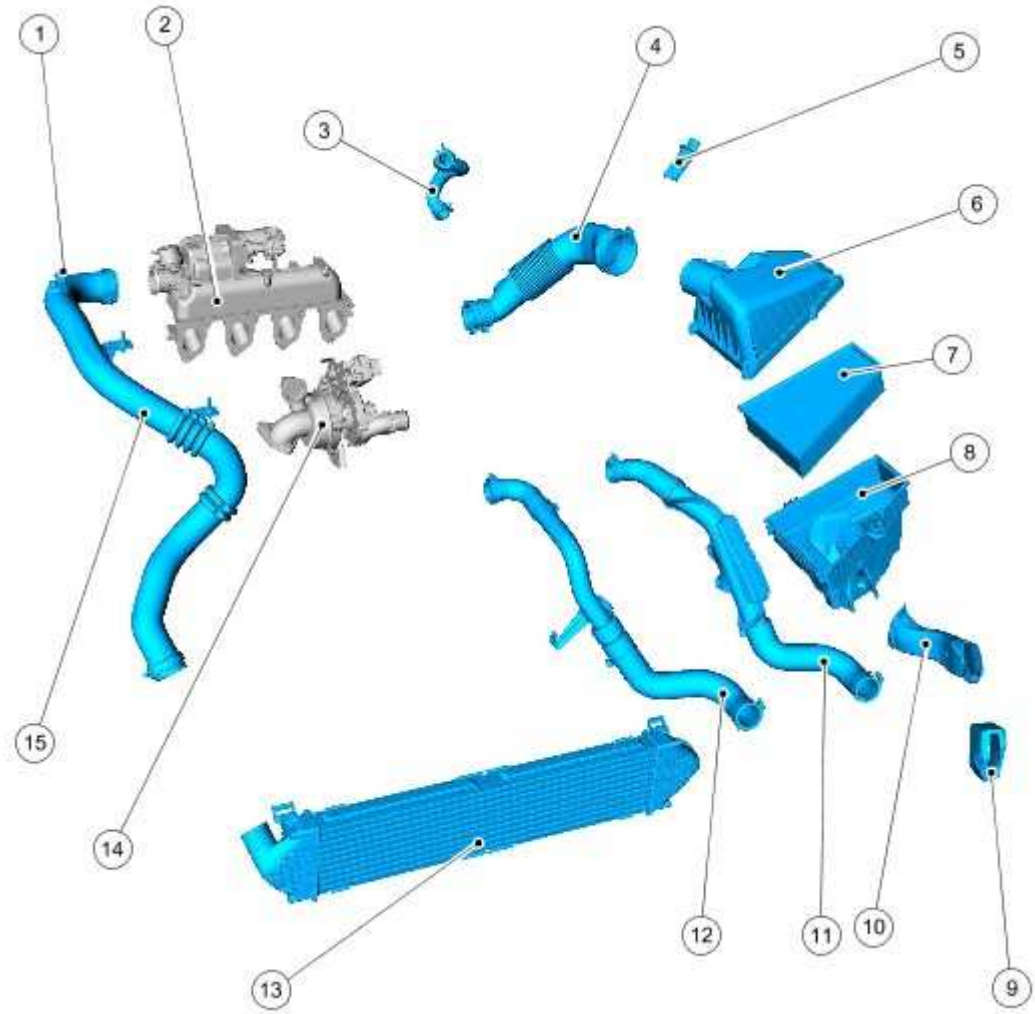
Description and Operation



E64816

Item	Part Number	Description
1	-	Intake air temperature (IAT) sensor
2	-	Intake manifold
3	-	Positive crankcase ventilation (PCV) hose
4	-	Air cleaner outlet pipe
5	-	Mass air flow (MAF) sensor
6	-	Air cleaner cover
7	-	Air cleaner element
8	-	Air cleaner housing
9	-	Noise, vibration and harshness (NVH) foam
10	-	Air cleaner intake pipe
11	-	Charge air cooler intake pipe - vehicles with MTX-75 transaxle
12	-	Charge air cooler intake pipe - vehicles with MMT6 transaxle
	-	

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13			Charge air cooler
	14	-	Turbocharger
15		-	Charge air cooler outlet pipe

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Removal and Installation

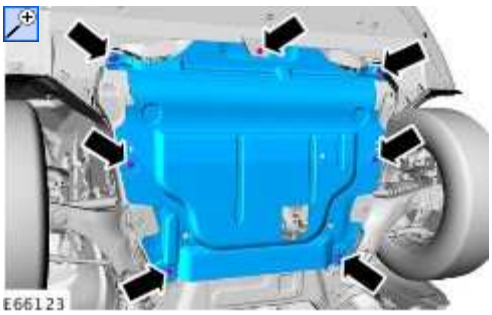
Removal

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

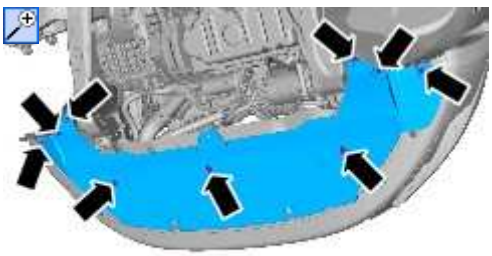
All vehicles

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E66123

2.


E68962

3.

Vehicles with 2.5L engine

E74610

4.

All vehicles

5.
   1. *Torque:* 5 Nm
   2. *Torque:* 5 Nm

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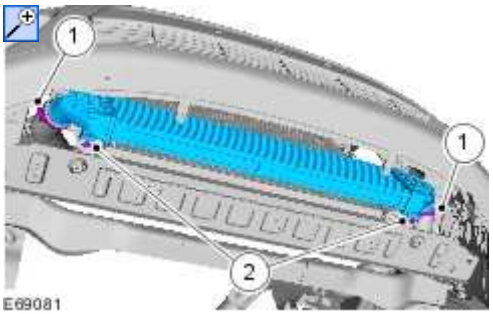

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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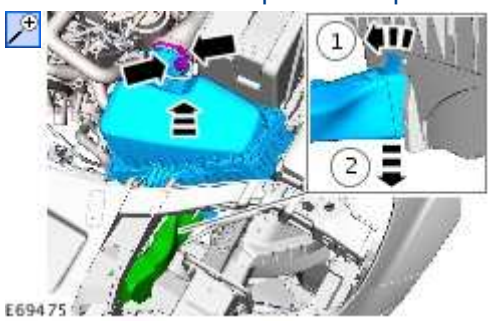
Removal and Installation

Removal

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



1. *Torque:* 3 Nm

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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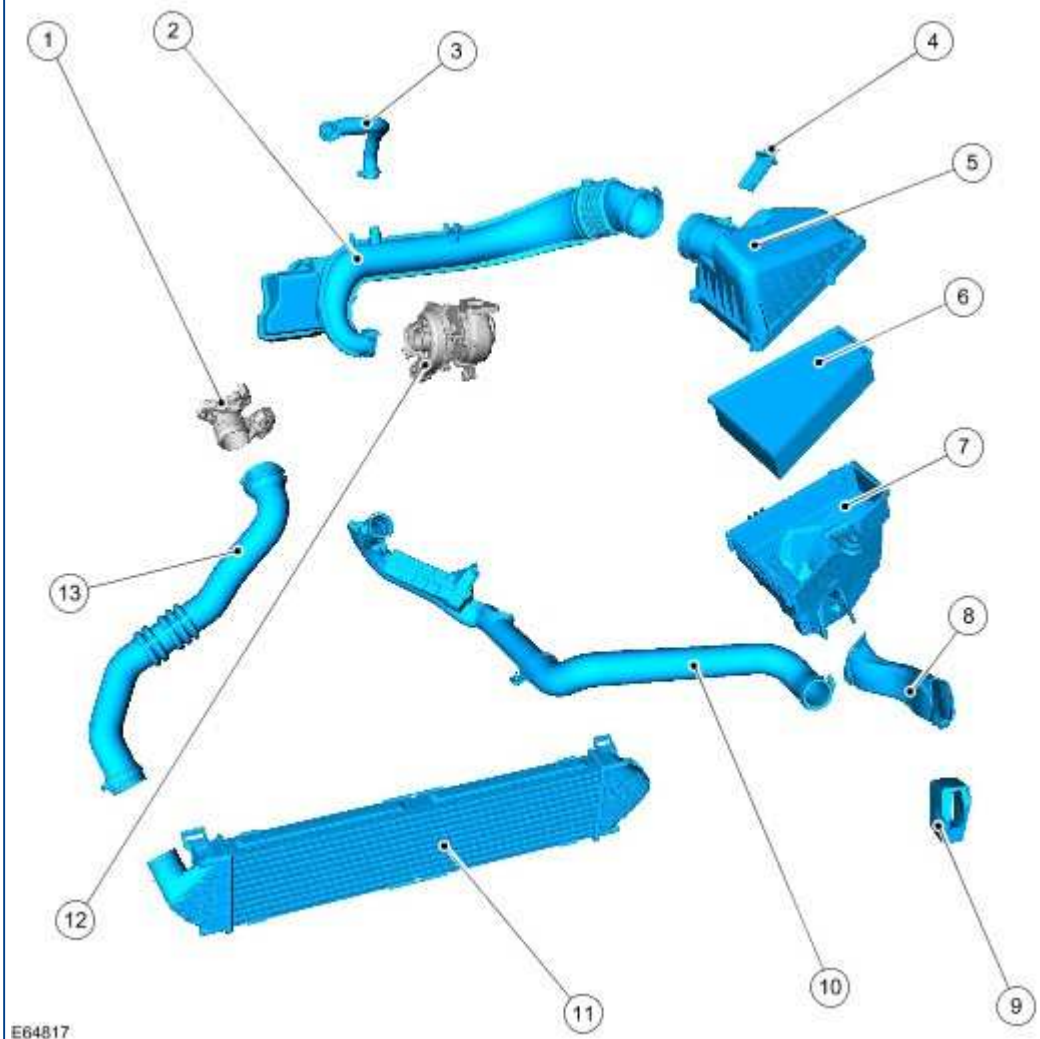
Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V - Intake Air Distribution and Filtering	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Description and Operation



Item	Part Number	Description
1	-	Intake air shutoff throttle
2	-	Air cleaner outlet pipe
3	-	Positive crankcase ventilation (PCV) hose
4	-	Mass air flow (MAF) sensor
5	-	Air cleaner cover
6	-	Air cleaner element
7	-	Air cleaner housing
8	-	Air cleaner intake pipe
9	-	Noise, vibration and harshness (NVH) foam
10	-	Charge air cooler intake pipe
	-	

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11			Charge air cooler
	12	-	Turbocharger
13		-	Charge air cooler outlet pipe

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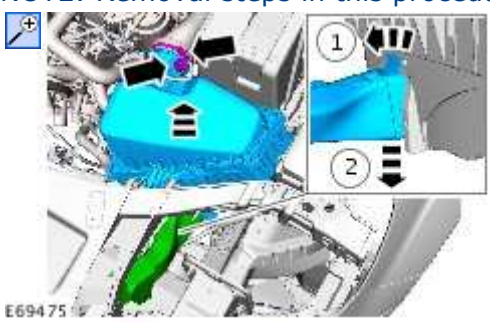
Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V - Air Cleaner	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

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



1. *Torque:* 3 Nm

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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Removal and Installation

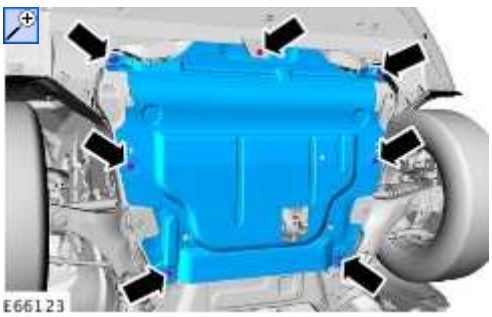
Removal

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

All vehicles

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



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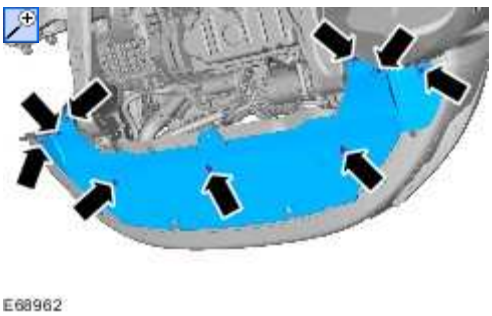

3.

Vehicles with 2.5L engine

4.

All vehicles

5.
   1. *Torque:* 5 Nm
   2. *Torque:* 5 Nm

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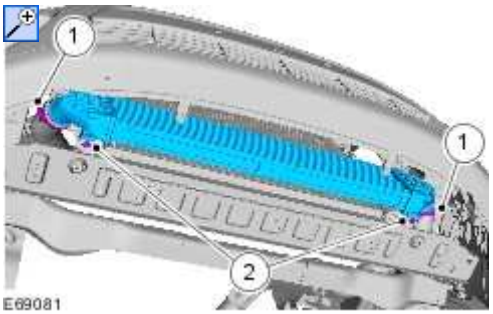

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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Diagnosis and Testing

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Air cleaner element • Air cleaner intake hose • Air cleaner outlet hose • Charge air cooler • Charge air cooler intake hose • Charge air cooler outlet hose	• Mass air flow (MAF) sensor • Manifold absolute pressure (MAP) sensor • Electrical connector(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Excessive intake air noise	* Detached air cleaner hose(s). * Detached turbocharger hose(s). * Detached charge air cooler hose(s).	* CHECK the hose(s) for security and leaks to atmosphere. INSTALL new intake air components as necessary. TEST the system for normal operation.
Oil in the air intake system	* Blocked or damaged positive crankcase ventilation (PCV) valve. * Blocked or damaged PCV pipe(s)/hose(s). * Blocked or damaged crankcase vent oil separator.	* REFER to: Engine Emission Control (303-08E Engine Emission Control - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Diagnosis and Testing).
	* Turbocharger.	* REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
Water in the air cleaner	* Air intake pipe splash shield.	* CHECK the air intake pipe splash shield for correct installation and alignment. REPAIR/INSTALL the air intake pipe splash shield as necessary. TEST the system for normal operation.
	* Blocked air cleaner drain.	* CHECK the air cleaner drain for blockage. TEST the system for normal operation.
Engine lacks	* Air cleaner element	* INSPECT the air cleaner for signs of blockage. INSTALL

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power	blocked.	a new air cleaner element as necessary.
	* Charge air cooler pipe(s).	* INSPECT the charge air cooler pipes for damage. INSTALL a new charge air cooler pipe(s) as necessary.
	* Charge air cooler blocked.	* INSPECT the charge air cooler for blockage. INSTALL a new charge air cooler as necessary. REFER to: Charge Air Cooler (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
	* Fuel charging and controls	* REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Turbocharger.	* REFER to: Turbocharger (303-04J Fuel Charging and Controls - Turbocharger - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).

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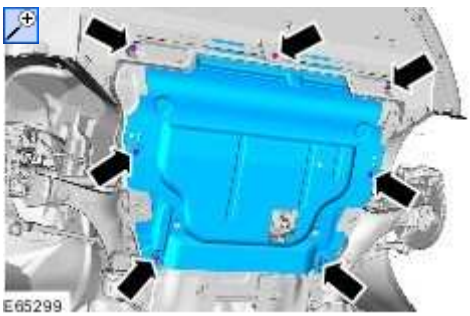
Removal and Installation

Removal

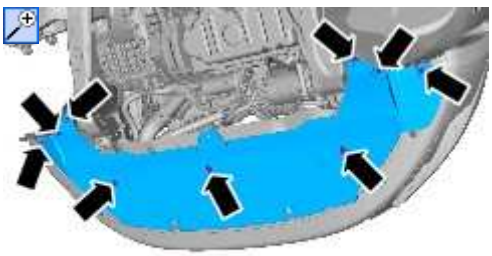
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

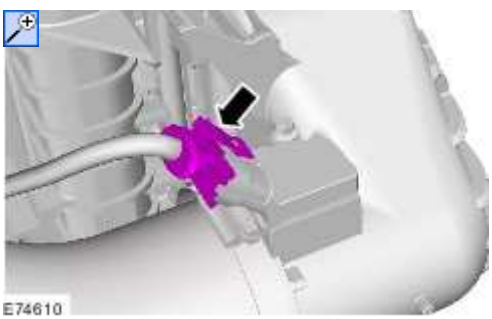

E65299

2.


E68962

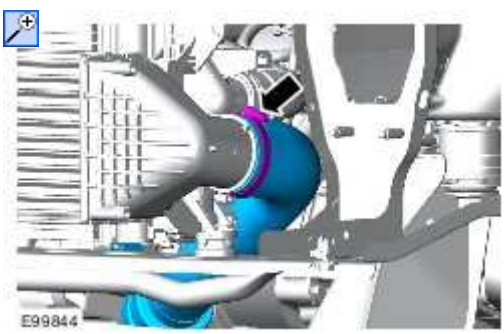
3.

Vehicles with 2.5L engine


E74610

4.

All vehicles


E99844

5. *Torque:* 4 Nm

6. *Torque:* 4 Nm

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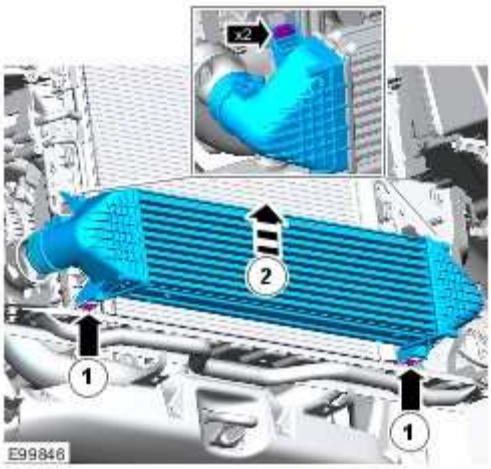
7.



Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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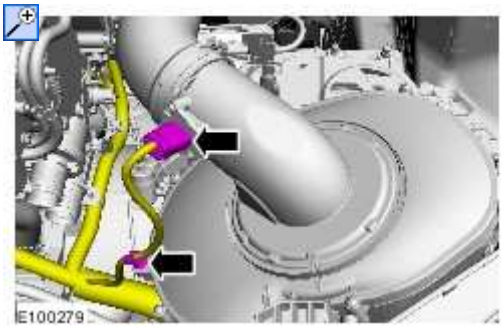
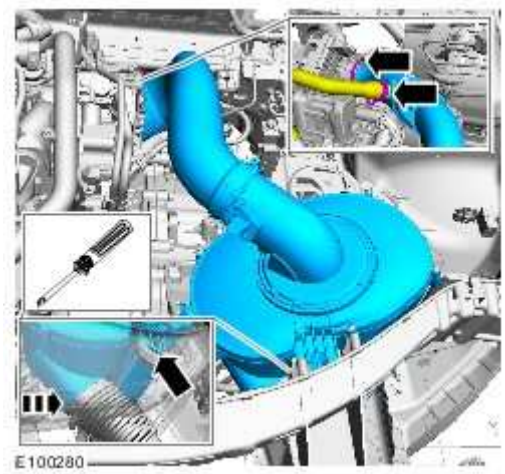
Removal and Installation

Removal

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



1.



2. *Torque:* 3 Nm

Installation

1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   To install, reverse the removal procedure.

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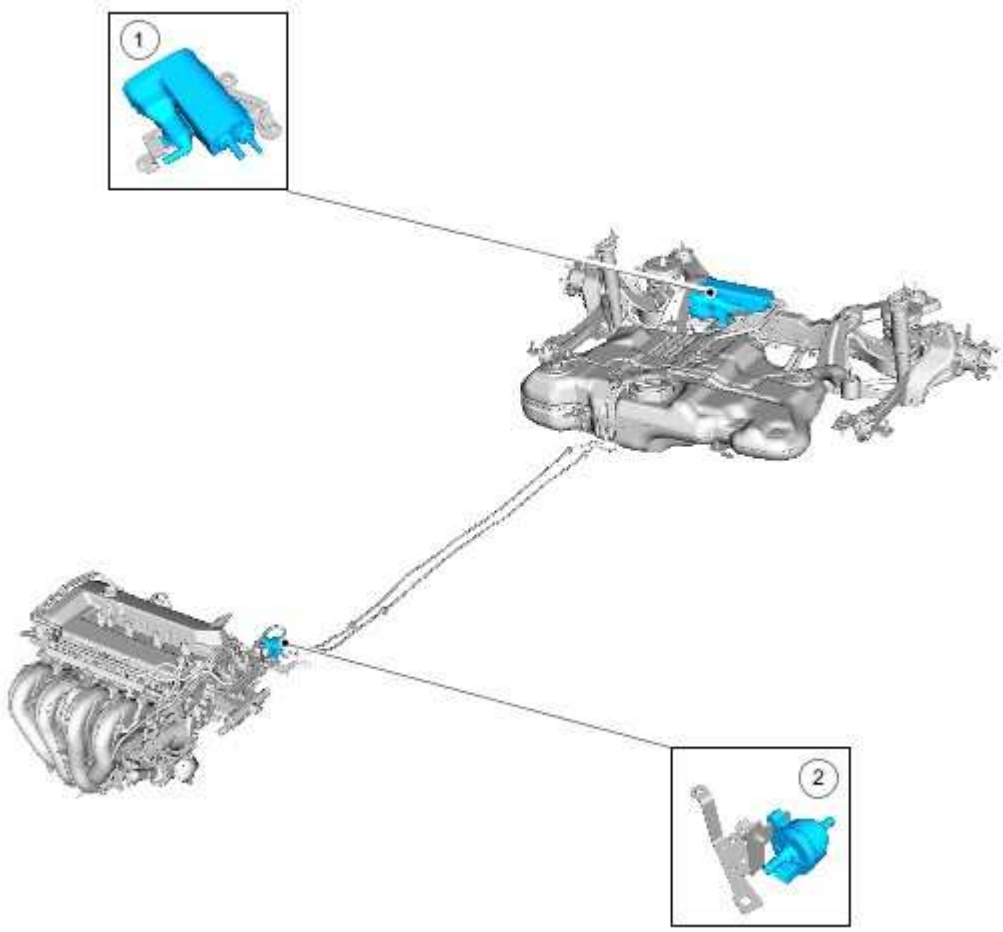
Description and Operation



E64484

Item	Part Number	Description
1	-	Evaporative emission canister
2	-	Evaporative emission canister purge valve

The evaporative emission system consists of an evaporative emission canister and an evaporative emission canister purge valve. A combination of plastic lines and rubber hoses connect the evaporative emission canister to the fuel tank and the evaporative emission canister purge valve. The evaporative emission canister purge valve is also connected to the intake manifold.

When the evaporative emission canister purge valve is closed, the fuel tank is vented into the evaporative emission canister through the fuel tank vent valves and the fill limit vent valve. The evaporative emission canister absorbs the fuel vapor and prevents the release of hydrocarbons into the atmosphere. When the evaporative emission canister purge valve is opened, the evaporative emission canister is exposed to the intake manifold vacuum and the fuel vapor deposits are drawn into the manifold where they mix with the incoming air/fuel charge.

The evaporative emission canister purge valve is controlled by the powertrain control module (PCM) in relation to the driving characteristics of the vehicle.

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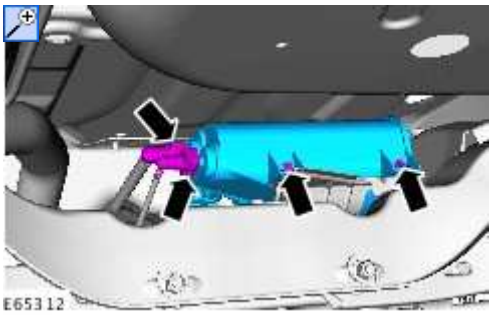
Removal and Installation

Removal

WARNING: Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

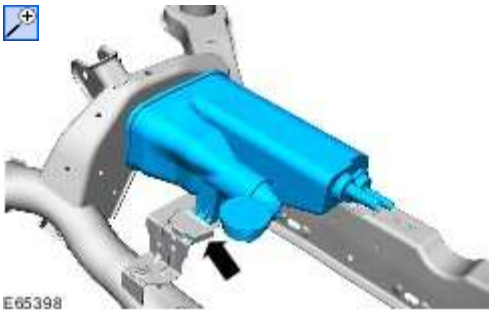
1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
   Torque: 10 Nm

Installation



1. NOTE: Use soap solution to aid installation.

2. To install, reverse the removal procedure.

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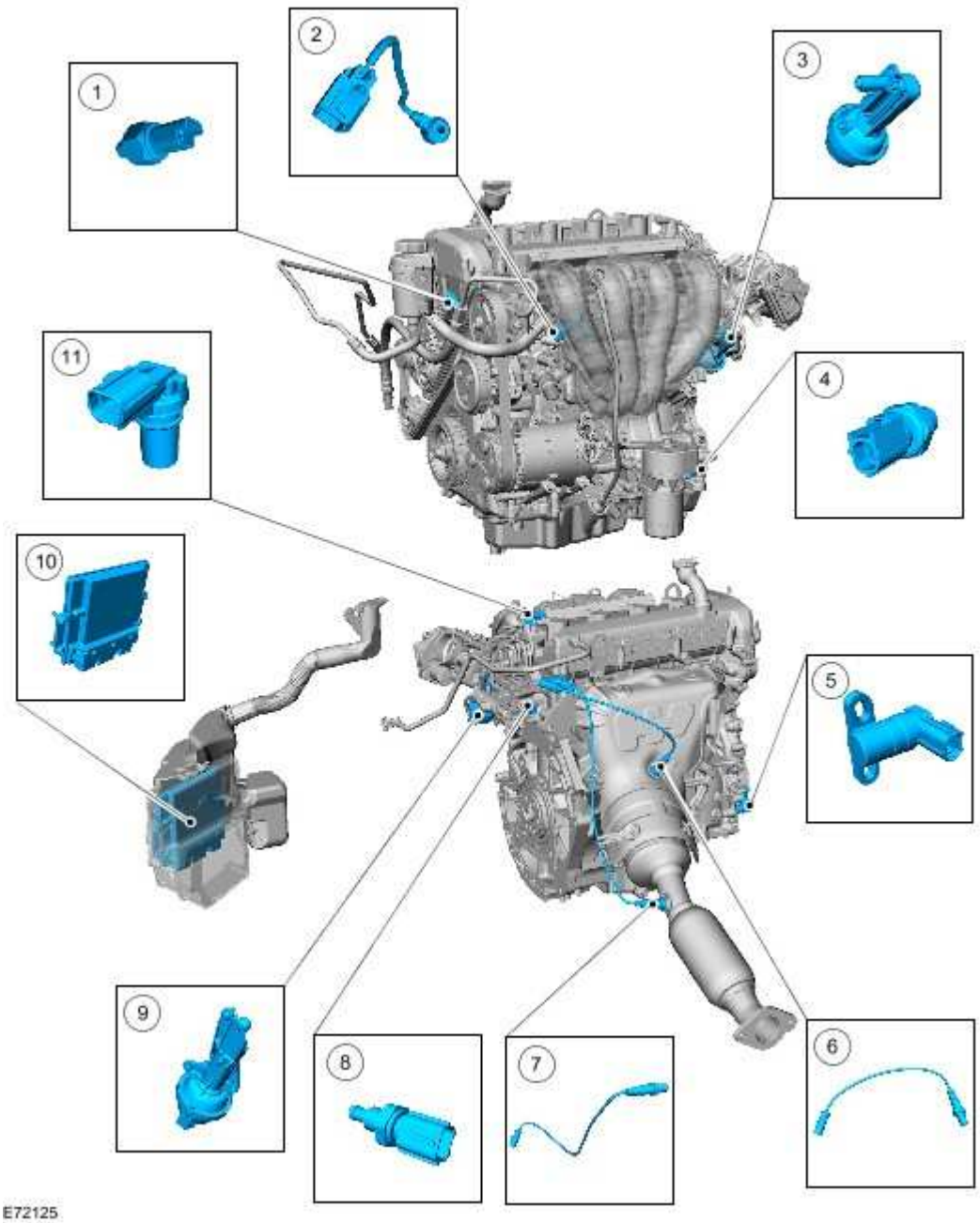
Description and Operation

General overview



Item	Part Number	Description
1	-	Power steering pressure (PSP) switch
2	-	Knock sensor (KS)
3	-	Intake manifold runner control (IMRC) actuator
4	-	Engine oil pressure (EOP) sensor
5	-	Crankshaft position (CKP) sensor
	-	

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6			Heated oxygen sensor (HO2S)
	7	-	Catalyst monitor sensor
8		-	Engine coolant temperature (ECT) sensor
9		-	Intake manifold tuning (IMT) valve
10		-	Powertrain control module (PCM)
11		-	Camshaft position (CMP) sensor

Components

PSP switch

E65161

The PSP switch is located in the power steering line.

The PSP switch registers pressure in the line between the power steering pump and steering gear. This switch opens on reaching a defined pressure.

KS

E65157

In conjunction with the PCM, the KS monitors the combustion process and regulates the injection period so that predetermined volumes of fuel are injected into the cylinders at every operating cycle.

By constantly measuring the amount of knock present and adjusting the injection period, the emission values of the engine remain stable.

IMRC actuator

E65155

The IMRC meters the amount of air flow air velocity in the intake manifold. At low engine speeds the IMRC is fully closed, keeping air flow velocity high, while at low volume. As the

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engine speed increases, the IMRC opens to allow for more air to enter the intake manifold.

EOP sensor

E65159

The EOP sensor is located in the oil filter housing. The EOP is connected to the instrument cluster and is not directly part of the electronic engine control system. The EOP sensor registers engine oil pressure. The sensor opens when a defined oil pressure is reached and the engine oil pressure warning light is illuminated on the instrument cluster.

CKP sensor

E65151

The CKP sensor is an inductive pulse generator which scans 36-1 cast protrusions on the flywheel. Minus one means that one of the cast protrusions is missing and this gap is located at 90 degrees before top dead centre. This gap is used by the PCM as a reference for crankshaft position.

The CKP sensor uses the Hall effect principle.

HO2S

E65154

The HO2S is a linear characteristic type sensor, installed forward of the catalytic converter. The PCM uses this as it's primary sensor to measure the oxygen content of the exhaust gasses within the exhaust system to provide closed-loop fuelling control.

Catalyst monitor sensor

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E65150

The catalyst monitor sensor is a non-linear characteristic type sensor fitted to the catalytic converter. The PCM uses this as it's secondary sensor to measure the oxygen content of the exhaust system gasses within the exhaust after they have passed through the catalytic converter. As well as providing additional closed-loop fuelling control, the PCM uses this information to determine the efficiency of the catalytic converter.

ECT sensor

E65153

The ECT sensor is screwed directly into the coolant outlet connector and measures the temperature of the engine coolant rather than the cylinder head temperature. This is a more accurate measurement of the engine temperature and the information is used by the instrument cluster for the temperature gauge indication. It is also used by the PCM to calculate fuel injection timing and period of injection which will vary dependant on the engine temperature.

IMT valve

E65156

The IMT valve controls the position of the swirl plates located in the intake manifold.

The IMT valve is controlled by a vacuum operated solenoid which is located on top of the intake manifold. The IMT valve is adjusted by the solenoid to the desired settings determined by the PCM.

PCM

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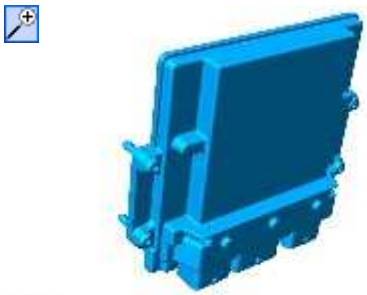
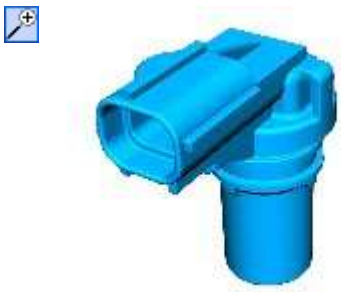


E65160

The PCM is attached to the windshield washer reservoir.

The PCM can be diagnosed through the data link connector (DLC) using the Worldwide Diagnostic System (WDS).

CMP sensor



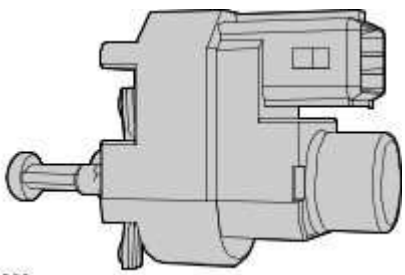
E65152

The CMP sensor uses the Hall effect principle and is supplied with a reference voltage of 5 volts.

If the signal from the CMP sensor fails while the engine is running, the engine continues to run using the signals from the CKP sensor.

If the CMP signal is missing at the next starting operation, it will not be possible to start the engine.

Brake pedal position (BPP) switch and brake light switch



E43363

The BPP switch is connected to the instrument cluster through the CAN bus.

The BPP switch is closed when de-energized and sends a ground signal to the PCM.

The brake light switch is connected with the PCM through a conventional electrical connector.

The brake light switch is open when de-energized. When the brake light switch is closed, it sends 12 volts to the PCM.

The signals of the BPP switch and the brake light switch are used if the accelerator pedal position (APP) sensor should fail.

In this instance, the PCM compares the signals of the BPP switch and brake light switch.

Accelerator pedal position (APP) sensor

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E43365

The APP sensor is a double contact-less inductive sensor.

For safety reasons, the APP sensor consists of two sensors.

If the APP sensor malfunctions when the vehicle is in operation, a diagnostic trouble code (DTC) will be stored in the PCM.

If one of the sensors in the APP sensor should fail, the engine will operate at reduced power.

If the vehicle is fitted with a driver information system, the fault message "REDUCED ACCELERATION" will be displayed.

If both sensors of the APP switch fail, after a single operation of the BPP switch and the brake light switch and then after a plausibility check, the engine is controlled up to a speed of 1200 RPM. The vehicle can be accelerated to a maximum speed of 56 km/h (35 mph).

When the BPP switch and the brake light switch are actuated again, engine speed will drop to idle speed. Once the BPP switch and the brake light switch are de-energized again, engine speed is increased again.

If the vehicle is fitted with an information and message system, the fault message "REDUCED TOP SPEED" will be displayed.

If the vehicle is not fitted with an information and message system, the malfunction indicator lamp (MIL) will be illuminated to indicate a system fault.

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Electronic Engine Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 - Electronic Engine Controls—Vehicles With: Ethanol Capability - Overview	S-MAX/Galaxy 2006.5 (02/2006-)

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Description and Operation

As a general rule, engine management works according to the same principles as for petrol operation. The PCM (powertrain control module), the sensors and the actuators are the same for petrol and for ethanol operation E85. For vehicles operated with ethanol, however, a fuel type determination and adaptation function is activated. This determines the fuel composition and adapts the control mode accordingly.

Fuel type determination

The mixture of fuel in the tank can vary from an ethanol share of 0% to 85%. This ethanol share is important for the engine management, as it has a strong influence on the engine running characteristics and the exhaust gas emissions. To determine the ethanol share in the fuel, the HO2S (heated oxygen sensor) and the fuel level sensor are used.

Adaptation for ethanol operation

The optimal fuel-air mixture for ethanol fuel E85 is 9.7 kg air per 1 kg E85. For petrol, the optimal fuel-air mixture is 14.5 kg air per 1 kg petrol. Ethanol operation therefore requires a richer mixture. To achieve this, injectors with a higher flow rate are used. In addition, the ignition time is "advanced", as the speed of transmission of the flame front of ethanol fuel E85 is lower.

The requirements for petrol and ethanol operation are very different, which is why special characteristics maps have been saved in the PCM for both fuel types.

Errors during fuel type determination and adaptation can have a significant influence on fuel consumption and the engine running characteristics. If a leak upstream of the HO2S causes the engine management to change the control mode to ethanol operation, the spark plugs may fail due to an excessive fuel supply and the engine will not run satisfactorily in the cold state. If the engine management switches to petrol during ethanol operation, the engine will run irregularly or will not start.

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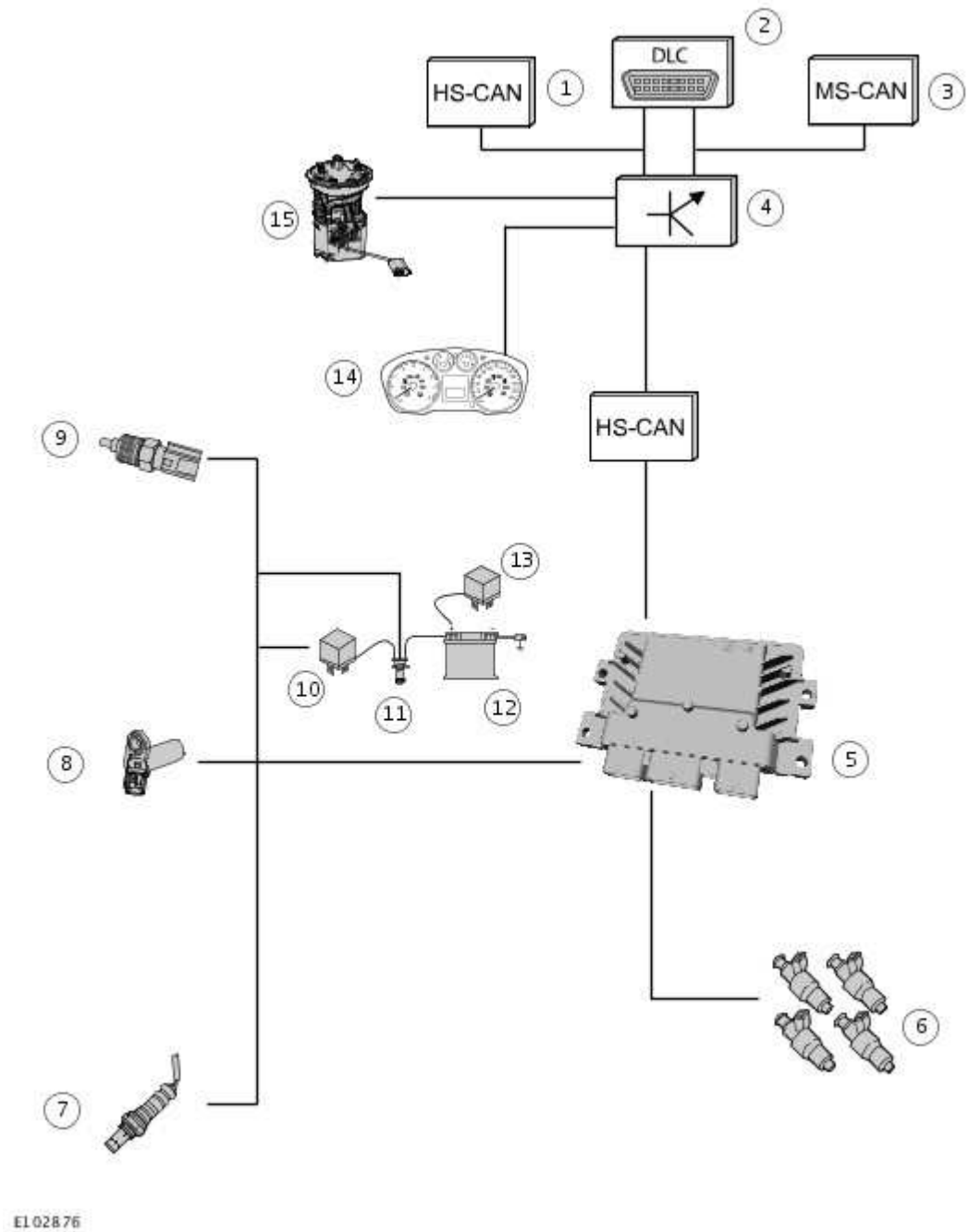
Description and Operation

Control Diagram

NOTE: This description only deals with components relevant to ethanol operation or modified components.



Item	Description
1	High speed CAN (controller area network)

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2	DLC (data link connector)
3	Medium speed CAN
4	GEM (generic electronic module)
5	PCM (powertrain control module)
6	injectors
7	HO2S (heated oxygen sensor)
8	CKP (crankshaft position)
9	ECT (engine coolant temperature)
10	Starter Relay
11	Ignition lock
12	PCM relay
13	Battery
14	Instrument cluster
15	Fuel pump driver module **Comments:** Of which the following are relevant here: Float arm, resistor board Refer to: Fuel Tank and Lines - 2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Vehicles With: Ethanol Capability (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Description and Operation).
16	Instrument cluster

System Operation

Fuel type determination and adaptation

The crucial factor for optimal adaptation of the fuel-air mixture is knowledge of the fuel composition in the fuel tank. To determine the ethanol share in the fuel, the HO2S signal and the fuel level sensor are used. A corresponding algorithm in the PCM calculates the fuel composition from these.

The following prerequisites must be fulfilled for fuel type determination:

- The fuel level must be increased by at least 10 liters if the fuel level sensor has reported that the fuel tank is empty.
- The fuel level must be increased by at least 5 liters if the fuel tank is partially full.
- Approximately 0.1 liters of fuel must have been consumed since refueling
- Engine management is working in a closed loop (Lambda control is active). This requires an engine temperature of approximately 30 to 40°C
- The engine load is in the range between idling and full load (provided no fuel enrichment is carried out to protect the catalyst)
- No error codes are saved in the PCM

The following events can trigger a fuel type determination:

- a sufficient increase in the fuel level in the fuel tank
- an empty fuel tank or very low fuel level after prolonged standstill of the vehicle or starting of the engine
- programming of the PCM

As the fuel level rises, the float arm of the fuel level sensor rises and changes the sensing position on the resistance track of the resistor board. The resistor board transfers the resulting drop in voltage to the GEM via direct wiring. The GEM sends this value to the CAN via PCM. When the above conditions for fuel type determination have been met, the PCM

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begins the fuel type determination.

Fuel type determination is carried out on the basis of the fuel type and the fuel level saved before refueling. The PCM compares the previous fuel level with the new fuel level and calculates the quantity of fuel topped up. With this information, the PCM calculates in advance which new fuel types could result if either petrol or ethanol E85 were added to the tank. With this advance calculation, the PCM can adapt the fuel injection and ignition angle more quickly.

After being started, the engine is managed based on the fuel type saved before topping up, until around 0.1 liters of fuel have been consumed. This ensures that the fuel determination only begins when new fuel is already being used. The starting point for the fuel type determination is the average of the two pre-calculated new fuel types. If the same fuel has been added, the HO2S will send a Lambda value fluctuating around 1. If a different fuel type has been added, the HO2S sends a Lambda value greater or less than 1. If the Lambda value is greater than 1, this means that ethanol E85 was added. Otherwise, petrol has been added. As soon as the PCM detects the direction of the Lambda value, it switches the engine management to the relevant settings for the two pre-calculated fuel types. When approximately 0.4 liters of fuel have been consumed, the fuel type can be confirmed and saved. However, the fuel type is only saved if the Lambda value fluctuates within a predefined range around 1 for a predefined period and air quantity.

Once the pre-calculated fuel type has been confirmed and saved, more accurate fuel type determination and adaptation are carried out.

If the fuel type determination is interrupted before a new fuel type has been saved, certain tests are carried out. The purpose of these tests is to check whether sufficient information about the fuel type is available to pre-calculate the possible fuel types. If not, engine starting is begun with the pre-calculated fuel type for petrol refueling and continuously adjusted towards the pre-calculated fuel type for ethanol refueling, until the engine can be started.

The requirements for petrol and ethanol operation are very different, which is why a special characteristics map has been saved in the PCM for both fuel types. For all fuel mixtures between petrol and ethanol E85, the PCM calculates a corresponding intermediate characteristics map.

Special features in ethanol operation

- Because ethanol vaporizes more slowly and approximately 30% more fuel has to be vaporized, the greater the ethanol share in the fuel, the earlier and longer the injectors must be opened.
- Ethanol has a higher boiling point than petrol. A greater ethanol share reduces cold starting ability. With a 75% ethanol share and no engine preheating, the engine cannot be started at temperatures as low as -10°C. By preheating with the engine preheater over a period of 2 hours the engine can be started at temperatures as low as -30°C.
- The knock resistance of ethanol E85 is around 104 RON (research octane number). As the ethanol share increases, the "advanced" ignition return is reduced. With an ethanol share of 50% or more, knocking combustion is eliminated and the ignition timing can be set to the optimum value. The KS (knock sensor)signal is still present, but is no longer needed for engine management
- In the partial load range, the fuel consumption is about 30% higher than in petrol operation. At full load the fuel consumption is about 10% higher than in petrol operation, as the engine runs with a Lambda value equal to 1 (provided no fuel enrichment is carried out to protect the catalyst). In petrol operation the Lambda value is about 0.8 at full load.
- During fuel type determination and adaptation, the HO2S remains active even if the throttle valve is fully open. If the catalytic converter threatens to overheat, HO2S control is interrupted and the catalytic converter is cooled through fuel enrichment.
- The error memory is disabled during fuel type determination and adaptation.

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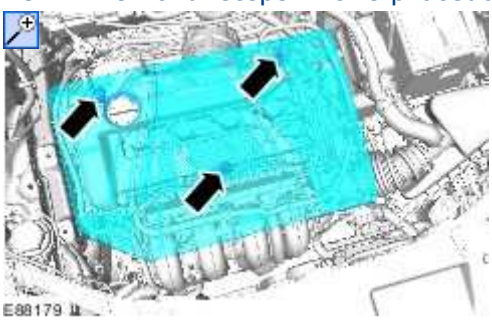
Removal and Installation

Materials

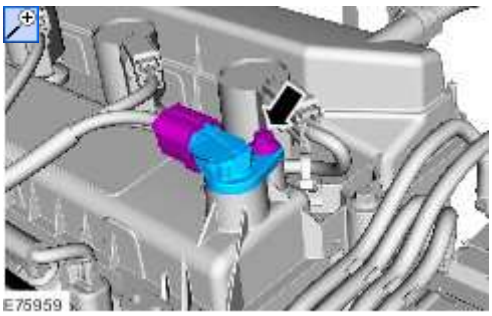
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

Removal

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



1.



2. CAUTION: Only use the specified material to lubricate the seals.
Material: Engine Oil - 5W-30 (WSS-M2C913-C)
Torque: 8 Nm

Installation

1. To install, reverse the removal procedure.

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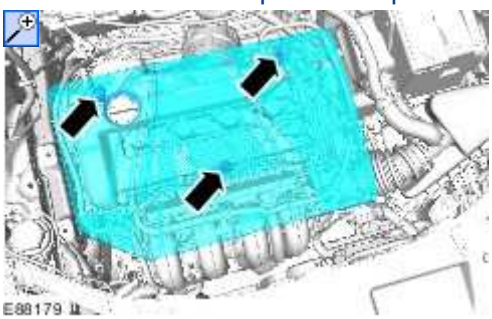
Removal and Installation

Removal

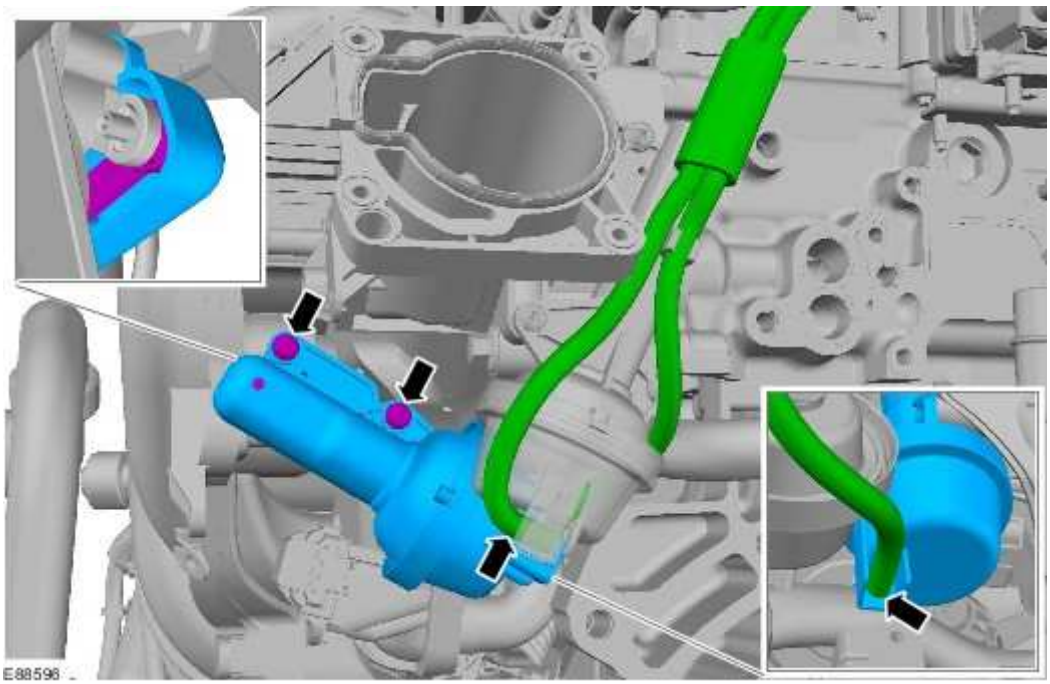
NOTE: Removal steps in this procedure may contain installation details.



1.

2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



3. *Torque:* 2 Nm

Installation

1. To install, reverse the removal procedure.

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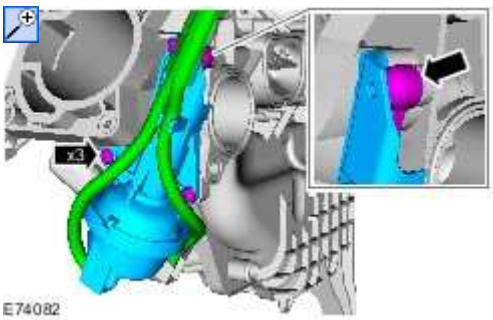
Removal and Installation

Removal

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

1. Detach the throttle body.

   Refer to: Throttle Body - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



2. Disconnect the actuator arm from the intake manifold tuning (IMT) valve.

   Torque: 2 Nm

Installation

1. To install, reverse the removal procedure.

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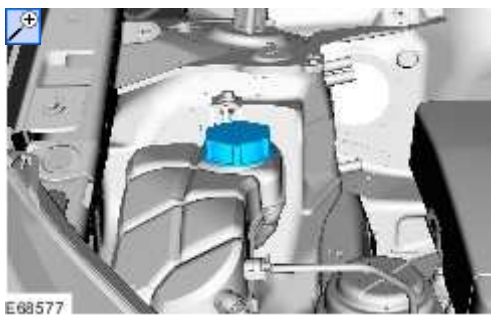
Removal and Installation

Removal

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

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

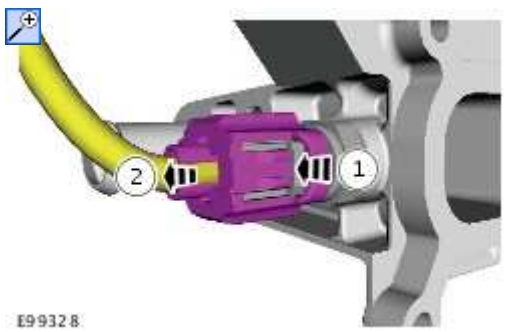
2.



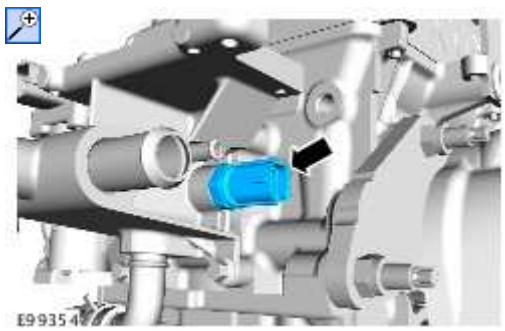
3. WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
Loosen: 1 turn(s)

4. Close the coolant expansion tank cap.

5.



Vehicles built up to 11/2007



6. WARNING: Be prepared to collect escaping fluid.
Torque: 12 Nm

Vehicles built 11/2007 onwards

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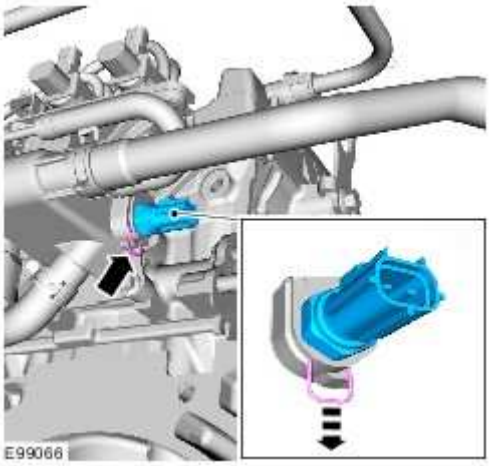

7.
WARNING: Be prepared to collect escaping fluid.
NOTE: The O-ring seal is to be reused unless damaged.

Installation

1. To install, reverse the removal procedure.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

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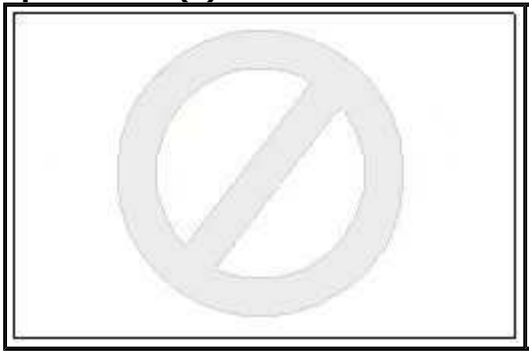
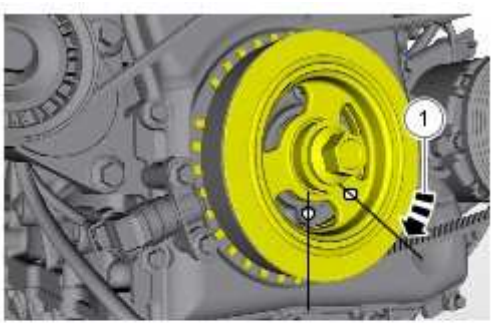
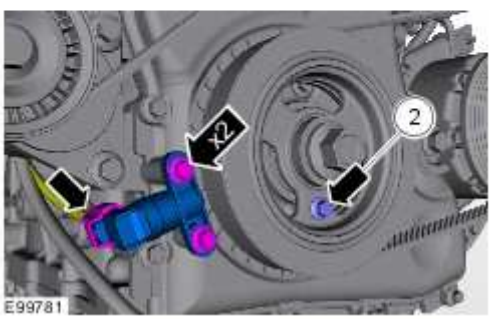
Removal and Installation

Special Tool(s)

	303-1390 Alignment Tool, Crankshaft Position Sensor

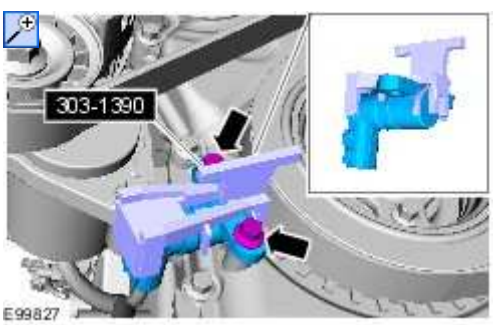
Removal





1.
    1. CAUTION: Only rotate the crankshaft clockwise.
       NOTE: Make sure that the installation marks are aligned.
    2. Bolt M6x18 mm

Installation



1. *Special Tool(s):* 303-1390
   Torque: 7 Nm

2.

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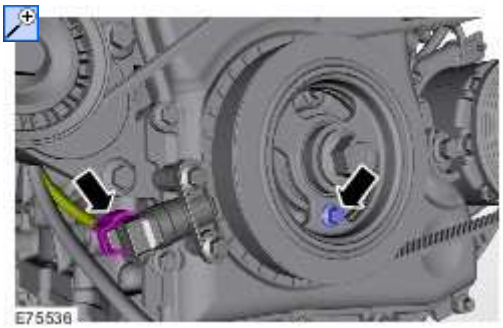

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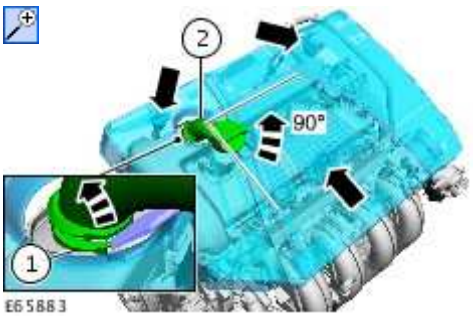
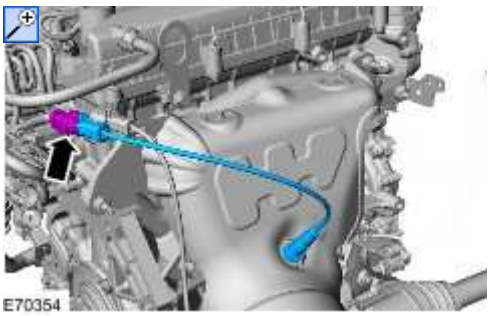
Removal and Installation

Removal



1.



2. *Torque:* 47 Nm

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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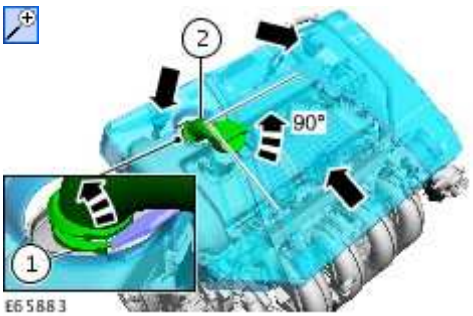
Electronic Engine Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 - Catalyst Monitor Sensor	S-MAX/Galaxy 2006.5 (02/2006-)

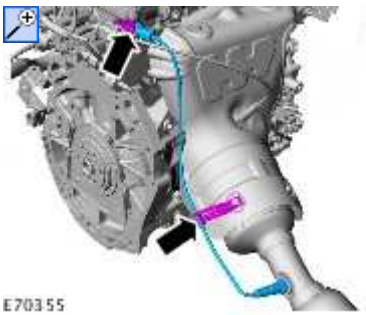
Print

Removal and Installation

Removal



1.



2. *Torque:* 47 Nm

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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Removal and Installation

General Equipment

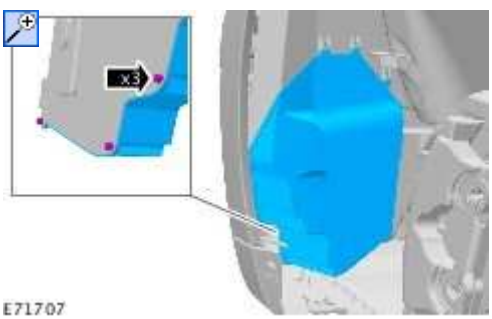
3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Left-hand side wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4.

5. 

   Vehicles with PCM security shield
6. *Torque:* 3 Nm

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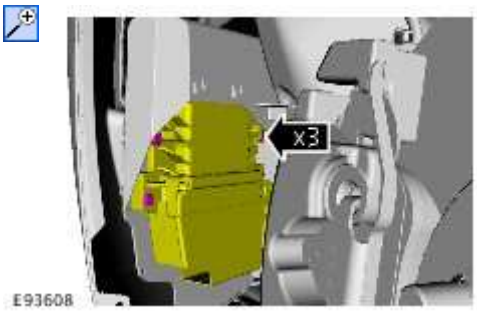
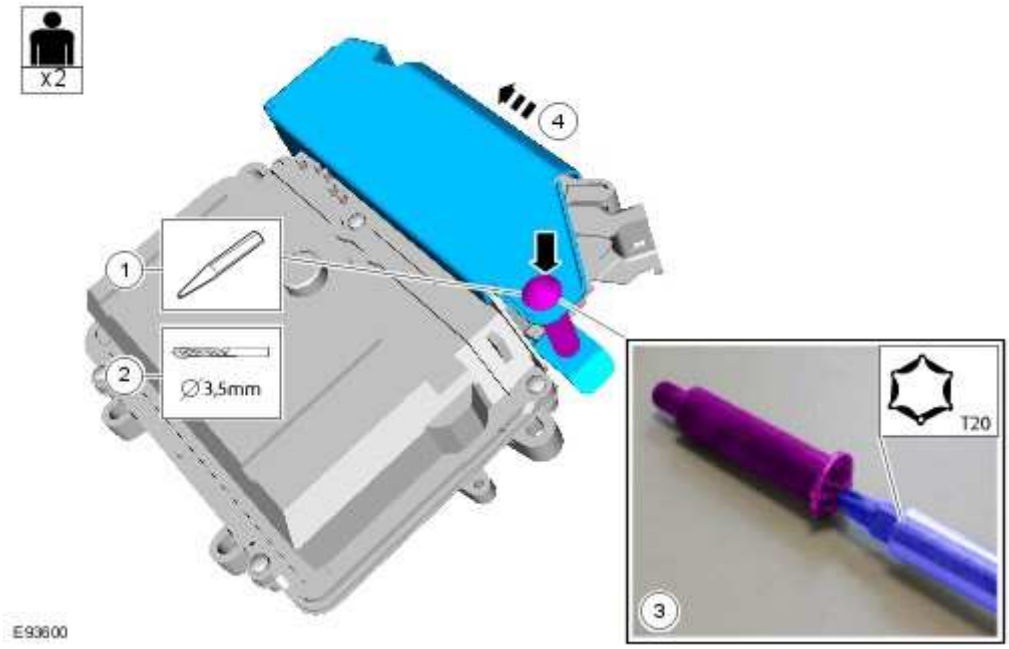
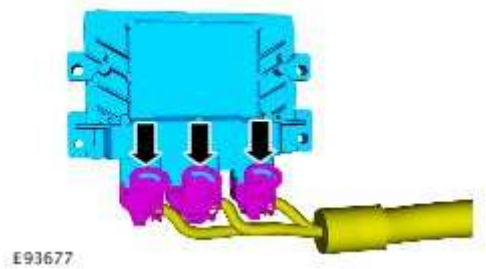


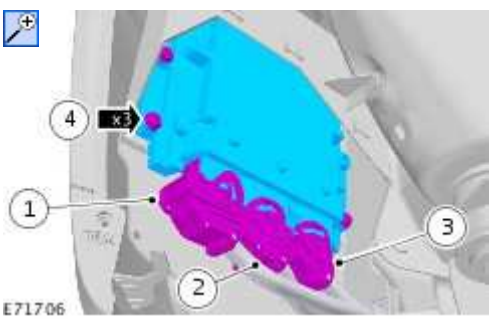


7. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit

8.



Vehicles without PCM security shield



9. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield

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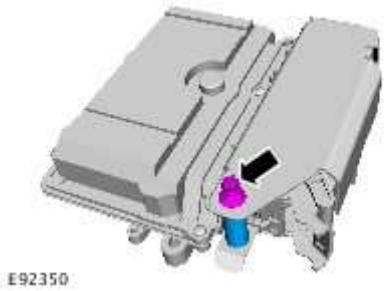

2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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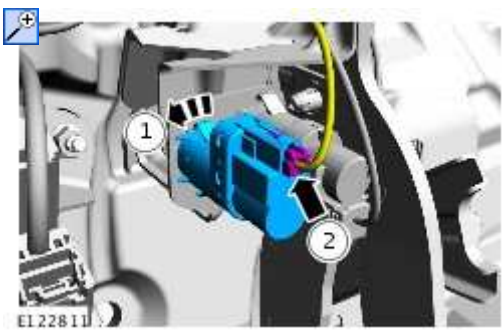
Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

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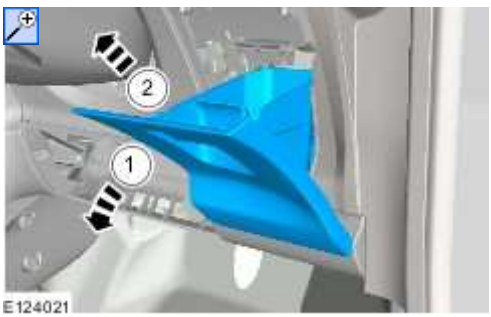
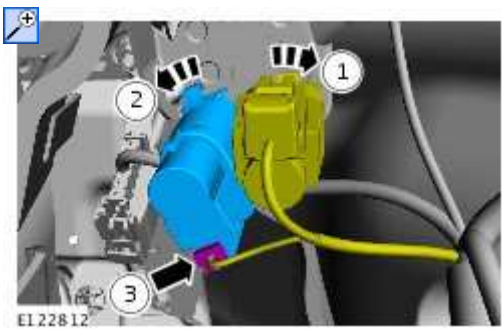
Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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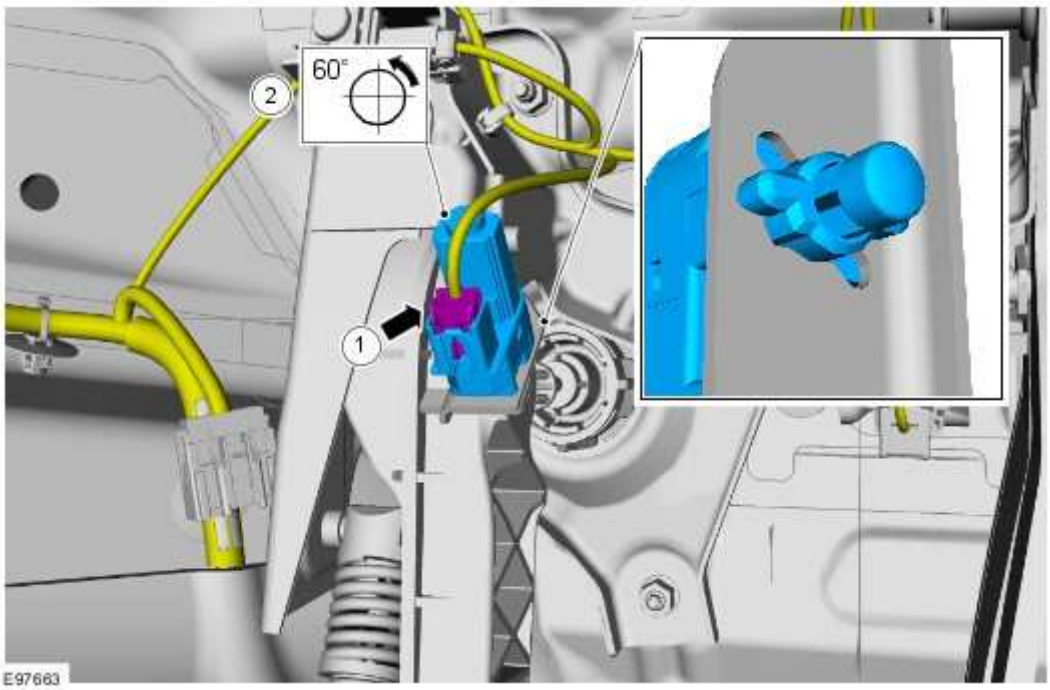
Removal and Installation

Removal



1. CAU
Make su
that the
pedal re
in the re
position.

Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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Removal and Installation

Special Tool(s)

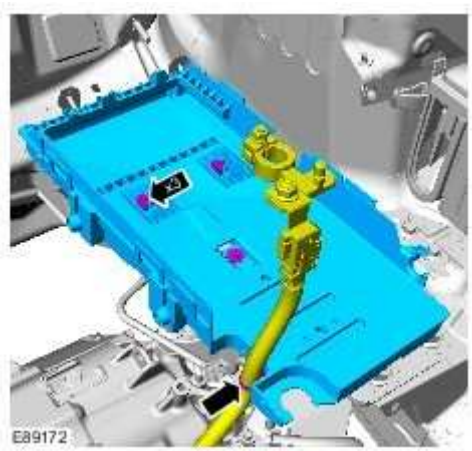
	308-651 Installer, Clutch Master Cylinder Sensor

Removal

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

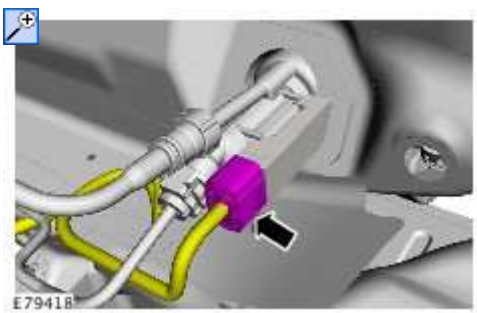
Left-hand drive vehicles

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.



All vehicles

3.



4. *Remove the Special Tool(s):* 308-651

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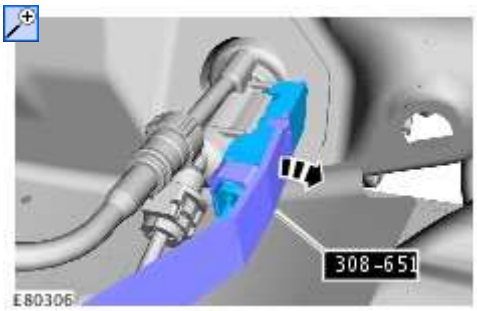

Installation

1. To install, reverse the removal procedure.

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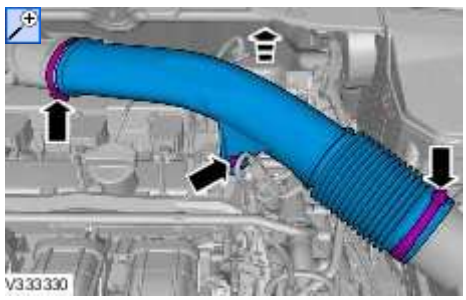
Removal and Installation

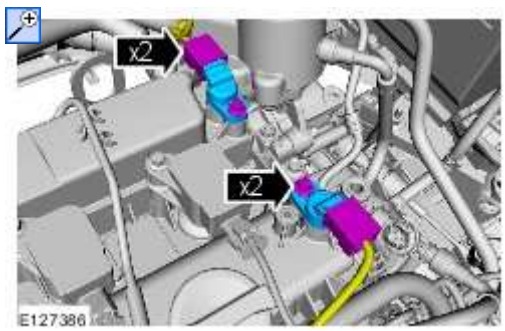
Removal

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

1.



2. *Torque:* 10 Nm



3. NOTE: Note the position of the components before removal.
Torque: 7 Nm

Installation

1. To install, reverse the removal procedure.

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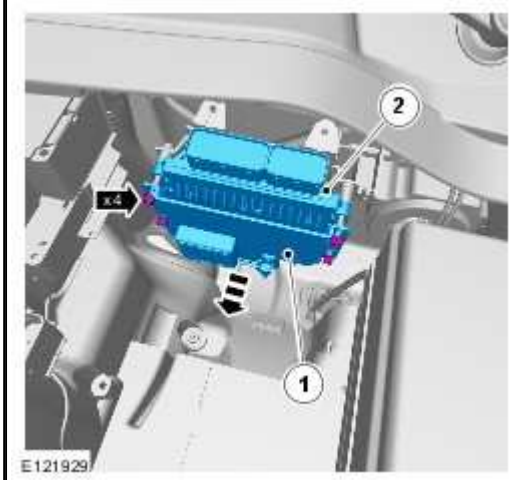
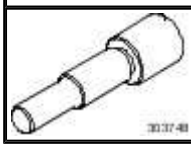
Removal and Installation

Special Tool(s)

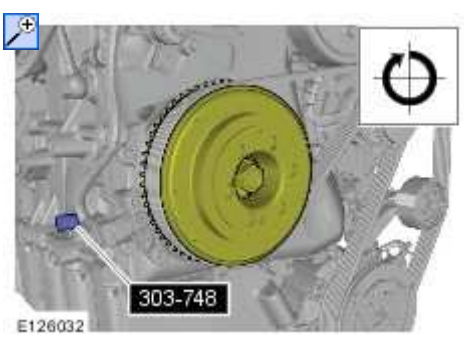
	303-1521 Alignment Tool, Crankshaft Position Sensor
	303-748 Locking Tool, Crankshaft

Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2.
   1. *Torque:* 20 Nm
   2. *Install the Special Tool(s):* 303-748



3. Rotate the crankshaft slowly until the crankshaft stops.

   Special Tool(s): 303-748

4.

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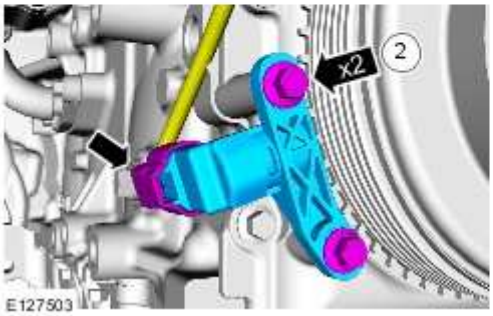
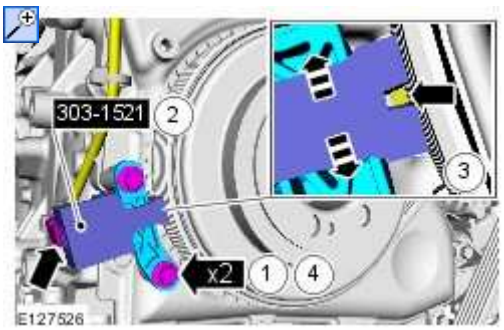


Installation



1. To install, reverse the removal procedure.
2.
    1. NOTE: Only tighten the bolts finger tight at this stage.
    2. *Install the Special Tool(s):* 303-1521
    3. CAUTION: Make sure that the component aligns with the installation mark.
    4. *Torque:* 7 Nm
3. *Remove the Special Tool(s):* 303-1521

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Removal and Installation

General Equipment

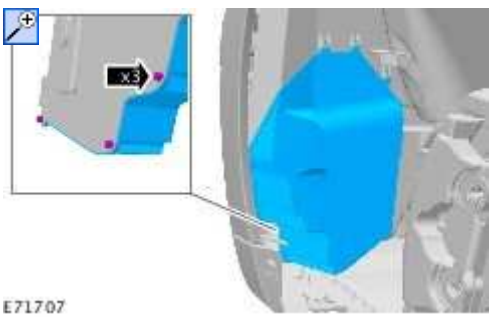
3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Left-hand side wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4.

5. 

   Vehicles with PCM security shield
6. *Torque:* 3 Nm

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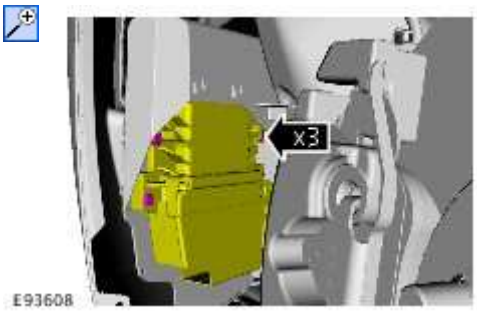
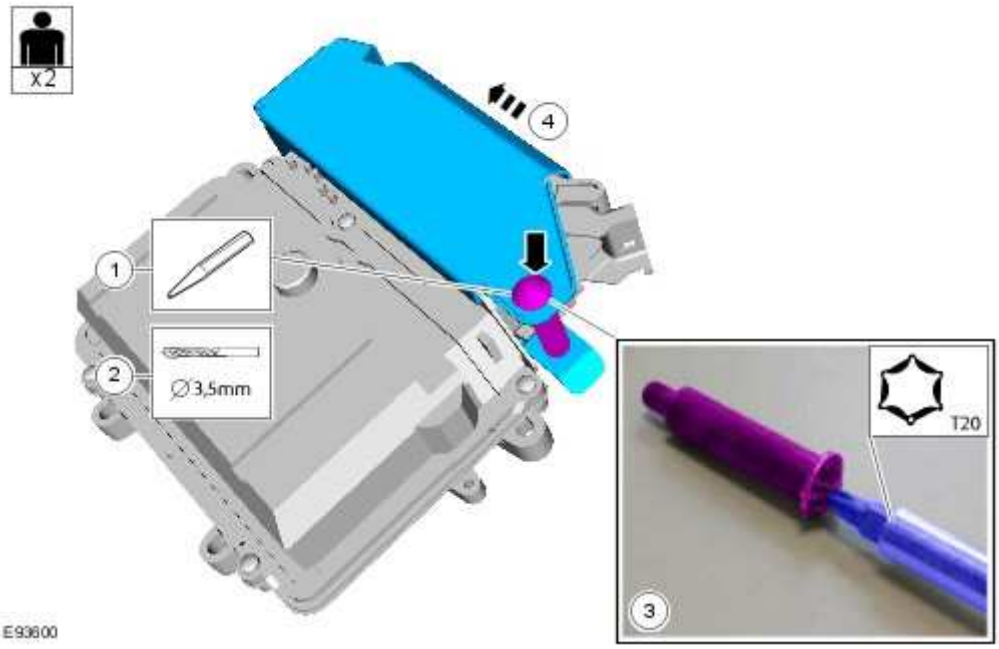
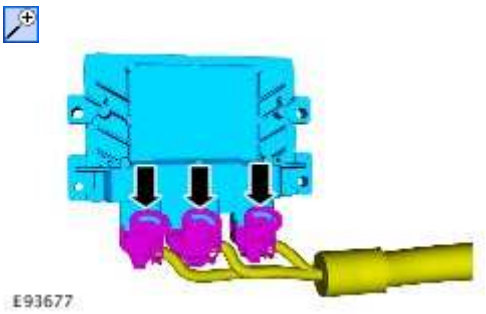


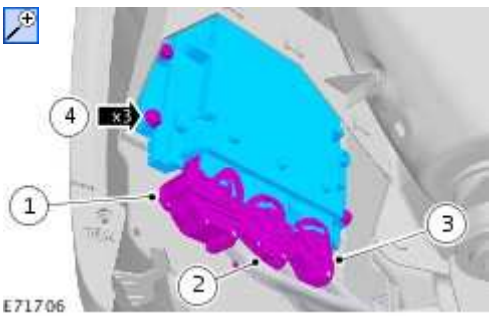
7. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit





8.

Vehicles without PCM security shield



9. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield

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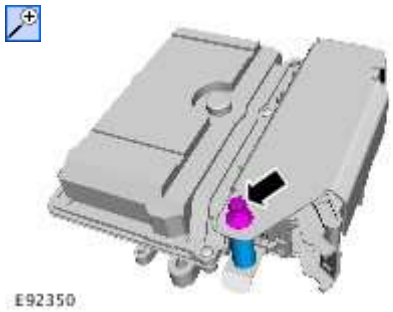

2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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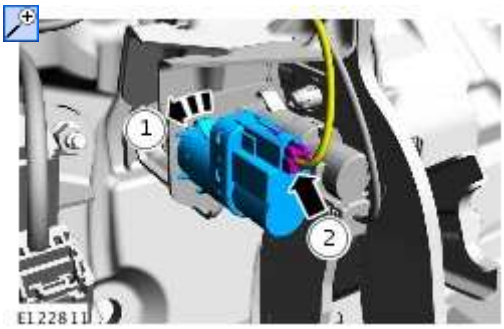
Print

Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

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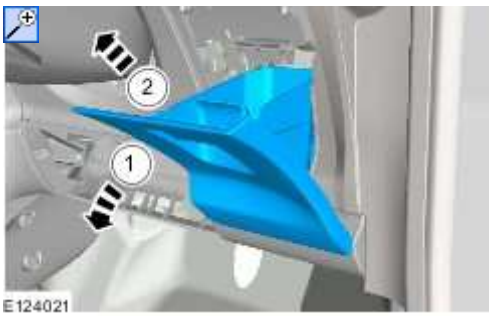
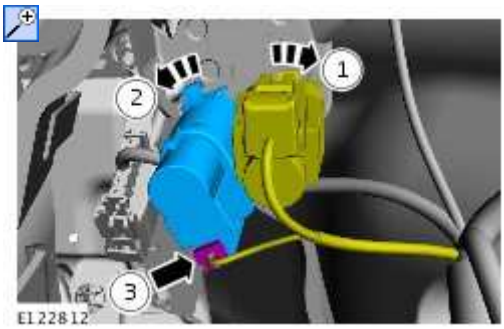
Print

Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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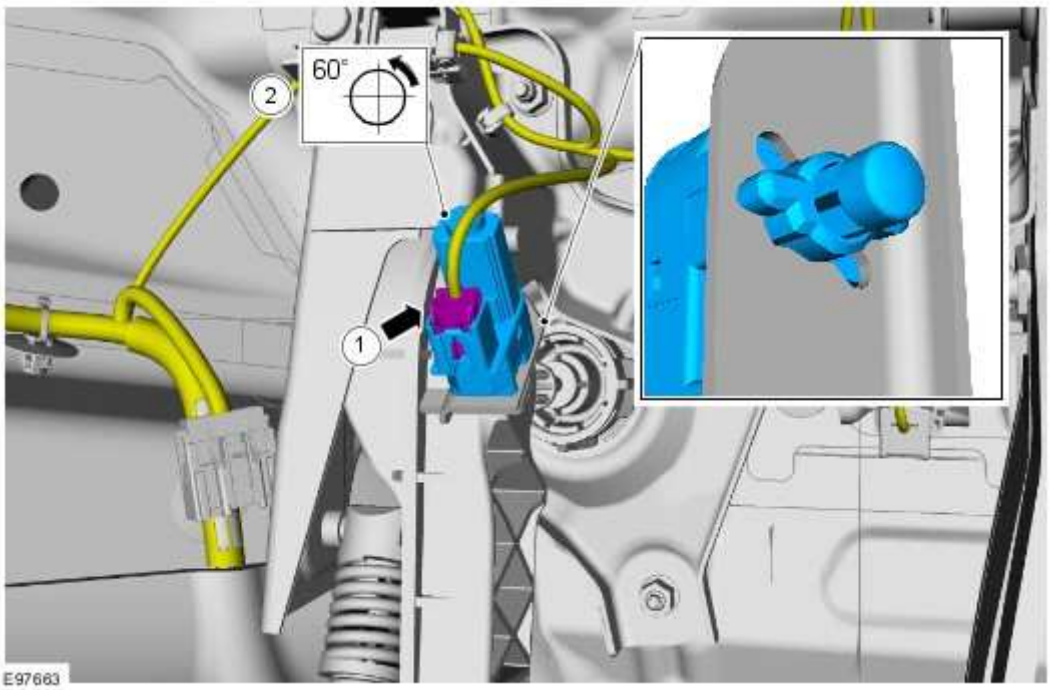
Removal and Installation

Removal



1. CAU
Make su
that the
pedal re
in the re
position.

Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

http://vnx.su

Removal and Installation

Special Tool(s)

E51255	310-137 Disconnect Tool, Fuel Line

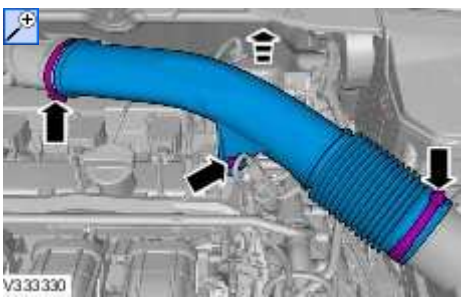
Removal

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

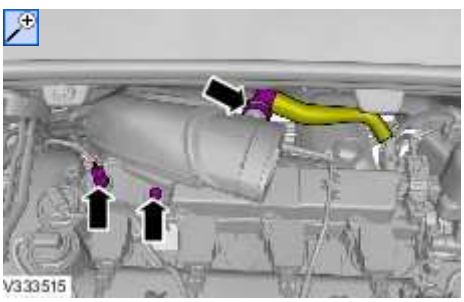
1.

E124808

2. *Torque:* 10 Nm

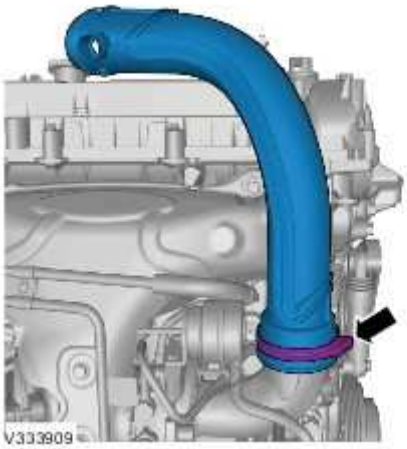

V333330

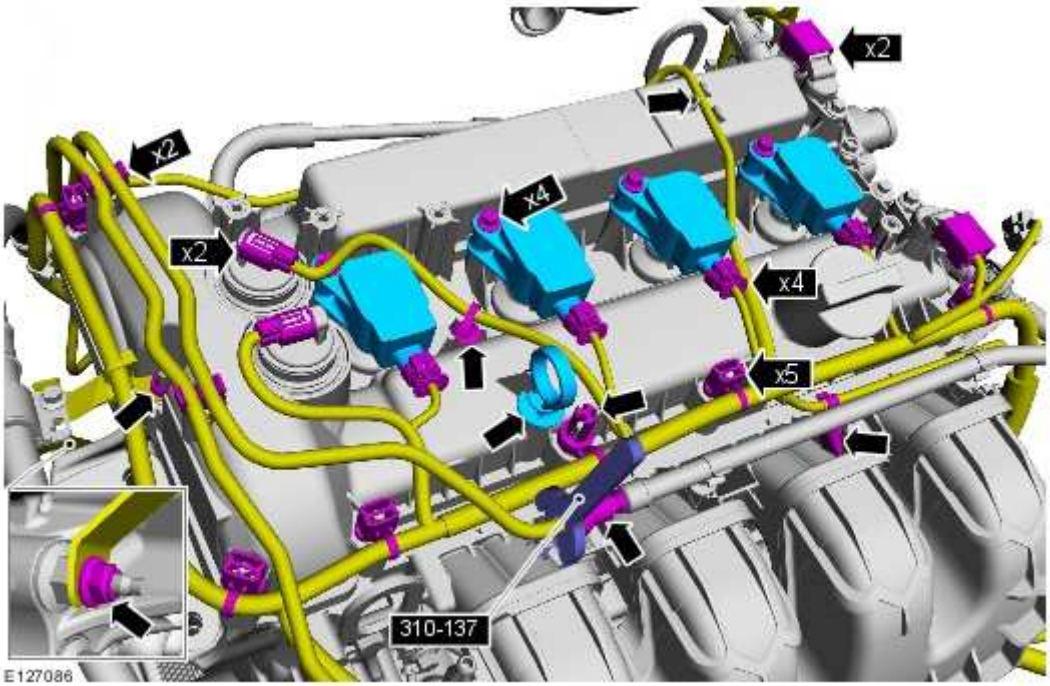
3. *Torque:* 10 Nm


V333515

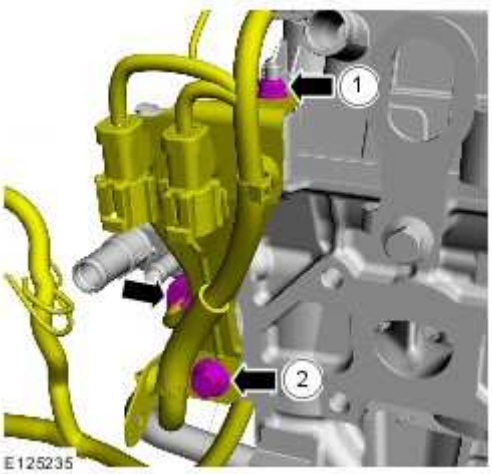
4.

http://vnx.su





5. *Special T*
(s): 310-
137
Torque:
Nm



6. *Torque:*
1 10 Nm
2 24 Nm

7.

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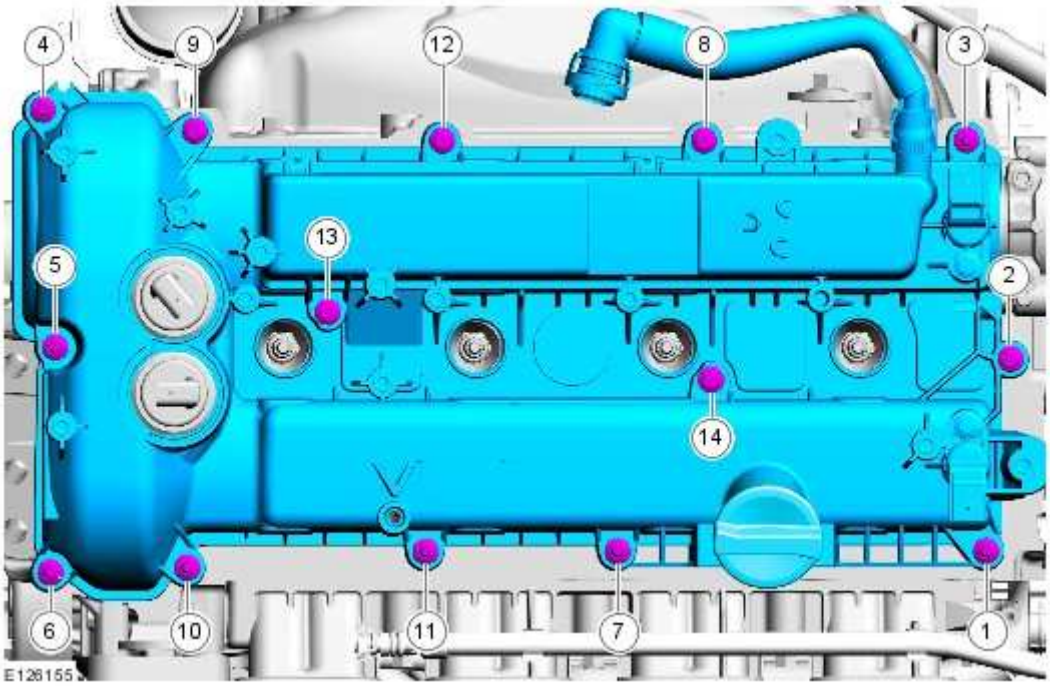
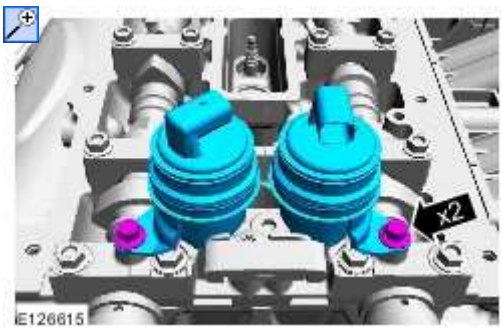
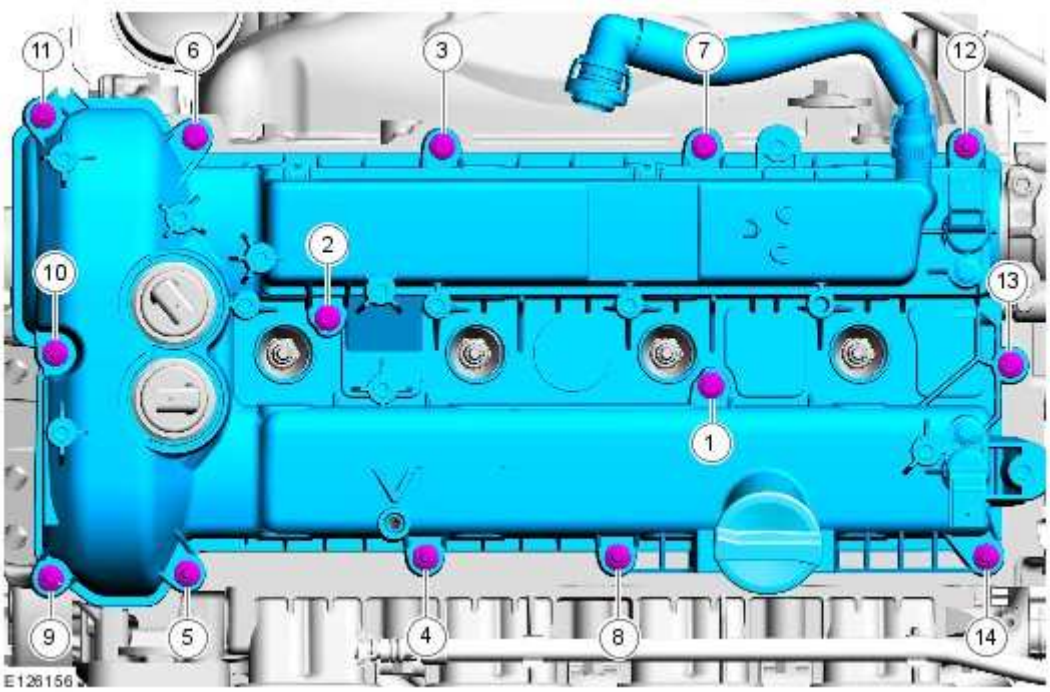




8. CAUTION: Note the position of the components before removal.
Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.



2. NOTE: The gasket is to be reused unless damage
Torque: Nm

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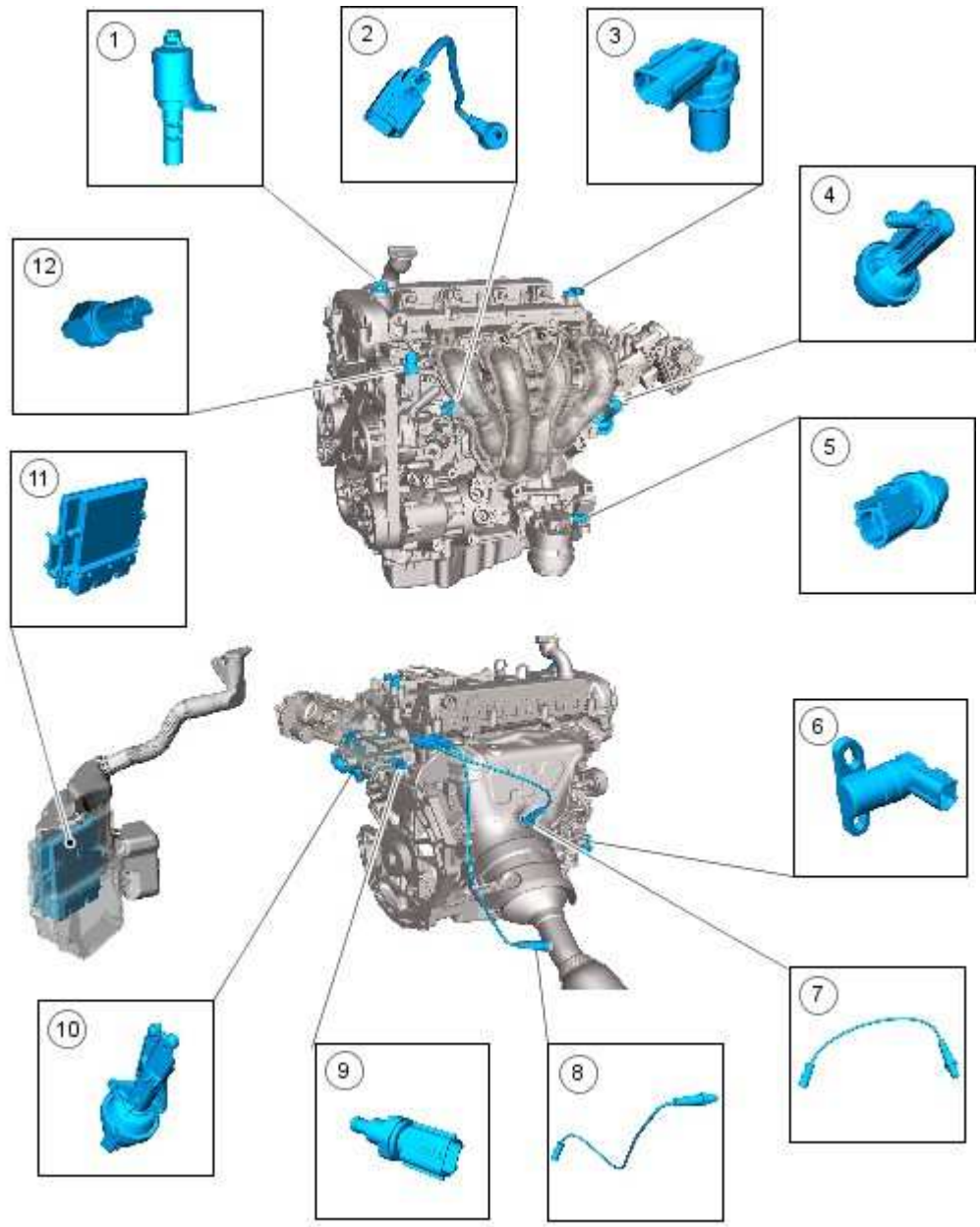
Description and Operation

General overview



E81414

Item	Part Number	Description
1	-	Variable valve timing (VVT) oil control solenoid
2	-	Knock sensor (KS)
3	-	Camshaft position (CMP) sensor
4	-	Intake manifold runner control (IMRC) actuator
5	-	Engine oil pressure (EOP) sensor
6	-	Crankshaft position (CKP) sensor
	-	

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7			Heated oxygen sensor (HO2S)
	8	-	Catalyst monitor sensor
9		-	Engine coolant temperature (ECT) sensor
10		-	Intake manifold tuning (IMT) valve
11		-	Powertrain control module (PCM)
12		-	Power steering pressure (PSP) switch

Components

VVT oil control solenoid

E81322

The VVT oil control solenoid supplies engine oil to the VVT control unit in accordance with the actuation by the PCM. This causes the camshaft/valve timing to be either advanced or retarded.

KS

E65157

In conjunction with the PCM, the KS monitors the combustion process and regulates the injection period so that predetermined volumes of fuel are injected into the cylinders at every operating cycle.

By constantly measuring the amount of knock present and adjusting the injection period, the emission values of the engine remain stable.

CMP sensor

E65152

The CMP sensor is a variable reluctance sensor supplied with a reference voltage of 5 volts.

If the signal from the CMP sensor fails while the engine is running, the engine continues to

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run using the signals from the CKP sensor.

If the CMP signal is missing at the next starting operation, it will not be possible to start the engine.

IMRC actuator

E65155

The IMRC meters the amount of air flow air velocity in the intake manifold. At low engine speeds the IMRC is fully closed, keeping air flow velocity high, while at low volume. As the engine speed increases, the IMRC opens to allow for more air to enter the intake manifold.

EOP sensor

E65159

The EOP sensor is located in the oil filter housing. The EOP is connected to the PCM and registers engine oil pressure. The sensor opens when a defined oil pressure is reached and the PCM sends a signal to the instrument cluster to illuminate the engine oil pressure warning light.

CKP sensor

E65151

The CKP sensor is an inductive pulse generator which scans 36-1 cast protrusions on the flywheel. Minus one means that one of the cast protrusions is missing and this gap is located at 90 degrees before top dead centre. This gap is used by the PCM as a reference for crankshaft position.

The CKP sensor uses the Hall effect principle.

HO2S

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E65154

The HO2S is a linear characteristic type sensor, installed forward of the catalytic converter. The PCM uses this as it's primary sensor to measure the oxygen content of the exhaust gasses within the exhaust system to provide closed-loop fuelling control.

Catalyst monitor sensor

E65150

The catalyst monitor sensor is a non-linear characteristic type sensor fitted to the catalytic converter. The PCM uses this as it's secondary sensor to measure the oxygen content of the exhaust system gasses within the exhaust after they have passed through the catalytic converter. As well as providing additional closed-loop fuelling control, the PCM uses this information to determine the efficiency of the catalytic converter.

ECT sensor

E65153

The ECT sensor is screwed directly into the coolant outlet connector and measures the temperature of the engine coolant rather than the cylinder head temperature. This is a more accurate measurement of the engine temperature and the information is used by the instrument cluster for the temperature gauge indication. It is also used by the PCM to calculate fuel injection timing and period of injection which will vary dependant on the engine temperature.

IMT valve

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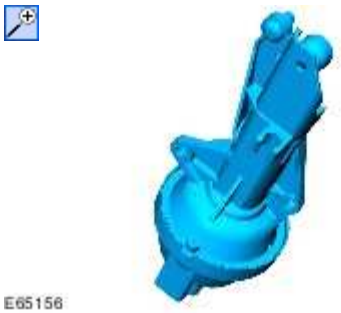
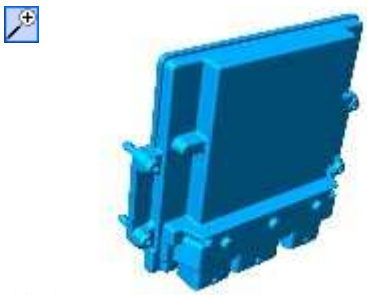


E65156

The IMT valve controls the position of the swirl plates located in the intake manifold. For additional information, refer to: Fuel Charging and Controls (303-04A Fuel Charging and Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Description and Operation).

The IMT valve is controlled by a vacuum operated solenoid which is located on top of the coolant outlet connector. The IMT valve is adjusted by the solenoid to the desired settings determined by the PCM.

PCM



E65160

The PCM is attached to the windshield washer reservoir.

The PCM can be diagnosed through the data link connector (DLC) using the Worldwide Diagnostic System (WDS).

PSP switch

E65161

The PSP switch is located in the power steering line.

The PSP switch registers pressure in the line between the power steering pump and steering gear. This switch opens on reaching a defined pressure.

Brake pedal position (BPP) switch and brake light switch

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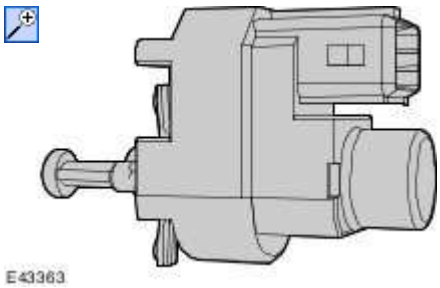

E43363

The BPP switch is connected to the GEM through the CAN bus.

The BPP switch is closed when de-energized and sends a ground signal to the PCM.

The brake light switch is connected with the PCM through a conventional electrical connector.

The brake light switch is open when de-energized. When the brake light switch is closed, it sends 12 volts to the PCM.

The signals of the BPP switch and the brake light switch are used if the accelerator pedal position (APP) sensor should fail.

In this instance, the PCM compares the signals of the BPP switch and brake light switch.

APP sensor

E43365

The APP sensor is a double contact-less inductive sensor.

For safety reasons, the APP sensor consists of two sensors.

If the APP sensor malfunctions when the vehicle is in operation, a diagnostic trouble code (DTC) will be stored in the PCM.

If one of the sensors in the APP sensor should fail, the engine will operate at reduced power.

If both sensors of the APP switch fail, after a single operation of the BPP switch and the brake light switch and then after a plausibility check, the engine is controlled up to a speed of 1200 RPM. The vehicle can be accelerated to a maximum speed of 56 km/h (35 mph).

When the BPP switch and the brake light switch are actuated again, engine speed will drop to idle speed. Once the BPP switch and the brake light switch are de-energized again,

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engine speed is increased again.

If the vehicle is not fitted with an information and message system, the malfunction indicator lamp (MIL) will be illuminated to indicate a system fault.

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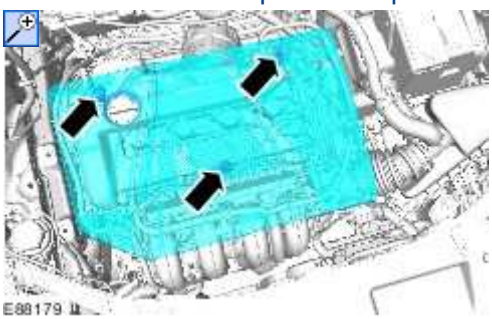
Removal and Installation

Materials

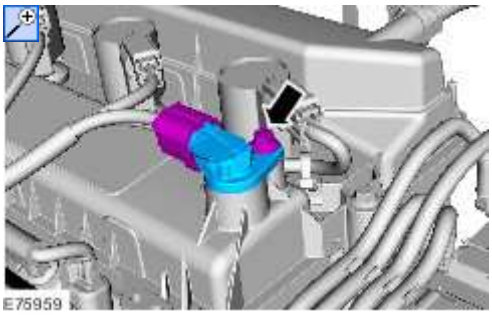
Name	Specification
Engine Oil - 5W-30	WSS-M2C913-C

Removal

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



1.



2. CAUTION: Only use the specified material to lubricate the seals.
Material: Engine Oil - 5W-30 (WSS-M2C913-C)
Torque: 8 Nm

Installation

1. To install, reverse the removal procedure.

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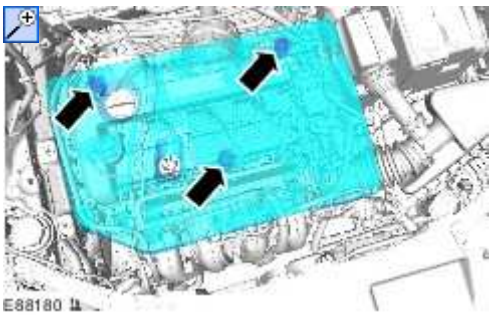
Removal and Installation

Removal

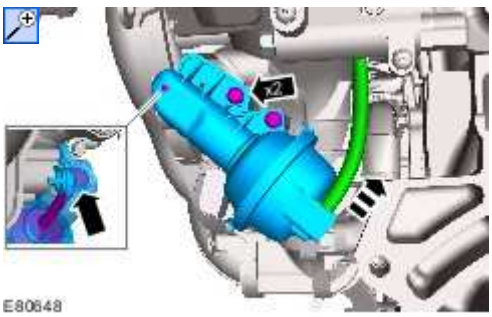
NOTE: Removal steps in this procedure may contain installation details.



1.

2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



3. *Torque:* 2 Nm

Installation

1. To install, reverse the removal procedure.

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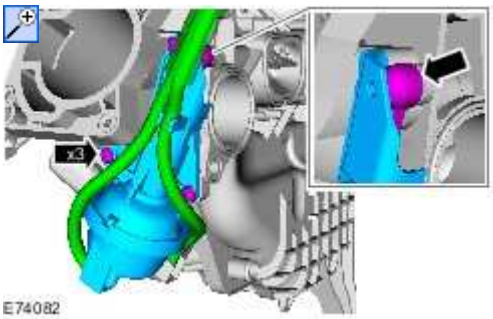
Removal and Installation

Removal

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

1. Refer to: Throttle Body - 2.0L Duratec-HE (MI4) (303-04 Fuel Charging and Controls - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4), Removal and Installation).
   Refer to: Throttle Body - 2.3L Duratec-HE (MI4) (303-04, Removal and Installation).



2. Disconnect the actuator arm from the intake manifold tuning (IMT) valve.

   Torque: 2 Nm

Installation

1. To install, reverse the removal procedure.

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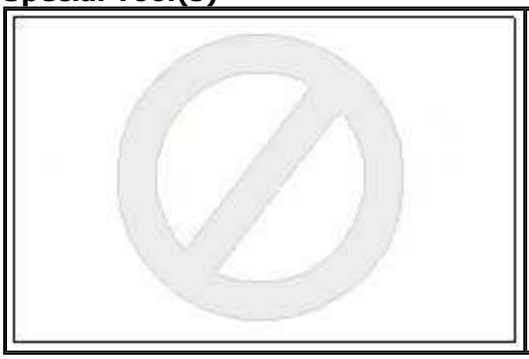
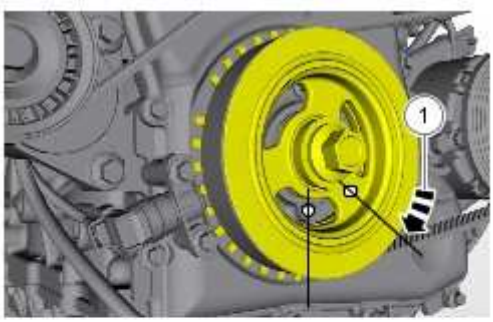
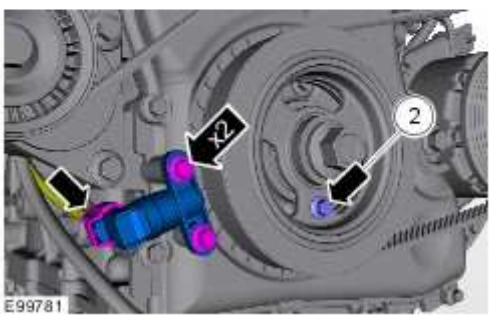
Removal and Installation

Special Tool(s)

	303-1390 Alignment Tool, Crankshaft Position Sensor

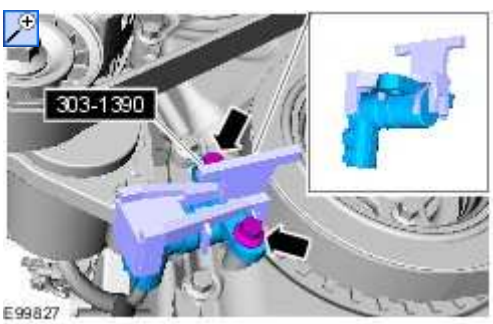
Removal





1.
    1. CAUTION: Only rotate the crankshaft clockwise.
       NOTE: Make sure that the installation marks are aligned.
    2. Bolt M6x18 mm

Installation



1. *Special Tool(s):* 303-1390
   Torque: 7 Nm

2.

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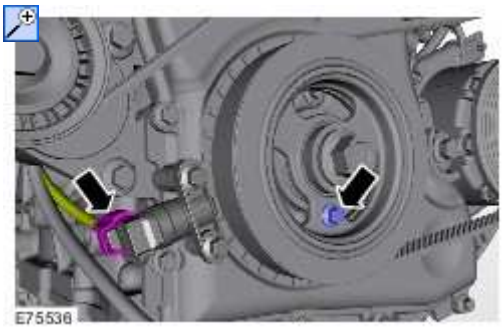

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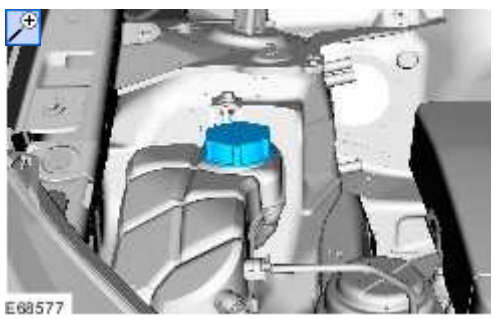
Removal and Installation

Removal

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

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

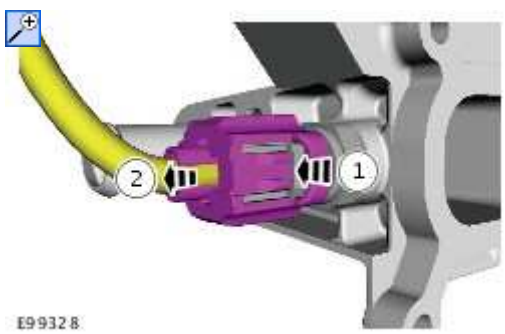
2.



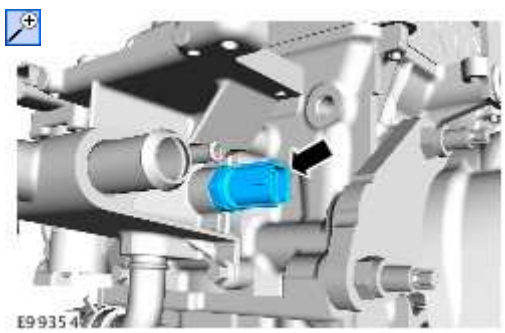
3. WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.
Loosen: 1 turn(s)

4. Close the coolant expansion tank cap.

5.



Vehicles built up to 11/2007



6. WARNING: Be prepared to collect escaping fluid.
Torque: 12 Nm

Vehicles built 11/2007 onwards

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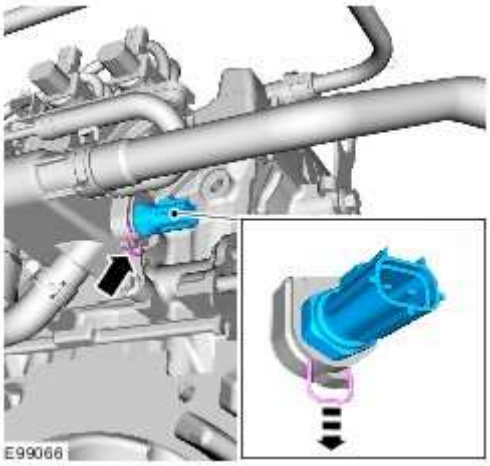

7.
WARNING: Be prepared to collect escaping fluid.
NOTE: The O-ring seal is to be reused unless damaged.

Installation

1. To install, reverse the removal procedure.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, General Procedures).

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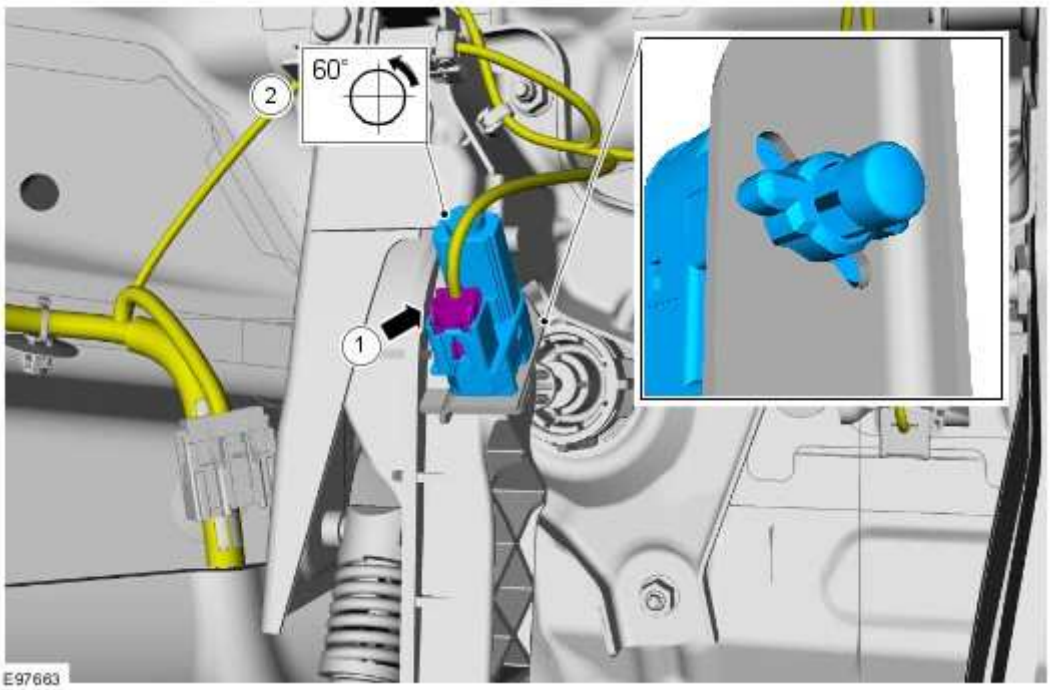
Removal and Installation

Removal



1. CAU
Make su
that the
pedal re
in the re
position.

Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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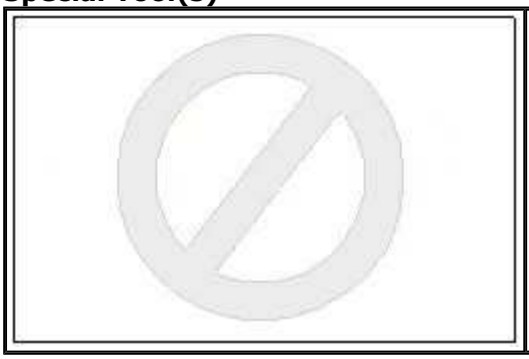
Removal and Installation

Special Tool(s)

	308-651 Installer, Clutch Master Cylinder Sensor

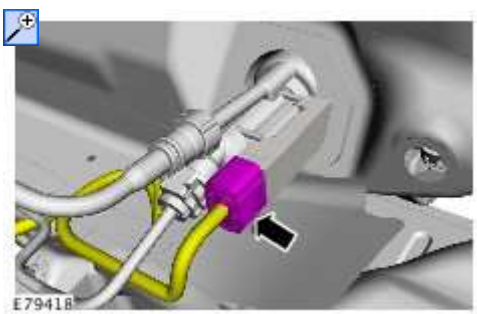
Removal

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

Left-hand drive vehicles

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.

All vehicles

3. 

4. *Remove the Special Tool(s):* 308-651

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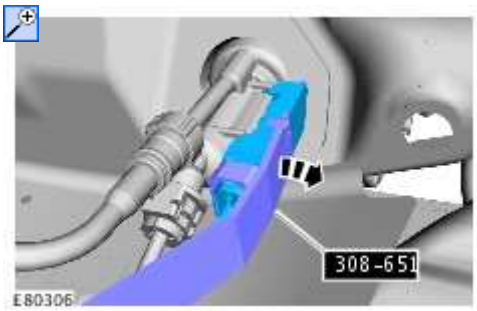


Installation

1. To install, reverse the removal procedure.

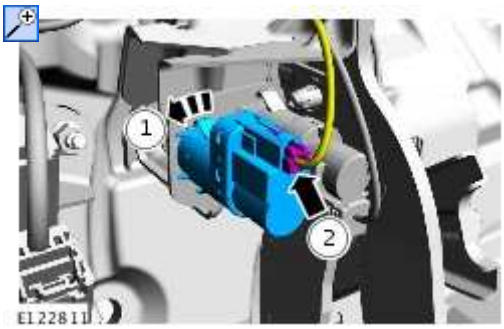
http://vnx.su

Print

Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

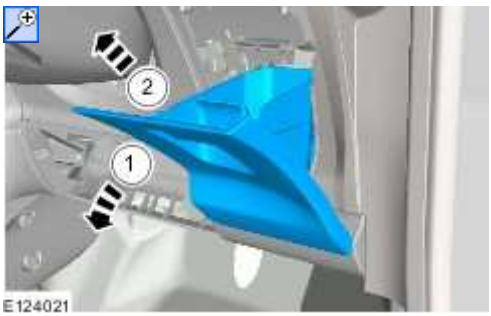
1. To install, reverse the removal procedure.

http://vnx.su

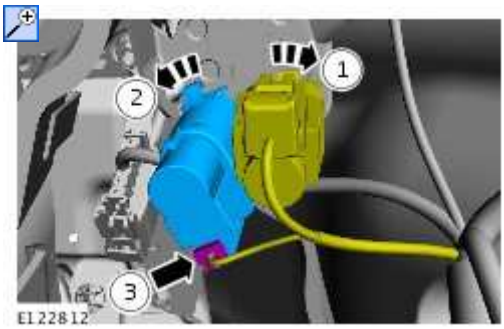
Print

Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

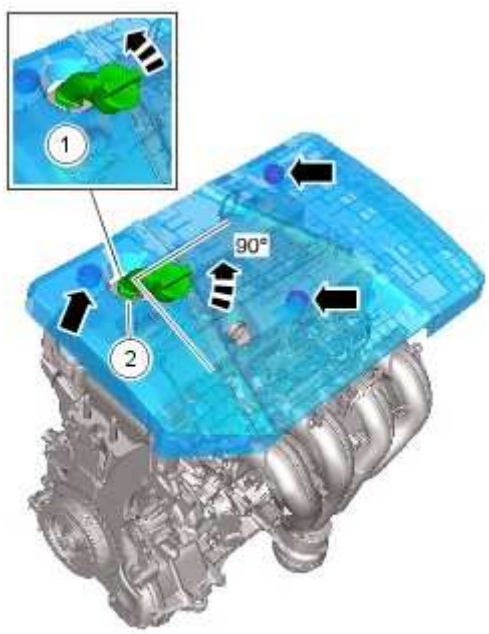
1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

http://vnx.su

Print

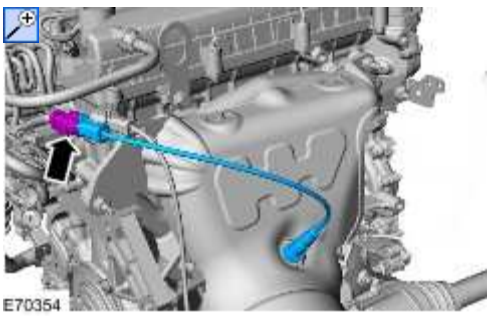
Removal and Installation

Removal



E77025

1.


E70354

2. *Torque:* 47 Nm

Installation

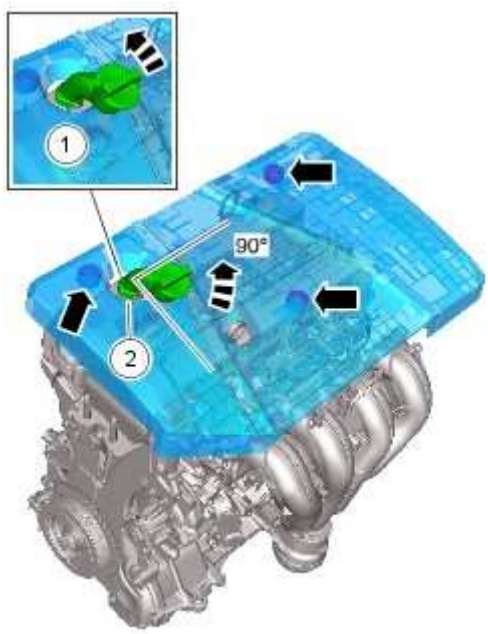
1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

http://vnx.su

Print

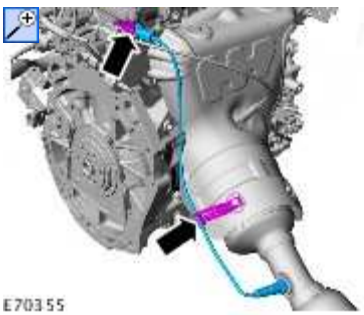
Removal and Installation

Removal



E77025

1.



E70355

2. *Torque:* 47 Nm

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

http://vnx.su

Print

Removal and Installation

General Equipment

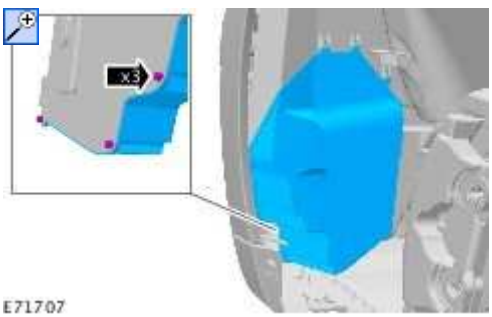
3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

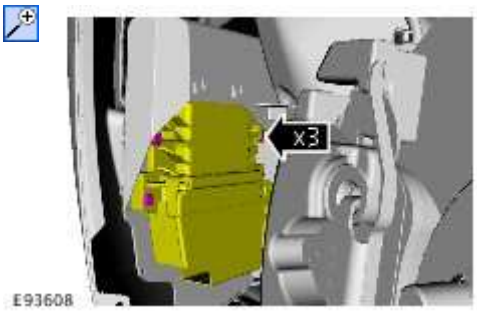
   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Left-hand side wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4.

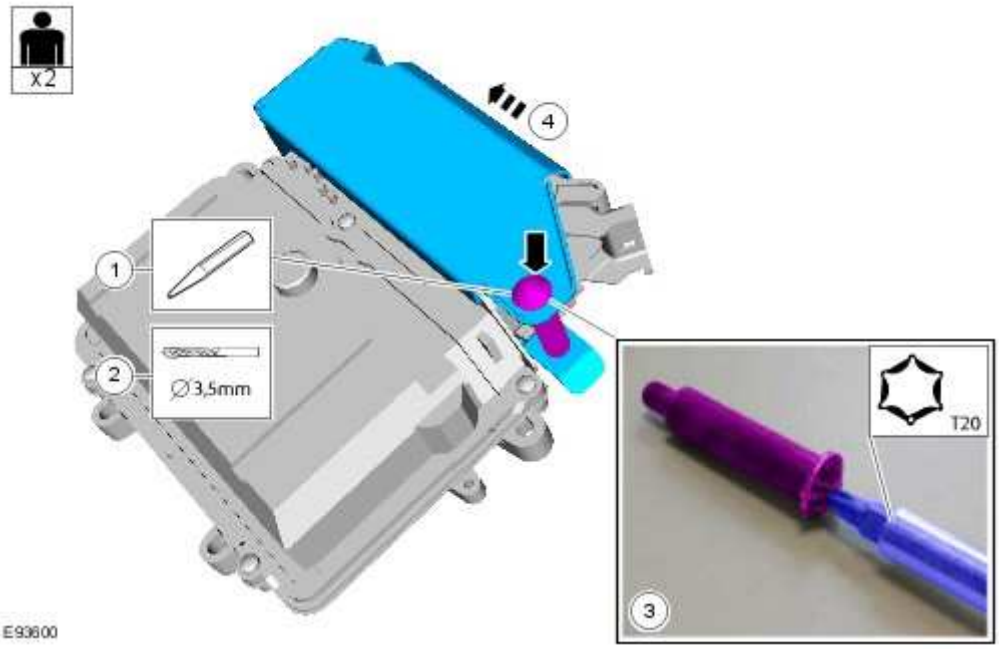
5. 

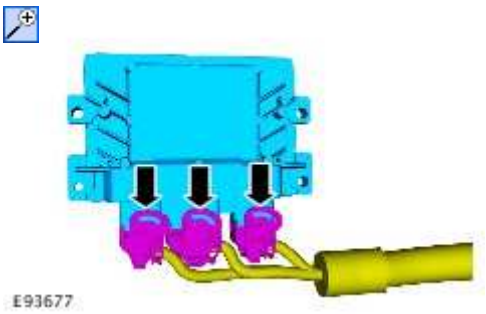
   Vehicles with PCM security shield
6. *Torque:* 3 Nm

http://vnx.su



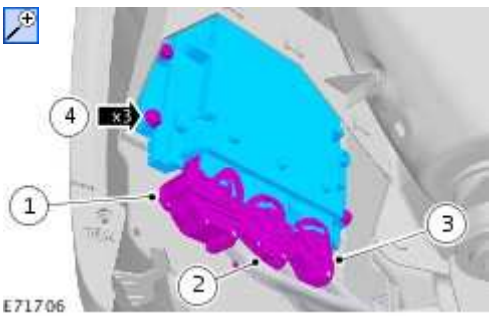
7. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit





8.

Vehicles without PCM security shield



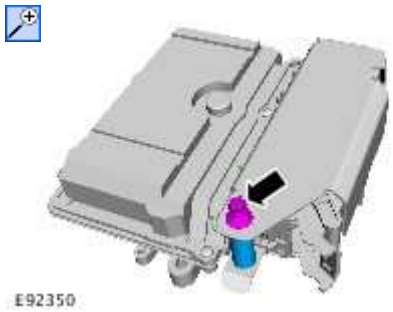
9. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield

http://vnx.su



2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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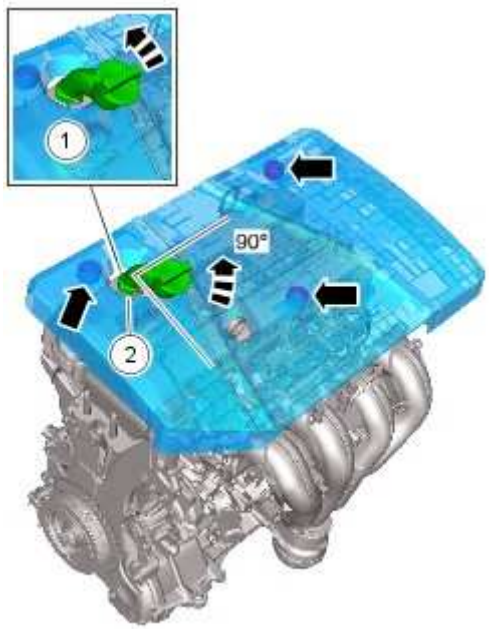
Print

Removal and Installation

Removal

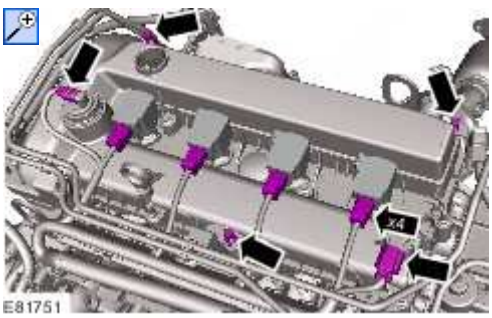
NOTE: Removal steps in this procedure may contain installation details.

1.



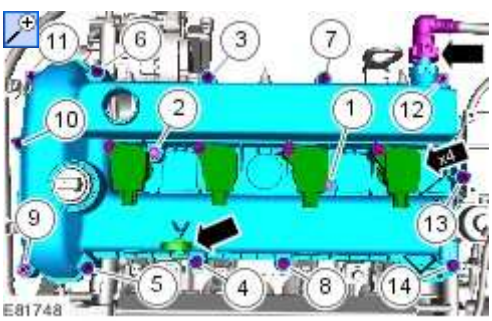
E77025

2.



E81751

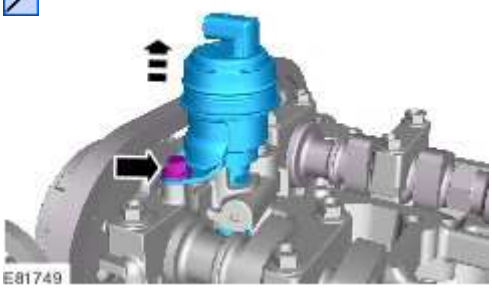
3. *Torque:* 10 Nm

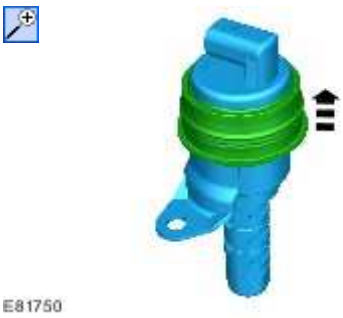


E81748

4. *Torque:* 10 Nm

http://vnx.su





5.

Installation

1. NOTE: Make sure that new components are installed.
   To install ,reverse the removal procedure.

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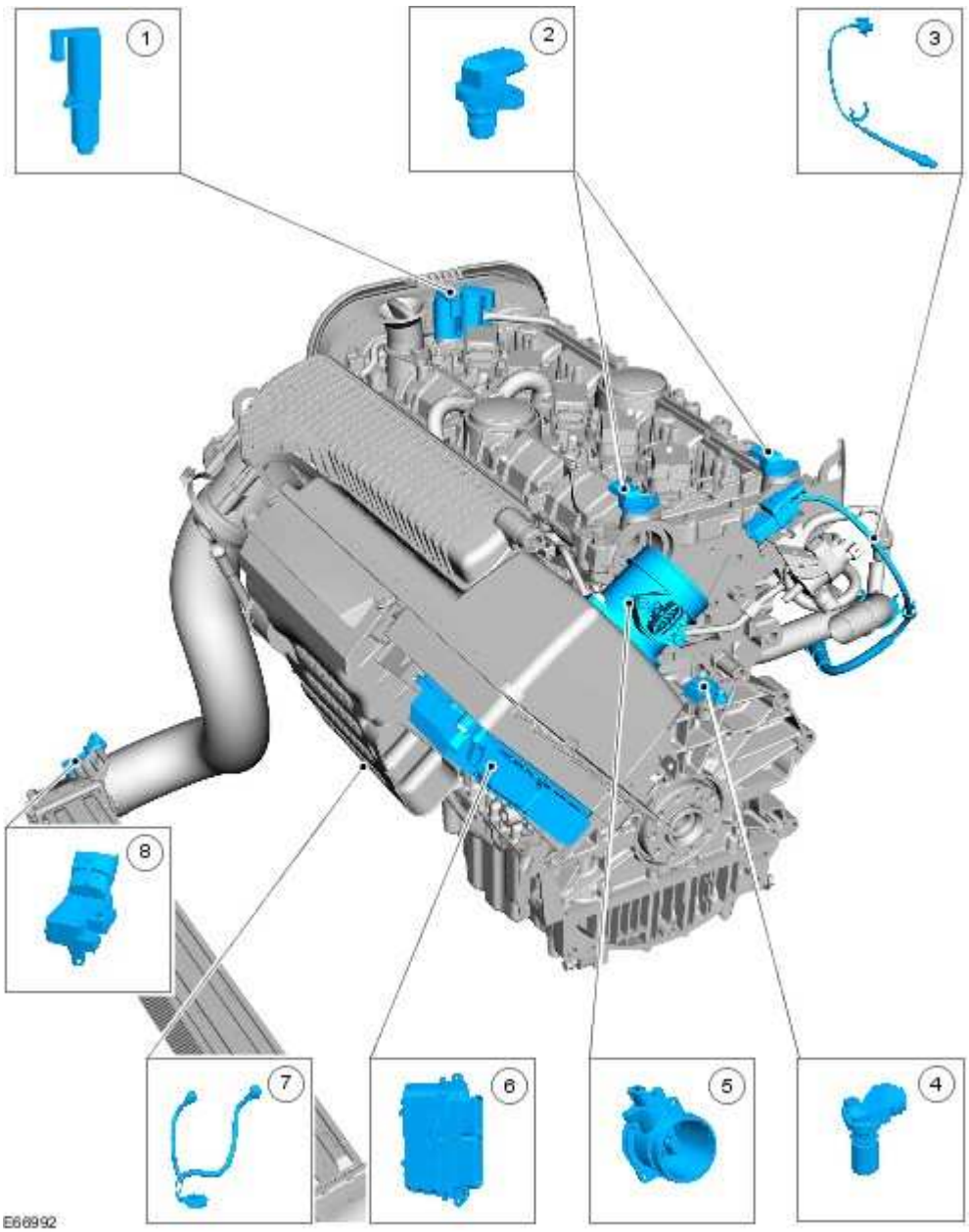
Description and Operation

2.5L Duratec-ST (VI5)



Item	Part Number	Description
1	-	Variable valve timing (VVT) oil control solenoid
2	-	Camshaft position (CMP) sensor
3	-	Heated oxygen sensor (HO2S)
4	-	Crankshaft position (CKP) sensor
5	-	Mass air flow (MAF) sensor
6	-	Powertrain control module (PCM)
7	-	Knock sensor (KS)
	-	

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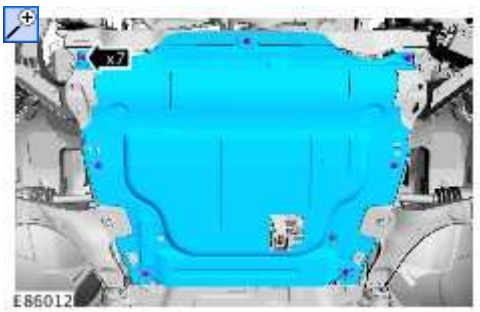
Removal and Installation

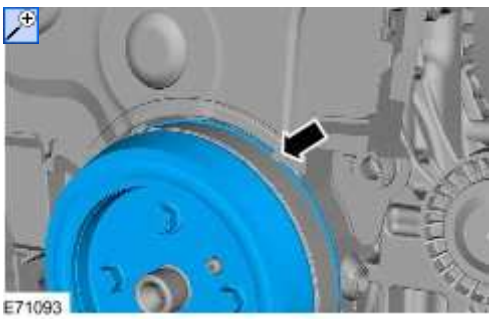
Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

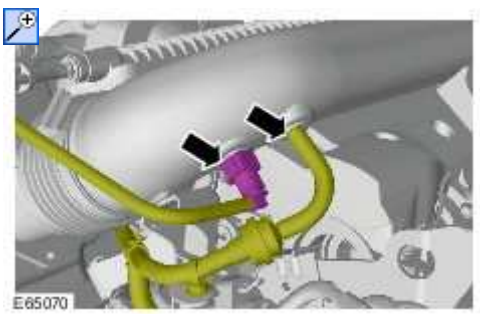


2.

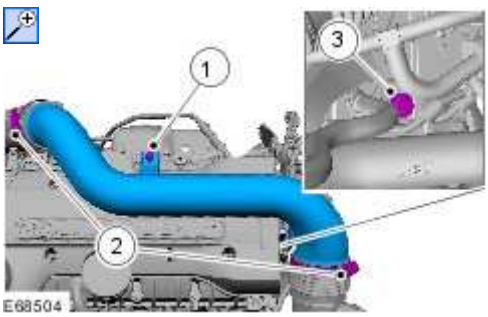


3. Turn the engine to top dead center (TDC).

4. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



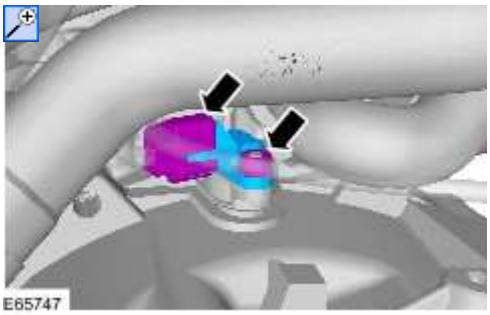
5. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.



6. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   1. *Torque:* 10 Nm
   2. *Torque:* 4 Nm
   3. *Torque:* 10 Nm

7. *Torque:* 10 Nm

http://vnx.su



Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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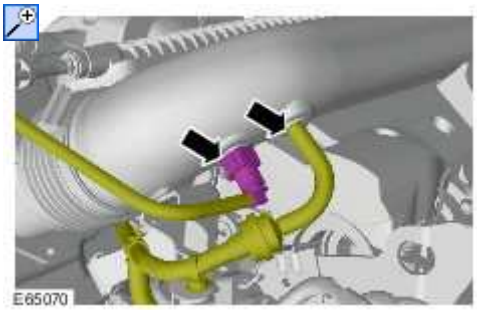
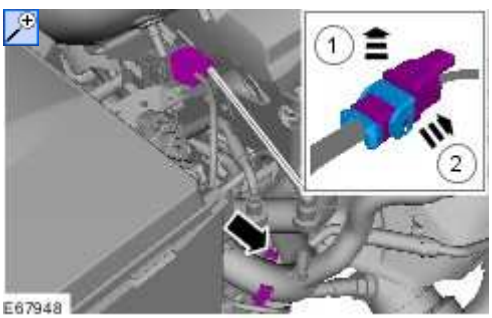
Removal and Installation

Removal

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

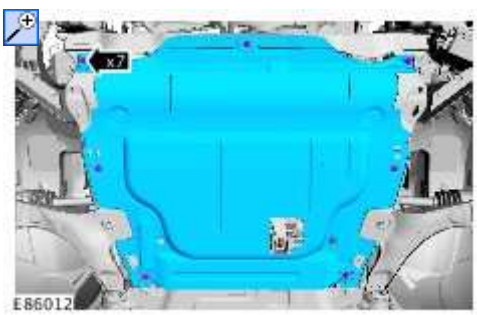


1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.

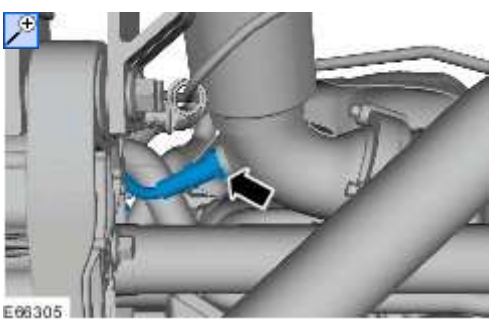


2.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5. *Torque:* 45 Nm

Installation

1. To install, reverse the removal procedure.

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Print

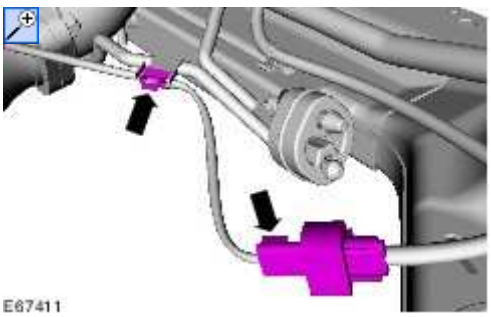
Removal and Installation

Removal

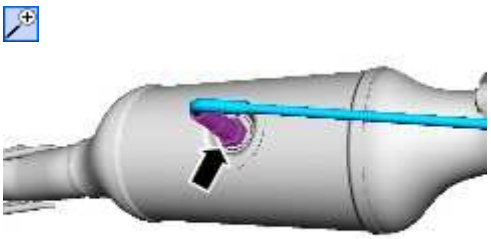
NOTE: Removal steps in this procedure may contain installation details.

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E67411

2.


E68051

3. *Torque:* 47 Nm

Installation

1. To install, reverse the removal procedure.

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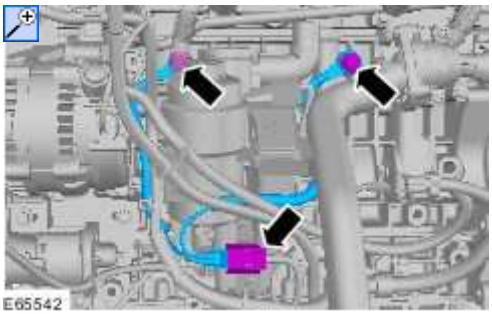
Removal and Installation

Removal

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

1. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).



2. NOTE: Make sure that the sensor is installed in the same location as when removed.
   Torque: 20 Nm

Installation

1. To install, reverse the removal procedure.

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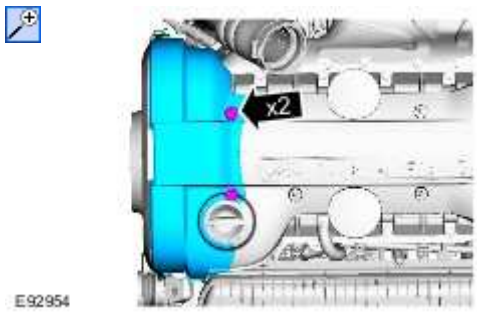
Print

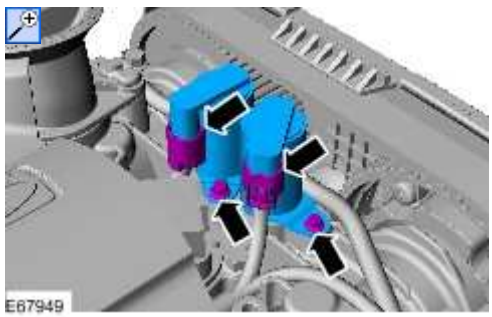
Removal and Installation

Removal

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



1. *Torque:* 10 Nm



2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

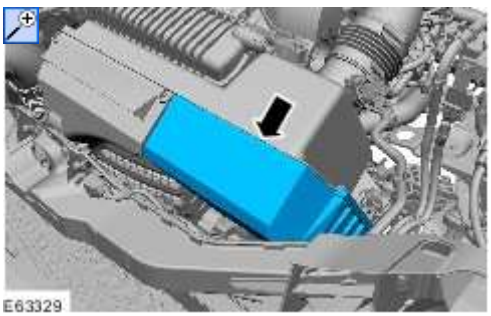
NOTE: Removal steps in this procedure may contain installation details.

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Vehicles without PCM security shield

3.



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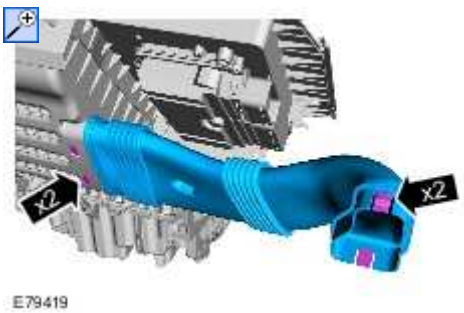

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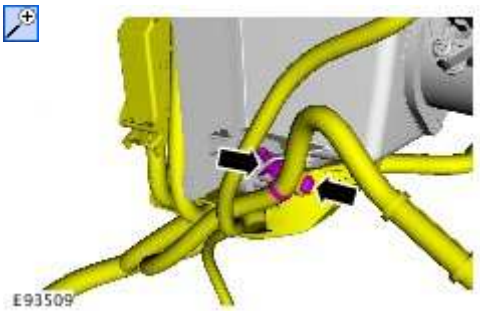
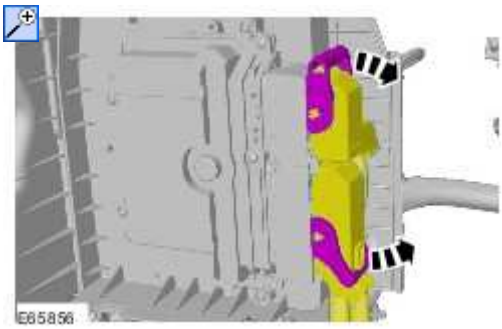
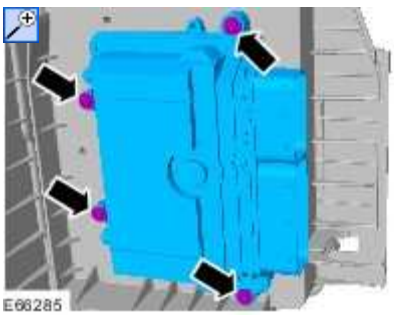


6.

http://vnx.su





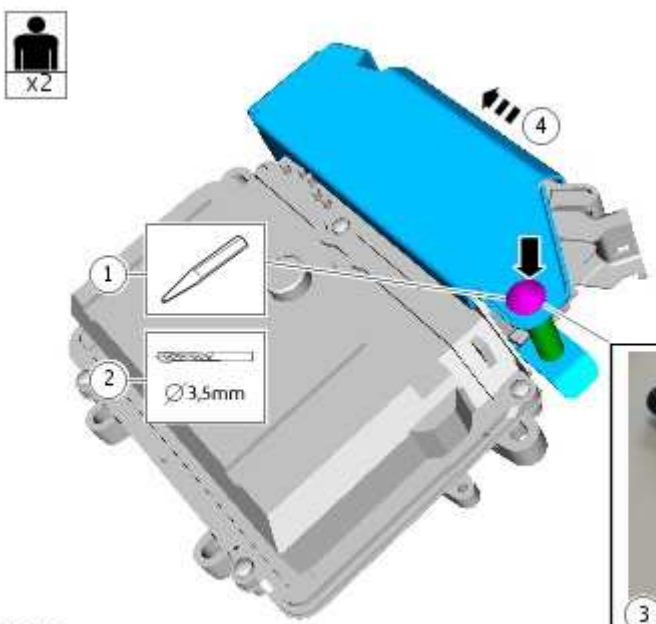
7. *Torque:* 7 Nm

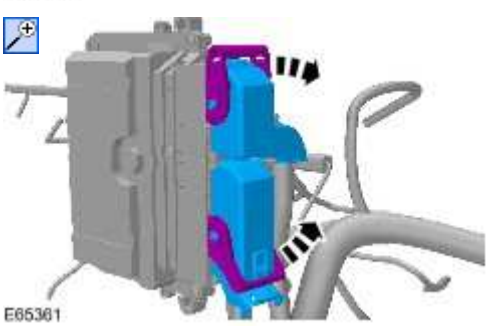
Vehicles with PCM security shield

8. Refer to: Air Cleaner (303-12 Intake Air Distribution Filtering - 2.5L Duratec-ST (VI5), Removal and Installation).

9.

1. *Genera*
   Equipm
   Center
   punch
2. *Genera*
   Equipm
   3.5 mn
   drill bit

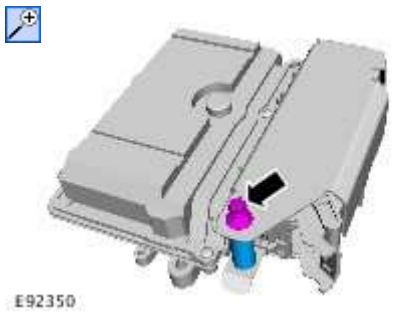




10.

Installation

http://vnx.su



1. To install, reverse the removal procedure.

Vehicles with PCM security shield

2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM and throttle body configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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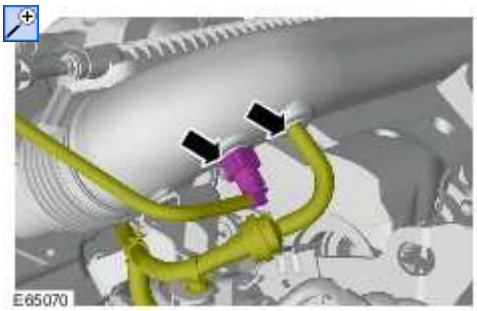
Removal and Installation

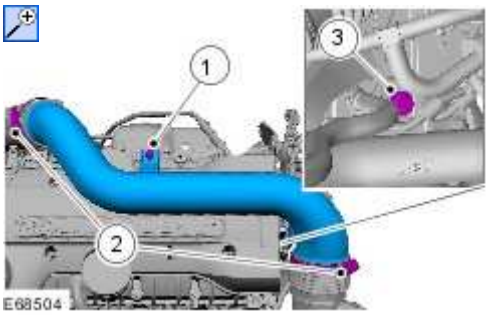
Removal

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

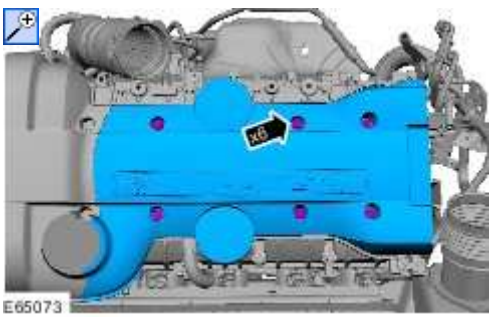
1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



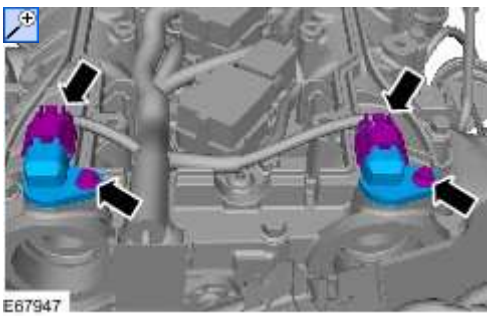
2. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.



3. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   1. *Torque:* 10 Nm
   2. *Torque:* 4 Nm
   3. *Torque:* 10 Nm



4. *Torque:* 10 Nm



5. *Torque:* 10 Nm

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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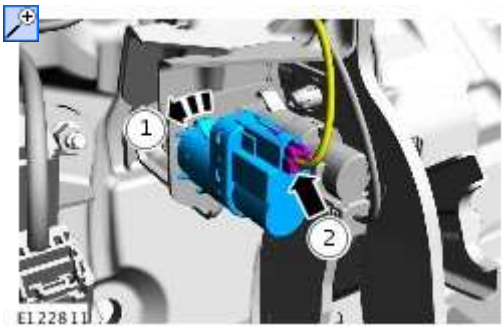
Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

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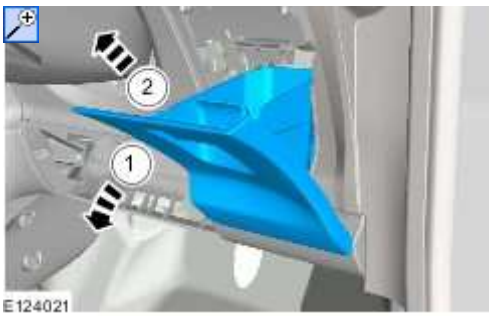
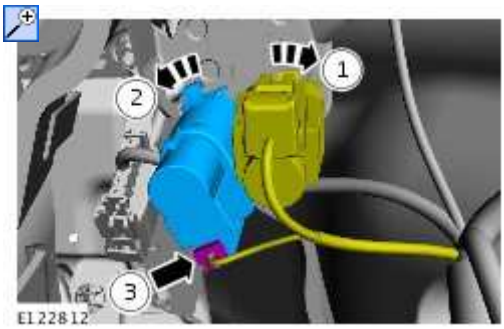
Print

Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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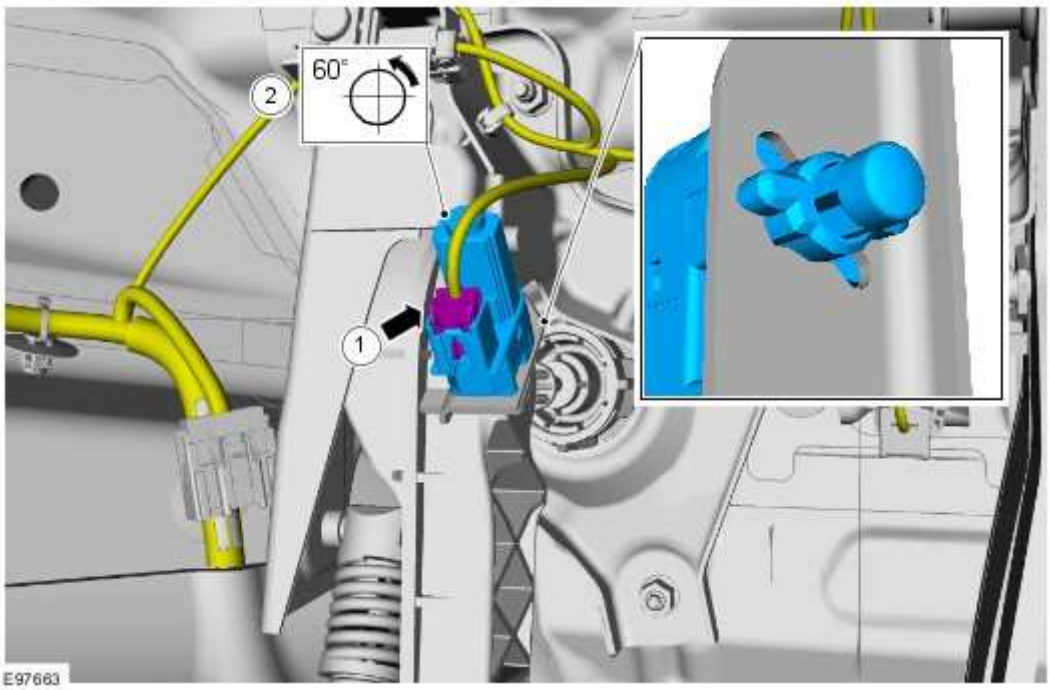
Removal and Installation

Removal



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Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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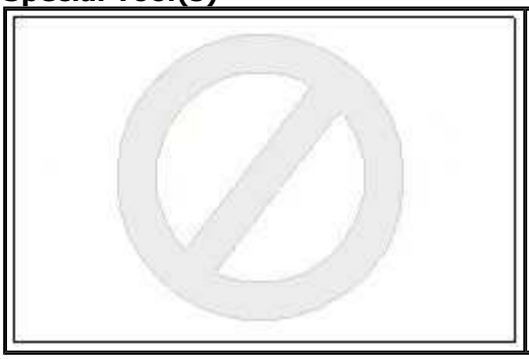
Removal and Installation

Special Tool(s)

	308-651 Installer, Clutch Master Cylinder Sensor

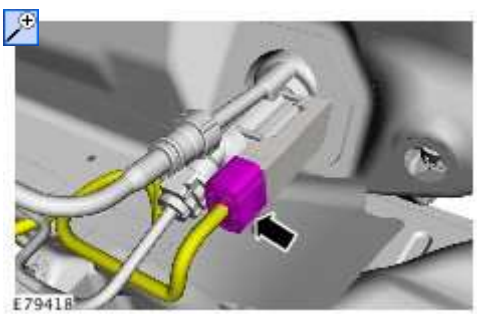
Removal

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

Left-hand drive vehicles

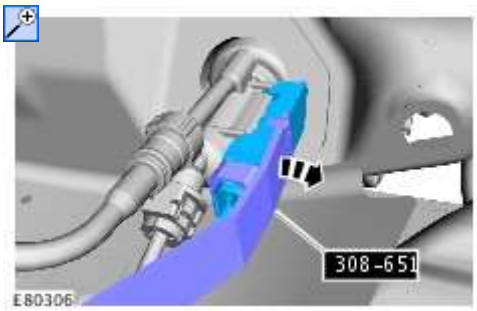
1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.

All vehicles

3. 

4. *Remove the Special Tool(s):* 308-651

http://vnx.su



Installation

1. To install, reverse the removal procedure.

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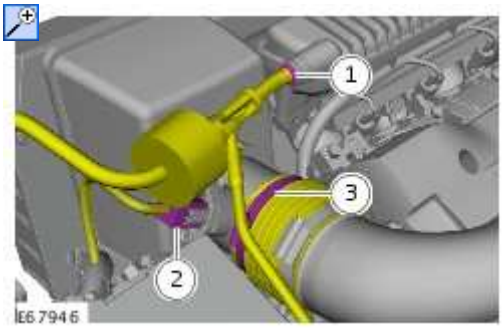
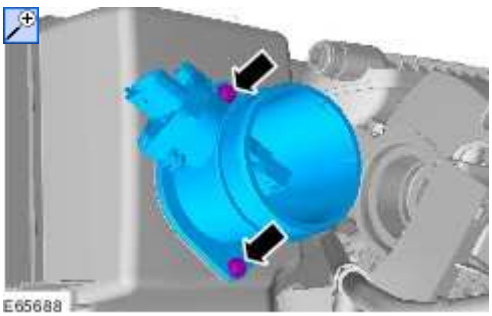
Removal and Installation

Removal

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



1. CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
   3. *Torque:* 4 Nm



2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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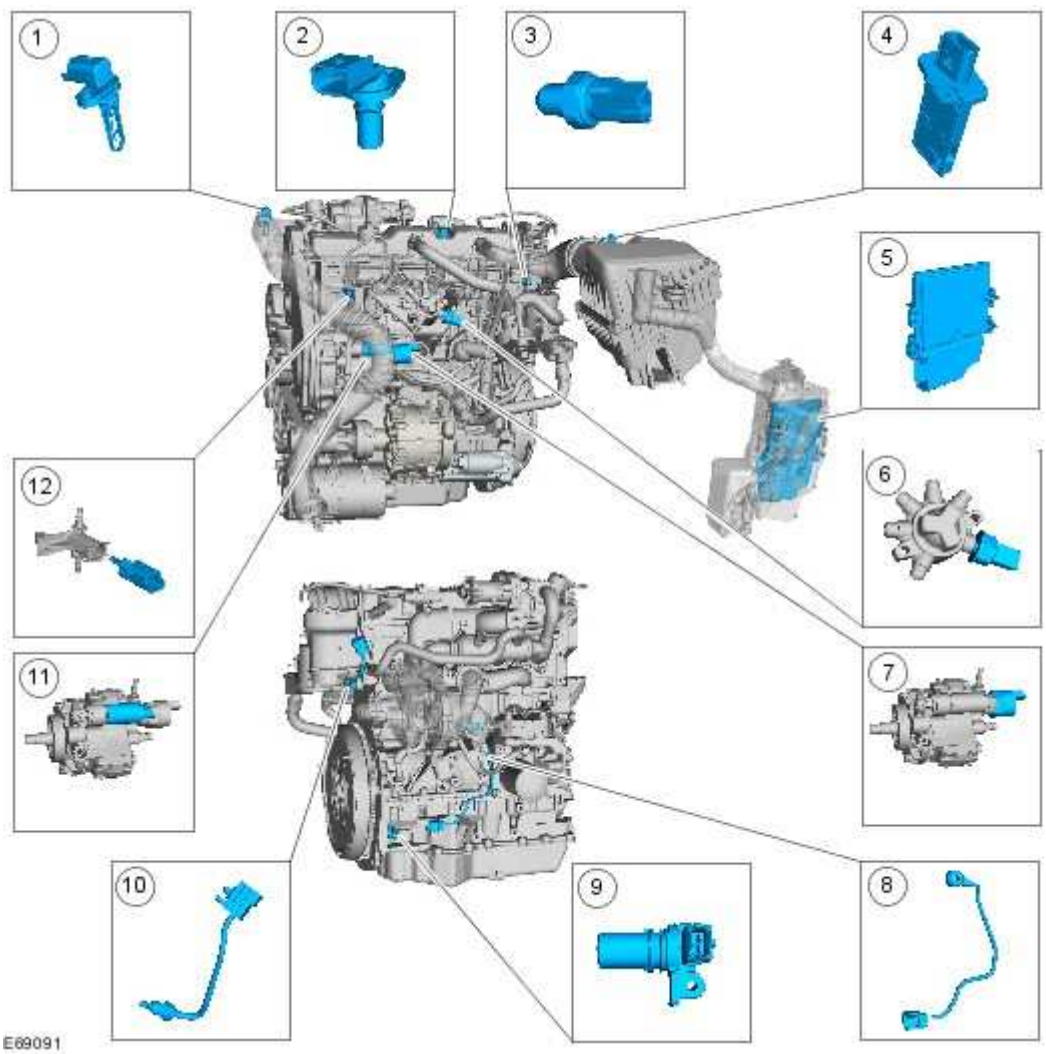
Description and Operation

General overview



Item	Part Number	Description
1	-	Intake air temperature (IAT) sensor
2	-	Camshaft position (CMP) sensor
3	-	Engine oil pressure (EOP) sensor
4	-	Mass air flow (MAF) sensor
5	-	Powertrain control module (PCM)
6	-	Fuel rail pressure (FRP) sensor
7	-	Fuel pressure regulator
8	-	Knock sensor (KS)
9	-	Crankshaft position (CKP) sensor
10	-	Cylinder head temperature (CHT) sensor
11	-	Fuel metering valve
	-	

http://vnx.su

12		Fuel temperature sensor

Components

IAT sensor

E69092

The IAT sensor is a temperature dependent resistor which has a negative temperature coefficient, therefore its temperature changes inversely with respect to ambient temperature. The IAT sensor is supplied with a reference voltage by the PCM. When the intake air changes temperature, the resistance of the IAT sensor changes therefore changing the output voltage. The output voltage is assigned to a corresponding intake air temperature by the PCM.

The signal from the IAT sensor is used as a correction variable for calculating the fuel injection quantity.

CMP sensor

E69093

The CMP sensor uses the Hall effect principle and is supplied with a reference voltage of 5 volts.

During starting, the CKP sensor and the CMP sensor are synchronized. If both signals are present, the engine will be started.

If the signal from the CMP sensor fails while the engine is running, the engine continues to run using the signals from the CKP sensor.

If the CMP signal is missing at the next starting operation, it will not be possible to start the engine.

EOP sensor

E69094

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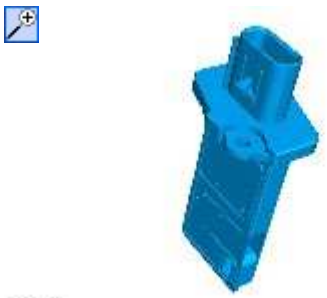
The EOP sensor is located in the cylinder head. The EOP is connected to the instrument cluster and is not directly part of the electronic engine control system. The EOP sensor registers engine oil pressure. The sensor opens when a defined oil pressure is reached and the engine oil pressure warning light is illuminated on the instrument cluster.

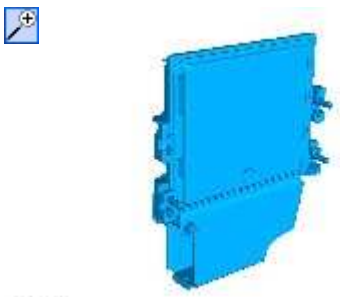
MAF sensor



E69095

The MAF sensor measures the mass of air entering the intake system, the measurement being based on the constant temperature hot wire principle. Suspended in a bypass duct are a hot wire probe and an air temperature probe. The PCM makes sure that the hot wire probe is always 200ºC hotter than the air temperature probe. The hot wire probe is cooled by the air flowing through the intake system and the PCM varies the heating current to maintain the 200ºC temperature difference. The change in heating current is measured as a voltage drop across a precision resistor and is assigned to a corresponding mass air flow calculation by the PCM.

PCM



E69096

The PCM is attached to the windshield washer reservoir and has 3 electrical connectors with a total of 128 pins.

The PCM monitors and processes the signals from the sensors. The fuel injectors, the fuel metering valve and the fuel pressure regulator are also controlled by the PCM.

The PCM can be diagnosed through the data link connector (DLC) using the Worldwide Diagnostic System (WDS).

FRP sensor

E69097

The FRP sensor is located in the fuel rail and measures the fuel pressure within the fuel system.

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The fuel pressure sensor consists of a piezoelectric element that sends a variable voltage signal to the PCM, as a function of fuel pressure.

The PCM uses this signal to calculate how long the fuel injectors are to be actuated for and to regulate the fuel pressure by means of the fuel pressure regulator.

Fuel pressure regulator

E69098

The fuel pressure regulator is screwed directly onto the high-pressure outlet of the fuel pump.

The fuel pressure regulator regulates the fuel pressure at the high-pressure outlet and thereby the fuel pressure to the fuel rail.

In addition, the fuel pressure regulator dampens fuel pressure fluctuations which arise when the fuel pump is supplying fuel and as a result of the fuel injection process.

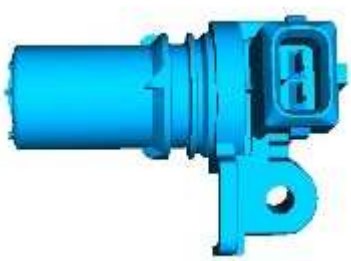
KS

E69099

In conjunction with the PCM, the KS monitors the combustion process and regulates the injection period so that predetermined volumes of fuel are injected into the cylinders at every operating cycle.

By constantly measuring the amount of knock present and adjusting the injection period, the emission values of the engine remain stable.

CKP sensor



E69100

The CKP sensor is an inductive pulse generator which scans 36-1 cast protrusions on the flywheel. Minus one means that one of the cast protrusions is missing and this gap is located at 90 degrees before top dead centre. This gap is used by the PCM as a reference for crankshaft position.

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The CKP sensor uses the Hall effect principle.

CHT sensor

E69101

The CHT sensor is screwed directly into the cylinder head and measures the temperature of the material of the cylinder head, rather than the coolant temperature. This is a more accurate measurement of the engine temperature and the information is used by the instrument cluster for the temperature gauge indication. It is also used by the PCM to calculate fuel injection timing and period of injection which will vary dependant on the engine temperature.

Fuel metering valve

E69102

The fuel metering valve adjusts the quantity of fuel to the high-pressure pump elements as a function of engine operating conditions. This improves engine efficiency.

The fuel metering valve is controlled by the PCM using pulse-width modulation.

The fuel metering valve is closed when de-energized.

Fuel temperature sensor

E69103

The fuel temperature sensor is designed as a resistor with a negative temperature coefficient (NTC).

The fuel temperature sensor monitors the temperature of the fuel returning to the fuel tank from the fuel pump and the fuel injectors and sends a signal to the PCM.

The signal is required by the PCM for making fine adjustments to the fuel injection timing and the fuel injection quantity.

Brake pedal position (BPP) switch and brake light switch

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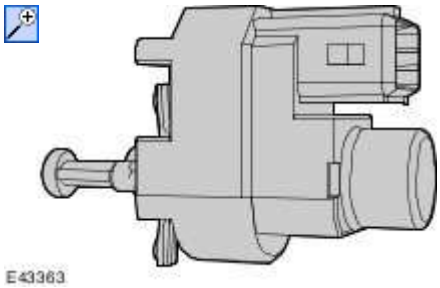

E43363

The BPP switch is connected to the instrument cluster through the CAN bus.

The BPP switch is closed when de-energized and sends a ground signal to the PCM.

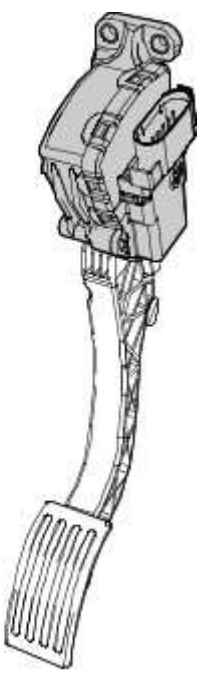
The brake light switch is connected with the PCM through a conventional electrical connector.

The brake light switch is open when de-energized. When the brake light switch is closed, it sends 12 volts to the PCM.

The signals of the BPP switch and the brake light switch are used if the APP sensor should fail.

In this instance, the PCM compares the signals of the BPP switch and brake light switch.

APP sensor


E43365

The APP sensor is a double contactless inductive sensor.

For safety reasons, the APP sensor consists of two sensors.

If the APP sensor malfunctions when the vehicle is in operation, a diagnostic trouble code (DTC) will be stored in the PCM.

If one of the sensors in the APP sensor should fail, the engine will operate at reduced power.

If the vehicle is fitted with a driver information system, the fault message "REDUCED ACCELERATION" will be displayed.

If both sensors of the APP switch fail, after a single operation of the BPP switch and the brake light switch and then after a plausibility check, the engine is controlled up to a speed of 1200 RPM. The vehicle can be accelerated to a maximum speed of 56 km/h (35 mph).

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When the BPP switch and the brake light switch are actuated again, engine speed will drop to idle speed. Once the BPP switch and the brake light switch are de-energized again, engine speed is increased again.

If the vehicle is fitted with an information and message system, the fault message "REDUCED TOP SPEED" will be displayed.

If the vehicle is not fitted with an information and message system, the malfunction indicator lamp (MIL) will be illuminated to indicate a system fault.

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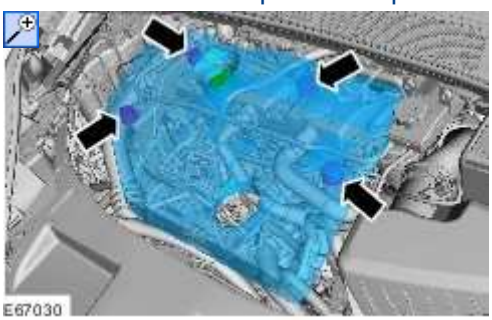
Electronic Engine Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Camshaft Position (CMP) Sensor	S-MAX/Galaxy 2006.5 (02/2006-)

Print

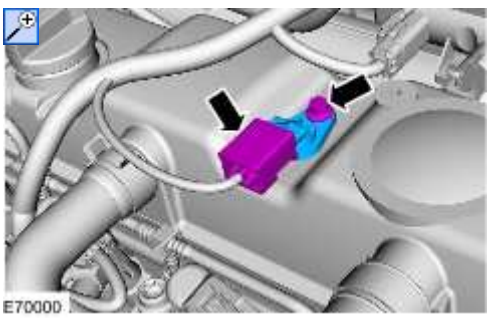
Removal and Installation

Removal

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



1.



2. *Torque:* 10 Nm

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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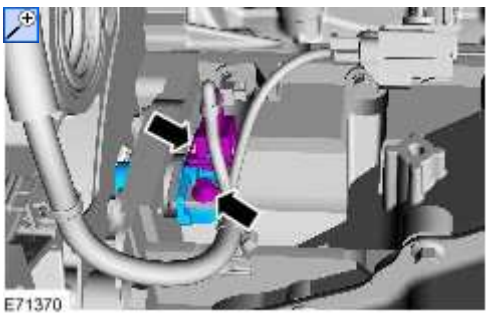
Removal and Installation

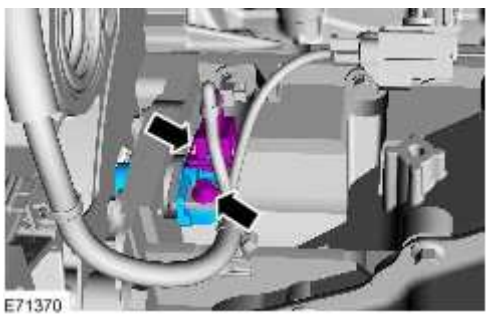
Removal


E71370

1. Discard the CKP sensor.

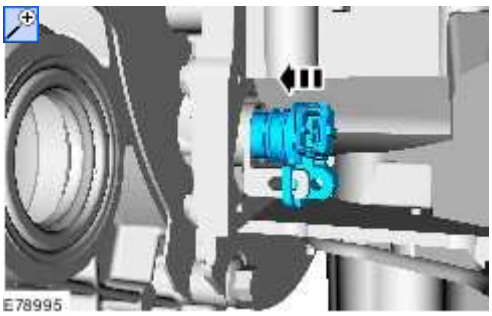
Installation

1. NOTE: Make sure that a new component is installed.
   - If the new CKP sensor has a raised feature on the tip, follow steps 2 and 3.
   - If the new CKP sensor has a flat tip, follow steps 4 through to 6.

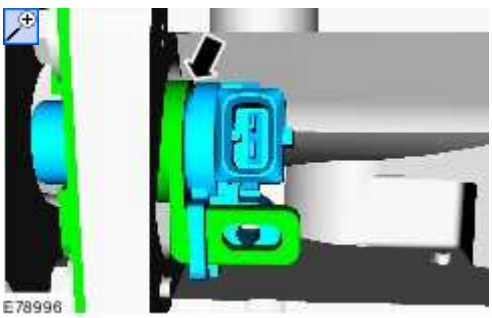

E71370

2. Push the CKP sensor against the flywheel.

   Torque: 6 Nm


E78995

3. Install the CKP sensor against the flywheel.


E78996

4. Using suitable feeler gauges, take note of the measurement of the gap between the CKP sensor and the CKP sensor housing.

5.

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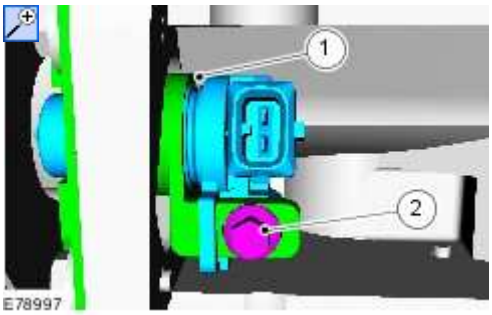
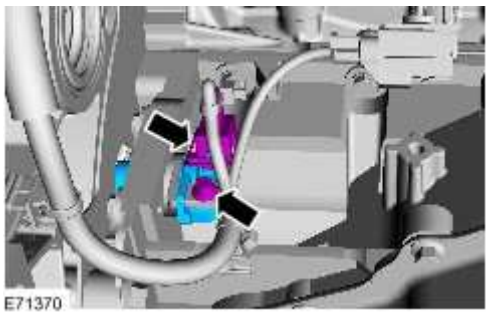


1. Add 1.2 mm to the measurement recorded in step 6. Using suitable feeler gauges set to the calculated figure, set the gap between the CKP sensor and the CKP sensor housing.
2. Finger tighten the CKP sensor bolt.



6. *Torque:* 6 Nm

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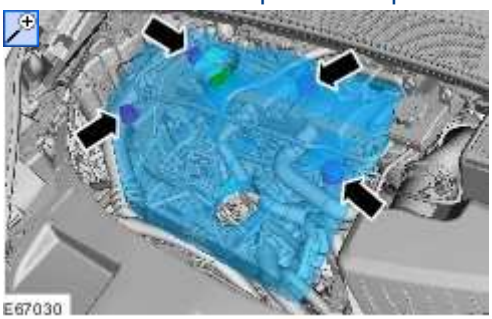
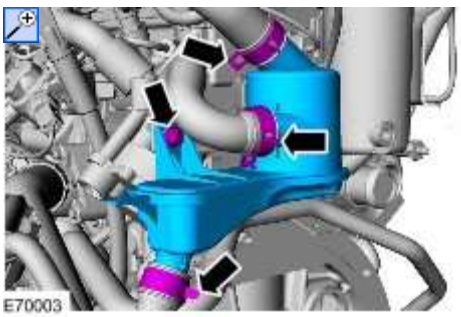
Removal and Installation

Removal

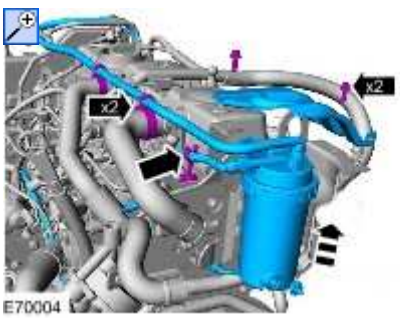
NOTE: Removal steps in this procedure may contain installation details.



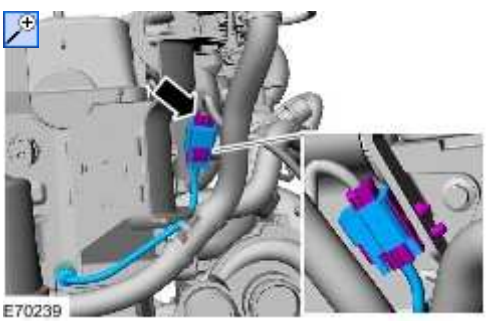
1.



2. *Torque:* 23 Nm



3. CAUTION: Make sure that no strain is placed on the fuel lines and wiring harnesses.
Torque: 9 Nm



4. NOTE: Make sure that the sensor housing is clean and free of foreign material.
Torque: 20 Nm

Installation

NOTE: Make sure that a new component is installed.

1. To install, reverse the removal procedure.

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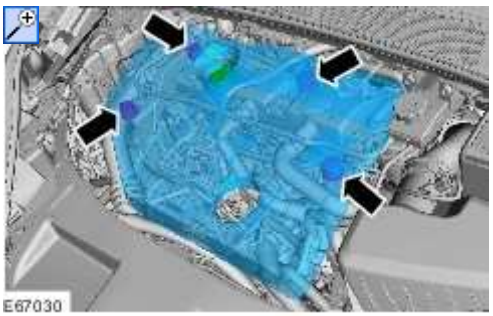
Removal and Installation

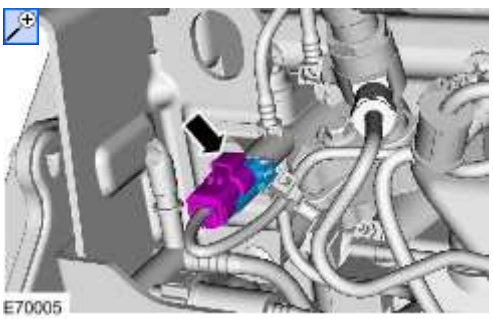
Removal



1.

2. Clean the fuel temperature sensor and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



3.

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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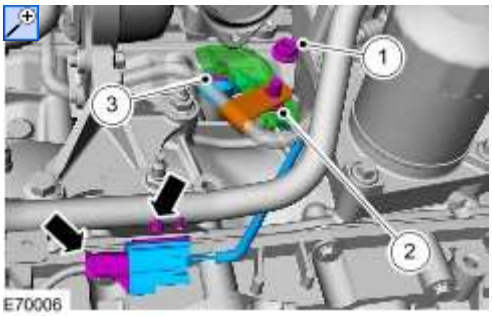
Removal and Installation

Removal

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

1. Remove the catalytic converter.

   Refer to: Catalytic Converter (309-00D Exhaust System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



2. NOTE: Note the position of the component before removal.
   1. Discard the nut.

      Torque: 18 Nm
   2. *Torque:* 23 Nm
   3. *Torque:* 20 Nm

Installation

1. CAUTION: A new component may be supplied with a longer cable than the one removed. Make sure that the cable cannot be damaged or cause a noise, vibration or harshness (NVH) concern.
   NOTE: Make sure that the sensor is installed in the same location as when removed.
   NOTE: Make sure that a new component is installed.
   To install, reverse the removal procedure.

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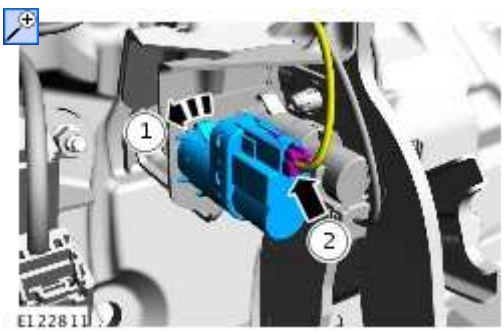
Electronic Engine Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx - Brake Pedal Position (BPP) Switch—LHD FWD	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

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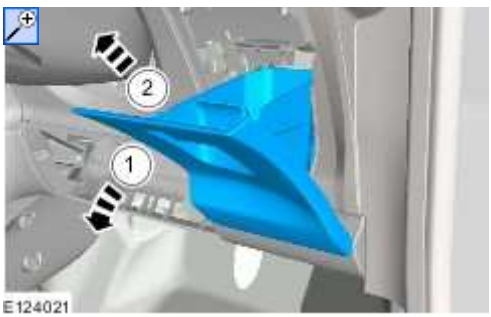
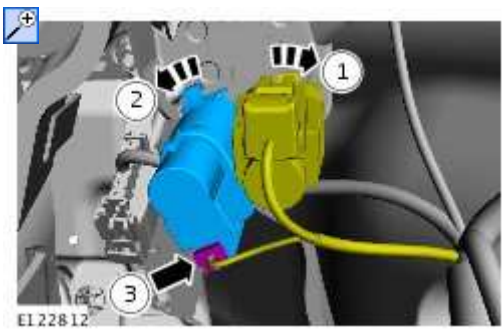
Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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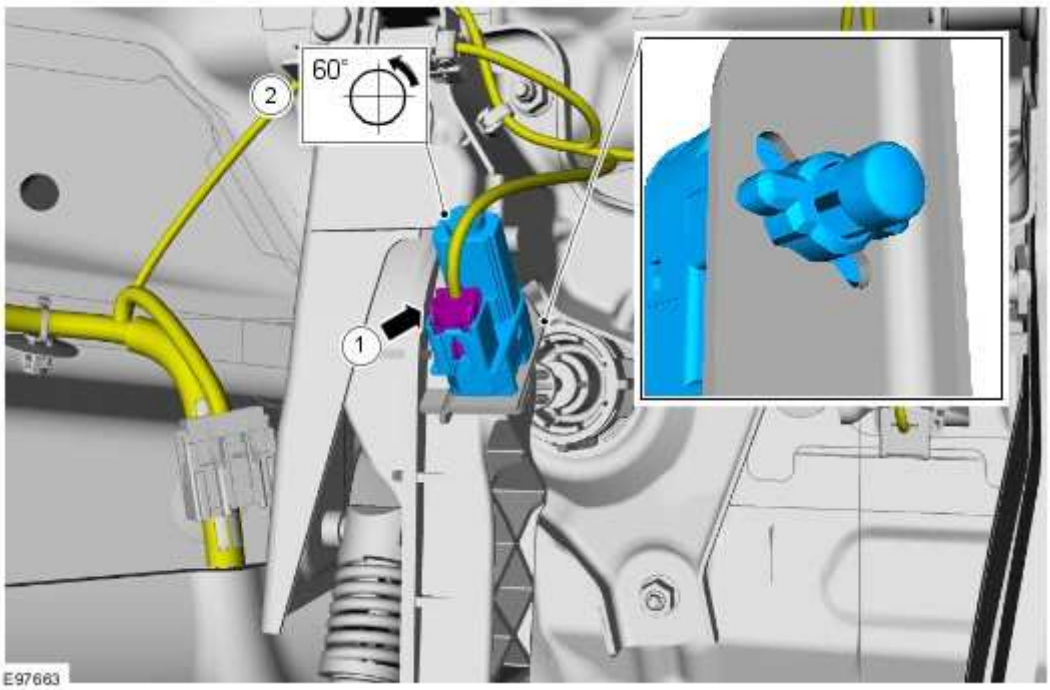
Removal and Installation

Removal



1. CAU
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Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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Removal and Installation

Special Tool(s)

	308-651 Installer, Clutch Master Cylinder Sensor

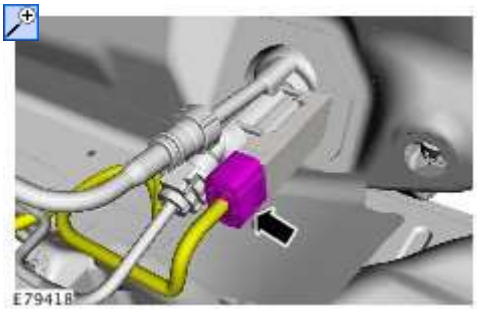
Removal

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

Left-hand drive vehicles

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.

All vehicles

3. 

4. *Remove the Special Tool(s):* 308-651

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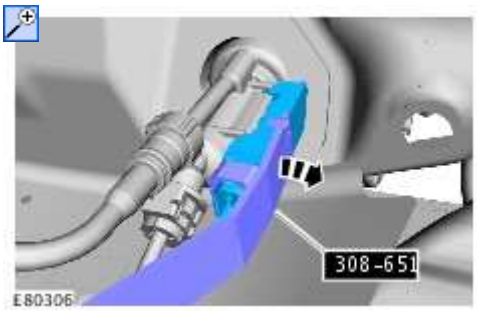

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

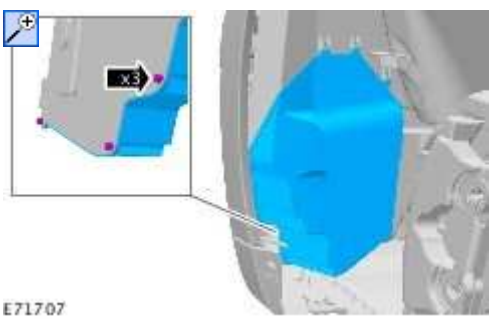
3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Left-hand side wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4.

5. 

   Vehicles with PCM security shield
6. *Torque:* 3 Nm

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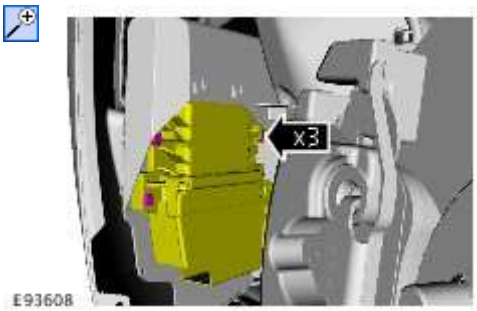
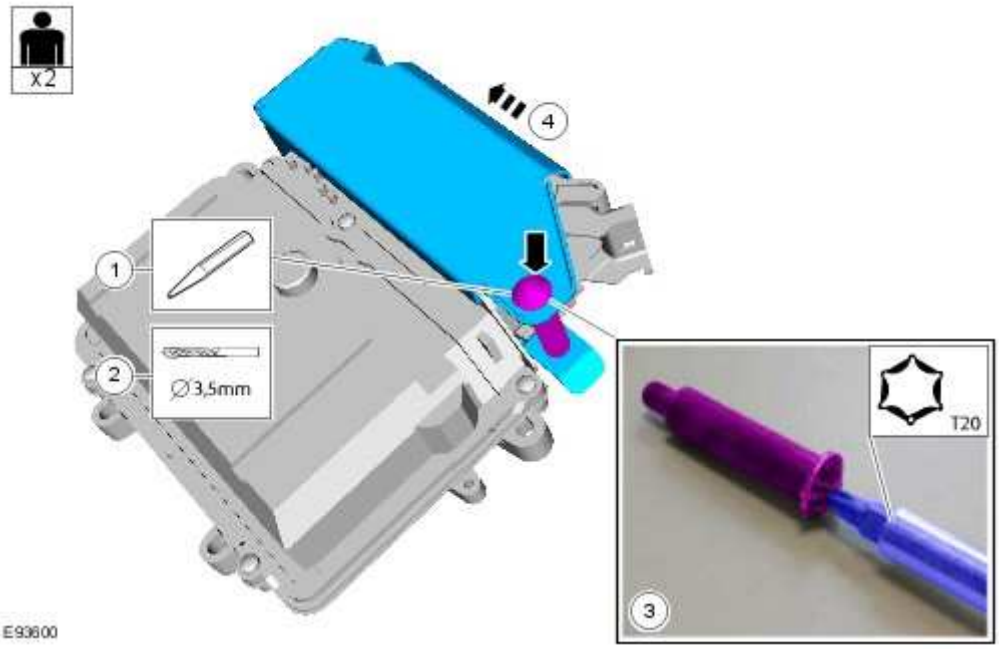
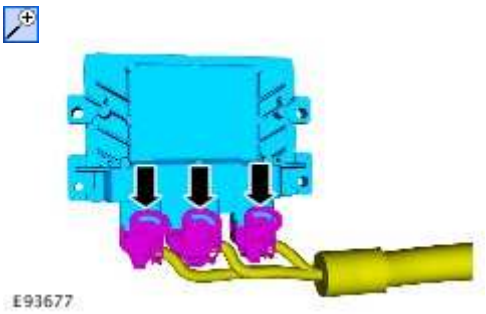


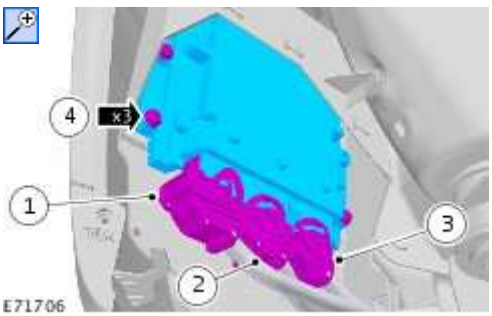
7. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit





8.

Vehicles without PCM security shield



9. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield

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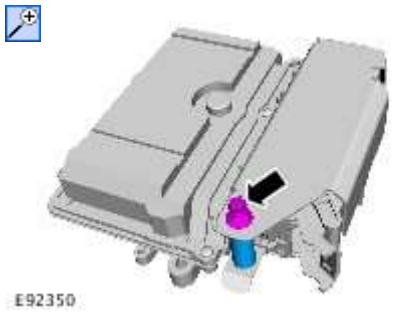

2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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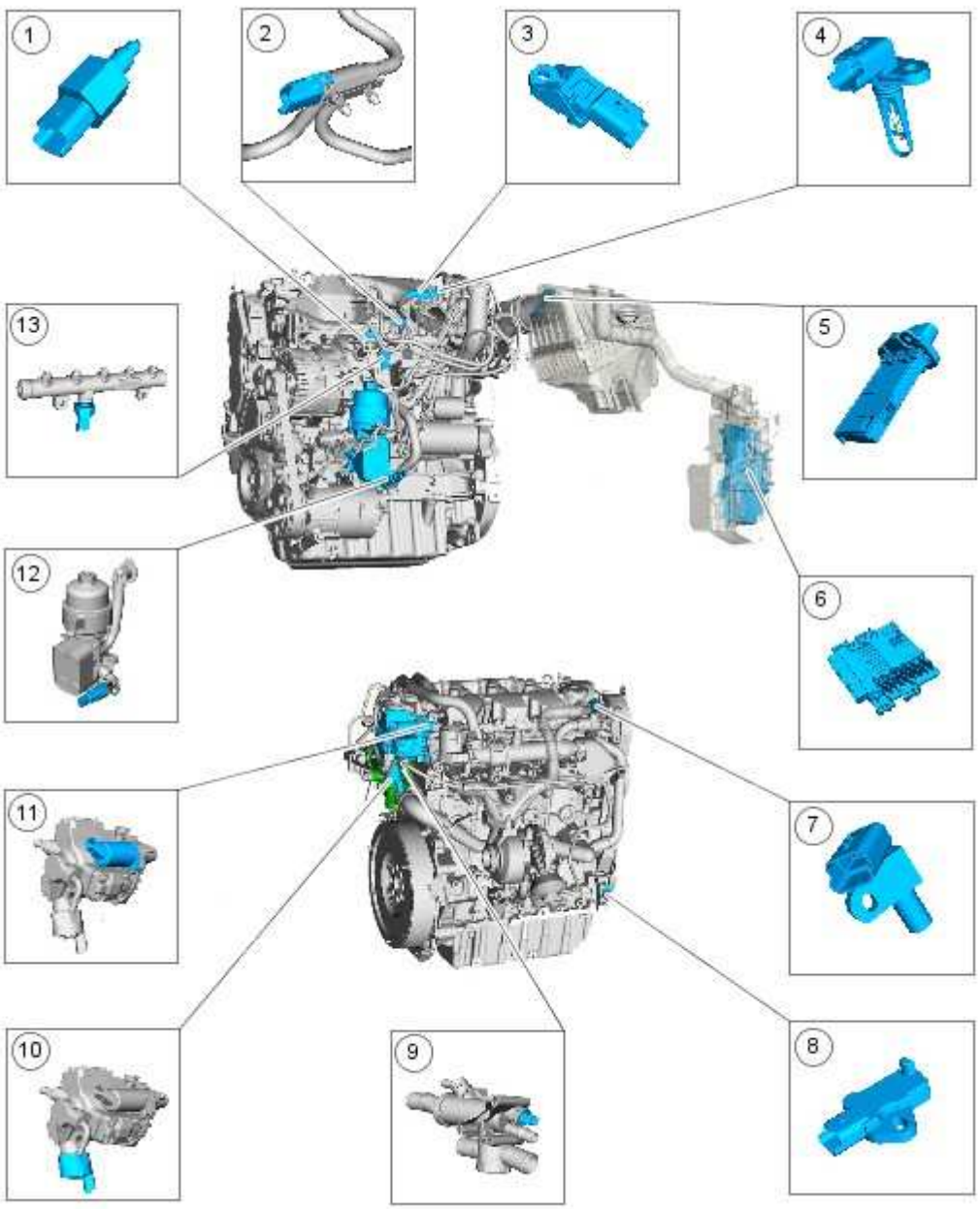
Description and Operation

General overview



E69334

Item	Part Number	Description
1	-	Water-in-fuel sensor
2	-	Fuel temperature sensor
3	-	Manifold absolute pressure (MAP) sensor
4	-	Intake air temperature (IAT) sensor
	-	

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5		Mass air flow (MAF) sensor
	6 -	Powertrain control module (PCM)
7	-	Camshaft position (CMP) sensor
8	-	Crankshaft position (CKP) sensor
9	-	Engine coolant temperature (ECT) sensor
10	-	Fuel pressure regulator
11	-	Fuel metering valve
12	-	Engine oil pressure (EOP) sensor
13	-	Fuel rail pressure (FRP) sensor

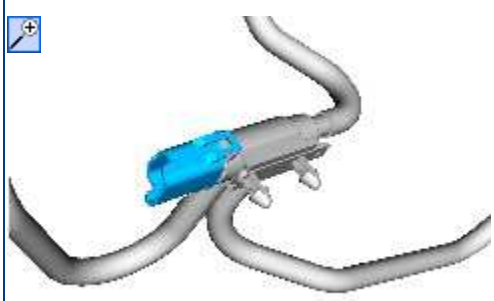
Components

Water-in-fuel sensor

E69336

The water-in-fuel sensor is located in the fuel filter and sends a signal to the PCM if water has accumulated in the fuel filter.

Fuel temperature sensor



E69727

The fuel temperature sensor is designed as a resistor with a negative temperature coefficient (NTC).

The fuel temperature sensor monitors the temperature of the fuel returning to the fuel tank from the fuel pump and the fuel injectors and sends a signal to the PCM.

The signal is required by the PCM for making fine adjustments to the fuel injection timing and the fuel injection quantity.

MAP sensor

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E69335

The MAP sensor measures the charging pressure in the intake air shutoff throttle and sends the PCM an analog voltage signal.

IAT sensor

E69092

The IAT sensor is a temperature dependent resistor which has a negative temperature coefficient, therefore its temperature changes inversely with respect to ambient temperature. The IAT sensor is supplied with a reference voltage by the PCM. When the intake air changes temperature, the resistance of the IAT sensor changes therefore changing the output voltage. The output voltage is assigned to a corresponding intake air temperature by the PCM.

The signal from the IAT sensor is used as a correction variable for calculating the fuel injection quantity.

MAF sensor

E69095

The MAF sensor measures the mass of air entering the intake system. The measurement is based on the constant temperature hot wire principle. Suspended in a bypass duct are a hot wire probe and an air temperature probe. The PCM makes sure that the hot wire probe is always 200ºC hotter than the air temperature probe. The hot wire probe is cooled by the air flowing through the intake system and the PCM varies the heating current to maintain the 200ºC temperature difference. The change in heating current is measured as a voltage drop across a precision resistor and is assigned to a corresponding mass air flow calculation by the PCM.

PCM

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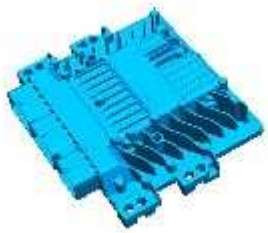

E69342

The PCM is attached to the windshield washer reservoir and has 3 electrical connectors with a total of 128 pins.

The PCM monitors and processes the signals from the sensors. The fuel injectors, the fuel metering valve and the fuel pressure regulator are also controlled by the PCM.

The PCM can be diagnosed through the data link connector (DLC) using the Worldwide Diagnostic System (WDS).

CMP sensor

E69343

The CMP sensor uses the Hall effect principle and is supplied with a reference voltage of 5 V.

During starting, the CKP sensor and the CMP sensor are synchronized. If both signals are present, the engine can be started.

If the signal from the CMP sensor fails while the engine is running, the engine continues to run using the signals from the CKP sensor.

If the CMP signal is missing at the next starting operation, it will not be possible to start the engine.

CKP sensor

E69337

The CKP sensor is an inductive pulse generator which scans 36-1 cast protrusions on the flywheel. Minus one means that one of the cast protrusions is missing and this gap is located at 90 degrees before top dead centre. This gap is used by the PCM as a reference for crankshaft position.

The CKP sensor uses the Hall effect principle.

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ECT sensor

E69338

The ECT sensor is screwed directly into the coolant outlet connector and measures the temperature of the engine coolant rather than the cylinder head temperature. The information is used by the instrument cluster for the temperature gauge indication. It is also used by the PCM to calculate fuel injection timing and period of injection which will vary dependant on the engine temperature.

Fuel pressure regulator

E69339

The fuel pressure regulator is screwed directly onto the high-pressure outlet of the fuel pump.

The fuel pressure regulator regulates the fuel pressure at the high-pressure outlet and thereby the fuel pressure to the fuel rail.

In addition, the fuel pressure regulator dampens fuel pressure fluctuations which arise when the fuel pump is supplying fuel and as a result of the fuel injection process.

Fuel metering valve

E69340

The fuel metering valve adjusts the quantity of fuel to the high-pressure pump elements as a function of engine operating conditions. This improves engine efficiency.

The fuel metering valve is controlled by the PCM using pulse-width modulation.

The fuel metering valve is closed when de-energized.

EOP sensor

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E69341

The EOP sensor is located in the oil filer housing. The EOP is connected to the instrument cluster and is not directly part of the electronic engine control system. The EOP sensor registers engine oil pressure. The sensor opens when a defined pressure is reached and the engine oil pressure warning light is illuminated on the instrument cluster.

FRP sensor

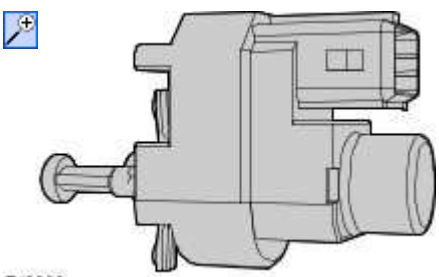
E69726

The FRP sensor is located in the fuel rail and measures the fuel pressure within the fuel system.

The FRP sensor consists of a piezoelectric element that sends a variable voltage signal to the PCM, as a function of fuel pressure.

The PCM uses this signal to calculate how long the fuel injectors are to be actuated for and to regulate the fuel pressure by means of the fuel pressure regulator.

Brake pedal position (BPP) switch and brake light switch



E43363

The BPP switch is connected to the instrument cluster through the CAN bus.

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The BPP switch is closed when de-energized and sends a ground signal to the PCM.

The brake light switch is connected with the PCM through a conventional electrical connector.

The brake light switch is open when de-energized. When the brake light switch is closed, it sends 12 volts to the PCM.

The signals of the BPP switch and the brake light switch are used if the accelerator pedal position (APP) sensor should fail.

In this instance, the PCM compares the signals of the BPP switch and brake light switch.

APP sensor

E43365

The APP sensor is a double contactless inductive sensor.

For safety reasons, the APP sensor consists of two sensors.

If the APP sensor malfunctions when the vehicle is in operation, a diagnostic trouble code (DTC) will be stored in the PCM.

If one of the sensors in the APP sensor should fail, the engine will operate at reduced power.

If the vehicle is fitted with a driver information system, the fault message "REDUCED ACCELERATION" will be displayed.

If both sensors of the APP switch fail, after a single operation of the BPP switch and the brake light switch and then after a plausibility check, the engine is controlled up to a speed of 1200 RPM. The vehicle can be accelerated to a maximum speed of 56 km/h (35 mph).

When the BPP switch and the brake light switch are actuated again, engine speed will drop to idle speed. Once the BPP switch and the brake light switch are de-energized again, engine speed is increased again.

If the vehicle is fitted with an information and message system, the fault message "REDUCED TOP SPEED" will be displayed.

If the vehicle is not fitted with an information and message system, the malfunction indicator lamp (MIL) will be illuminated to indicate a system fault.

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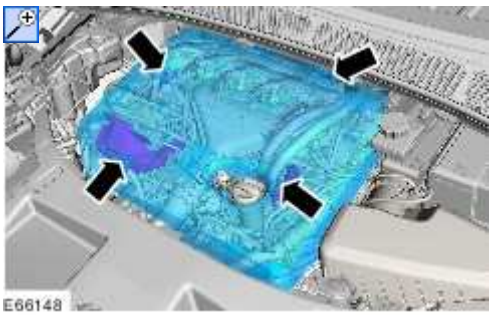
Removal and Installation

Removal

CAUTION: Make sure that the ignition key is removed.

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



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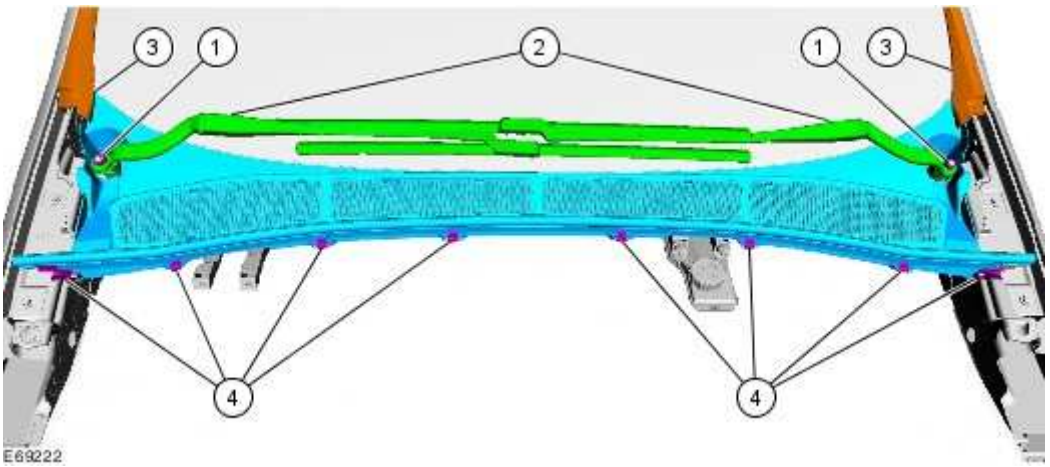
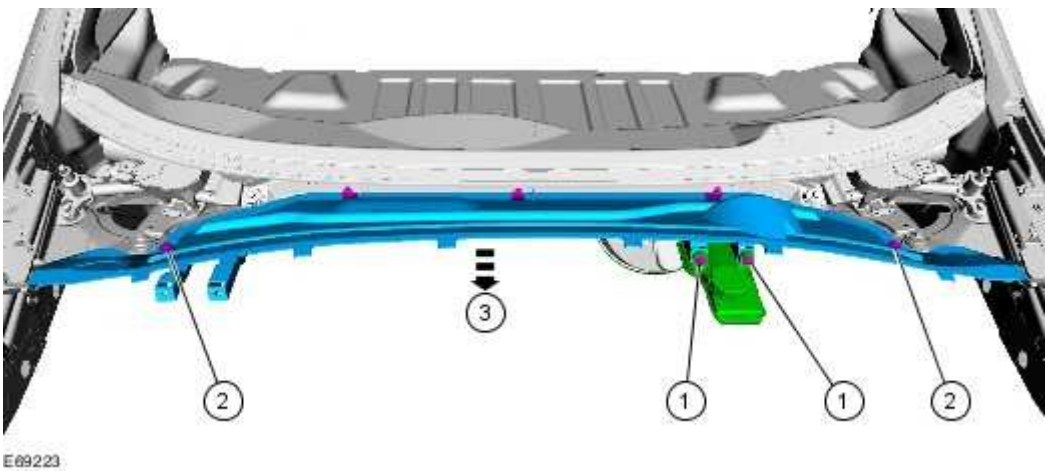


2.

1. *Torq* 22 N
3. Deta the A pillar exte trim pane lowe clips



3.

2. *Torq* 10 N

4.

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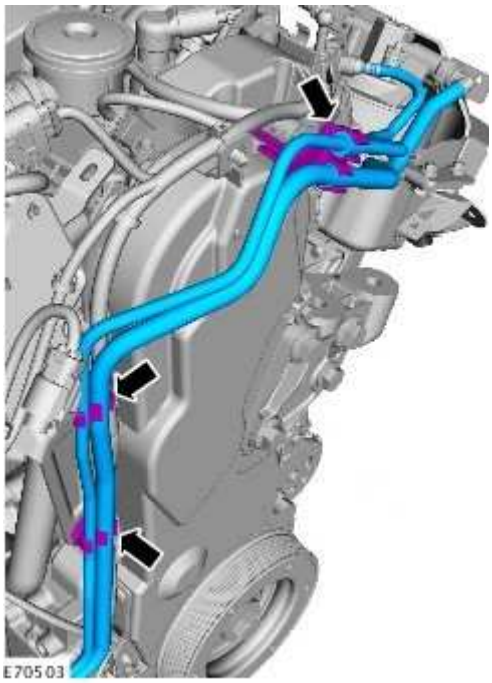

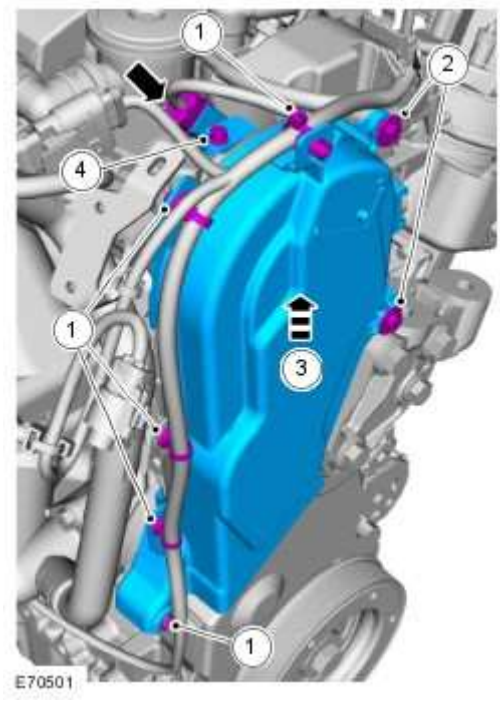

5.
   1. Detach the clips.
   2. *Torque:* 7 Nm
   4. *Torque:* 2 Nm

Installation

1. CAUTION: Only rotate the crankshaft clockwise.
   NOTE: Make sure that the sensor housing is clean and free of foreign material.
   NOTE: Make sure that a new component is installed.
   1. Rotate the engine until the back of one of the three webs of the camshaft pulley is in line wit the CMP sensor hole in the timing belt cover b plate.
   2. Install the CMP sensor until the tip of the sens touches the back of the camshaft pulley.

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2. To install, reverse the removal procedure.

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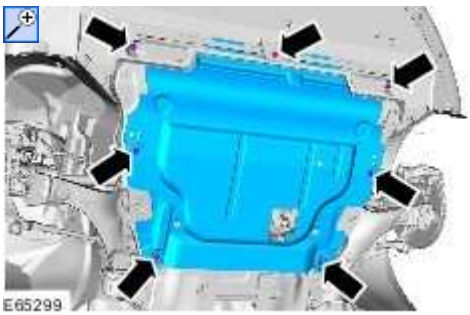
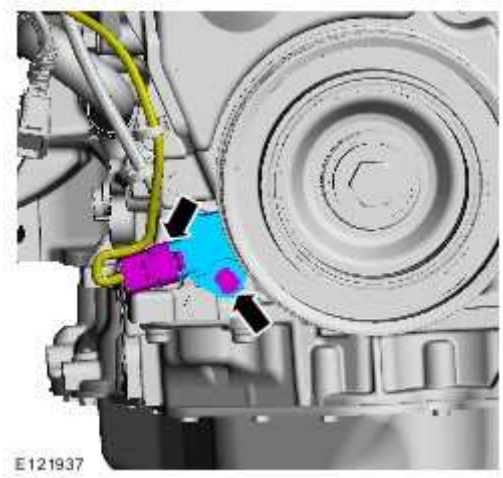
Removal and Installation

Removal

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

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. 

3. 

    1. *Torque:* 8 Nm

Installation

CAUTION: Make sure that the component is correctly located on the locating dowels.
NOTE: Make sure that new components are installed.

1. To install, reverse the removal procedure.

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Removal and Installation

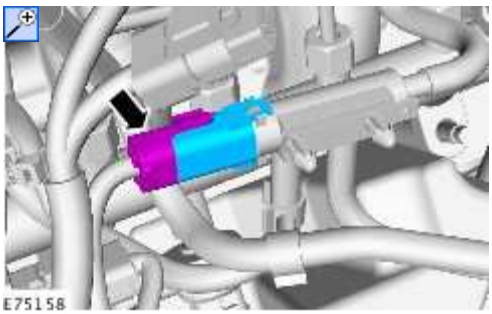
Removal

1. Remove the intake manifold.

   Refer to: Intake Manifold (303-01F Engine - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

2. Clean the fuel temperature sensor and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

3. 

Installation

1. NOTE: Make sure that the sensor housing is clean and free of foreign material.
   To install, reverse the removal procedure.

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Removal and Installation

General Equipment

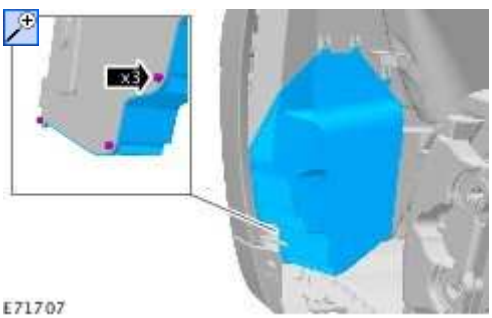
3.5 mm drill bit
Center punch
Ford diagnostic equipment

Removal

1. NOTE: This step is only necessary when installing a new component.
   Download the PCM and throttle body configuration information into the diagnostic tool, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Left-hand side wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
4.

5. 

   Vehicles with PCM security shield
6. *Torque:* 3 Nm

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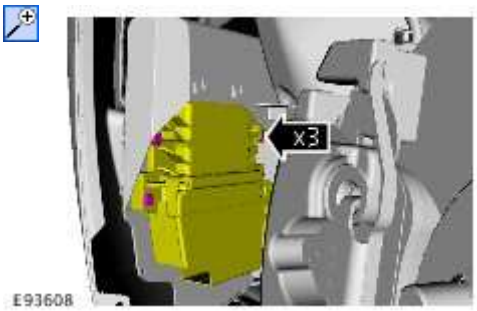
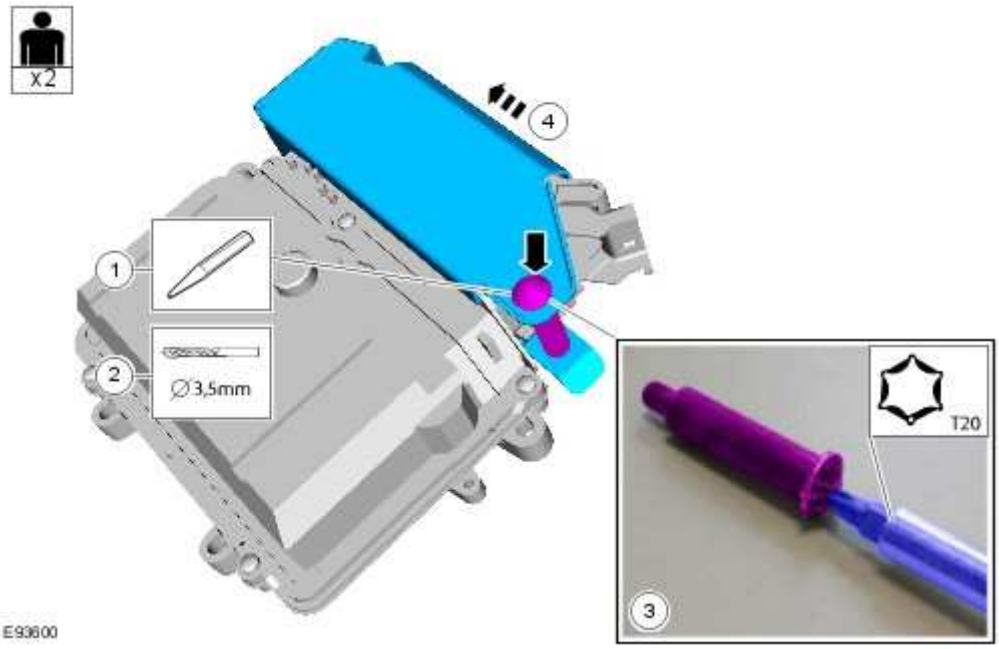
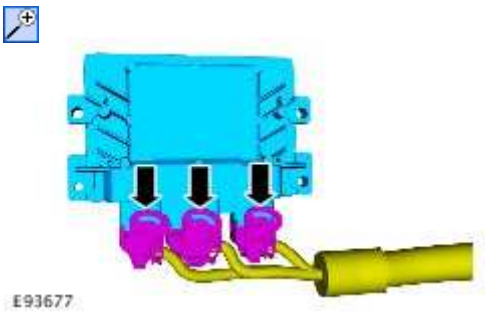


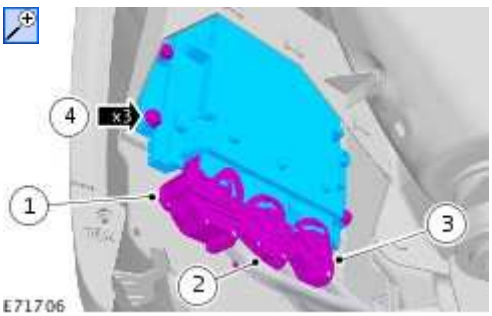
7. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit





8.

Vehicles without PCM security shield



9. *Torque:* 3 Nm

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield

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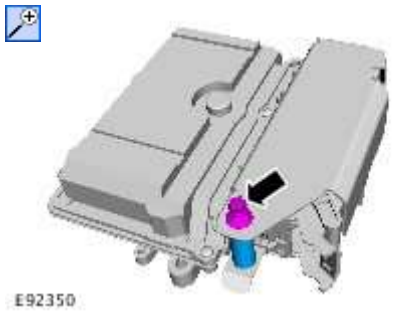

2. Tighten the shear bolt until the head is sheared off.

All vehicles

3. NOTE: This step is only necessary when installing a new component.
   Upload the PCM configuration information into the PCM, using the Programmable Modules Installation routine.

   General Equipment: Ford diagnostic equipment

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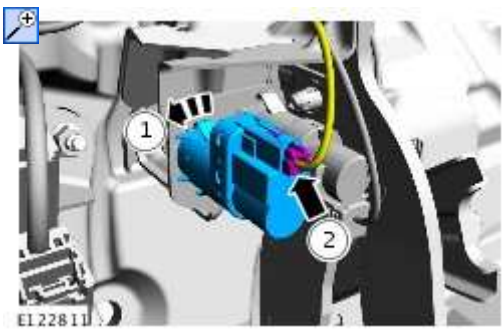
Electronic Engine Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW - Brake Pedal Position (BPP) Switch—LHD FWD	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

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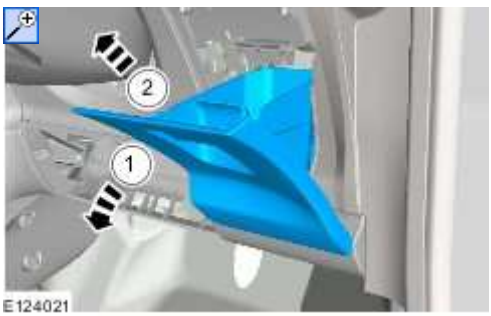
Electronic Engine Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW - Brake Pedal Position (BPP) Switch—RHD FWD	S-MAX/Galaxy 2006.5 (02/2006-)

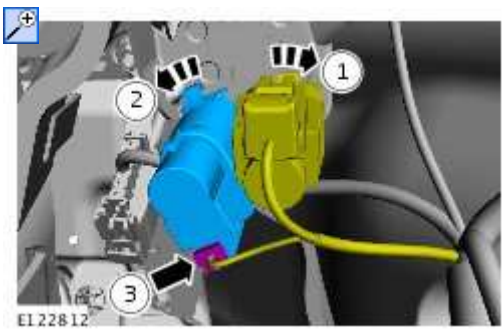
Print

Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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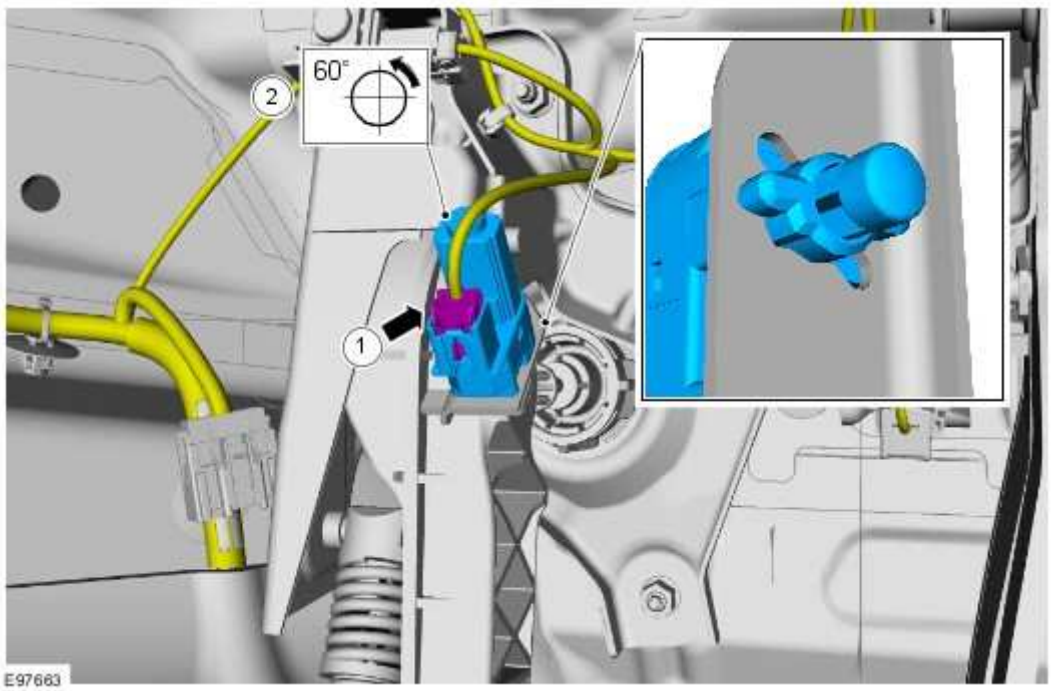
Removal and Installation

Removal



1. CAU
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pedal re
in the re
position.

Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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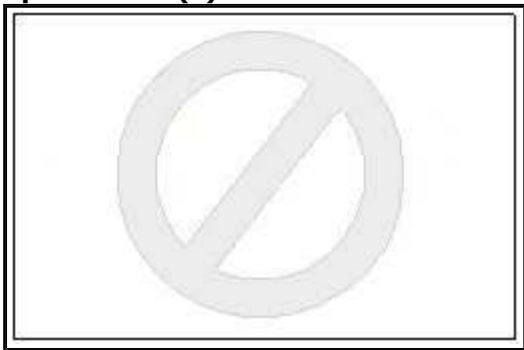
Removal and Installation

Special Tool(s)

	308-651 Installer, Clutch Master Cylinder Sensor

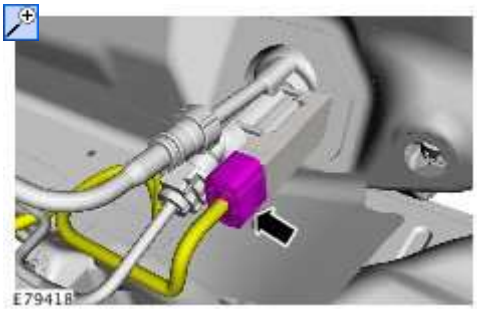
Removal

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

Left-hand drive vehicles

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.

All vehicles

3. 

4. *Remove the Special Tool(s):* 308-651

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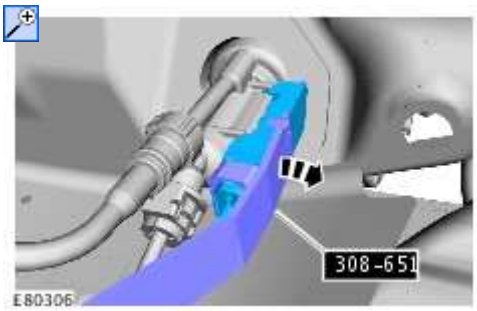

Installation

1. To install, reverse the removal procedure.

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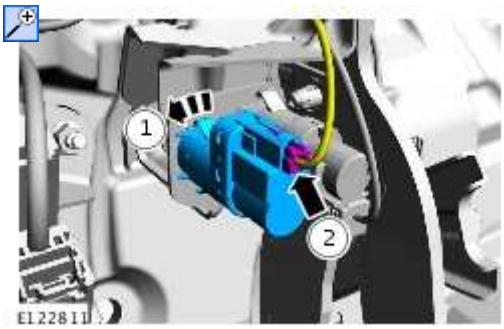
Electronic Engine Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW - Brake Pedal Position (BPP) Switch—LHD FWD	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

CAUTION: Make sure that the brake pedal remains in the rest position.



1.

Installation

CAUTION: Make sure that the brake pedal remains in the rest position.

1. To install, reverse the removal procedure.

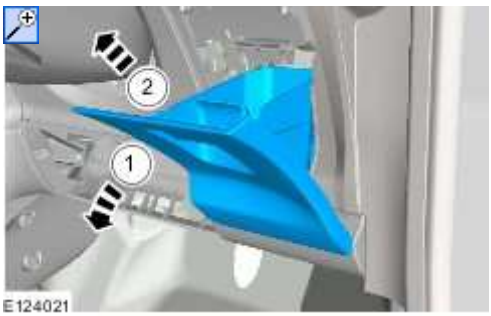
http://vnx.su

Electronic Engine Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW - Brake Pedal Position (BPP) Switch—RHD FWD	S-MAX/Galaxy 2006.5 (02/2006-)

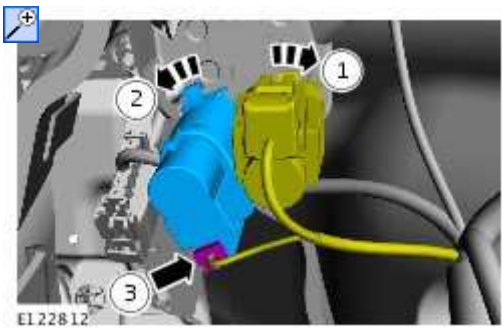
Print

Removal and Installation

Removal



1.



2. CAUTION: Make sure that the brake pedal remains in the rest position.

Installation

1. CAUTION: Make sure that the brake pedal remains in the rest position.
   To install, reverse the removal procedure.

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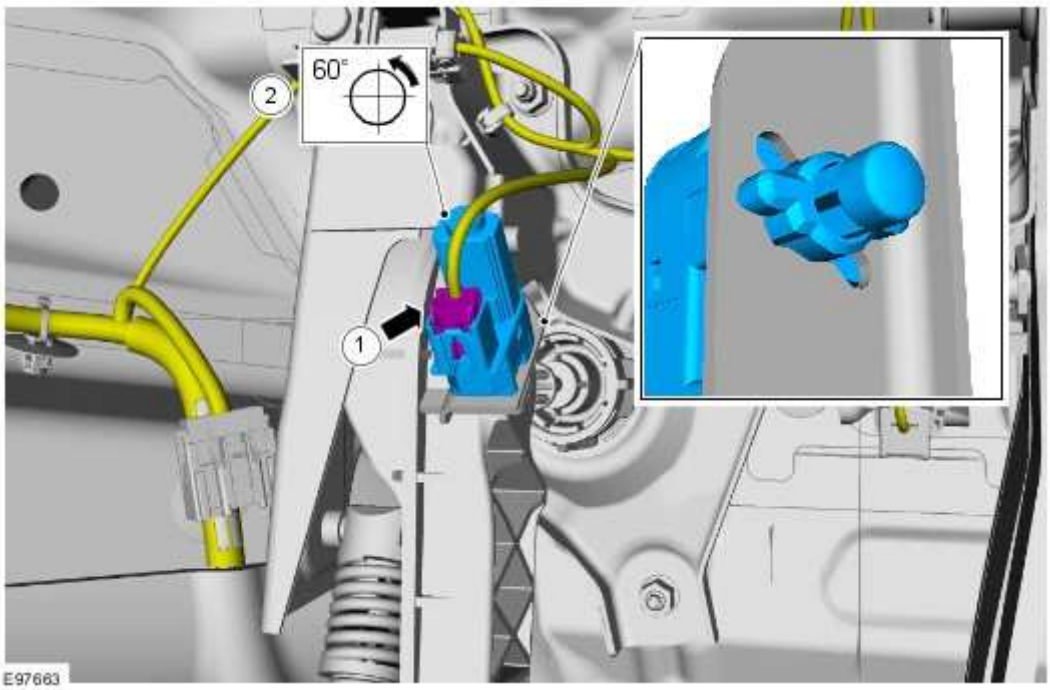
Removal and Installation

Removal



1. CAU
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position.

Installation

1. CAUTION: Make sure that the clutch pedal rer
in the rest position.
To install, reverse the removal procedure.

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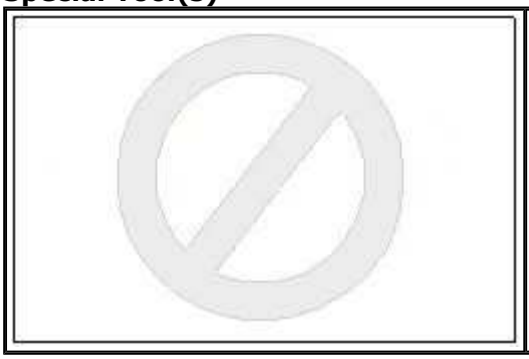
Removal and Installation

Special Tool(s)

	308-651 Installer, Clutch Master Cylinder Sensor

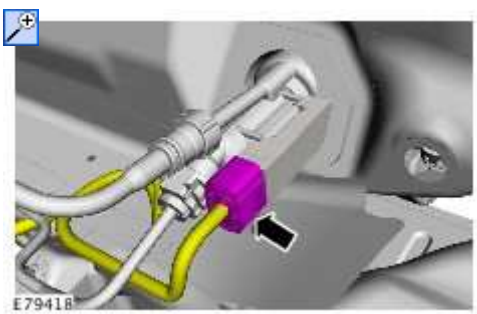
Removal

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

Left-hand drive vehicles

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2.

All vehicles

3. 

4. *Remove the Special Tool(s):* 308-651

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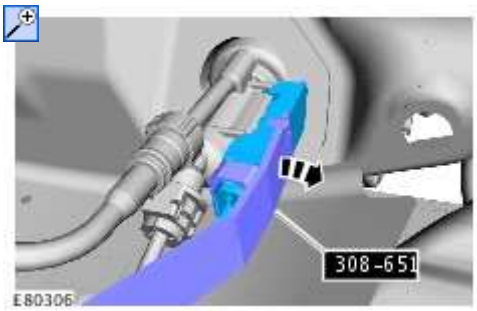

Installation

1. To install, reverse the removal procedure.

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Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Specifications	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Automatic transmission fluid	WSS-M2C924-A
Silicone Sealant	WSK-M4G320-A

Capacities

	Liters
Automatic transmission fluid	7.0

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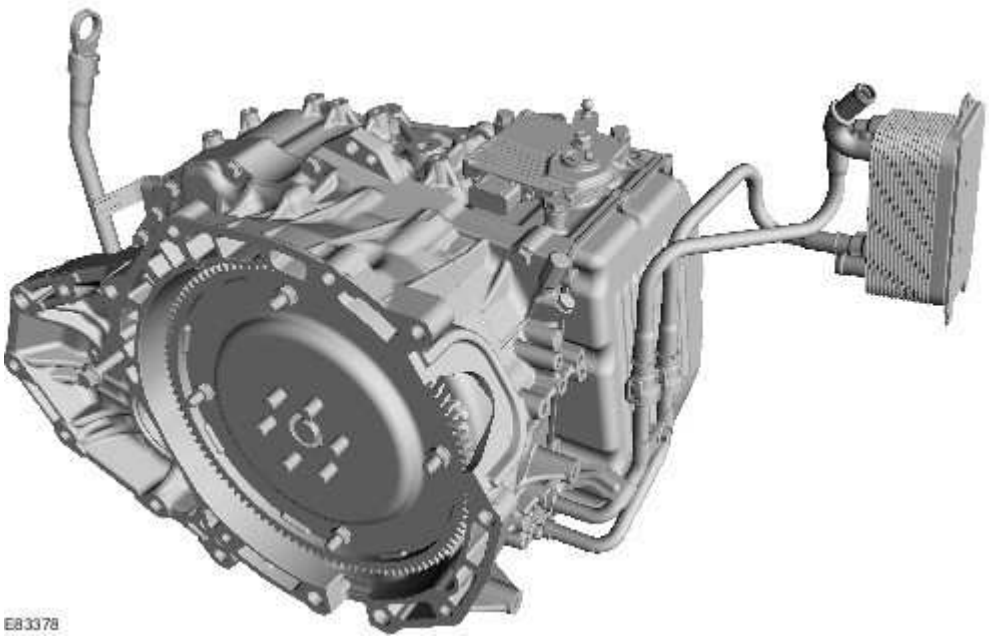
Description and Operation

Transmission Description

The AWF21 is an electronically controlled 6-speed automatic transmission which was developed together with Aisin Warner.


E83378

It has the following features:

- Two planetary gearsets, one of which is designed as a Ravigneaux gearset
- Shift Select as standard
- Gear position sensor integrated in the TCM (transmission control module)
- Drivers can choose between normal and sport mode gearshift programs.
- A total of 8 solenoid valves to control the hydraulic circuit.
  - 6 solenoid valves to control the gearshift progress.
  - 1 solenoid valve to control the lockup function of the torque converter.
  - 1 solenoid valve to control the system pressure.
- In 1st, 2nd and reverse gear the engine torque is limited to 400 Nm.
- The maximum permitted torque at the input shaft of the transmission behind the converter is 700 Nm when a forward gear is engaged (D or Shift Select) and 600 Nm when reverse is engaged.
- Oil capacity of 7 litres. The oil level on the 2.0L Duratorq (DW) diesel application is checked through an overflow pipe, and on the 2.3L Duratec-HE (MI4) application, it is checked using a conventional engine oil dipstick.
- Weight: 94 kg.

Transmission ratios in the individual gears:

Gear	Transmission Ratio		
	Without end stage	Incl. end stage for (DW) diesel	Incl. end stage for 2.3L MI4
First	4,148	13,81	15,56
Second	2,370	7,89	8,89
Third	1,556	5,18	5,4
Fourth	1,155	3,85	4,33

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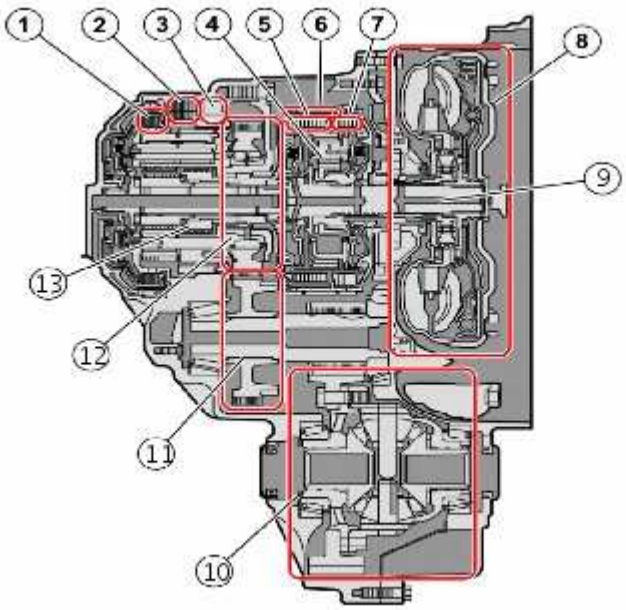
5th	0,859	2,86	3,22
6th	0,686	2,28	2,57
Reverse	3,394	11,30	12,73

Transmission components



Item	Component
1	C2 clutch
2	B2 brake
3	F1 freewheel
4	Front planetary gearset
5	C1 clutch
6	B1 brake
7	C3 clutch
8	TORQUE CONVERTER
9	Differential unit
10	Driven gear wheel of the intermediate stage
11	Driving gear wheel of the intermediate stage
12	Ravigneaux planetary gear set
13	Turbine shaft

Ravigneaux planetary gearset

One of the special features of the AWF21 transmission is its Ravigneaux planetary gearset.

The Ravigneaux planetary gearset has the following features:

- It offers the possibility of more gears than a conventional planetary gearset.
- Compact design (space-saving) in relation to the available transmission ratios.
- Two sun gears with different diameters
- Two sets of planetary gears - inner and outer. The inner planetary gears are in constant mesh with the smaller, rear sun gear and with the outer planetary gears. The outer planetary gears are in constant mesh with the ring gear and the larger, front sun gear.
- The planetary gears are all fitted on a joint planetary gear holder.

Operation

The transmission ratios are achieved via the following combinations of locked and/or coupled components. The table shows the principle of obtaining a high ratio (1), a low ratio

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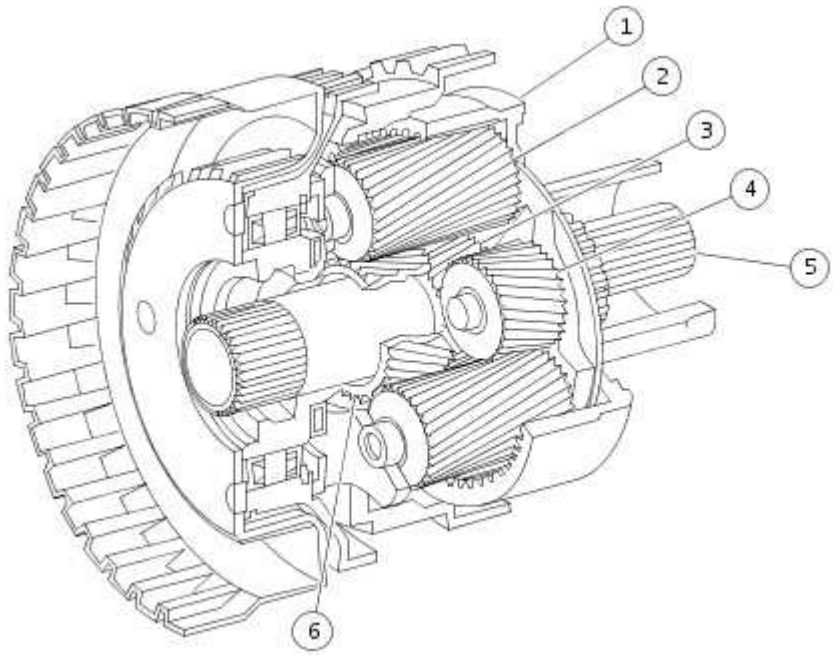
(6) and a reverse rotation (i.e. reverse gear with a high ratio).



E66430

Item	Part Number	Description
1	-	Ring gear
2	-	Long planet gear
3	-	Small planet gear
4	-	Short planet gear
5	-	Transmission input shaft
6	-	Large sun gear

Gear / ratio	Input torque	Locked	Output torque
1	Small sun gear	Planetary gear holder	RIng gear
2	Small sun gear	Large sun gear	RIng gear
3	Small sun gear and large sun gear	No component	Ring gear
4	Small sun gear and planetary gear holder	No component	Ring gear
5	Large sun gear and planetary gear holder	No component	RIng gear
6	Planetary gear holder	Large sun gear	RIng gear
Reverse.	Large sun gear	Planetary gear holder	RIng gear

On the AWF21 transmission the Ravigneaux planetary gearset is connected in series with a conventional planetary gearset. The conventional planetary gearset can generate a speed reduction on the two sun gears of the Ravigneaux planetary gearset for gears 1 to 5 and for reverse gear.

Electrical control

The following components are part of the control system for the automatic transmission:

- TCM. Controls activation and deactivation of the solenoid valves by processing the input signals from, among others the speed sensor and rotational speed sensor of the transmission, as well as the temperature sensor. It also saves adaptive data, DTCs and frozen values for diagnosis.
- Gearshift position sensor, integrated in the TCM.
- Solenoid valves S1 and S2. Primarily control engine braking in 1st gear.
- Solenoid valve SLU. Controls the lockup function, and is also used during certain gearshift processes.

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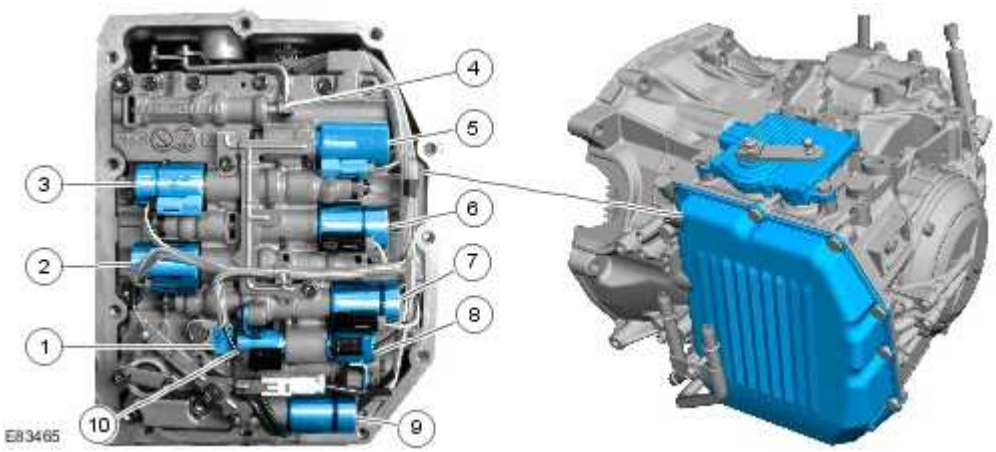
- Solenoid valve SLT. Controls the transmission system pressure.
- The solenoid valves SLC1, SLC2 and SLC3 control which clutches are used.
- Solenoid valve SLB1. Controls the use of brake B1.
- Rotational speed sensor, input shaft
- Output shaft rotational speed sensor
- Oil temperature sensor
- GSM (Gear Selector Module), in the gear selector housing. Provides information to the TCM about the desired driving mode, etc. Shift select mode and sport mode W.
- Hydraulic system with oil pump, torque converter, hydraulic control housing and oil cooler.
- A front planetary gearset and a rear planetary gearset, the transmission ratios of which are controlled by clutches and brakes.

Solenoid valves



Item	Component
1	Oil temperature sensor
2	Solenoid valve SLU
3	Solenoid valve SLC3
4	Solenoid valve SLB1
5	Input shaft rotational speed sensor
6	Output shaft rotational speed sensor
7	Solenoid valve S1
8	Solenoid valve S2
9	Solenoid valve SLT
10	Solenoid valve SLC2
11	Solenoid valve SLC1
12	transmission control module

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Diagnosis and Testing

Construction features, transmission differential side

WARNINGS:

The ESD protection measures must be adhered to without fail, as otherwise the transmission electronics could be destroyed.

Electrical connectors to and from the automatic transmission control electronics must only be separated or connected when no voltage is present.

Because of bodily electrostatic charge, connectors must not be disturbed, as this may cause damage to the transmission control electronics.
NOTE: In order for the diagnosis of the automatic transmission to be meaningful, all other systems such as the PCM, IC and ABS must be operating correctly, because through the CAN databus they may have an effect on the TCM and therefore on the transmission control.
NOTE: Electrical faults which appear - even only momentarily - when the ignition is switched on, will be stored in the fault memory of the relevant control unit and may have effects on the control system. Loose connections and fuses or connectors which have been removed or disconnected for testing purposes all count as electrical faults.

Introduction

WARNING: Adhere to the ESD protection measures listed below without fail, as otherwise the transmission control electronics could be destroyed
NOTE: Always take into account TSBs and OASIS messages.
NOTE: Do not take any short cuts or assume that critical checks or adjustments have already been made.
NOTE: Follow the test procedure described in the WDS/IDS exactly. In this way, test steps or important component tests are prevented from being overlooked.
Troubleshooting an electronically controlled automatic transaxle is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

Details of ESD protection

When dealing with the mechatronics, for example during a repair, suitable protective measures must be taken, especially ESD protection.

The term ESD means: Electro Static Discharge.

A person who is electrostatically charged and not earthed carries a voltage field with them, and so endangers "electrostatically sensitive components" which are contained in the control electronics. Carelessness when working on the transmission, touching the contacts of the central connector with the hand or making measurements using a multimeter will destroy the control electronics.

Preliminary inspection

NOTE: Many concerns with an automatic transmission are caused by incorrect operating conditions or operating error on the part of the driver. It is therefore very important to include the environment when making a diagnosis.

Apply the parking brake and move the selector lever to the "P" position when:

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- Parking the vehicle,
- performing tests or making adjustments,
- leaving the vehicle standing with the engine running.

Know and understand customer concern

The problem must be fully understood before fault diagnosis is started, in order to clearly establish the cause of a concern. Detailed information from the customer may be needed for this.

Ask the customer under which conditions the concern appears. For example:

- Cold or warm engine?
- At what engine speed, vehicle speed, load?
- In which gear or range?
- At high or low outdoor temperature?
- With the vehicle loaded or empty?
- On what road surface?
- In what driving situation:
  - while accelerating?
  - on overrun?
  - when shifting up or down?
- Do noises occur?
- What is the quality of the shift?
- Does the gear engaged correspond to the display?
- When the incorrect operation occurred, did a warning appear in the IC?

Verification of Condition

NOTE: If noise or vibration is a concern, check for dependency on: rpm, vehicle speed, gear range or temperature.
NOTE: In some cases, faults in the automatic transmission may cause concerns over the way the engine runs. For example, it can cause the engine to stall if the torque converter lock-up clutch does not disengage.
If necessary and it is possible, ask the customer to demonstrate the concern to you. It may also be an error in the way in which the vehicle is operated. Reproduce the fault by possibly driving the vehicle yourself.

Visual Inspection

The visual inspection extends to obvious damage to mechanical or electrical components, e. g.

- Electrical connectors and cable connections
- Ease of operation of the selector lever
- Selector lever position and selector lever display
- Fluid leakage
- Transmission fluid level check
- Transmission fluid quality check
- Modifications/retrofitting/tuning
- Damage

If any causes for a concern are found during the visual inspection, they must be corrected before any further checks are made.

Electrical connectors and cable connections

Electrical connectors to and from the automatic transmission control electronics must only be separated or connected when no voltage is present.

Ease of operation of the selector lever

A selector lever which is difficult to move may be the cause of a customer concern.

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Therefore move the selector lever through all positions and in doing so check it for ease of movement. If there is difficulty in movement, detach the cable from the transmission and move the lever again, to determine whether the stiffness is caused by the transmission or the cable.

Selector lever position and selector lever display

This test is possible with the vehicle stationary and the engine running, and while driving. When moving through the selector lever positions, compare the position selected with the display in the instrument cluster.

For adjustment work
REFER to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

Test for fluid leaks

CAUTIONS:

Only use the automatic transmission fluid approved by Ford.

Do not use a pressure washer or steam cleaner near any electrical connector.
NOTE: Refer to the service instructions for the frequency of changing the automatic transmission fluid.
NOTE: Careful location of the source of leaks can avoid unnecessary or expensive repairs.
Thoroughly clean the transmission, engine and surrounding area. Depending on the severity of the leak, a short or longer road test should be performed. It can also be useful to look for leaks with the vehicle on the lifting platform and the engine idling. Check that the fluid which has leaked out is really transmission fluid, and not engine oil.

Transmission fluid level check

It is not possible to check the level of the transmission fluid visually, because there is no dipstick. If there is a concern, the transmission fluid level must be checked.

If it is necessary to check the transmission fluid level, the fluid must be drained and refilled, REFER to: (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21)

Transmission Fluid Level Check (General Procedures),
Transmission Fluid Drain and Refill (General Procedures).

Fluid quality check

NOTE: Dirty or overheated transmission fluid can cause impairment. The quality of the transmission fluid should therefore be tested if there is a concern.
Check the automatic transmission fluid for contamination and smell. If there are signs of contamination, a test amount must be drained off through a paper filter and checked. If the automatic transmission fluid smells burnt, this indicates overheating.

Modifications/retrofitting/tuning

Additional aftermarket systems (e.g. air conditioning, car telephone, cruise control, etc. etc.) which are not approved by Ford, or which have been unprofessionally installed, and also chip and engine tuning, can have an effect on the engine and transmission management and lead to faults.

Diagnostics

Electrical faults which appear, even only momentarily, when the ignition is switched on, will be stored in the fault memory of the relevant control unit and may have effects on the control system. Loose connections and fuses or connectors which have been removed or disconnected for testing purposes all count as electrical faults.

In order for the diagnosis of the automatic transmission to be meaningful, all other systems

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such as the PCM, IC and ABS must be operating correctly, because through the CAN databus they may have an effect on the TCM and therefore on the transmission control.

Perform a WDS/IDS self-test on the vehicle

In the self-test, the WDS/IDS downloads all the stored DTCs from the fault memories of the individual controllers and displays them on its screen.

- Print out the DTCs (faults) displayed (this is important for later analysis and/or in the case of a guarantee).
- Read out the freeze frame data belonging to each DTC and print them out.
- Check the conditions under which the fault occurred.
- Clear all fault memory, because stored faults may have an effect on the control process.

Fault finding road test with WDS/IDS

After the road test repeat the WDS/IDS selft-test.

Perform diagnosis with WDS/IDS.

In the event of fault codes, follow the instructions given by the WDS/IDS.

Rectify the faults displayed in the WDS/IDS.

Clear all fault memories again.

Functional test

To verify the function after the repair has been carried out, road test the vehicle and then run a WDS self test to check that no DTCs (faults) have been stored.

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General Procedures

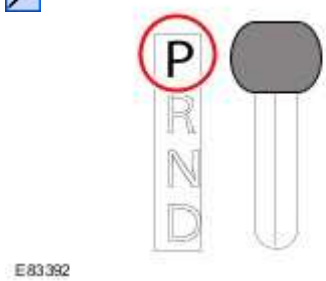
Materials

Name	Specification
Automatic Transmission Oil E-AW	WSS-M2C924-A / 4U7J-M2C924-AA

General Equipment

Ford diagnostic equipment

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Make sure that the transmission is not in emergency operation mode.

   General Equipment: Ford diagnostic equipment
3. Make sure that the parking brake is fully applied.
4. Start the engine.
5. Move the transmission selector lever to all positions. In doing so, wait until the transmission engages the corresponding range.
6. 

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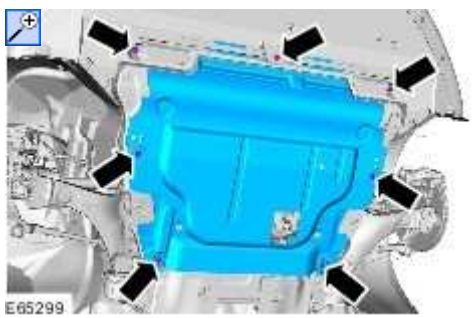
7. Ensure that the gear oil temperature is 55 ± 2 °C.

   General Equipment: Ford diagnostic equipment

   Vehicles with diesel engine
8. 
E65299
9.
   - Transmission fluid must run out of the check bore.
   - Allow excess transmission fluid to drain

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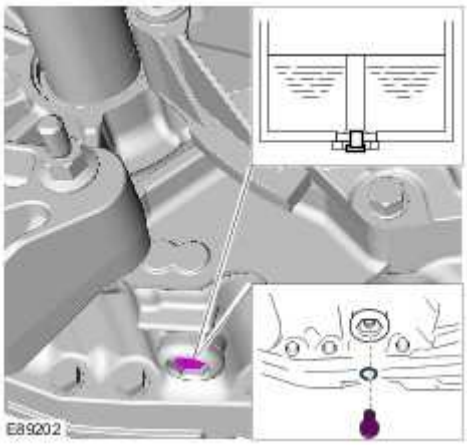
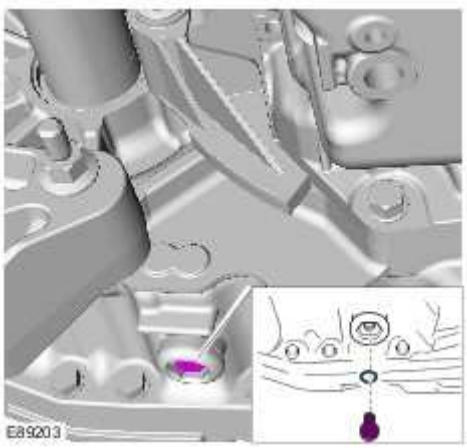


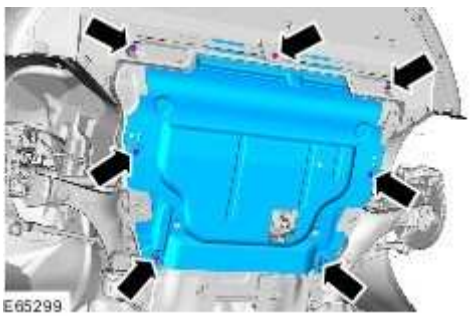
from the transmission and from the rising tube.

10. When the gear oil test temperature of reaches 55 ± 2 °C is reached, install the oil overflow plug if the gear oil continues to escape (1 mm thick stream of oil).
11. If no transmission fluid escapes, top up with transmission fluid until it does escape.

    Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
    Material: Automatic Transmission Oil E-AW (WSS-M2C924-A / 4U7J-M2C924-AA)



12. *Torque:* 8 Nm



13.

Vehicles with 2.3L engine

14.

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15. CAUTIONS:

    Use lint free cloth.

    The service reminder indicator (SRI) flashes if one of the service parameters has not been programmed.
    Adjust the oil level in the automatic transmission if necessary.

    Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
    Material: Automatic Transmission Oil E-AW (WSS-M2C924-A / 4U7J-M2C924-AA)

16.

All vehicles

17. Stop the engine.

18. Disconnect the diagnostic tester.

    General Equipment: Ford diagnostic equipment

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General Procedures

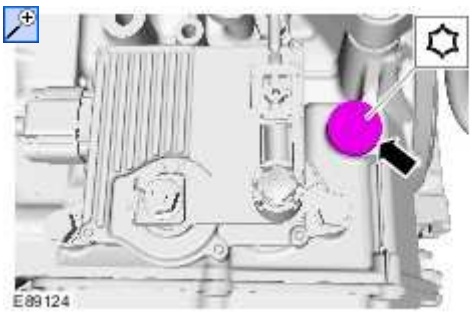
Materials

Name	Specification
Automatic Transmission Oil E-AW	WSS-M2C924-A / 4U7J-M2C924-AA

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

Vehicles with diesel engine

2. Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

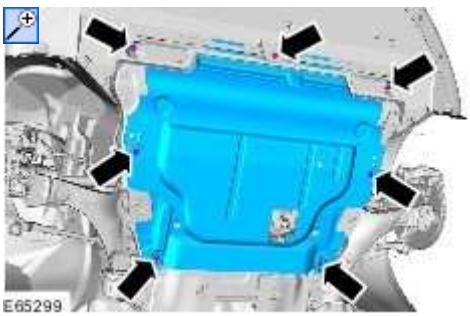


3.

Vehicles with 2.3L engine

4.

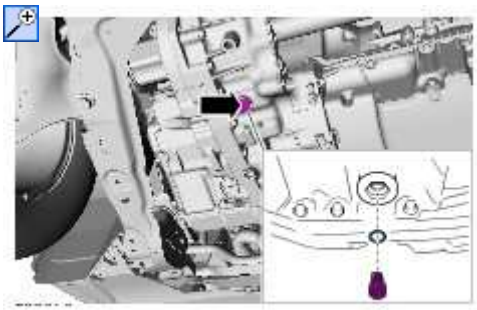
All vehicles



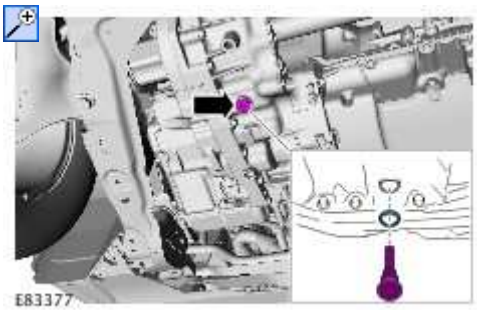
5.

Vehicles with diesel engine

http://vnx.su

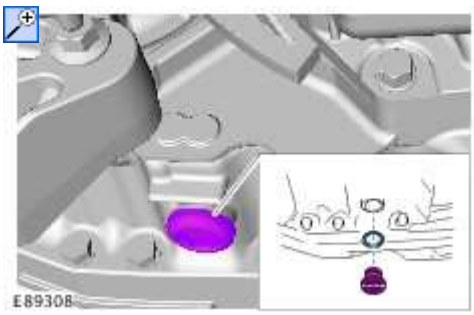


6. Collect the automatic transmission fluid (ATF) in a suitable container.

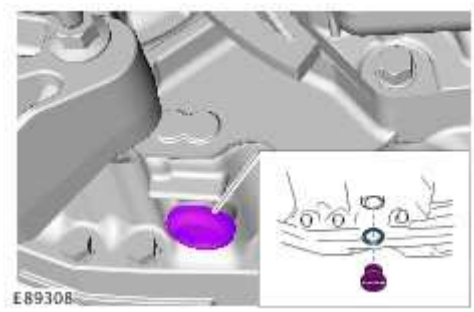


7. Drain off automatic transmission fluid.

Vehicles with 2.3L engine

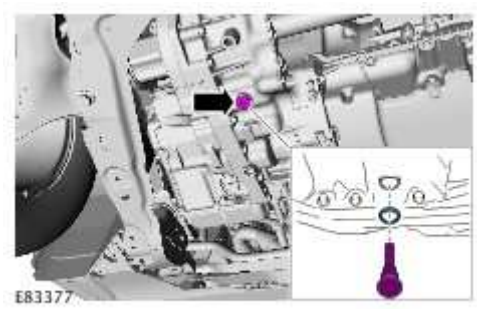


8. Drain off automatic transmission fluid.



9. *Torque:* 47 Nm

Vehicles with diesel engine



10. *Torque:* 47 Nm

11. *Torque:* 8 Nm

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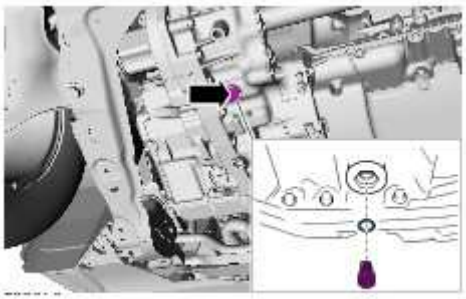


All vehicles

12. Fill the transaxle with automatic transmission fluid.

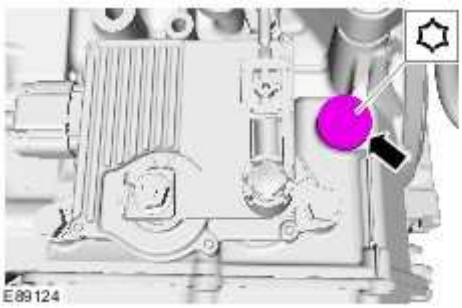
    Refer to: Specifications (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Specifications).
    Material: Automatic Transmission Oil E-AW (WSS-M2C924-A / 4U7J-M2C924-AA)

Vehicles with 2.3L engine

13.

Vehicles with diesel engine

14. *Torque:* 40 Nm



All vehicles

15. Refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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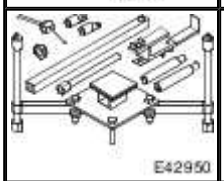
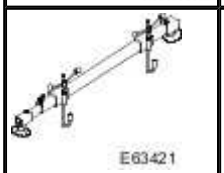
Removal and Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
E63418	303-290B-16 Adapter for 303-290B

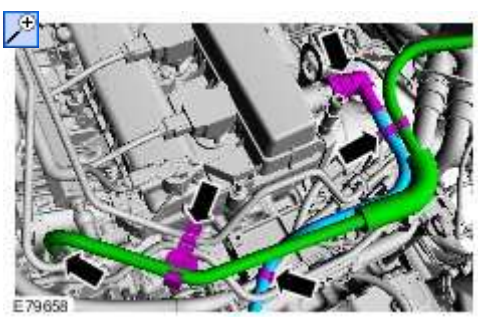
General Equipment

Schlitzschraubendreher
Transmission jack

Removal

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

1. *General Equipment:* Schlitzschraubendreher



2.

3. Remove the following items:
   1. Air cleaner

   Refer to: Air Cleaner (303-12A Intake Air

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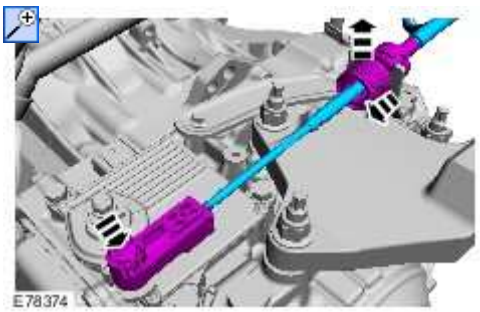
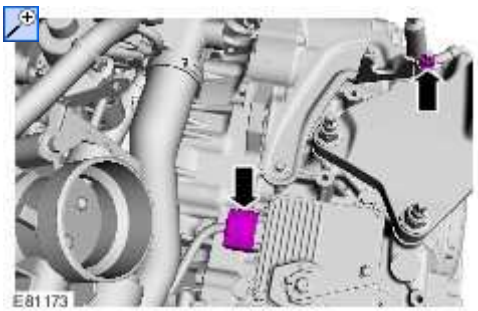
Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

2. Battery console

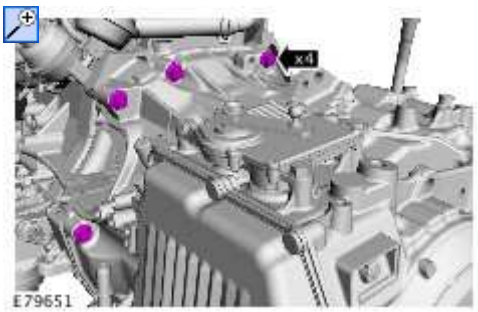
   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).



4. CAUTION: The gearshift cables must not be kinked or twisted.



5. *Torque:* 15 Nm



6. *Torque:* 48 Nm

7. Remove the following items:
   1. Subframe

      Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
   2. Drive shafts

      Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
      Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
   3. Starter motor

      Refer to: Starter Motor (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS)

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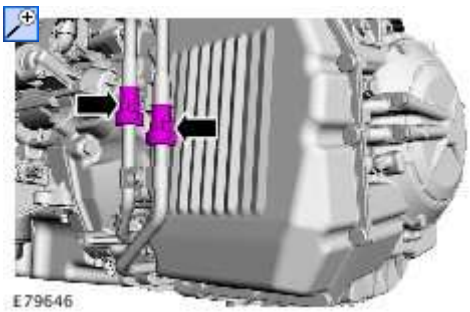
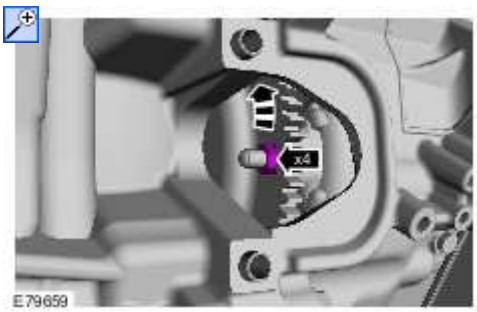
- MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

8. 

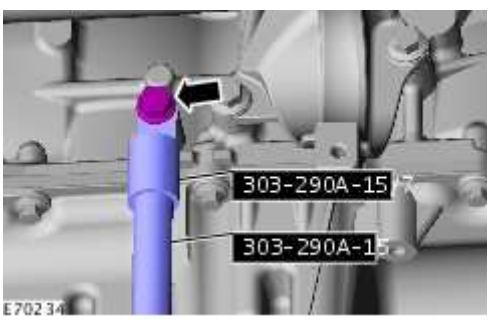
9. *Torque:* 36 Nm



10. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

11. *Special Tool(s):* 303-290A-15

12. *Special Tool(s):* 303-290A-15



13.
    1. *Torque:* 25 Nm
    2. *Torque:* 80 Nm
    3. Discard the bolt.

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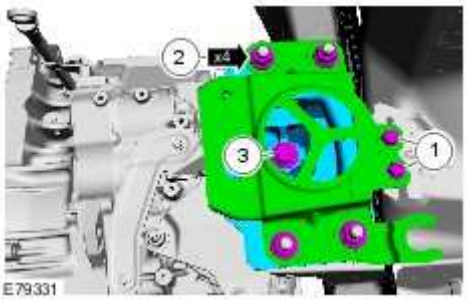
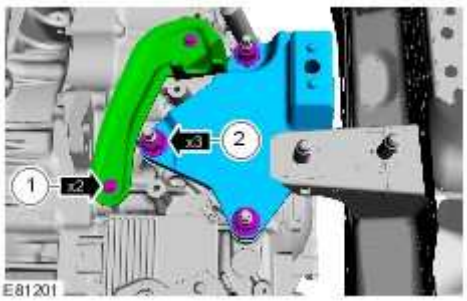
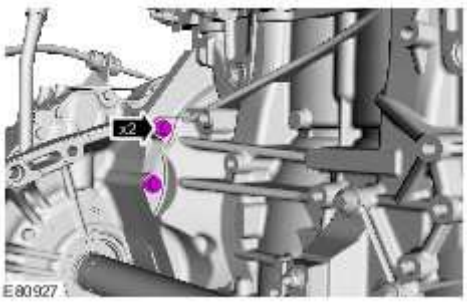


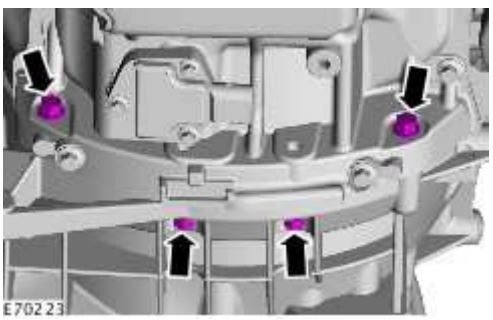
Torque: 133 Nm



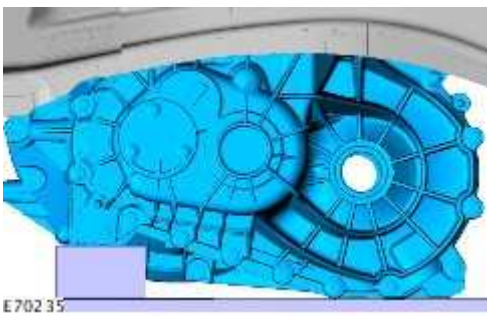
14.
1. *Torque:* 10 Nm
2. *Torque:* 80 Nm



15. *Torque:* 48 Nm



16. *Torque:* 48 Nm



17. Support the transmission with a wooden block and secure it to the transmission jack using a retaining strap.

General Equipment: Transmission jack

18. Support the transmission using the transmission jack and remove.

General Equipment: Transmission jack

Installation

1. To install reverse the removal procedure.

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2. Adjust the selector cable.

   Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

3. Check the transmission fluid fill level.

   Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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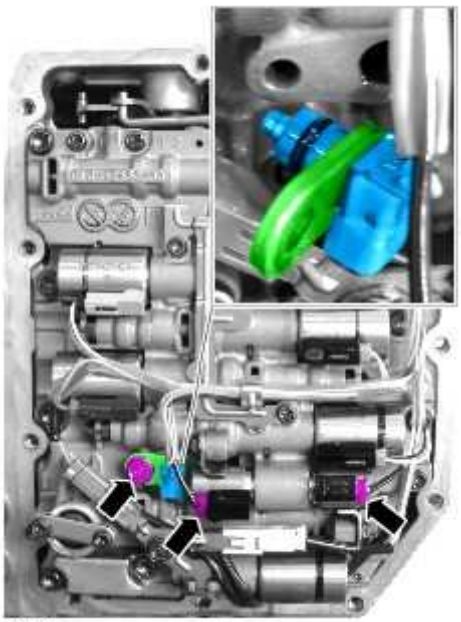
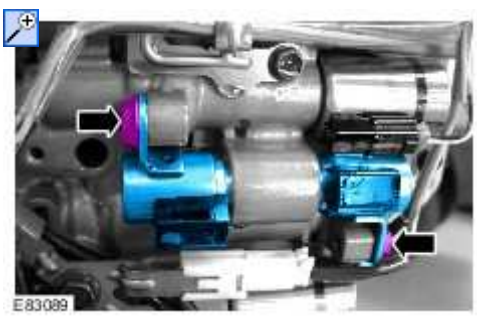
Removal and Installation

Removal

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

1. Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
2. *Torque:* 10 Nm


E82896


E83089

3. *Torque:* 10 Nm

Installation

1. To install reverse the removal procedure.

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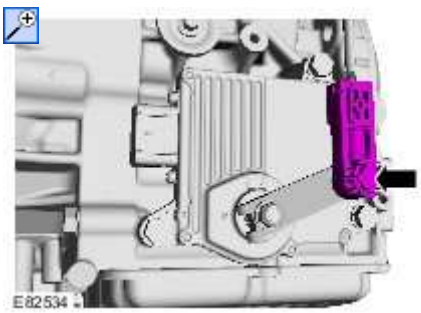
Removal and Installation

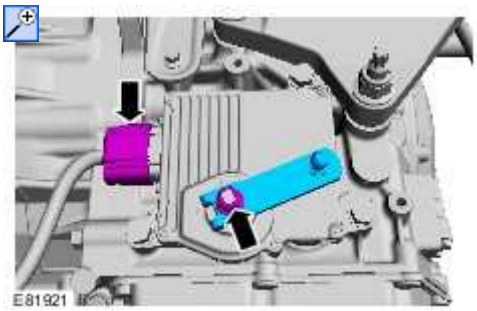
Removal

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

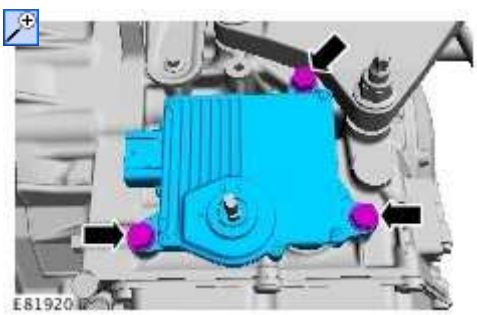
1. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).



2. NOTE: Before removing the TCM, make certain that the selector lever is in the N position.

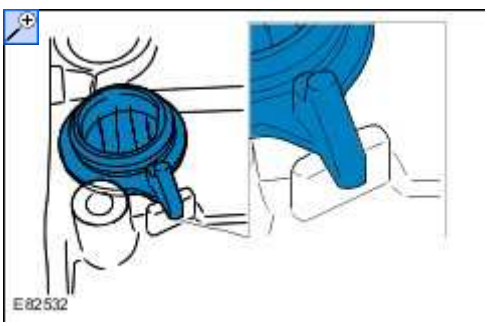


3. *Torque:* 16 Nm



4.

Installation



1. CAUTION: Make sure that the component is clean, free of foreign material and lubricant.

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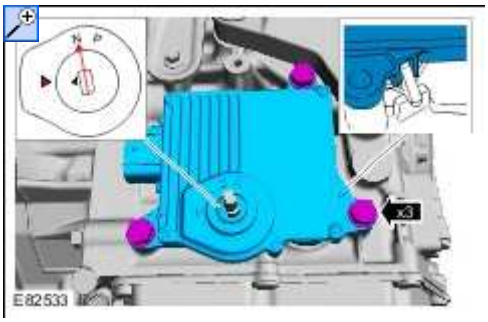

2. CAUTIONS:

   Make sure that the terminals or pins/sockets of the transmission control module (TCM) and the TCM connector are not bent or damaged.

   The component must be aligned with the installation markings.
   NOTE: The new TCM is set in the N position at the factory
   Torque: 25 Nm
3. To install reverse the removal procedure.
4. Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).
5. NOTE: New units must be configured using the Programmable Module Installation Routine in the Worldwide Diagnostic System (WDS).

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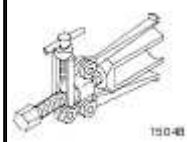
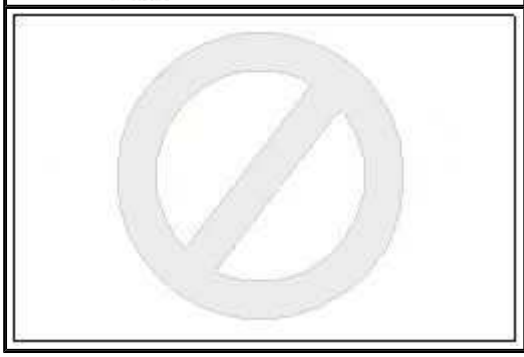
Removal and Installation

Special Tool(s)

	205-078 Remover, Drive Pinion Seal
	307-300 Gauge Bar, Shim Selection
	307-300-02 Depth Gauge, Shim Selection
	307-300-03 Adapter for 307-300-02
	308-095 Installer, Input Shaft Bearing

Materials

Name	Specification
Automatic Transmission Oil E-AW	WSS-M2C924-A / 4U7J-M2C924-AA

Removal

E81922

1. Refer to: Transmission - 2.3L Duratec-HE (118kW/160PS) - MI4 (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
2. Check the mating face of the torque converter for damage.

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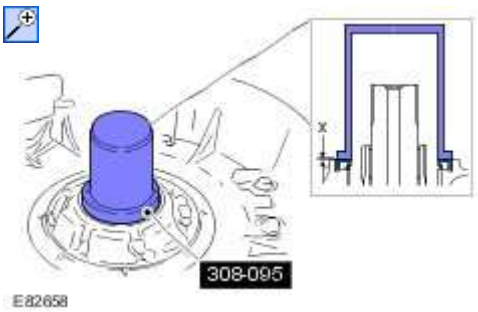
3. *Special Tool(s):* 205-078

Installation



1. CAUTIONS:

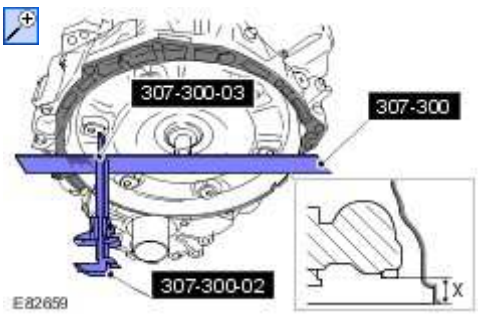
   ⚠ New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

   ⚠ Make sure that the specified installation depth is achieved.
   X = 0mm +/- 0.2mm

   Special Tool(s): 308-095

2. ⚠ CAUTION: Take extra care not to damage the seal.
   Coat the mating face of the torque converter with oil.

   Material: Automatic Transmission Oil E-AW (WSS-M2C924-A / 4U7J-M2C924-AA)



3. ⚠ CAUTION: Make sure that the specified installation depth is achieved.
   X = greater than 34.5mm

   Special Tool(s): 307-300, 307-300-02, 307-300-03

4. ⚠ CAUTION: Ensure the torque converter remains with the transmission.
   Refer to: Transmission - 2.3L Duratec-HE (118kW/160PS) - MI4 (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).

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Removal and Installation

General Equipment

Schlitzschraubendreher

Removal

E81877

1. Refer to: Transmission Control Module (TCM) (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
2. CAUTION: Take extra care not to damage the mating faces.
   Mask the screwdriver with adhesive tape.

   General Equipment: Schlitzschraubendreher

Installation

E81874

1. CAUTIONS:

   New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.

   Make sure that the specified installation depth is achieved.
   X = 0mm + 0.4mm/- 0.3mm. Use a suitable long-reach socket, size 15/16 mm.
2. Refer to: Transmission Control Module (TCM) (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).

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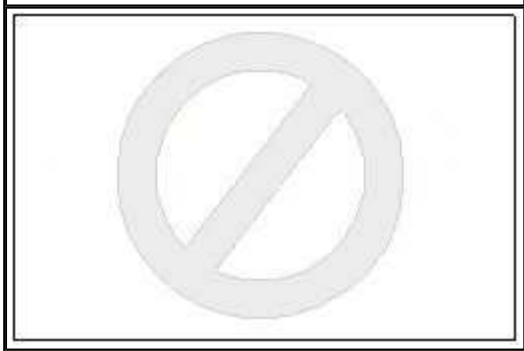
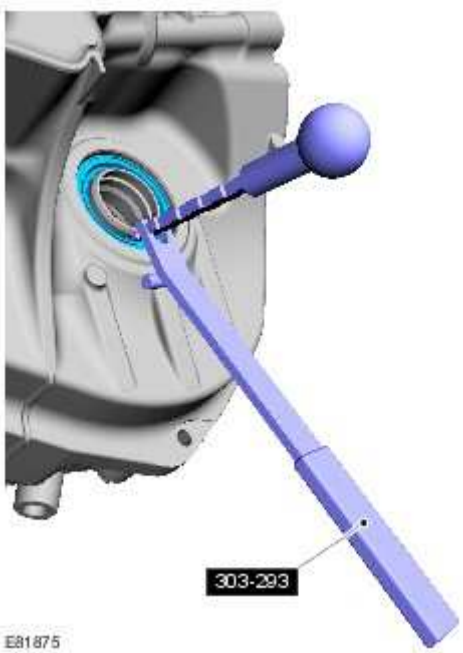
Removal and Installation

Special Tool(s)

	303-293 Remover, Crankshaft Seal
	307-599 Installer, Halfshaft Seal

Removal



1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
2. CAUTION: Take extra care not to damage the mating faces.
   Special Tool(s): 303-293

Installation

1. CAUTION: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Special Tool(s): 307-599

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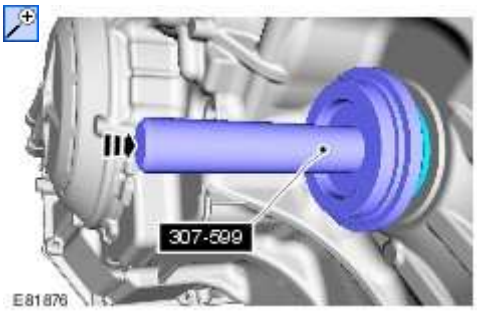

2. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
3. Refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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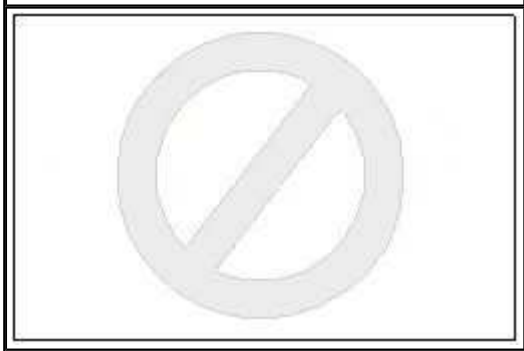
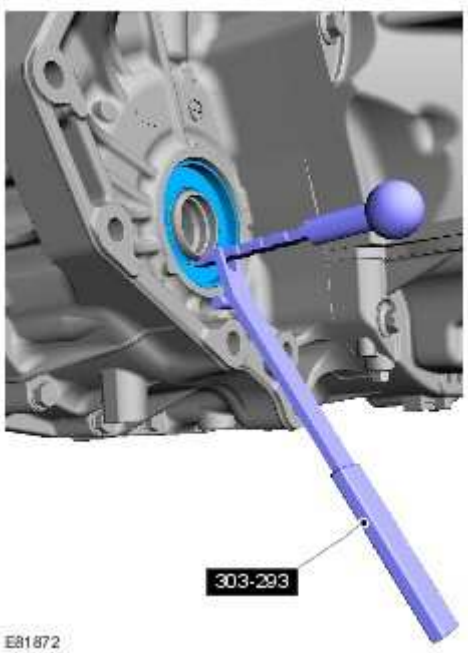
Removal and Installation

Special Tool(s)

	303-293 Remover, Crankshaft Seal
	307-599 Installer, Halfshaft Seal

Removal



1. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
2. CAUTION: Take extra care not to damage the mating faces.
   Special Tool(s): 303-293

Installation

1. CAUTION: New crankshaft rear seal carriers are supplied with an alignment sleeve which must be removed after installation.
   Special Tool(s): 307-599

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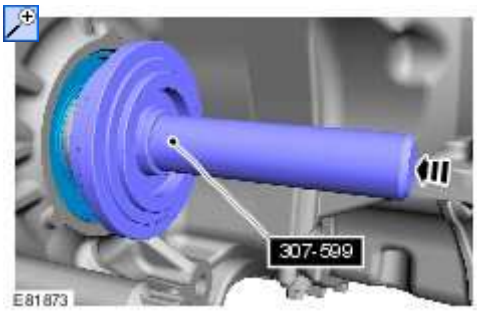

2. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
3. Refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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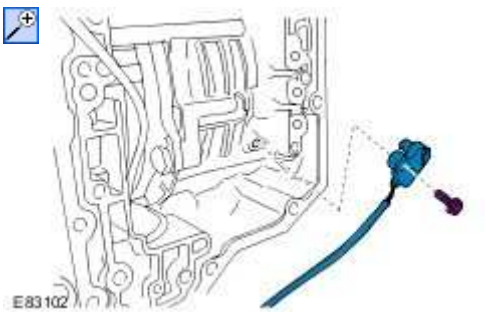
Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - Turbine Shaft Speed (TSS) Sensor	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

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



1. Refer to: Main Control Valve Body (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
2. CAUTION: Apply only minimal force to the sensor.
   Torque: 6 Nm

Installation

1. To install reverse the removal procedure.

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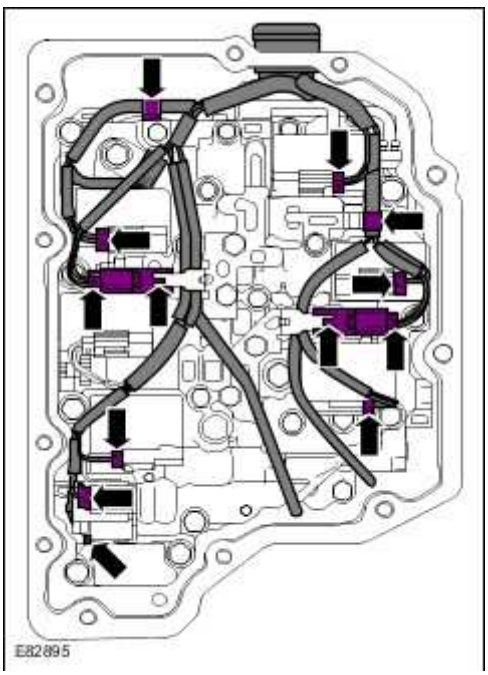
Removal and Installation

Removal

1. Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).

2.



3. NOTE: Note the position of the electrical connectors.

4. NOTE: Make sure that the tape has not detached from the edges of the component.

5.

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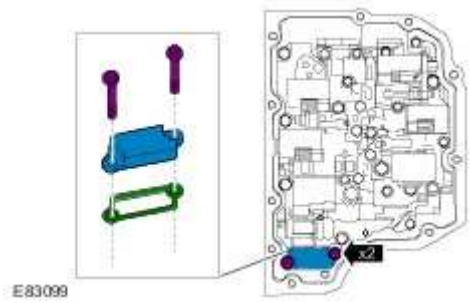
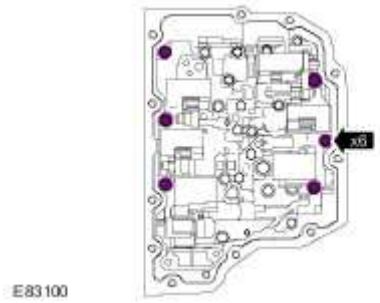
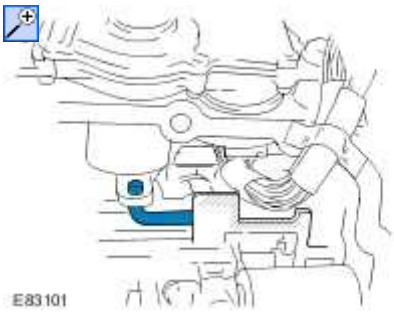




6. With every pass, undo the bolts one turn at a time alternately.

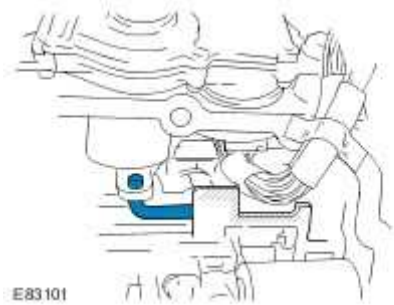


7. CAUTIONS:

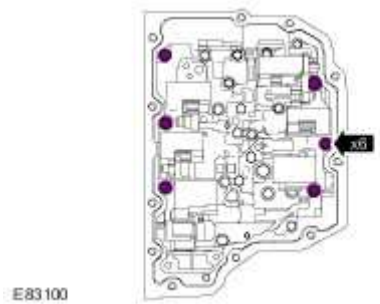
   ⚠ New engine front covers are supplied with a crankshaft front seal alignment sleeve which will be pushed out during installation.

   ⚠ Make sure that no component falls off during removal.

Installation



1. ⚠ CAUTION: New engine front covers are supplied with a crankshaft front seal alignment sleeve which will be pushed out during installation.



2. ⚠ CAUTION: Make sure that new bolts are installed.
   NOTE: Only tighten the bolts finger tight at this stage.

3. ⚠ CAUTION: Make sure that new bolts are installed.
   NOTE: Only tighten the bolts finger tight at this stage.

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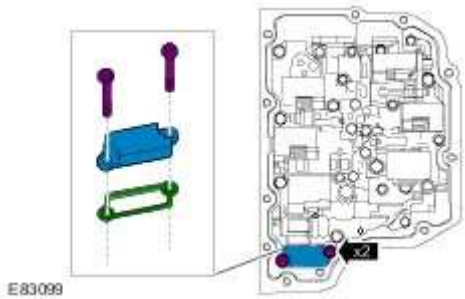
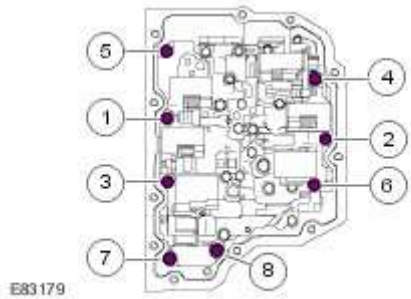
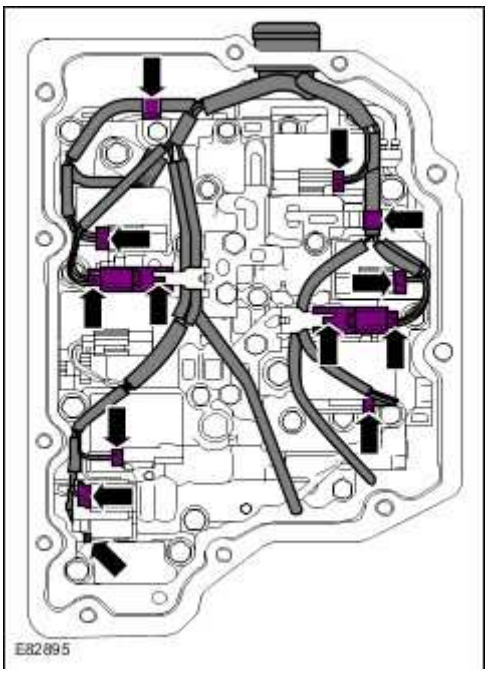


4. *Torque:* 10 Nm





5. NOTE: Make sure that these components are installed to the noted removal position.
Torque: 10 Nm

6.

7. Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).

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Removal and Installation

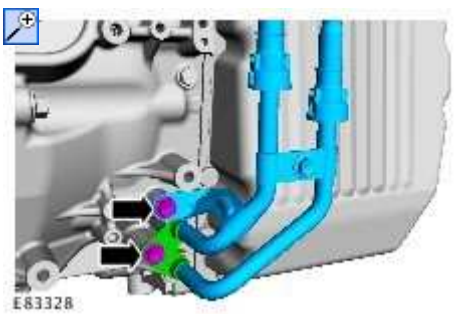
Materials

Name	Specification
Silicone Sealant LB	WSS-M4G320-A3 / 6G9N-M4G320-AA
Thread Locking MS	WSK-M2G349-A7 / 2U7J-M2G349-AA

Removal

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

1. Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
2. Refer to: Transmission Fluid Drain and Refill (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).



3. *Torque:* 25 Nm

4. CAUTION: Take extra care not to damage the mating faces.
   Slacken the oil pan with a plastic hammer, avoid distorting the oil pan.

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material.
   Apply sealant to the oil pan.

   Material: Silicone Sealant LB (WSS-M4G320-A3 / 6G9N-M4G320-AA)

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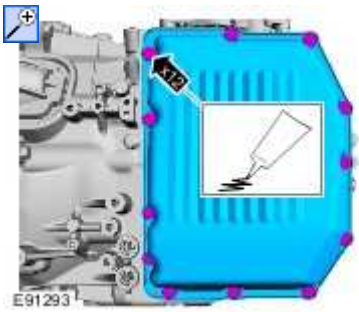

2. *Material:* Thread Locking MS (WSK-M2G349-A7 / 2U7J-M2G349-AA)
   Torque: 13 Nm

3. To install reverse the removal procedure.

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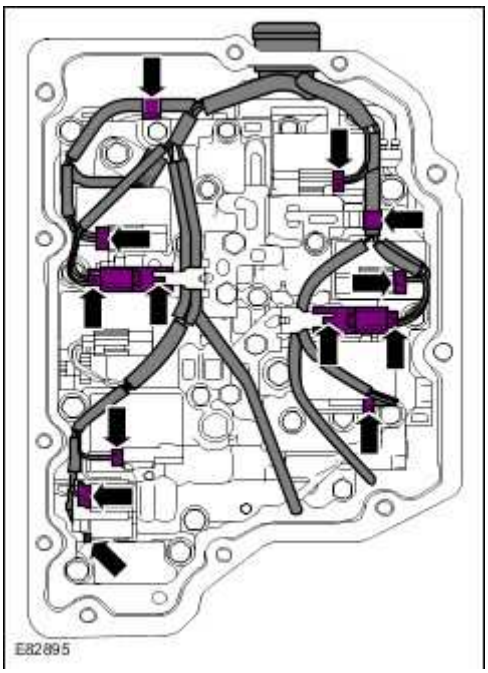
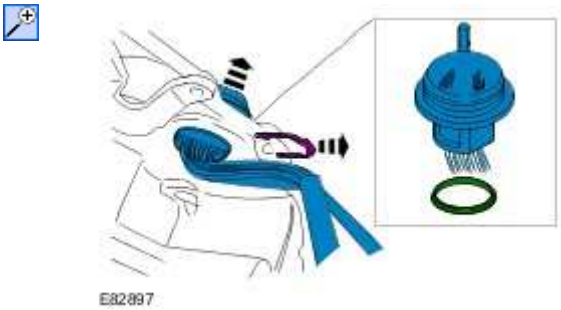
Removal and Installation

Removal

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

1. Refer to: Transmission Control Module (TCM) (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
2. Refer to: Transmission Fluid Pan (307-01 Automatic Transmission/Transaxle - Vehicles With: 6-Speed Automatic Transaxle - AWF21, Removal and Installation).
3.

4. NOTE: Note the position of the electrical connectors.


5. 

CAUTION: Make sure that the wiring harness does not catch.

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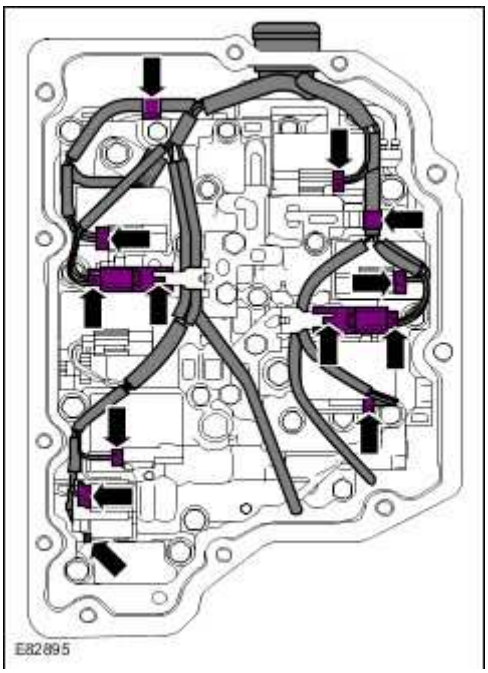
Installation

1. CAUTION: The component must be aligned with the installation markings.
    1. NOTE: Make sure that a new component is installed.



2. NOTE: Make sure that these components are installed to the noted removal position.
   Torque: 10 Nm

3.

4. To install reverse the removal procedure.

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Transmission/Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle (AWF21) - Specifications	S-MAX/Galaxy 2006.5 (02/2006-)

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	Specifications
Automatic Transmission Fluid	WSS-M2C924-A

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Transmission/Transaxle Cooling - Vehicles With: 6-Speed Automatic Transaxle (AWF21) - Transmission Cooling	S-MAX/Galaxy 2006.5 (02/2006-)

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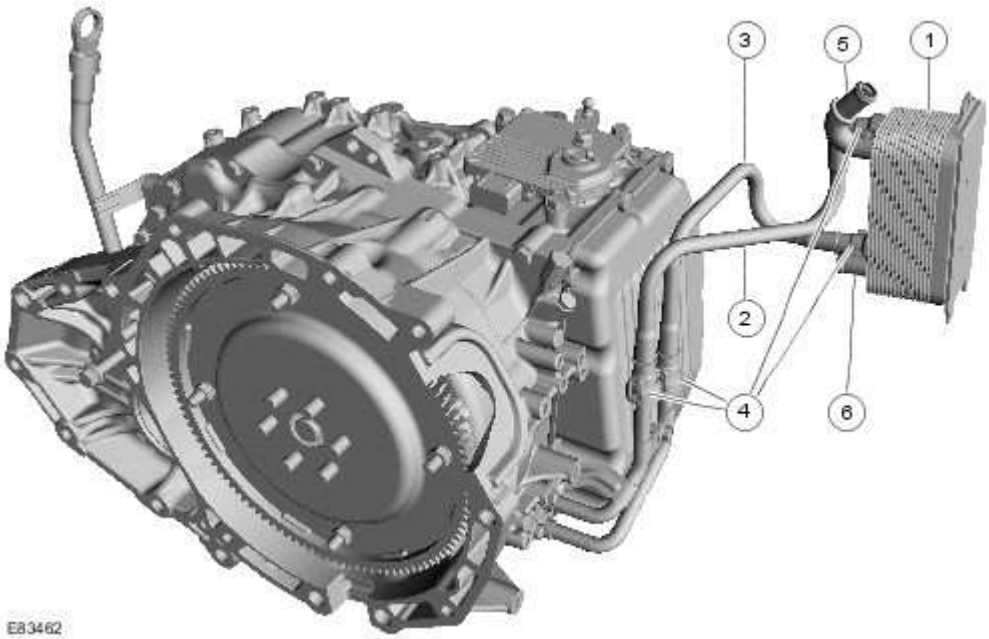
Description and Operation



Item	Part Number	Description
1	-	Transmission fluid cooler
2	-	Transmission fluid cooler supply
3	-	Transmission fluid cooler return
4	-	Quick-release coupling
5	-	Radiator supply
6	-	Radiator return

The transmission fluid cooler is positioned behind the radiator.

It is connected to the transmission by means of two hose lines with quick-release couplings.

It is connected to the radiator by means of two hose lines with hose clamps.

The quick-release couplings are colour-coded to prevent them from being mixed up.

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Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21 - External Controls	S-MAX/Galaxy 2006.5 (02/2006-)

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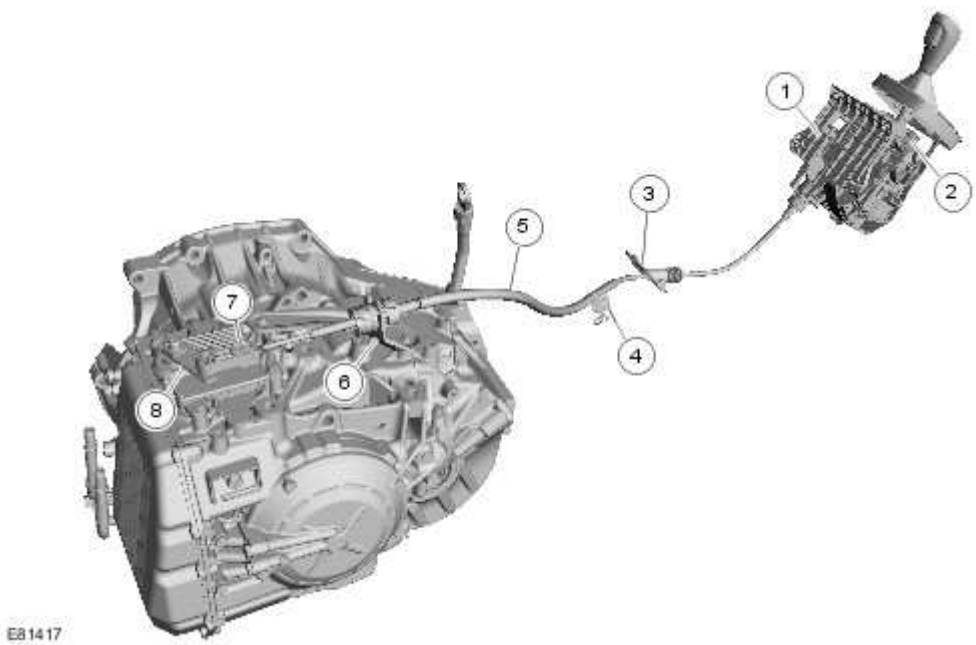
Description and Operation

Selector lever and selector lever cable



Item	Part Number	Description
1	-	Selector Lever
2	-	Emergency release lever
3	-	Selector lever cable guide
4	-	Fastening clip
5	-	Selector cable
6	-	Selector lever cable bracket
7	-	Adjusting mechanism for the selector lever cable
8	-	Shift valve shaft lever

The length of the selector cable can be adjusted on the transmission side.

The selector lever must be set to "D" when performing the adjustment.

The emergency release for the selector lever lock is located underneath the selector lever gaiter.

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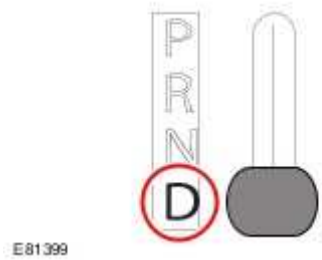
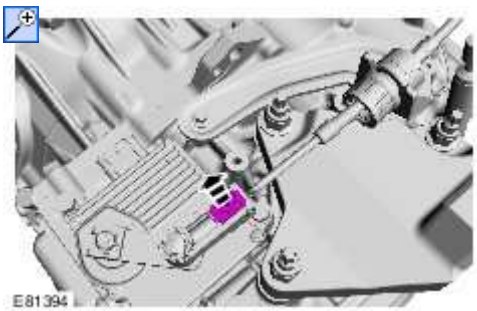
General Procedures

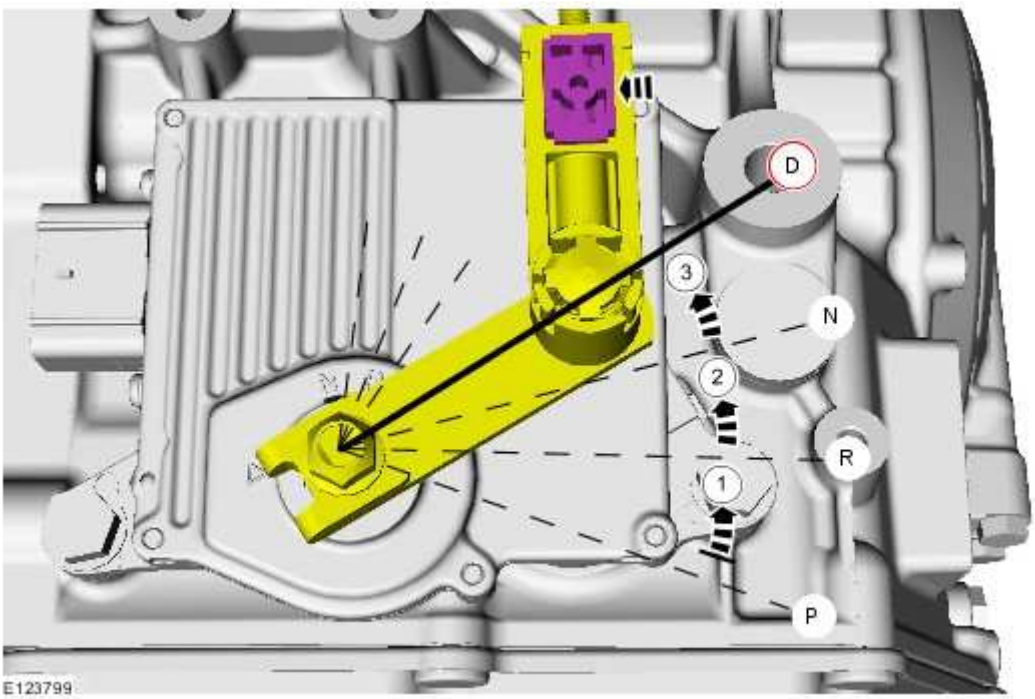
1. Refer to: Air Cleaner (303-12A Intake Air Distributio and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Remov and Installation).
2. Select position D.



E81399


E81394

3.



E123799

4. The selector lever and the shift mechani must be position

5. Refer to: Air Cleaner (303-12A Intake Air Distributio and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Remov

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and Installation).

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Removal and Installation

General Equipment

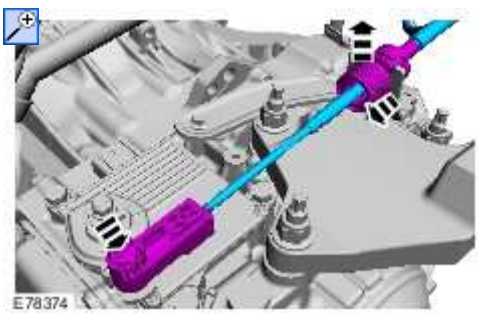
Knife

Removal

CAUTION: The gearshift cables must not be kinked or twisted.

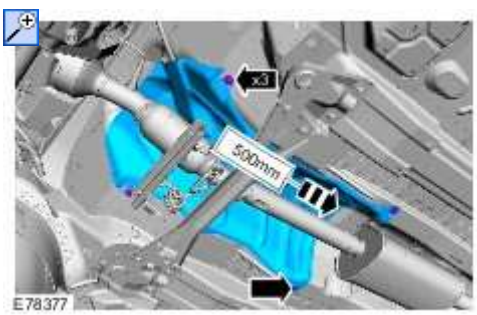
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

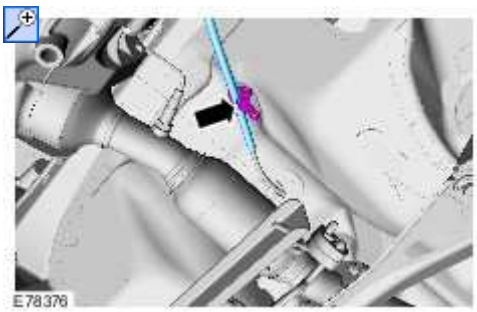


2.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5.

6. Lower Vehicle

Vehicles with electronic parking brake (EPB)

7. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body

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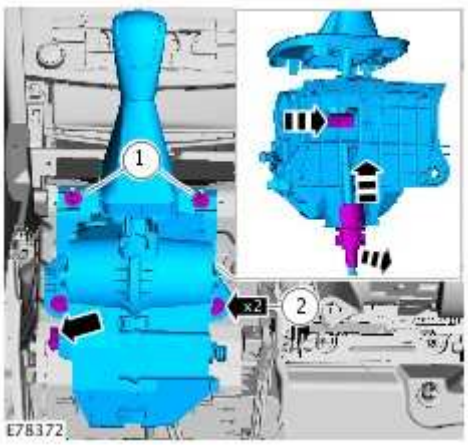
Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

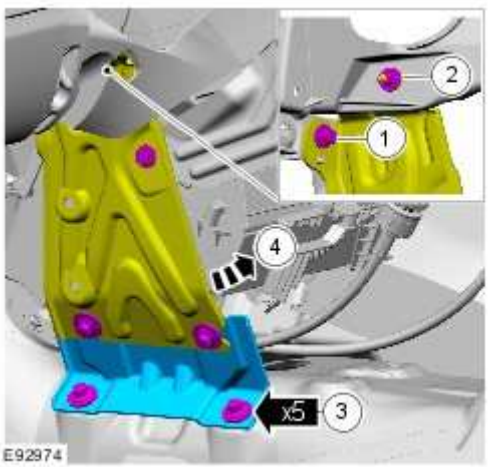
Vehicles with manual parking brake

8. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



9. *Torque:* 9 Nm



10.
    2. *Loosen:* 4 turn(s)

11.
    1. *Torque:* 25 Nm
    2. *Torque:* 9 Nm

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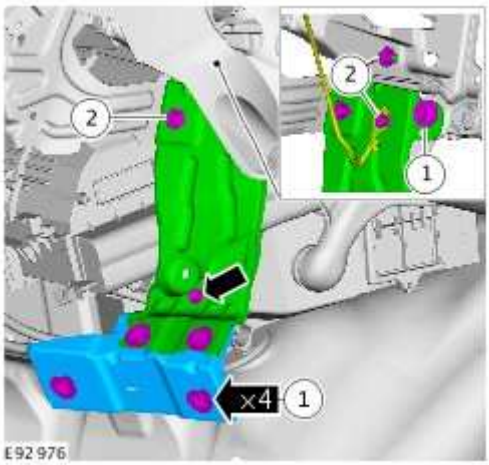
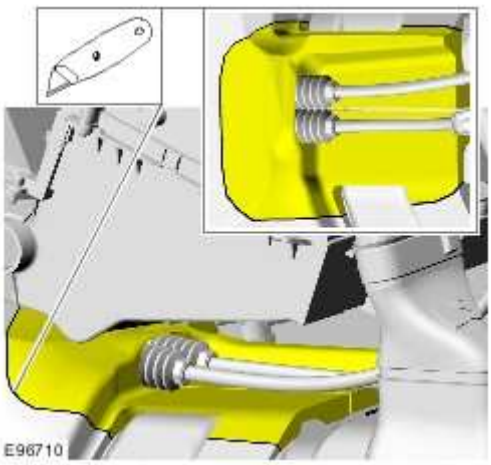
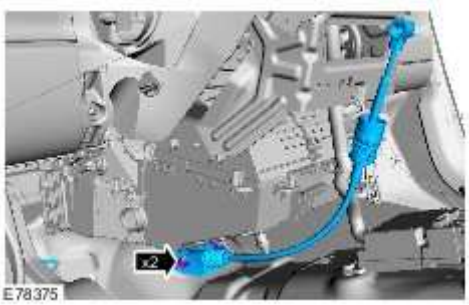


12. *General Equipment:* Knife



13. *Torque:* 9 Nm



Installation

1. To install reverse the removal procedure.
2.
    1. *Torque:* 25 Nm
    2. *Torque:* 9 Nm

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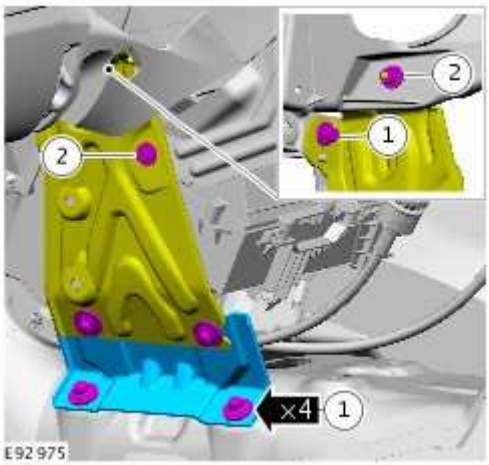

3. Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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Removal and Installation

Removal

CAUTION: The gearshift cables must not be kinked or twisted.
NOTE: Removal steps in this procedure may contain installation details.

Vehicles with electronic parking brake (EPB)

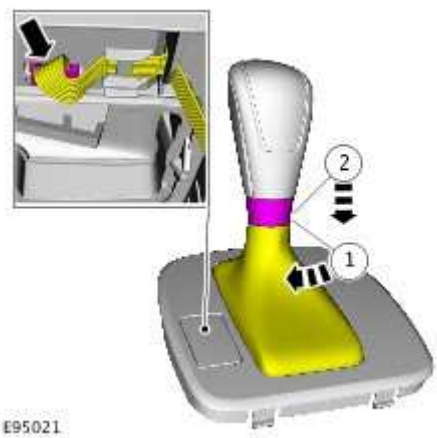
1. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

Vehicles with manual parking brake

2. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles

3.



4.

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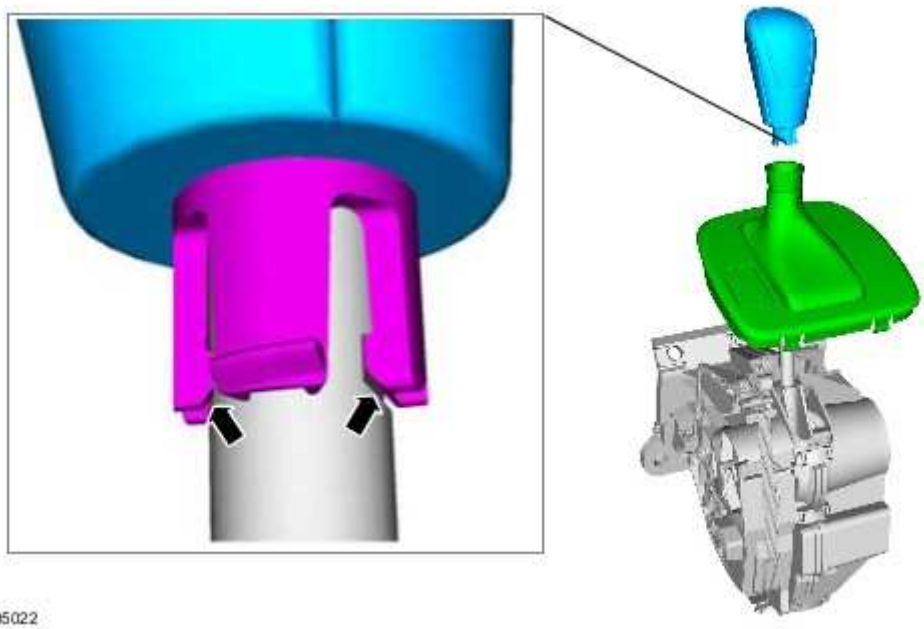
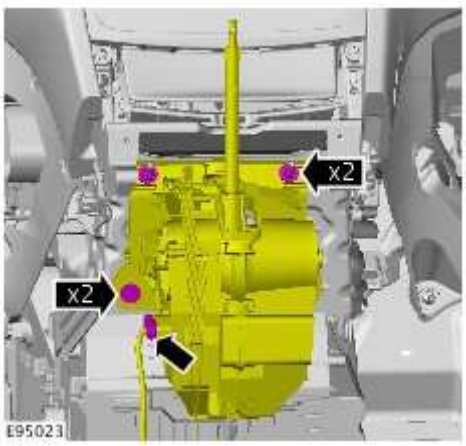
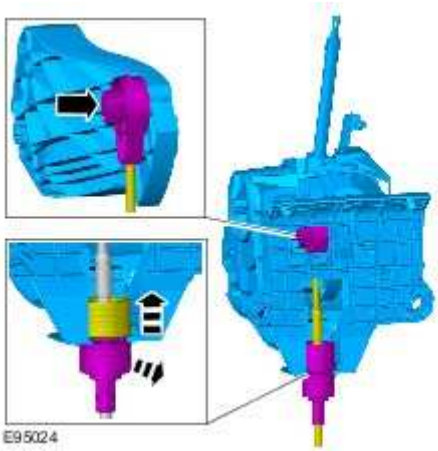




5. *Torque:* 9 Nm



6.

Installation

1. To install reverse the removal procedure.
2. Refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 6-Speed Automatic Transaxle - AWF21, General Procedures).

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Testing

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **3.** Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.
4. **4.** If the concern persists, check the symptoms and proceed according to the Ford approved diagnostic tool instructions.

Inspection and Verification - Manual Transaxle

The following checks should be carried out before repairing or installing a new transaxle.

The inspection and verification of manual transmission concerns can be considered in three main areas.

Gear Shifting Concerns

- Clutch does not operate correctly.
- External gearshift mechanism REFER to:
  External Controls (308-06A Manual Transmission/Transaxle External Controls - Vehicles With: 5-Speed Manual Transaxle - MTX75, Description and Operation),
  External Controls (308-06B Manual Transmission/Transaxle External Controls - Vehicles With: 6-Speed Manual Transaxle - MMT6, Description and Operation).

Transmission noise concerns

- Check the engine and transmission mountings for sufficient clearance to the transmission and the body.
- Other noises except gearshift noises
- Go through the driving situations/tests described in the table below under the conditions described there and answer each part of the diagnosis with a "Yes" or "No".

NOTE: If the response to one or more diagnoses is "Yes", the transmission must be removed and the dual mass flywheel checked according to GO to Pinpoint Test E. .

Item No.	Situation, test / diagnosis	Yes	No
1	Driving situation:	0	0
	Road test the vehicle. Accelerate the vehicle with maximum torque in 5th or 6th gear. REFER to: Specifications (308-01A Clutch - Vehicles With: 5-Speed Manual Transaxle - MTX75, Specifications), Specifications (308-01B Clutch - Vehicles With: 6-Speed Manual Transaxle - MMT6, Specifications), Specifications (308-01C Clutch - Vehicles With: 6-Speed Manual Transaxle - M66, Specifications).		
	Diagnosis:		

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	Are there extremely harsh vibrations from the powertrain? Vibrations disappear when the accelerator pedal is released briefly.		
1a	Driving situation:	0	0
	Road test the vehicle. Drive the vehicle in simulated "stop and go" mode (1st gear). Check for transmission rattle during gentle acceleration and deceleration.		
	Diagnosis:		
	Are there noises from the powertrain in driving situations between idling speed and a maximum of 2000 rev/min which occur at a specific, vehicle-dependent vehicle/engine speed?		
2	Driving situation:	0	0
	Raise the vehicle. Check all engine/transmission and exhaust mountings with the engine not running, while starting the engine and when it is idling.		
	Diagnosis:		
	Does the engine/transmission shake severely or make rattling noises during starting? Longer time before engine reaches idle speed. Renew any damaged components (engine/transmission or exhaust mountings) and redo the test.		
3	Driving situation:	0	0
	Check the front axle driveshafts and the manual transmission. Lock the wheels and apply the parking brake. Start the engine, engage 1st gear and slowly release the clutch pedal while the engine idles.		
	Diagnosis:		
	Engine speed does not drop, power not transferred, vehicle does not move.		
4	Driving situation:	0	0
	Start engine, put shift lever in neutral and slowly release the clutch. Switch off the engine.		
	Diagnosis:		
	Hard metallic noise as the engine stops, coming from the manual transmission during the last engine revolution before the engine finally stops, is NOT caused by the dual mass flywheel. On vehicles with a diesel engine and without an intake manifold flap solenoid valve, the concern (harsh, metallic noise) cannot be resolved by installing a new dual mass flywheel. In diesel engines with an intake manifold flap solenoid valve, check the operation of the solenoid valve.		
	If a clattering noise is detected as the engine is switched off with the clutch pedal depressed, check the transmission housing for grease residues (more than 2 grams) from the dual mass flywheel (remove the starter motor and check the bell housing).		

Fluid Leakage Concerns

- Check that the leaking fluid is actually transmission fluid and not hydraulic fluid (from the hydraulically operated clutch) or engine oil.
- Check the transmission fluid level. If necessary, drain off any excess fluid.
- Locate the oil leak with the aid of a fluorescent test fluid and an ultraviolet inspection lamp.
- Clean the transaxle and the adjacent areas carefully before road testing.

Symptom Chart – General Concerns

Symptom	Possible Sources	Action
High-effort gear shifting in one or more gears	* Synchronizer ring or synchronization damaged	* INSTALL a new synchronizer hub with synchronizer ring set and INSTALL a new gear wheel belonging to the synchronizer unit as necessary. - Because of various changes and the difficulty in estimating the level of wear, a complete new installation (as described above) is recommended.
	* Clutch does not operate correctly.	* CHECK the clutch function and the brake fluid level.
	* Internal gearshift	* Remove the internal gearshift mechanism and check

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	mechanism	the components. - RENEW.
Clashing or scratching noise during gear shifting	* Synchronizer hub or synchronizer ring damaged	* INSTALL a new synchronizer hub with synchronizer ring set and INSTALL a new gear wheel belonging to the synchronizer unit as necessary. - Because of various changes and the difficulty in estimating the level of wear, a complete new installation (as described above) is recommended.
	* Clutch does not operate correctly.	* CHECK the clutch function and the brake fluid level.
Gear engagement not functioning correctly	* External gearshift mechanism damaged	* CHECK the external gearshift mechanism for damage. If no concern is determined, REMOVE the transmission.REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
Gear jumps out of engagement while driving	* Missing snap rings; synchronization components damaged or worn clutch splines	* INSTALL a new gear set, synchronizer unit and selector fork as necessary. CHECK the transmission for damage, particularly to the sliding sleeve.
	* Incorrect sliding sleeve; worn clutch splines	* INSTALL a new gear set, synchronizer unit and selector fork as necessary. CHECK the transmission for damage, particularly to the sliding sleeve.
	* Selector forks	* RENEW gear wheels, sliding sleeves and selector forks as necessary. CHECK the transmission for damage, particularly to the sliding sleeve.
Gearshift lever feels loose	* Gearshift lever fixing.	* Check the external gearshift mechanism; replace if necessary. Check gear lever mounting, external gearshift mechanism and shift cables; tighten if necessary. REFER to: External Controls (308-06A Manual Transmission/Transaxle External Controls - Vehicles With: 5-Speed Manual Transaxle - MTX75, Description and Operation), External Controls (308-06B Manual Transmission/Transaxle External Controls - Vehicles With: 6-Speed Manual Transaxle - MMT6, Description and Operation).

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	* Internal gearshift mechanism	* Check the internal shift mechanism for play at the transmission.

Symptom Chart - Transaxle noises

Symptom	Possible Sources	Action
Gear wheels banging when shifting	* Clutch worn	* Check clutch * REFER to: (308-01A Clutch - Vehicles With: 5-Speed Manual Transaxle - MTX75) Clutch (Diagnosis and Testing), Clutch (Diagnosis and Testing), Clutch (Diagnosis and Testing).
	* Air in the clutch system; fluid loss	* Check the clutch system for leaks. Check the clutch master cylinder bleed screw for blockage. Remove any blockage from the clutch master cylinder bleed screw and bleed the clutch system as necessary. REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).
Slight buzzing, rattling or metallic scraping noise from the transmission at 2500 to 3500 rpm when on overrun or driving without load (particularly in 2nd and 3rd gear)	* Rotational vibration from the engine not sufficiently damped by the clutch.	* These noises do not affect the operation and durability of the transaxle.
	* Engine speed-dependent transmission noise	* CHECK transmission input shaft bearings. REMOVE the transmission REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
	* Vehicle speed-dependent transmission noise	* CHECK driveshaft tripod joints. REFER to: (205-04 Front Drive Halfshafts) Front Halfshaft LH (Removal and

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	Installation), Front Halfshaft RH (Removal and Installation).
* Steering angle-dependent transmission noise	* CHECK differential splines for damage. Turn the differential bevel gears against one another. For this purpose, REMOVE the differential. REFER to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation) / Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
* The engine and transaxle assembly is in contact with the body.	* Look for points of contact and REPAIR as necessary.
* Collar screws – engine/gearbox	* TIGHTEN the transmission bolts.REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Installation).
* Transaxle fluid level low.	* Check the transmission fluid level.
* Transaxle bearings and gear wheels (usually on high-mileage vehicles).	* REMOVE the transaxle. CHECK the bearings and gear wheels and INSTALL new components as necessary.REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle -

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		MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
Rattling or vibration noises.	* External selector mechanism	* CHECK the external gearshift mechanism.
	* Front or rear engine mounting defective	* CHECK front or rear engine mounting; RENEW if necessary.

Symptom Chart - Oil leakage

Symptom	Possible Sources	Action
Fluid Leakage	* Oil seals or O-ring seals	* CHECK the mating surfaces and INSTALL a new.
	* Fluid leak between the clutch-side and transmission-side housing halves.	* DISASSEMBLE the transmission and clean the mating faces. CHECK the surfaces for damage. Seal the transmission using WSK-M2G348-A5 sealer.
	* Fluid leak at transmission housing bolt	* Tighten transmission housing bolts to specified tightening torque.

Symptom Chart - Clutch

Symptom	Possible Sources	Action
Clutch slipping	* No clutch pedal free play * Clutch diaphragm springs broken * Clutch disc facing broken * Hardened or oiled clutch disc facing surface.	* GO to Pinpoint Test A.
Clutch chatter or shudder	* Engine mounting defective * Tilted clutch disc	* GO to Pinpoint Test B.
Clutch disengages too late or not at all; high-effort gear shifting	* Insufficient fluid. * Air in hydraulic system. * Excessive clutch pedal free play * Clutch diaphragm springs broken * Clutch disc deformed or broken * Corrosion on clutch disc splines * Insufficient or no grease on the transmission input shaft and clutch disc splines	* GO to Pinpoint Test C.
Clutch pedal pulsating	* Uneven diaphragm spring fingers * Frequency modulator defective (if present)	* GO to Pinpoint Test D.
Excessive noise	* Release bearing defective	* GO to

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	* Driveshaft guide bearing * Excessive crankshaft end play.	Pinpoint Test E.
Fluid Leakage	* Clutch master cylinder * Clutch slave cylinder * Hydraulic lines in area of engine and transmission	* GO to Pinpoint Test F.

Pinpoint test

PINPOINT TEST A : CLUTCH SLIPPAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: TEST CLUTCH SLIPPAGE	
	1 Lock the wheels and apply the parking brake.
	2 Ignition switch in position III.
	3 Start the engine, depress the clutch pedal and engage fourth gear.
	4 Run the engine at approx. 2000 rpm.
	5 Release the clutch pedal slowly.
	Does the engine stall when the clutch pedal is fully released? **Yes** Clutch OK. **No** GO to A2.
A2: CHECK CLUTCH PEDAL FREE PLAY	
	1 Measure the clutch pedal free play.
	2 Depress the clutch pedal by hand until an increase in resistance is clearly felt, then release the clutch pedal again.
	Is the clutch pedal free play approx. 10 mm? **Yes** Clutch pedal free play OK. **No** GO to A3.
A3: CHECK THE CLUTCH DIAPHRAGM SPRING	
	1 Remove the transmission. CHECK the clutch diaphragm spring. REFER to: Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
	Is the clutch diaphragm spring broken? **Yes** Renew the clutch set. **No** GO to A4.
A4: TEST CLUTCH FRICTION DISK	
	1 Remove the clutch disc and clutch pressure plate.
	Is the clutch disc contaminated with oil or the clutch pressure plate broken?

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	Yes CHECK the engine and transmission for leaks.INSTALL a new clutch disc and pressure plate. **No** CHECK system operates correctly

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: TEST CLUTCH CHATTER OR SHUDDER	
	1 Ignition switch in position III.
	2 Start the engine, depress the clutch and engage first gear.
	3 Run the engine at between 1200 rpm and 1500 rpm.
	4 Release the clutch pedal slowly.
	Does the vehicle jerk when it starts off? **Yes** GO to B2. **No** Clutch OK.
B2: TEST ENGINE/TRANSAXLE ISOLATOR, ROLL RESISTOR	
	1 Check the engine/transaxle mountings isolator and roll resistor for damage or loose bolts.
	Is the engine/transaxle isolator or roll restrictor loose or damaged? **Yes** TIGHTEN the bolts or INSTALL new bolts as necessary. CHECK system operates correctly **No** GO to B3.
B3: TEST CLUTCH PRESSURE PLATE	
	1 Remove clutch pressure plate.
	Is the clutch pressure plate damaged? **Yes** RENEW the clutch set. **No** GO to B4.
B4: TEST CLUTCH FRICTION DISK	
	1 CHECK the clutch disc.
	Does the clutch disc show evidence of damage due to tilting? **Yes** RENEW the clutch set. **No** CHECK flywheel.

PINPOINT TEST C : CLUTCH DISENGAGES TOO LATE OR NOT AT ALL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FLUID LEVEL	
	1 Check brake fluid level
	Is the brake fluid level between the MAX and MIN marks on the brake fluid reservoir? **Yes** GO to C2. **No** Fill with brake fluid, CHECK the brake and clutch systems for leaks.
C2: CLUTCH DISENGAGES TOO LATE OR NOT AT ALL	
	1 Bleed the clutch system.
	Does the clutch show improved disengaging characteristics following bleeding of

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	the system? **Yes** Clutch OK. **No** GO to C3.
C3: CHECK CLUTCH PEDAL FREE PLAY	
	1 Measure the clutch pedal free play.
	2 Depress the clutch pedal by hand until an increase in resistance is clearly felt, then release the clutch pedal again.
	Is the clutch pedal free play approx. 10 mm? **Yes** GO to C4. **No** CHECK that the clutch pedal moves freely; remove if necessary.
C4: CHECK THE CLUTCH DIAPHRAGM SPRING	
	1 Remove the transmission and CHECK the clutch diaphragm spring.REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
	Is the clutch diaphragm spring broken? **Yes** RENEW the clutch set. TEST the system for normal operation. **No** GO to C5.
C5: TEST CLUTCH FRICTION DISK	
	1 Remove the clutch disc.
	Is the clutch disc bent or broken? **Yes** RENEW the clutch set. **No** GO to C6.
C6: CHECK THE SPLINES ON THE CLUTCH DISC FOR INSUFFICIENT LUBRICATION AND/OR SIGNS OF CORROSION	
CAUTION: Do not use solvent cleaners to clean the inside of the clutch housing or the transmission input shaft. A lint-free damp cloth should be used for cleaning. Failure to follow this instruction may result in incorrect clutch operation.	
	1 CHECK the splines on the clutch disc for insufficient or no grease and/or signs of corrosion.
	Is there insufficient or no grease and/or signs of corrosion on the splines of the clutch disc? **Yes** CLEAN the splines of the clutch disc. GO to C7.

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	No CHECK the splines of the transmission input shaft for damage or insufficient or no grease and signs of corrosion. CLEAN and lubricate the splines on the clutch disc with the specified lubricant as required. CLEAN the splines of the transmission input shaft. If the transmission input shaft is damaged, REPLACE the components as required. TEST the system for normal operation.
C7: CHECK THE SPLINES ON THE CLUTCH DISC FOR SIGNS OF DAMAGE OR SIGNIFICANT FRICTION	
CAUTION: Do not use solvent cleaners to clean the inside of the clutch housing or the transmission input shaft. A lint-free damp cloth should be used for cleaning. Failure to follow this instruction may result in incorrect clutch operation.	
	1 CHECK the splines on the clutch disc for damage or signs of significant friction.
	Are there signs of damage or significant friction on the splines of the clutch disc? **Yes** RENEW the clutch set. Lubricate the splines of the clutch disc with the specified lubricant as required. TEST the system for normal operation. **No** CHECK the splines of the transmission input shaft for damage or insufficient or no grease and/or signs of corrosion. CLEAN and lubricate the splines on the clutch disc with the specified lubricant as required. CLEAN the splines of the transmission input shaft. If the transmission input shaft is damaged, REPLACE the components as required. TEST the system for normal operation.

PINPOINT TEST D : CLUTCH PEDAL PULSATING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE BELLEVILLE SPRING FINGERS FOR UNIFORMITY	
	1 Remove the transmission. REFER to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal), Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal), Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal). CHECK the diaphragm spring fingers for uniformity.
	Are the diaphragm spring fingers all at the same height? **Yes** Check the frequency modulator and RENEW if necessary (if present) **No** RENEW the clutch set.

PINPOINT TEST E : EXCESSIVE NOISE	

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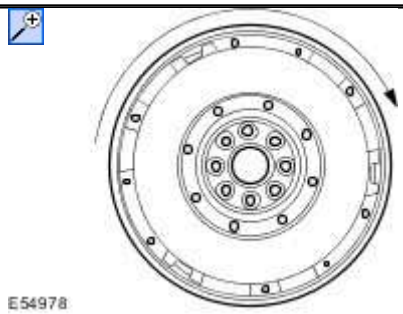
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK THE TRANSMISSION AT IDLING A)	
	1 Ignition switch in position III. 2 Start the engine. 3 Depress the clutch pedal fully.
	Is the noise apparent when the clutch is operated? **Yes** GO to E3. **No** There is a problem with the transaxle. REFER to Symptom Chart(s).
E2: CHECK THE TRANSMISSION AT IDLING B)	
	1
	Are the noises coming from the pedal box? **Yes** Go to "Service – Clutch Pedal". **No** GO to E3.
E3: TEST CLUTCH RELEASE BEARING	
	1 Check the release bearing for wear and corrosion.
	Are there signs of wear or rust? **Yes** INSTALL a new clutch release bearing. **No** CHECK the crankshaft for excessive end float.Are there still noises?GO to E5.
E4: ENGINE SELECTION – DIESEL ENGINES	
	1
	Does the engine have a 1.8L diesel engine or a 2.0L diesel engine? **Yes** Vehicles with a 1.8L diesel engineGO to E5. Vehicles with a 2.0L diesel engineGO to E13. **No** GO to E22.
E5: CHECK THE ROTATION OF THE SECONDARY MASS OF THE DUAL MASS FLYWHEEL	
 E54978	CAUTIONS: Do not rework or machine the dual mass flywheel if it is distorted. Do not clean the dual mass flywheel with any kind of liquid. Use only a dry cloth to clean the flywheel. Do not clean the gap between the primary and secondary mass. Only clean the bolt connection surface and the clutch surface. NOTE: Discoloration is not a reason in itself to replace the dual mass flywheel. 1 Remove the clutch disc and clutch pressure plate.
	Can the secondary mass be turned freely by more than 15 teeth? **Yes** INSTALL A NEW dual mass flywheel. **No** GO to E8.

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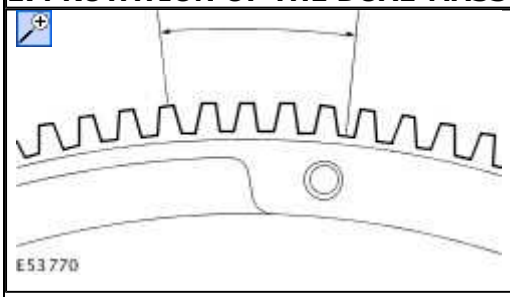
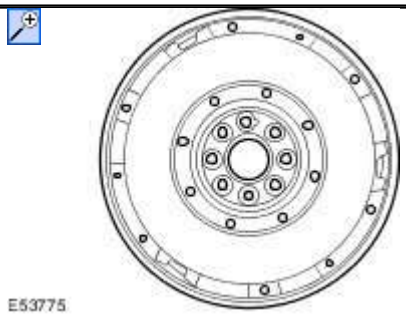
E6: CHECK THE SPRING RESISTANCE

	1 Twist the secondary mass in both directions.
	Can spring resistance be felt in both directions? **Yes** CONTINUE **No** INSTALL A NEW dual mass flywheel.

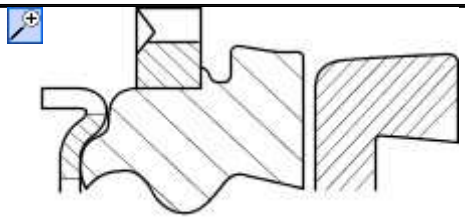
E7: ROTATION OF THE DUAL-MASS FLYWHEEL

 E53770	1 Secure the primary side. Twist the secondary side in a clockwise direction until spring resistance is felt and release. Mark the rest position on the primary and secondary sides. Then twist the secondary side in a counter-clockwise direction until spring resistance is felt and release. Mark the new rest position on the primary side. Count the number of teeth between the marks for both directions on the toothed ring.
	Are more than 5 teeth counted? **Yes** INSTALL A NEW dual mass flywheel. **No** GO to E8.

E8: CHECK THE DUAL-MASS FLYWHEEL

 E53775	1 Perform a visual inspection of the dual mass flywheel.
	Is the dual mass flywheel free of damage? **Yes** GO to E9. **No** INSTALL A NEW dual mass flywheel.

E9: CHECK THE TOOTHED RING OF THE DUAL-MASS FLYWHEEL

 E53772	1 Perform a visual inspection of the toothed ring of the dual mass flywheel.
	Perform a visual inspection of the toothed ring of the dual mass flywheel. **Yes** GO to E10. **No** INSTALL A NEW dual mass flywheel.

E10: CHECK THE WELD SEAM OF THE DUAL-MASS FLYWHEEL

	1 Visually inspect the weld seam of the dual mass flywheel to check for loss of grease.

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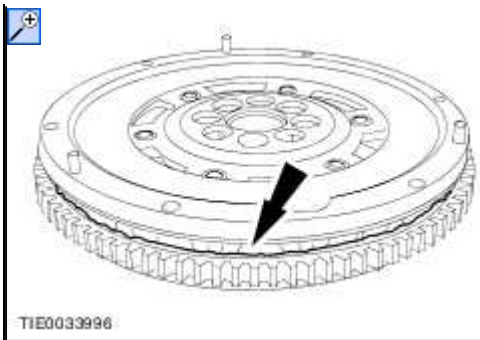


Is a clear loss of grease visible at the weld seam of the dual mass flywheel?

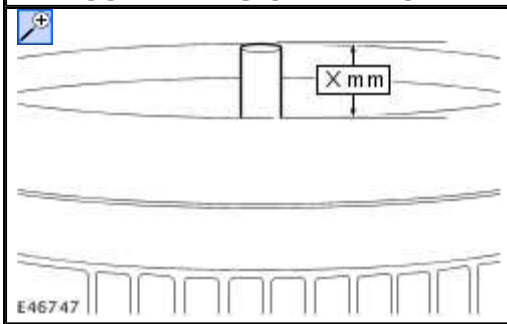
Yes

INSTALL A NEW dual mass flywheel.

No

GO to E11.

E11: GUIDE PINS OF THE DUAL-MASS FLYWHEEL



1 Check the installation of the guide pins of the dual-mass flywheel.

Are the guide pins for the dual mass flywheel present, and do they all have the same length?

Yes

GO to E12.

No

INSTALL A NEW dual mass flywheel.

E12: DISCOLORATION OF THE DUAL MASS FLYWHEEL DUE TO OVERHEATING

1 Check the dual mass flywheel for discoloration due to overheating.

Is any discoloration evident in the marked area?

Yes

INSTALL A NEW dual mass flywheel.

No

The dual mass flywheel is OK.

E13: CHECK THE ROTATION OF THE SECONDARY MASS OF THE DUAL MASS FLYWHEEL

CAUTIONS:

Do not rework or machine the dual mass flywheel if it is distorted.

Do not clean the dual mass flywheel with any kind of liquid. Use only a dry cloth to clean the

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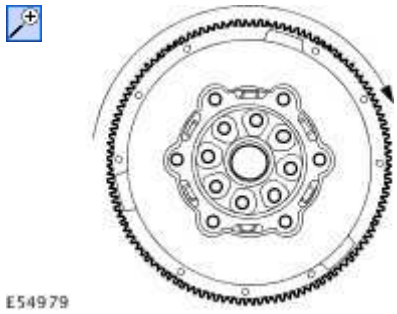


flywheel.

Do not clean the gap between the primary and secondary mass. Only clean the bolt connection surface and the clutch surface.
NOTE: Discoloration is not a reason in itself to replace the dual mass flywheel.

1 Remove the clutch disc and clutch pressure plate.

Can the secondary mass be turned freely by more than 15 teeth?

Yes

INSTALL A NEW dual mass flywheel.

No

GO to E17.

E14: CHECK THE SPRING RESISTANCE

1 Twist the secondary mass in both directions.

Can spring resistance be felt in both directions?

Yes

GO to E17.

No

GO to E15.

E15: CENTER THE FRICTION CONTROL DISC

1 Secure the primary side with Special Tool 303-254. Gradually turn the secondary side in one direction against the resistance until spring resistance to the force applied by hand is felt on both sides. If it is not possible to reach the spring resistance on both sides, gradually turn the secondary side in the opposite direction in the way described above.

Is it possible to find a middle position with spring resistance on either side?

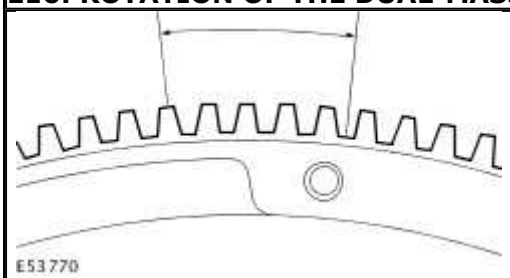
Yes

CONTINUE

No

INSTALL A NEW dual mass flywheel.

E16: ROTATION OF THE DUAL-MASS FLYWHEEL



1 Secure the primary side. Twist the secondary side in a clockwise direction until spring resistance is felt and release. Mark the rest position on the primary and secondary sides. Then twist the secondary side in a counter-clockwise direction until spring resistance is felt and release. Mark the new rest position on the primary side. Count the number of teeth between the marks for both directions on the toothed ring.

Are more than 5 teeth counted?

Yes

INSTALL A NEW dual mass flywheel.

No

GO to E17.

E17: CHECK THE DUAL-MASS FLYWHEEL

1 Perform a visual inspection of the dual mass flywheel.

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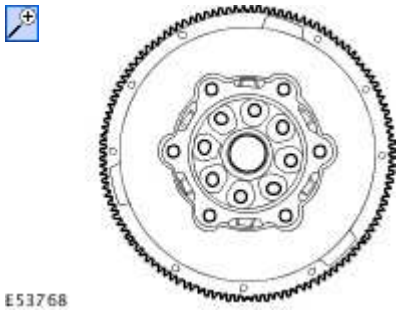


Is the dual mass flywheel free of damage?

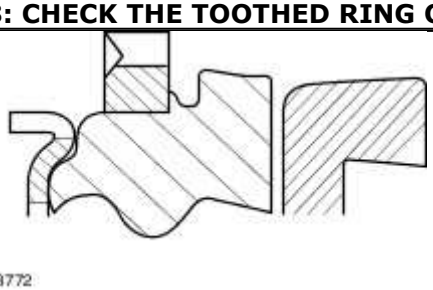
Yes

GO to E18.

No

INSTALL A NEW dual mass flywheel.

E18: CHECK THE TOOTHED RING OF THE DUAL-MASS FLYWHEEL



1 Perform a visual inspection of the toothed ring of the dual mass flywheel.

Perform a visual inspection of the toothed ring of the dual mass flywheel.

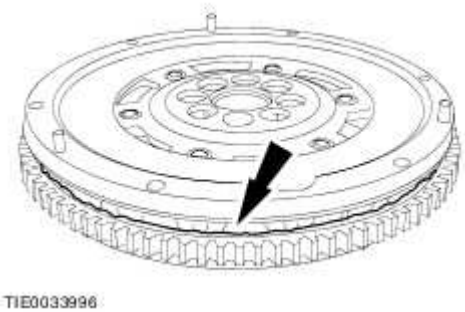
Yes

GO to E19.

No

INSTALL A NEW dual mass flywheel.

E19: CHECK THE WELD SEAM OF THE DUAL-MASS FLYWHEEL



1 Visually inspect the weld seam of the dual mass flywheel to check for loss of grease.

Is a clear loss of grease visible at the weld seam of the dual mass flywheel?

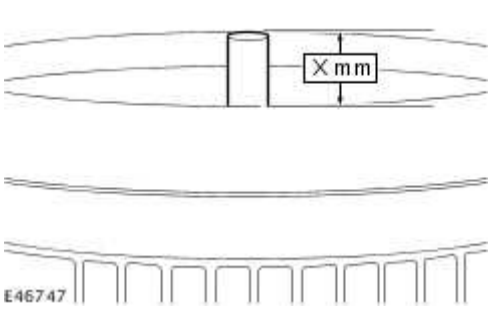
Yes

INSTALL A NEW dual mass flywheel.

No

GO to E20.

E20: GUIDE PINS OF THE DUAL-MASS FLYWHEEL



1 Check the installation of the guide pins of the dual-mass flywheel.

Are the guide pins for the dual mass flywheel present,

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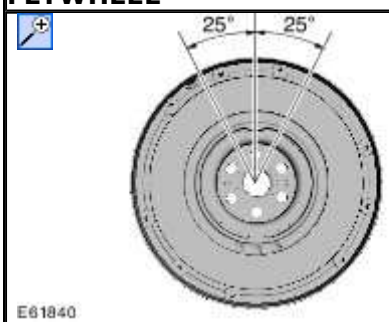
	and do they all have the same length? **Yes** GO to E21. **No** INSTALL A NEW dual mass flywheel.
E21: DISCOLORATION OF THE DUAL MASS FLYWHEEL DUE TO OVERHEATING	
 E74182	1 Check the dual mass flywheel for discoloration due to overheating.
	Is any discoloration evident in the marked area? **Yes** INSTALL A NEW dual mass flywheel. **No** The dual mass flywheel is OK.
E22: ENGINE SELECTION – PETROL ENGINES	
	1
	Does the vehicle have a 2.0L petrol engine or a 2.5L petrol engine? **Yes** Vehicles with a 2.0L petrol engineGO to E23. Vehicles with a 2.5L petrol engineGO to E29.
E23: CHECK THE ROTATION OF THE SECONDARY MASS OF THE DUAL MASS FLYWHEEL	
 E61840	CAUTIONS: Do not rework or machine the dual mass flywheel if it is distorted. Do not clean the dual mass flywheel with any kind of liquid. Use only a dry cloth to clean the flywheel. Do not clean the gap between the primary and secondary mass. Only clean the bolt connection surface and the clutch surface. NOTE: Discoloration is not a reason in itself to replace the dual mass flywheel. 1 Remove the clutch disc and clutch pressure plate.
	Can the secondary mass be turned freely by more than 15 teeth? **Yes** INSTALL A NEW dual mass flywheel. **No** GO to E25.
E24: ROTATION OF THE DUAL-MASS FLYWHEEL	
	1 Secure the primary side. Twist the secondary side in a clockwise direction until spring resistance is felt and release. Mark the rest position on the primary and secondary sides. Then twist the secondary side in a counter-clockwise direction until spring resistance is felt and release. Mark the new

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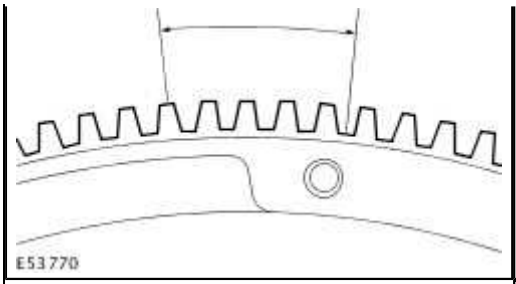
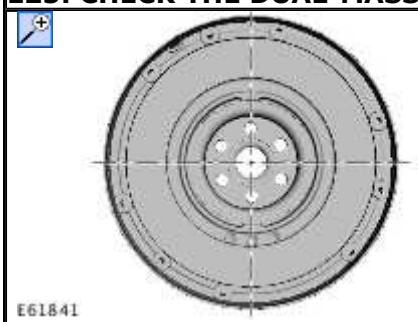


rest position on the primary side. Count the number of teeth between the marks for both directions on the toothed ring.

Are between 1 and 3.5 teeth counted?
Yes
GO to E25.
No
INSTALL A NEW dual mass flywheel.

E25: CHECK THE DUAL-MASS FLYWHEEL



1 Perform a visual inspection of the dual mass flywheel.

Is the dual mass flywheel free of damage?
Yes
GO to E26.
No
INSTALL A NEW dual mass flywheel.

E26: CHECK THE TOOTHED RING OF THE DUAL-MASS FLYWHEEL

1 Perform a visual inspection of the toothed ring of the dual mass flywheel.

Perform a visual inspection of the toothed ring of the dual mass flywheel.
Yes
GO to E27.
No
INSTALL A NEW dual mass flywheel.

E27: CHECK DUAL MASS FLYWHEEL FOR GREASE LEAKAGE

1 Visually inspect the weld seam of the dual mass flywheel to check for loss of grease.

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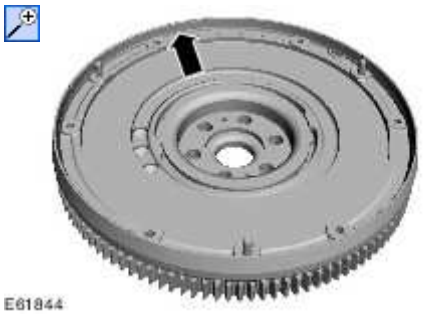
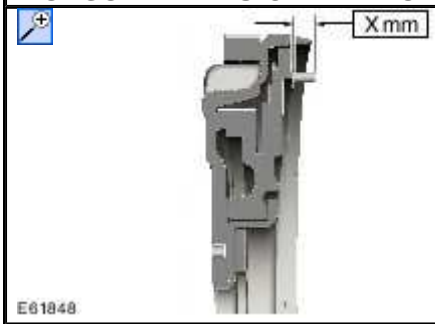


Is a clear loss of grease visible at the weld seam of the dual mass flywheel?
Yes
INSTALL A NEW dual mass flywheel.
No
GO to E28.

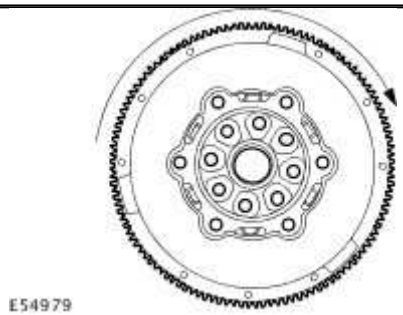
E28: GUIDE PINS OF THE DUAL-MASS FLYWHEEL



1 Check the installation of the guide pins of the dual-mass flywheel.

Are the guide pins for the dual mass flywheel present, and do they all have the same length?
Yes
The dual mass flywheel is OK.
No
INSTALL A NEW dual mass flywheel.

E29: CHECK THE ROTATION OF THE SECONDARY MASS OF THE DUAL MASS FLYWHEEL



CAUTIONS:

Do not rework or machine the dual mass flywheel if it is distorted.

Do not clean the dual mass flywheel with any kind of liquid. Use only a dry cloth to clean the flywheel.

Do not clean the gap between the primary and secondary mass. Only clean the bolt connection surface and the clutch surface.
NOTE: Discoloration is not a reason in itself to replace the dual mass flywheel.
1 Remove the clutch disc and clutch pressure plate.

Can the secondary mass be turned freely by more than 15 teeth?
Yes
INSTALL A NEW dual mass flywheel.
No
GO to E31.

E30: ROTATION OF THE DUAL-MASS FLYWHEEL

1 Secure the primary side. Twist the secondary side in a clockwise direction until spring resistance is

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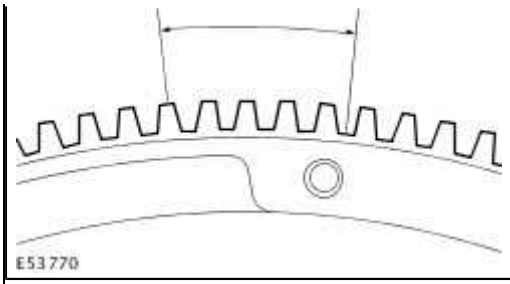
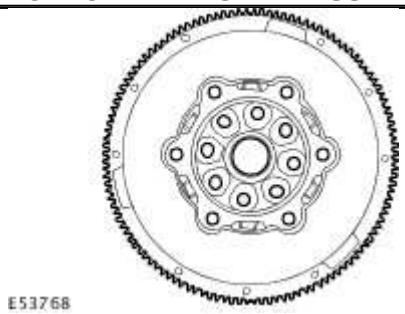


felt and release. Mark the rest position on the primary and secondary sides. Then twist the secondary side in a counter-clockwise direction until spring resistance is felt and release. Mark the new rest position on the primary side. Count the number of teeth between the marks for both directions on the toothed ring.

Are more than 8 teeth counted?
Yes
INSTALL A NEW dual mass flywheel.
No
GO to E31.

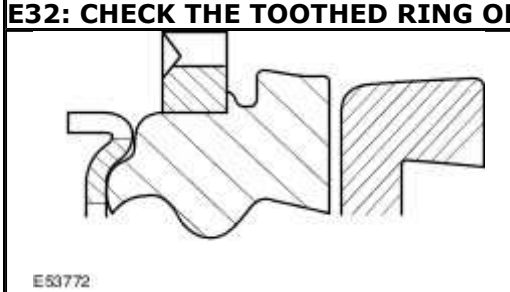
E31: CHECK THE DUAL-MASS FLYWHEEL



1 Perform a visual inspection of the dual mass flywheel.

Is the dual mass flywheel free of damage?
Yes
GO to E32.
No
INSTALL A NEW dual mass flywheel.

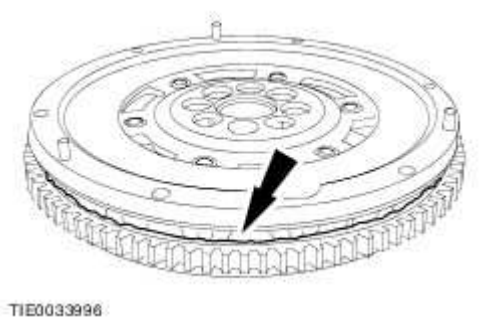
E32: CHECK THE TOOTHED RING OF THE DUAL-MASS FLYWHEEL



1 Perform a visual inspection of the toothed ring of the dual mass flywheel.

Perform a visual inspection of the toothed ring of the dual mass flywheel.
Yes
GO to E33.
No
INSTALL A NEW dual mass flywheel.

E33: CHECK THE WELD SEAM OF THE DUAL-MASS FLYWHEEL



1 Visually inspect the weld seam of the dual mass flywheel to check for loss of grease.

Is a clear loss of grease visible at the weld seam of the dual mass flywheel?
Yes

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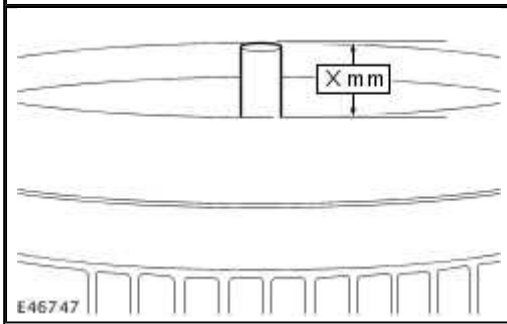
	INSTALL A NEW dual mass flywheel. **No** GO to E34.
E34: GUIDE PINS OF THE DUAL-MASS FLYWHEEL	
	1 Check the installation of the guide pins of the dual-mass flywheel.
	Are the guide pins for the dual mass flywheel present, and do they all have the same length? **Yes** The dual mass flywheel is OK. **No** INSTALL A NEW dual mass flywheel.

PINPOINT TEST F : FLUID LEAKAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE CLUTCH SLAVE CYLINDER	
	1 Check the clutch master cylinder for leaks.
	Is the clutch master cylinder OK? **Yes** GO to F2. **No** RENEW the clutch master cylinder.
F2: CHECK THE CLUTCH SLAVE CYLINDER	
	1 Check the clutch slave cylinder for leaks.
	Is the clutch slave cylinder OK? **Yes** GO to F3. **No** INSTALL a new clutch slave cylinder.
F3: INSPECT SYSTEM HYDRAULIC LINES	
	1 Check the hydraulic lines in area of engine and transmission for loose or damaged unions.
	Are the clutch hydraulic lines OK? **Yes** CARRY OUT a road test to verify the customer concern. **No** REPAIR or INSTALL new components as necessary. CARRY OUT a road test.

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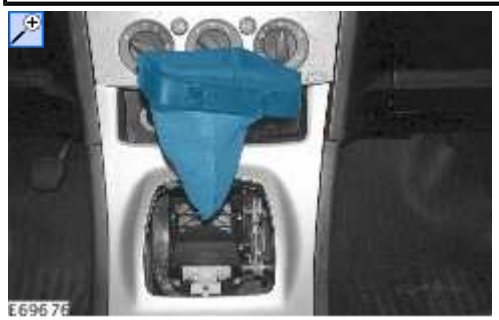
General Procedures

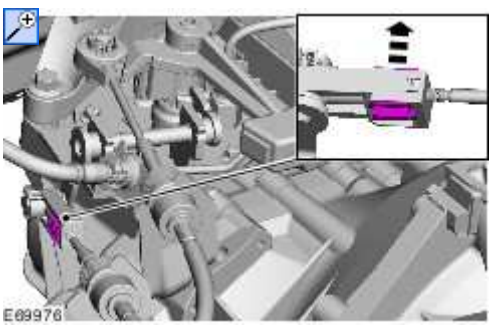
Special Tool(s)

	308-640 Aligner, Gearshift Lever

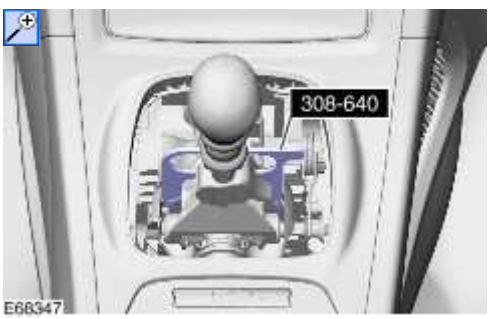


1.

2. 4th gear on the transmission must be engaged.



3.



4. *Special Tool(s):* 308-640

5.

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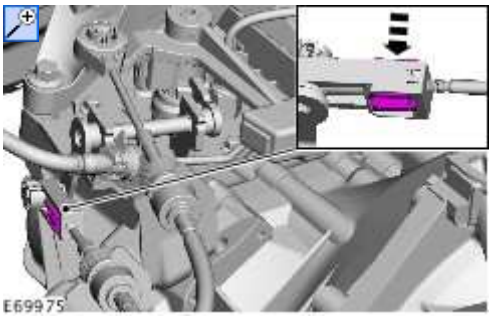

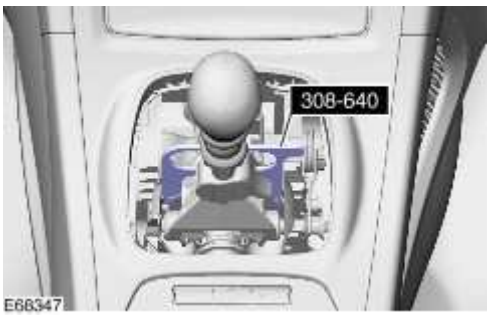

6. *Special Tool(s):* 308-640

7.

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General Procedures

Special Tool(s)

	308-640 Aligner, Gearshift Lever

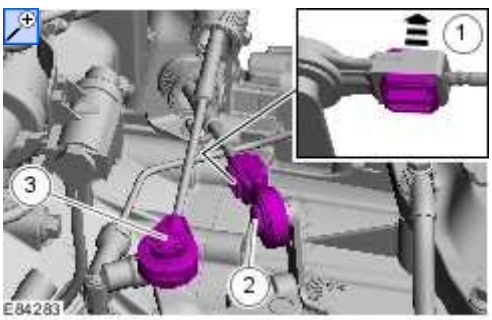
General Equipment

2.5 mm drill bit

All Vehicles

1. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

Vehicles built up to 10/2007



2. CAUTION: Gearshift cables must not be kinked or bent.

3.
   1. X = 44 mm.

      General Equipment: 2.5 mm drill bit
   2. NOTE: Ensure that 4th gear is engaged.

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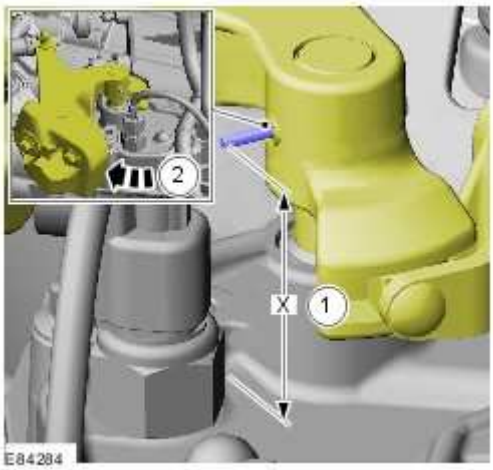
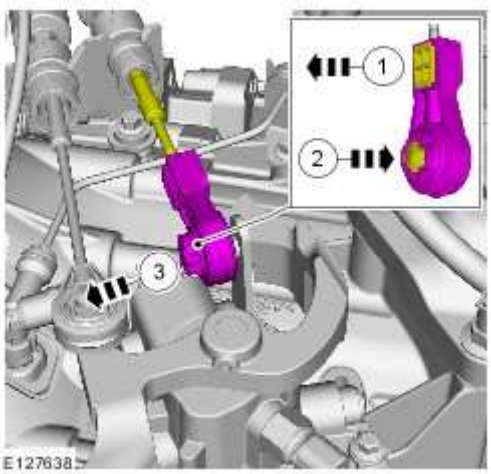
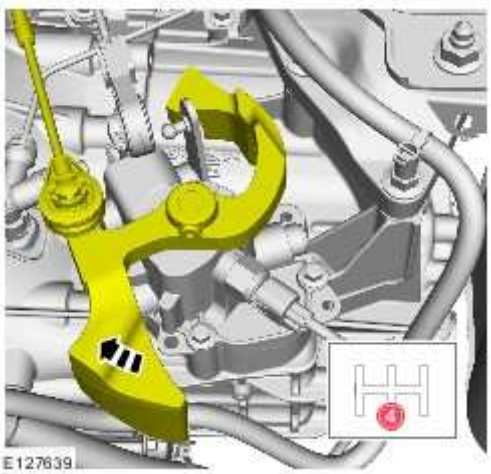


Vehicles built from 10/2007



4. CAUTION: Gearshift cables must not be kinked or bent.



5. NOTE: Ensure that 4th gear is engaged.

All Vehicles

6.

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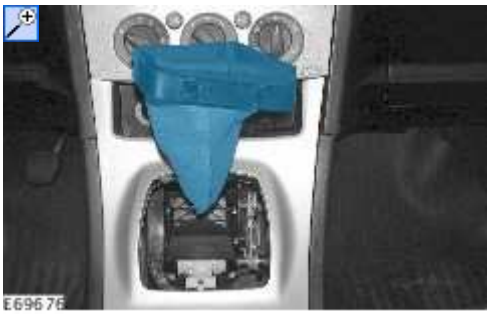
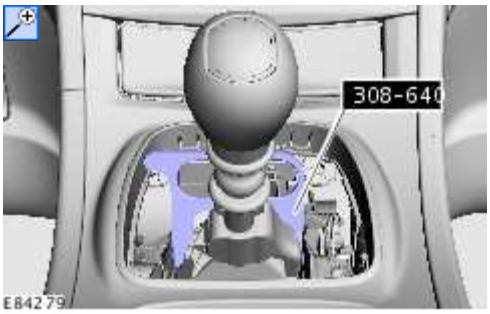
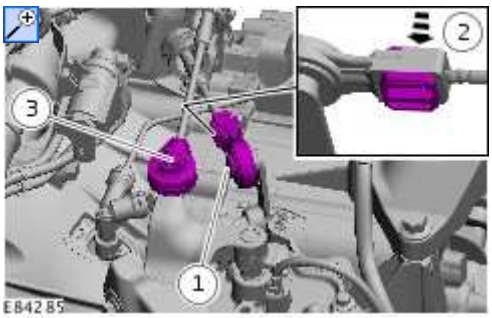




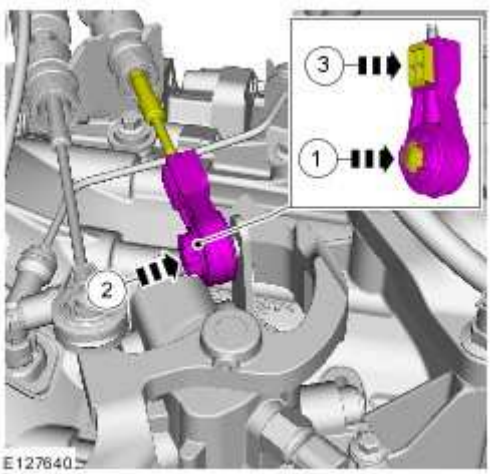
7. *Install the Special Tool(s):* 308-640

Vehicles built up to 10/2007



8. CAUTION: Gearshift cables must not be kinked or bent.

Vehicles built from 10/2007



9. CAUTION: Gearshift cables must not be kinked or bent.

All Vehicles

10. *Remove the Special Tool(s):* 308-640

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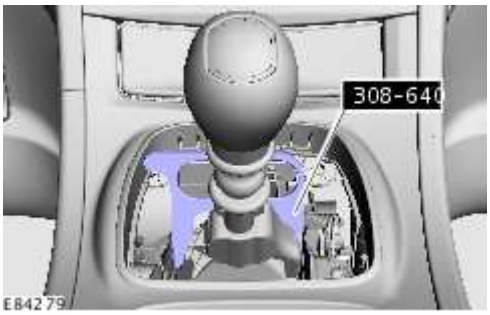

11.

12. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

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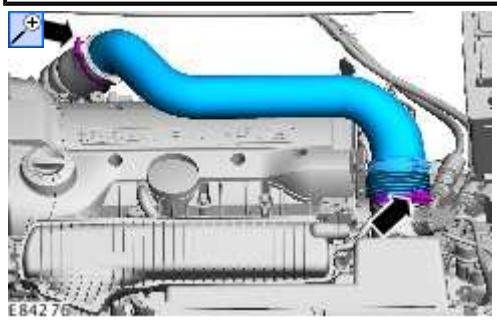
General Procedures

Special Tool(s)

	308-640 Aligner, Gearshift Lever



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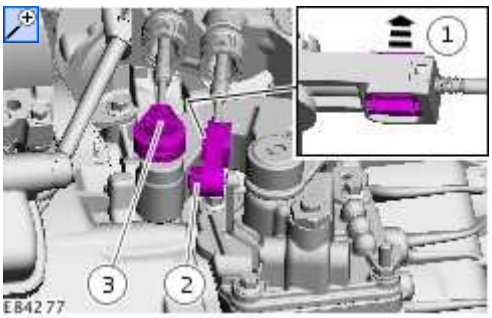
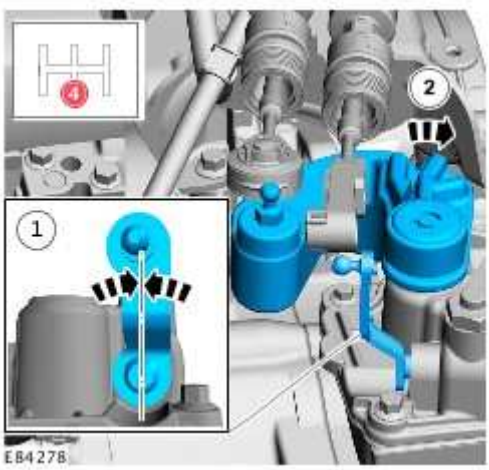


2. CAUTION: Gearshift cables must not be kinked or bent.



3.

2. NOTE: Ensure that 4th gear is engaged.

4.

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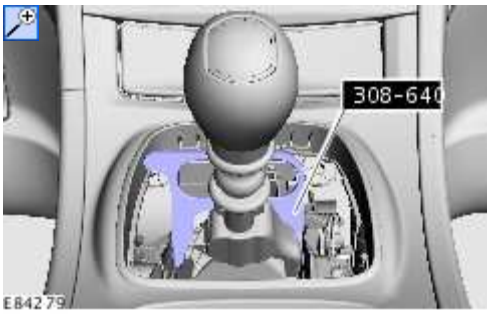
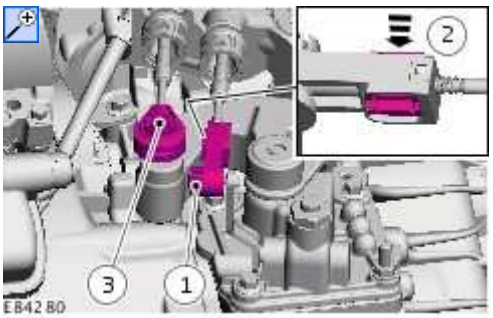
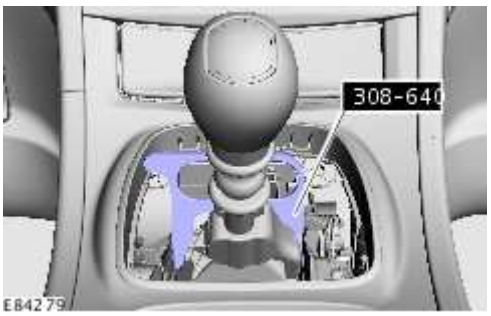


5. *Install the Special Tool(s):* 308-640



6. CAUTION: Gearshift cables must not be kinked or bent.



7. *Remove the Special Tool(s):* 308-640

8.

9.

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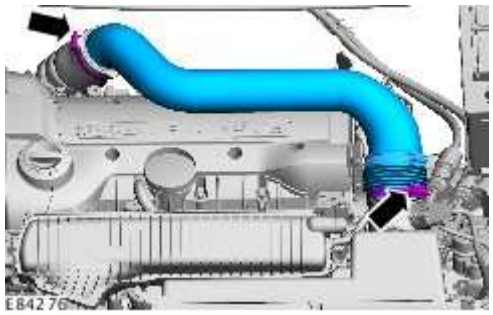

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Technical Data and Specifications

Clamped thickness - clutch plate *	Nominal thickness		Minimum thickness **	
	mm	inch	mm	inch
1.8L diesel engine	7.30	0.29	5.00	0.20
2.0L engine	8.20	0.32	5.70	0.22

*** Clamp the clutch disc hand-tight in the area of the friction linings.**

**** If the minimum thickness has been reached, the clutch disc must be renewed.**

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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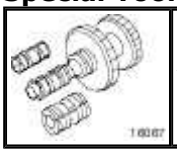
Removal and Installation

Special Tool(s)

	308-204 Aligner, Clutch Disc

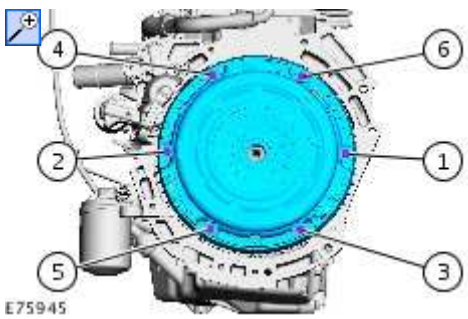
General Equipment

Ford diagnostic equipment

Removal

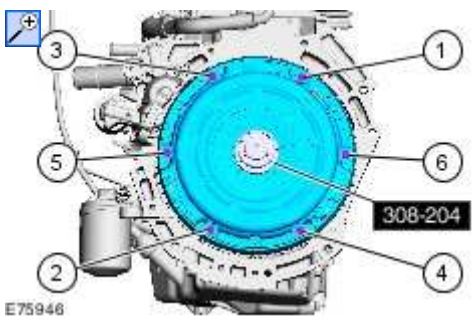
1. Remove the transmission.

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal).
   Refer to: Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal).



2. *Loosen:* Each bolt by two turn(s)

Installation



1. Tighten each bolt by two turns.

   Special Tool(s): 308-204
   Torque: 29 Nm

2. Install the transmission.

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation).
   Refer to: Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual

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Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation).

Fahrzeuge mit elektronischer Feststellbremse (EPB)

3. Elektronische Feststellbremse konfigurieren.

   General Equipment: Ford diagnostic equipment

4. Carry out a parking brake Function Test.

   General Equipment: Ford diagnostic equipment

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Technical Data and Specifications

Clamped thickness - clutch plate *	Nominal thickness		Minimum thickness **	
	mm	inch	mm	inch
1.8L diesel engine	7.30	0.29	5.00	0.20
2.0L diesel engine	8.20	0.32	5.70	0.22

*** Clamp the clutch disc hand-tight in the area of the friction linings.**

**** If the minimum thickness has been reached, the clutch disc must be renewed.**

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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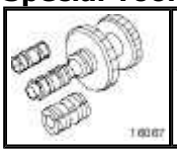
Removal and Installation

Special Tool(s)

	308-204 Aligner, Clutch Disc

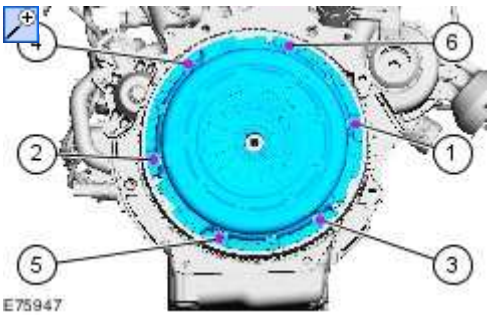
General Equipment

Ford diagnostic equipment

Removal

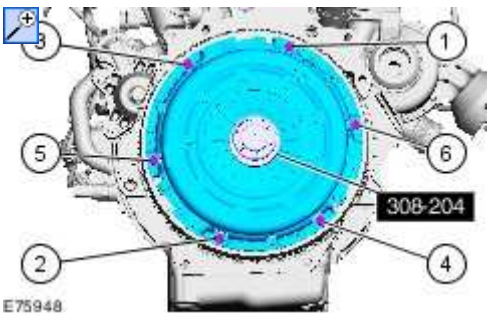
1. Remove the transmission.

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal).
   Refer to: Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal).



2. *Loosen:* Each bolt by two turn(s)

Installation



1. Tighten each bolt by two turns.

   Special Tool(s): 308-204
   Torque: 29 Nm

2. Install the transmission.

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation).
   Refer to: Transmission - 2.0L Duratorq-TDCi

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(85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation).

Vehicles with electronic parking brake (EPB)

3. Configure the electronic parking brake.

   General Equipment: Ford diagnostic equipment
4. Carry out a parking brake Function Test.

   General Equipment: Ford diagnostic equipment

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Technical Data and Specifications

Clamped thickness - clutch plate *	Nominal thickness		Minimum thickness **	
	mm	inches	mm	inches
2.5L Engine	8.40	0.33	5.90	0.23

*** Clamp the clutch disc hand-tight in the area of the friction linings.**

**** If the minimum thickness has been reached, the clutch disc must be renewed.**

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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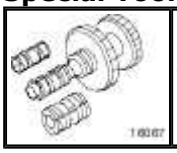
Removal and Installation

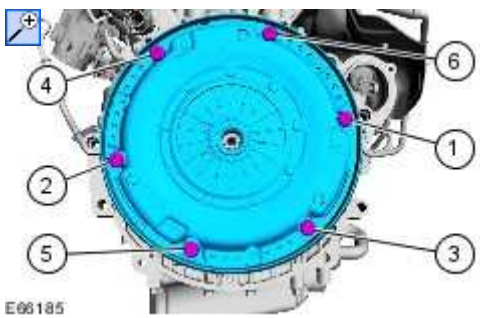
Special Tool(s)

	308-204 Aligner, Clutch Disc

General Equipment

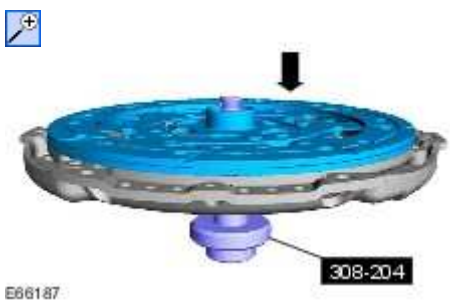
Ford diagnostic equipment

Removal

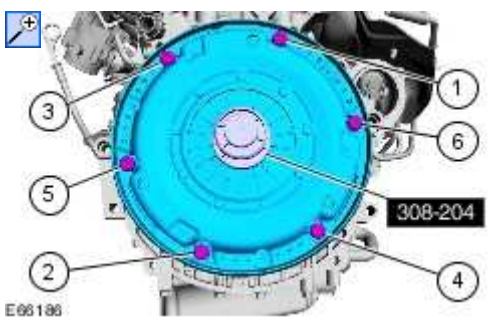


1. Refer to: Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
2. *Loosen:* Each bolt by two turn(s)

Installation



1. *Special Tool(s):* 308-204



2. Tighten each bolt 2 turns at a time.

   Special Tool(s): 308-204
   Torque: 23 Nm

3. Refer to: Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Installation).

Vehicles with electronic parking brake (EPB)

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4. Configure the electronic parking brake.

   General Equipment: Ford diagnostic equipment
5. Carry out a parking brake Function Test.

   General Equipment: Ford diagnostic equipment

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Clutch Controls

Description	
Functionality	Hydraulic
Adjustment	Automatic
Pedal travel (not adjustable)	144 ±3 mm

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Clutch Controls - Vehicles With: 5-Speed Manual Transaxle - MTX75 - Clutch Controls	S-MAX/Galaxy 2006.5 (02/2006-)

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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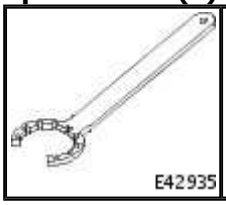
Removal and Installation

Special Tool(s)

 E42935	308-554 Remover/Installer, Clutch Master Cylinder

Materials

Name	Specification
Grease O-LI	WSD-M1C230-A / 95SX-M1C230-CA

Removal

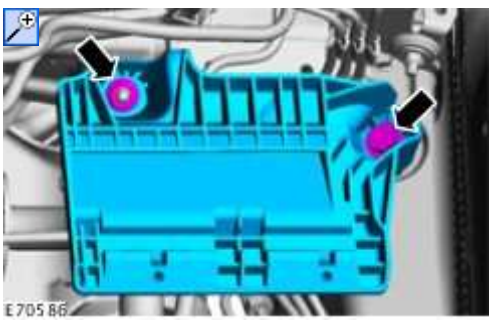
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

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

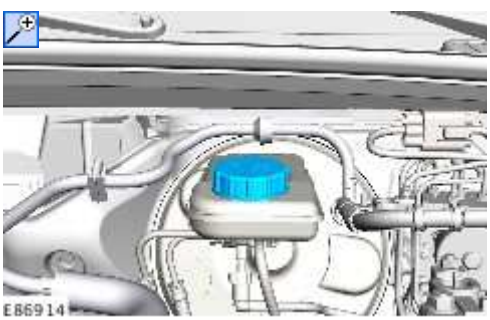
LHD Vehicles

2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).


E70586

3. *Torque:* 10 Nm

All vehicles


E86914

4. Extract brake fluid from the brake fluid reservoir until the level reaches the MIN mark.

5. CAUTION: Make sure that all openings are sealed.

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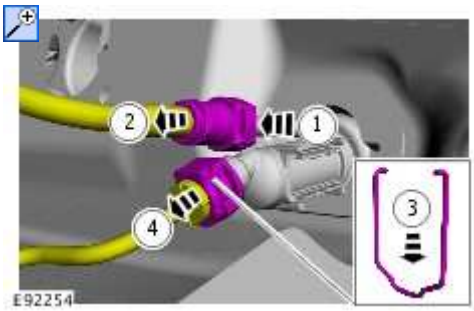
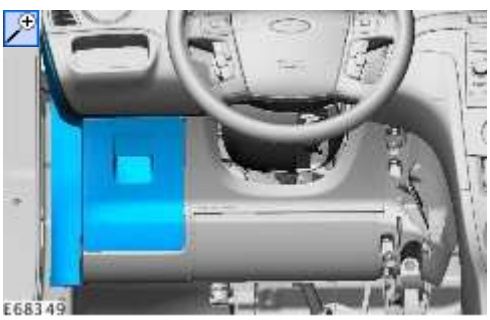
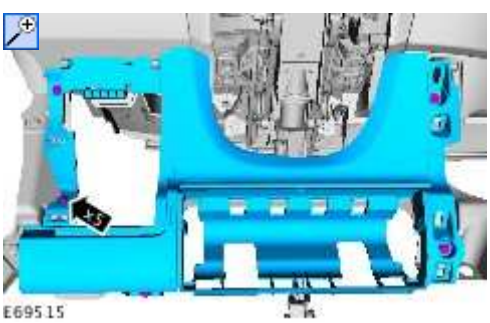


6.



7.

8. Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



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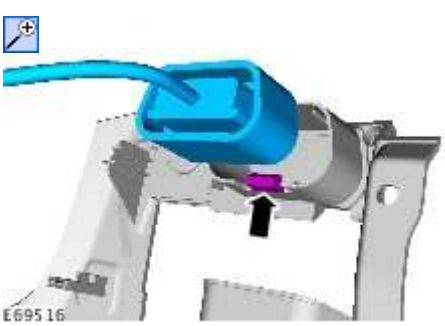

10.

11. *Torque:* 28 Nm

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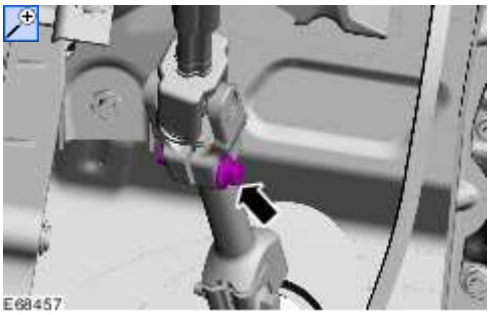
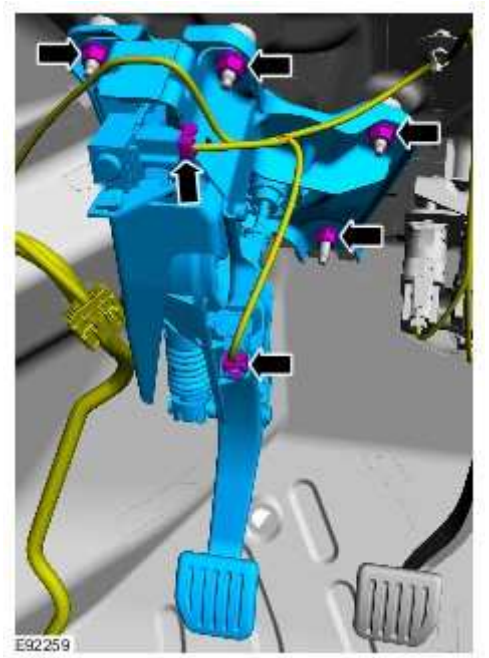
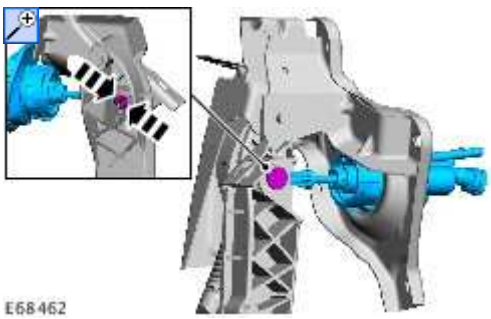


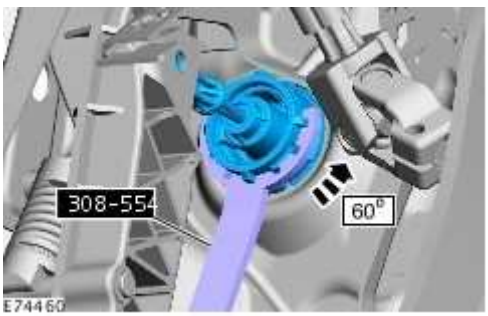
12. *Torque:* 28 Nm



13.



14. *Special Tool(s):* 308-554



15.

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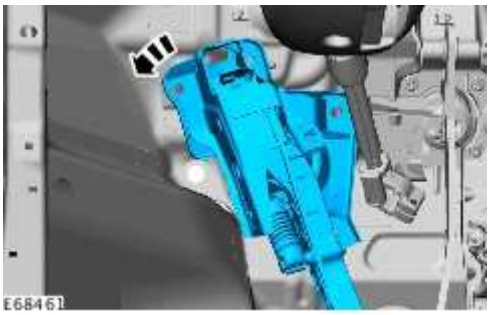
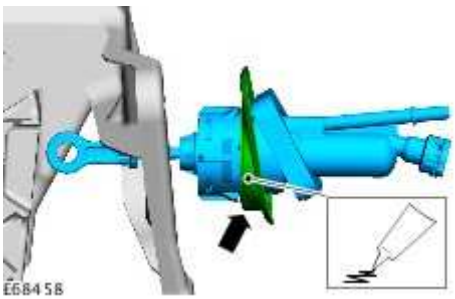


Installation



1. Coat the clutch master cylinder gaiter with grease before installing.

   Material: Grease O-LI (WSD-M1C230-A / 95SX-M1C230-CA)

2. To install, reverse the removal procedure.
3. Refer to: Kupplungssystem entlüften (308-00, General Procedures).

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Removal and Installation

Materials

Name	Specification
Flange Sealant - Anaerobic LR	WSK-M2G348-A5 / 2U7J-M2G348-AA

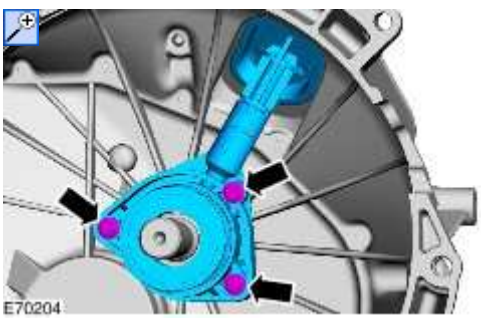
General Equipment

Adhesive tape

Removal

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

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal).
   Refer to: Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Removal).



3.
   - Wrap the input shaft splines with adhesive tape to protect the input shaft oil seal from damage.

     General Equipment: Adhesive tape
   - Discard the clutch slave cylinder bolts.
   - The clutch slave cylinder is to be reused unless damaged

Installation

1. Wrap the input shaft splines with adhesive tape to protect the input shaft oil seal from damage.
2. The clutch slave cylinder is to be reused unless damaged

   Material: Flange Sealant - Anaerobic LR (WSK-M2G348-A5 / 2U7J-M2G348-AA)

3. CAUTION: Make sure that new bolts are installed.
   Torque: 11 Nm

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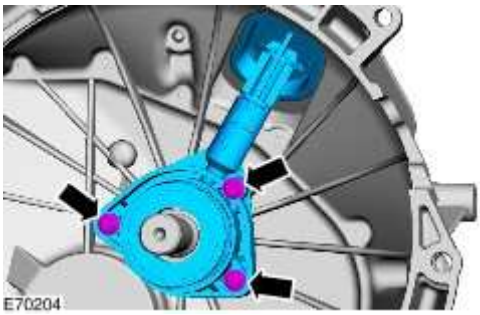

4. Remove the adhesive tape from the input shaft splines.
5. Install the transmission.

   Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation).
   Refer to: Transmission - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4 (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, Installation).
6. Bleed the clutch system.

   Refer to: Clutch System Bleeding (308-00, General Procedures).

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Clutch Controls

Description	
Functionality	Hydraulic
Adjustment	Automatic
Pedal travel (not adjustable)	144 ±3 mm

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Clutch Controls - Vehicles With: 6-Speed Manual Transaxle - MMT6 - Clutch Controls	S-MAX/Galaxy 2006.5 (02/2006-)

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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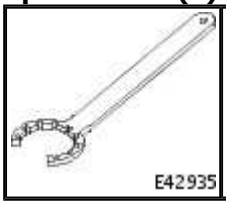
Removal and Installation

Special Tool(s)

 E42935	308-554 Remover/Installer, Clutch Master Cylinder

Materials

Name	Specification
Grease O-LI	WSD-M1C230-A / 95SX-M1C230-CA

Removal

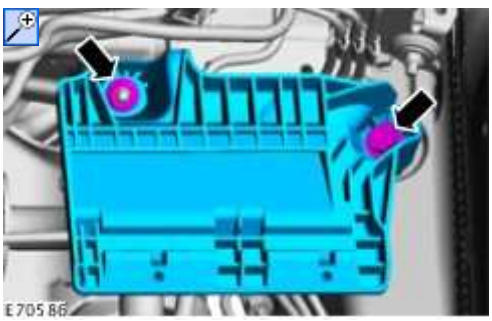
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

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

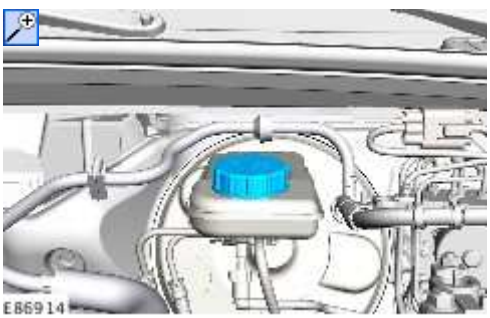
LHD Vehicles

2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).


E70586

3. *Torque:* 10 Nm

All vehicles


E86914

4. Extract brake fluid from the brake fluid reservoir until the level reaches the MIN mark.

5. CAUTION: Make sure that all openings are sealed.

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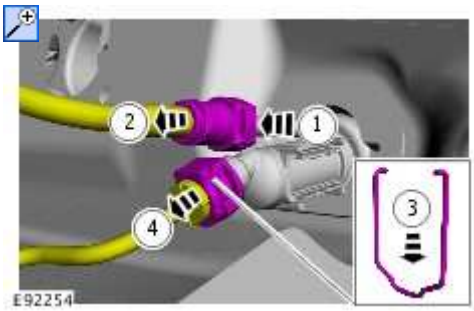
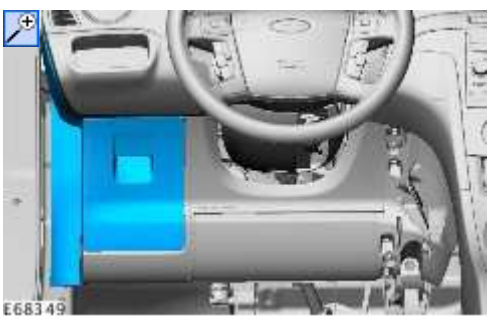
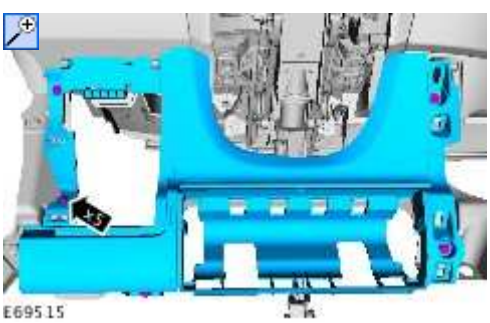


6.

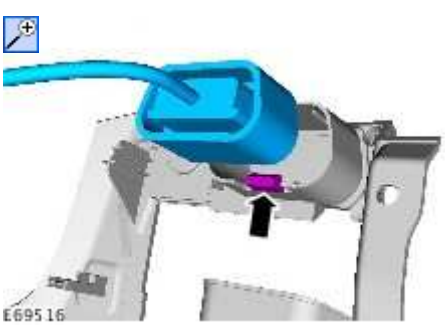


7.

8. Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



9.



10.

11. *Torque:* 28 Nm

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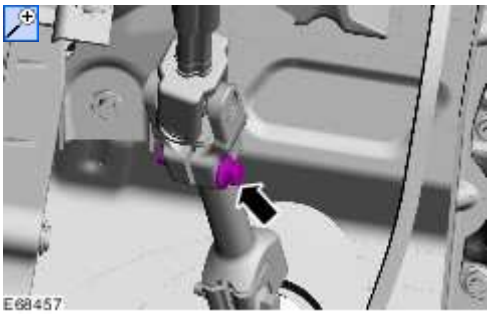
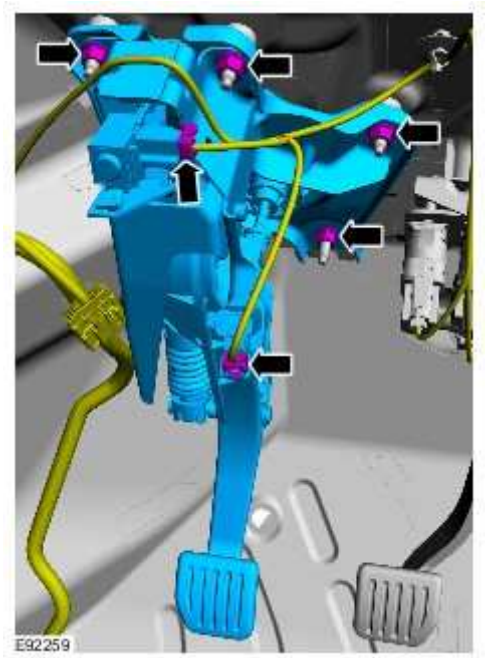


12. *Torque:* 28 Nm



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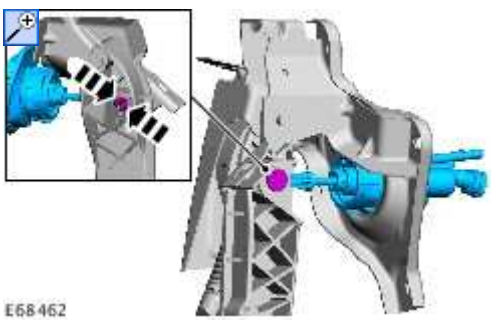
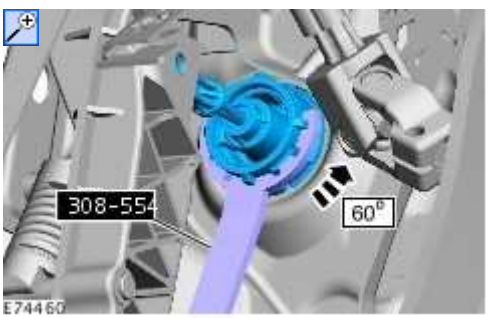


14. *Special Tool(s):* 308-554



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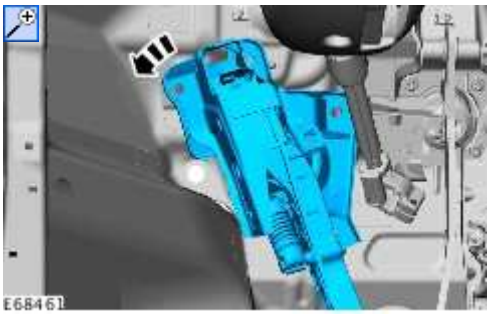
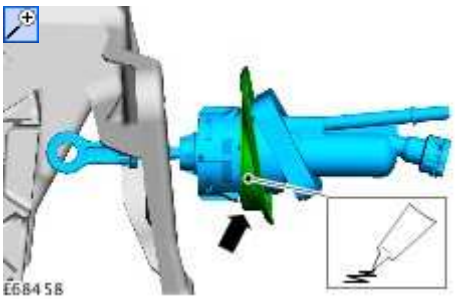


Installation



1. Coat the clutch master cylinder gaiter with grease before installing.

   Material: Grease O-LI (WSD-M1C230-A / 95SX-M1C230-CA)

2. To install, reverse the removal procedure.
3. Refer to: Kupplungssystem entlüften (308-00, General Procedures).

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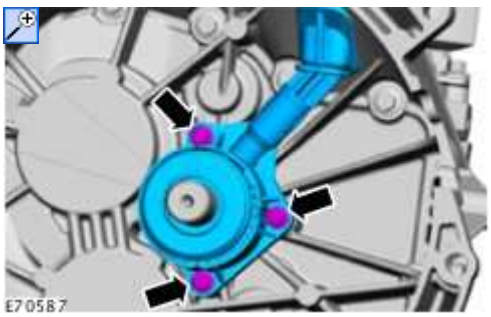
Removal and Installation

Removal

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



1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. CAUTION: Make sure that new bolts are installed.
   Torque: 11 Nm

Installation

1. Follow the disassembly procedure in reverse order.

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Clutch Controls

Description	
Operation	hydraulic
Adjustment	automatic

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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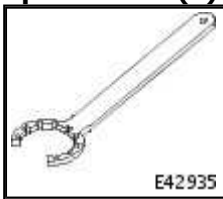
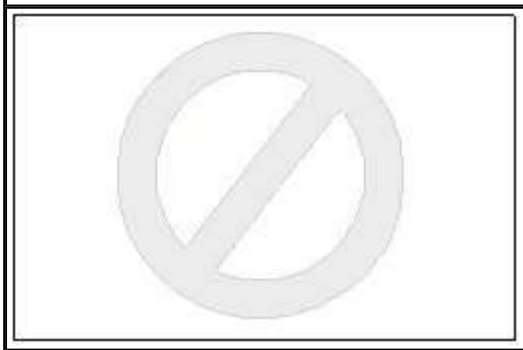
Removal and Installation

Special Tool(s)

 E42935	308-554 Remover/Installer, Clutch Master Cylinder
	308-651 Installer, Clutch Master Cylinder Sensor

Materials

Name	Specification
Grease O-LI	WSD-M1C230-A / 95SX-M1C230-CA

Removal

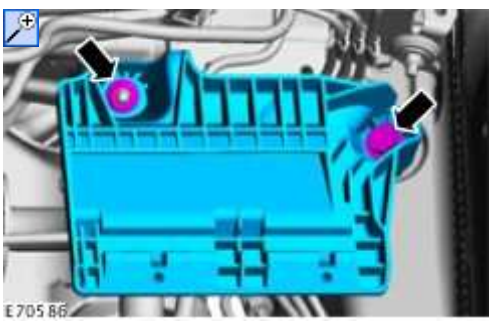
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

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

LHD vehicles

2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3. *Torque:* 10 Nm



All vehicles

4. Extract brake fluid from the brake fluid reservoir until the level reaches the MIN mark.

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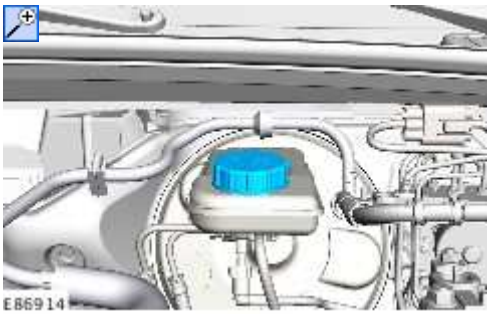
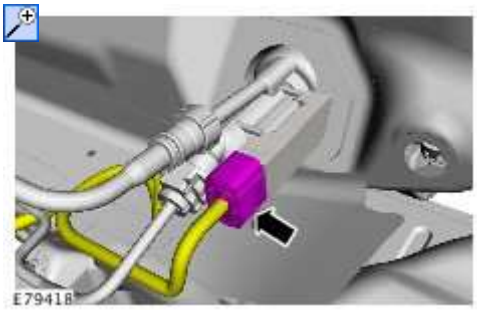
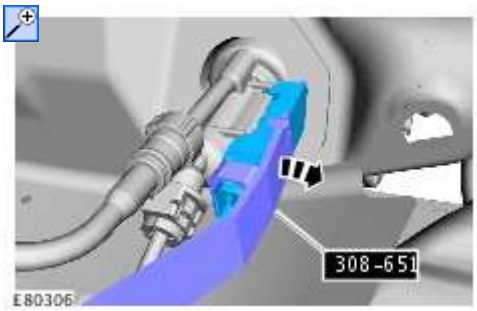


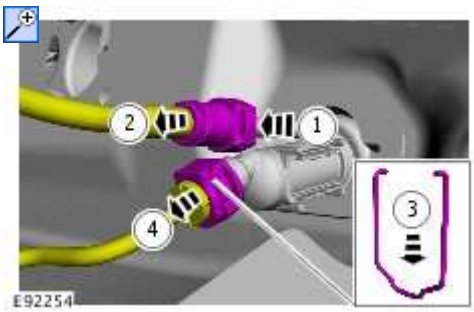


5. If equipped.



6. If equipped.

   Special Tool(s): 308-651



7. CAUTION: Make sure that all openings are sealed.

8.

9.

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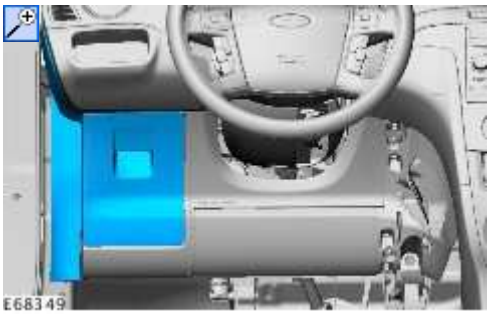
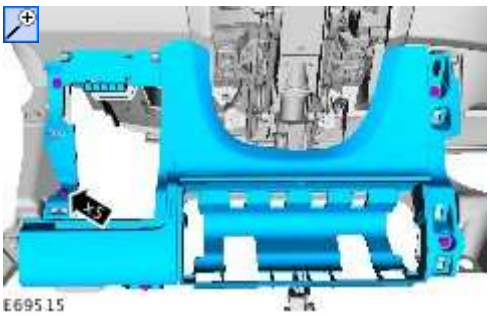


10. Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



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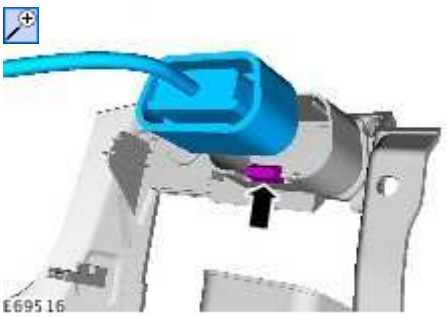

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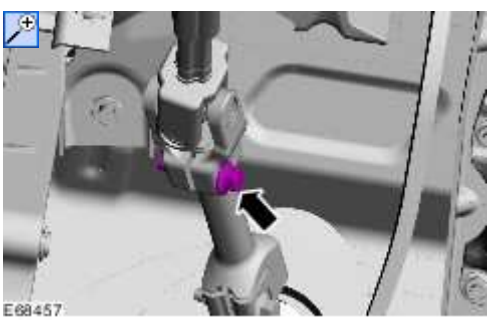

13. *Torque:* 28 Nm

14. *Torque:* 28 Nm

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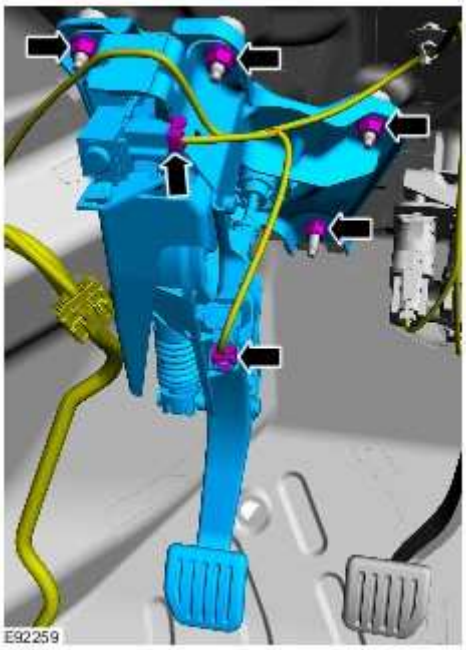
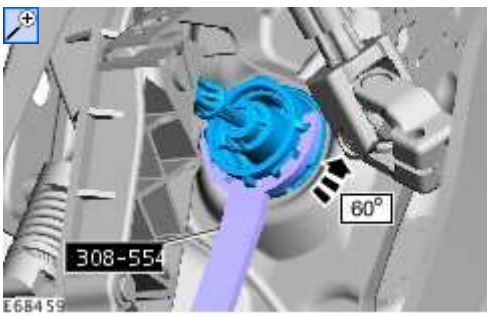
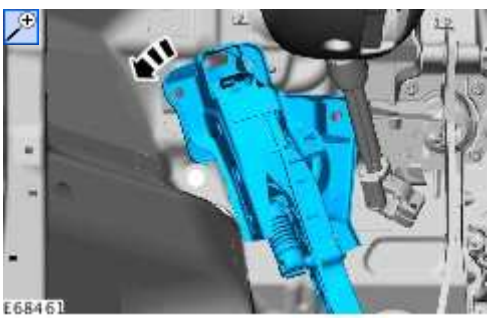




15. *Special Tool(s):* 308-554



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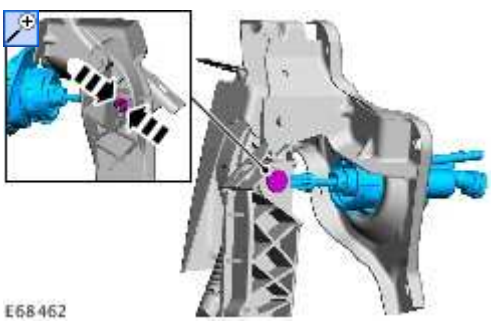

17.

Installation

1. Coat the clutch master cylinder gaiter with grease before installing.

   Material: Grease O-LI (WSD-M1C230-A / 95SX-M1C230-CA)

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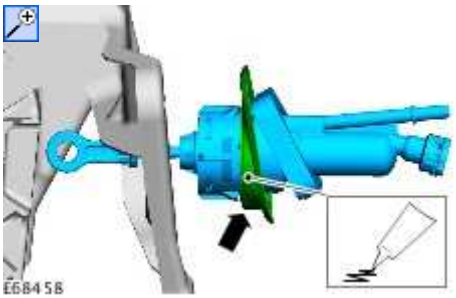

2. To install, reverse the removal procedure.
3. Refer to: Kupplungssystem entlüften (308-00, General Procedures).

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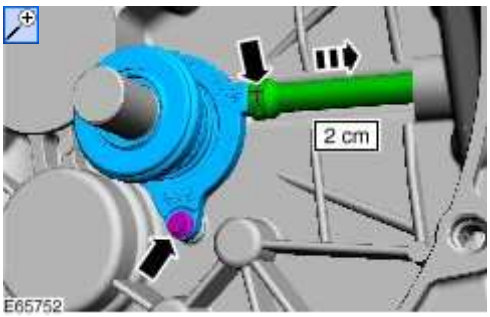
Removal and Installation

Removal



1. NOTE: Removal steps in this procedure may contain installation details.
   Remove the transmission.

   Refer to: Getriebe - 2.5L Duratec-ST (VI5) (308-03, Removal).

2. WARNING: If brake fluid is spilt on the paintwork, the affected areas must be immediately washed down with cold water.
   Torque: 11 Nm

Installation

1. To assemble, reverse the disassembly procedure.
2. Install the transmission.

   Refer to: Getriebe - 2.5L Duratec-ST (VI5) (308-03, Installation).
3. Bleed the clutch system.

   Refer to: Kupplungssystem entlüften (308-00, General Procedures).

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Capacities

	Liters
Manual transmission fluid (0-5 mm below the lower edge of the filler hole)	1.9

Transmission ratios

	1.8L diesel engine	2.0L engine
1st gear	3.800	3.800
2nd gear	2.048	2.136
3rd gear	1.258	1.483
4th gear	0.865	1.114
5th gear	0.674	0.902
Reverse gear	3.727	3.727
Final drive	3.563	4.067

Shim thickness required

Description	Input shaft	Output shaft	Differential assembly
Measuring shims (mm)	1.00	1.00	1.10
Measured end float (example) (mm)	+ 0.22	+ 0.32	+ 0.36
Preload figure (mm)	–	+ 0.13	+ 0.33
End float (mm)	– 0.07	–	–
Required shim thickness (example) (mm)	= 1.15	= 1.45	= 1.79
Shims available (mm)	1.15 – 1.71 (in steps of 0.01 mm)	1.31 – 1.91 (in steps of 0,02 mm)	1.40 – 2.20 (in steps of 0.05 mm)

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Description and Operation

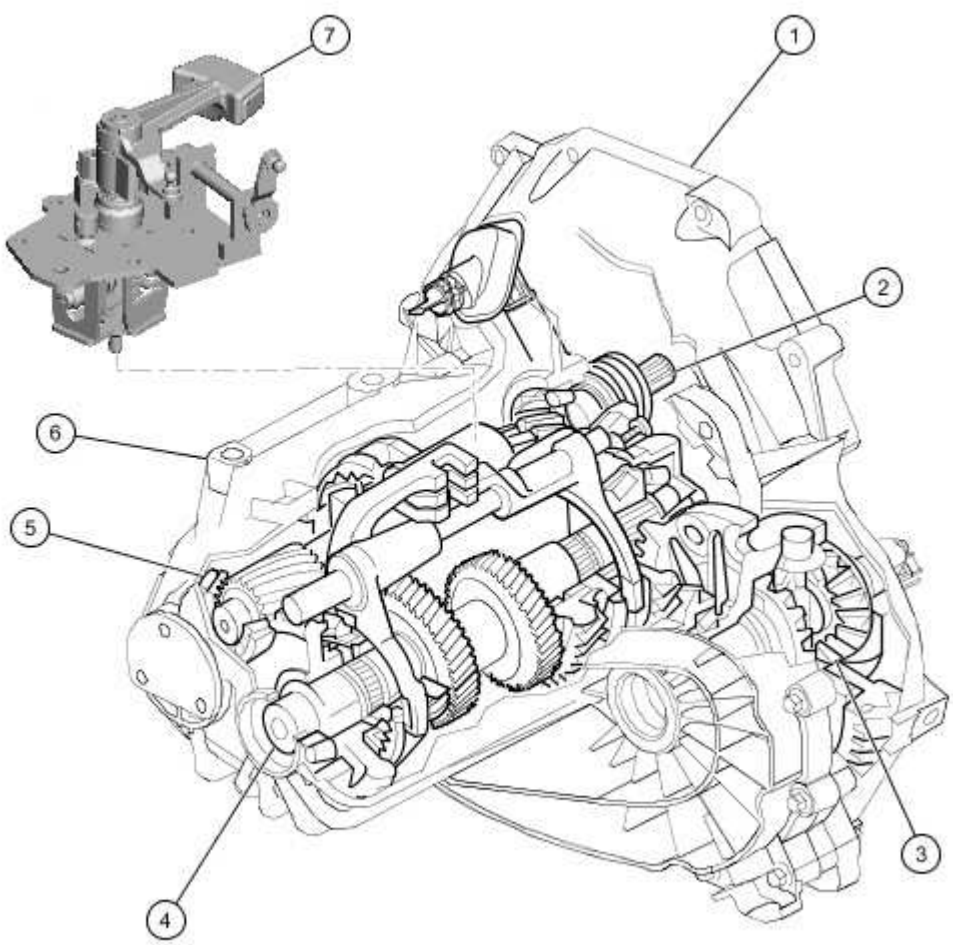
Manual Transmission

MTX-75 means:

- M: Manual
- T: Transmission
- X: Transaxle (front wheel drive)
- 75: Distance between input and output shaft in mm.
- Transmission with different axes (input and output shafts)
- The final drive is integrated into the transmission housing.

- 5-speed manual transmission for FWD
- 1st/2nd gear double synchroniser
- 3rd/4th gear and 5th/reverse gear single synchroniser

Overview



E55351

Item	Part Number	Description
1	-	Transaxle housing - clutch side
	-	

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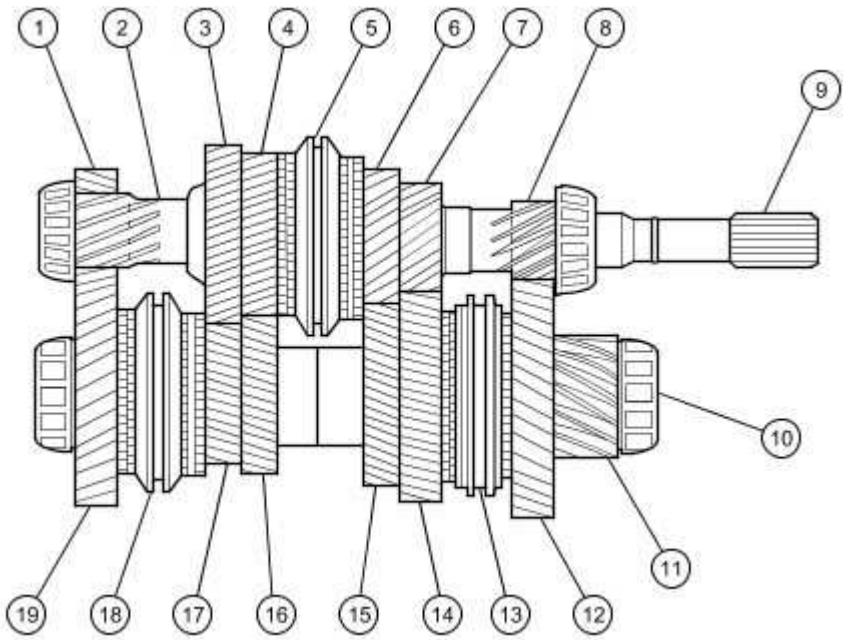
2		Input shaft
	3 -	Differential assembly
4	-	Output shaft
5	-	Reverse gear idler
6	-	Transaxle housing - transaxle side
7	-	Selector mechanism

Input and Output Shaft



E56211

Item	Part Number	Description
1	-	Reverse gear idler
2	-	Reverse gear teeth
3	-	Gear wheel - 5th gear
4	-	Gear wheel - 4th gear
5	-	3rd/4th gear synchroniser assembly
6	-	Gear wheel - 3rd gear
7	-	Teeth - 2nd gear
8	-	Teeth - 1st gear
9	-	Input shaft
10	-	Output shaft
11	-	Teeth - output shaft
12	-	Gear wheel - 1st gear
13	-	1st/2nd gear synchroniser assembly
14	-	Gear wheel - 2nd gear
15	-	Gear wheel - 3rd gear
16	-	Gear wheel - 4th gear
17	-	Gear wheel - 5th gear
18	-	5th/reverse gear synchronizer assembly
19	-	Gear wheel - reverse gear

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All gear wheels are constantly engaged.

The output shaft teeth are part of the output shaft and are constantly engaged with the differential crown wheel.

In the neutral position, none of the gear wheels is connected with the input or output shaft via the corresponding synchroniser assembly. No torque is transmitted to the differential.

The input and output shafts are respectively mounted by means of tapered roller bearings in the halves of the transaxle housing on the clutch and transaxle sides.

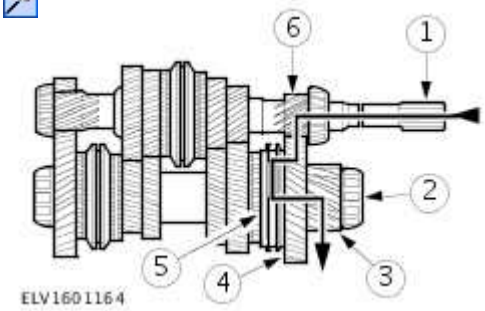
This bearing arrangement requires the shafts to be preloaded.

The 3rd/4th gear synchroniser assembly is located on the input shaft.

The 1st/2nd gear and 5th/reverse gear synchroniser assemblies are located on the output shaft.

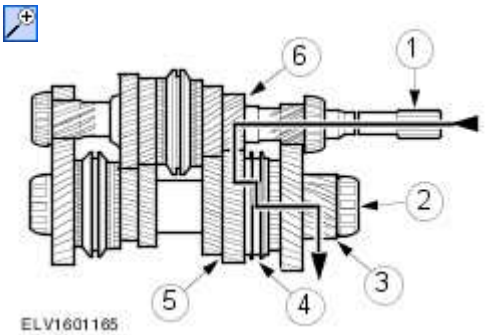
Power Flow

1st gear



Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
4	-	Gear wheel - 1st gear
5	-	1st/2nd gear synchroniser assembly
6	-	Teeth - 1st gear

2nd gear



Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
	-	

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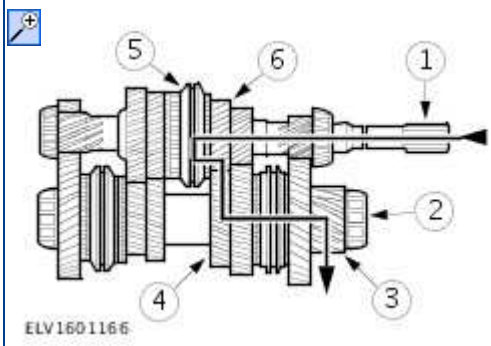
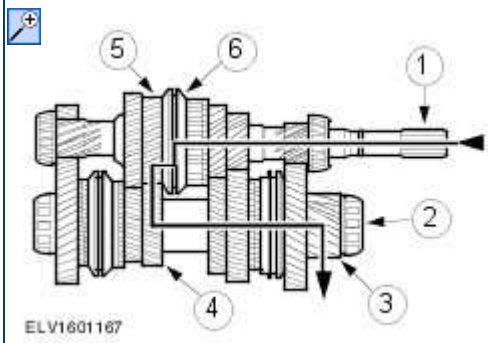
4			1st/2nd gear synchroniser assembly
	5	-	Gear wheel - 2nd gear
6		-	Teeth (2nd gear)

3rd gear



Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
4	-	Gear wheel - 3rd gear
5	-	3rd/4th gear synchroniser assembly
6	-	Gear wheel - 3rd gear

4th gear



Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
4	-	Gear wheel - 4th gear
5	-	Gear wheel - 4th gear
6	-	3rd/4th gear synchroniser assembly

5th gear

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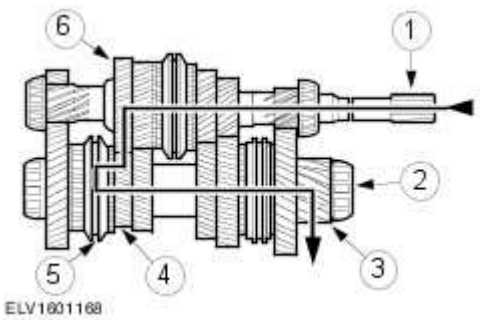
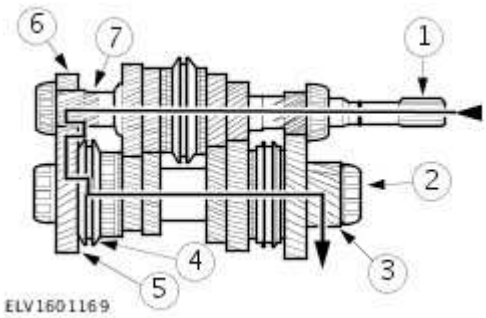


Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
4	-	Gear wheel - 5th gear
5	-	5th/reverse gear synchronizer assembly
6	-	Gear wheel - 5th gear

Reverse



Item	Part Number	Description
1	-	Input shaft
2	-	Output shaft
3	-	Teeth - output shaft
4	-	5th/reverse gear synchronizer assembly
5	-	Gear wheel - reverse gear
6	-	Reverse gear idler
7	-	Teeth - reverse gear

General Illustrations

Input shaft

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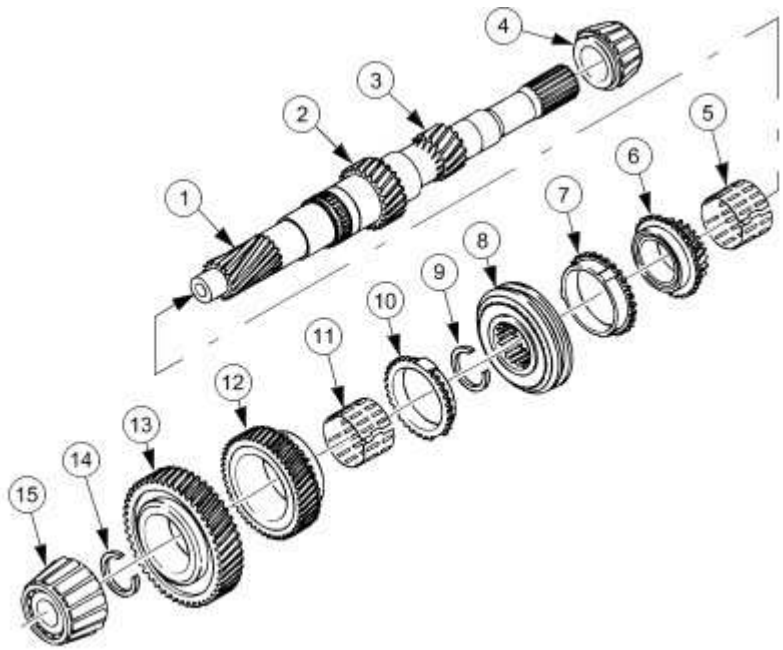

E37322

Item	Part Number	Description
1	-	Input shaft
2	-	Teeth - 2nd gear
3	-	Teeth - 1st gear
4	-	Tapered roller bearing (clutch side)
5	-	Needle roller bearing - 3rd gear
6	-	Gear wheel - 3rd gear
7	-	Synchronizer ring - 3rd gear
8	-	3rd/4th gear synchroniser assembly
9	-	Snap ring
10	-	Synchronizer ring - 4th gear
11	-	Needle roller bearing - 4th gear
12	-	Gear wheel - 4th gear
13	-	Gear wheel - 5th gear
14	-	Snap ring
15	-	Tapered roller bearing (transaxle side)

Output shaft

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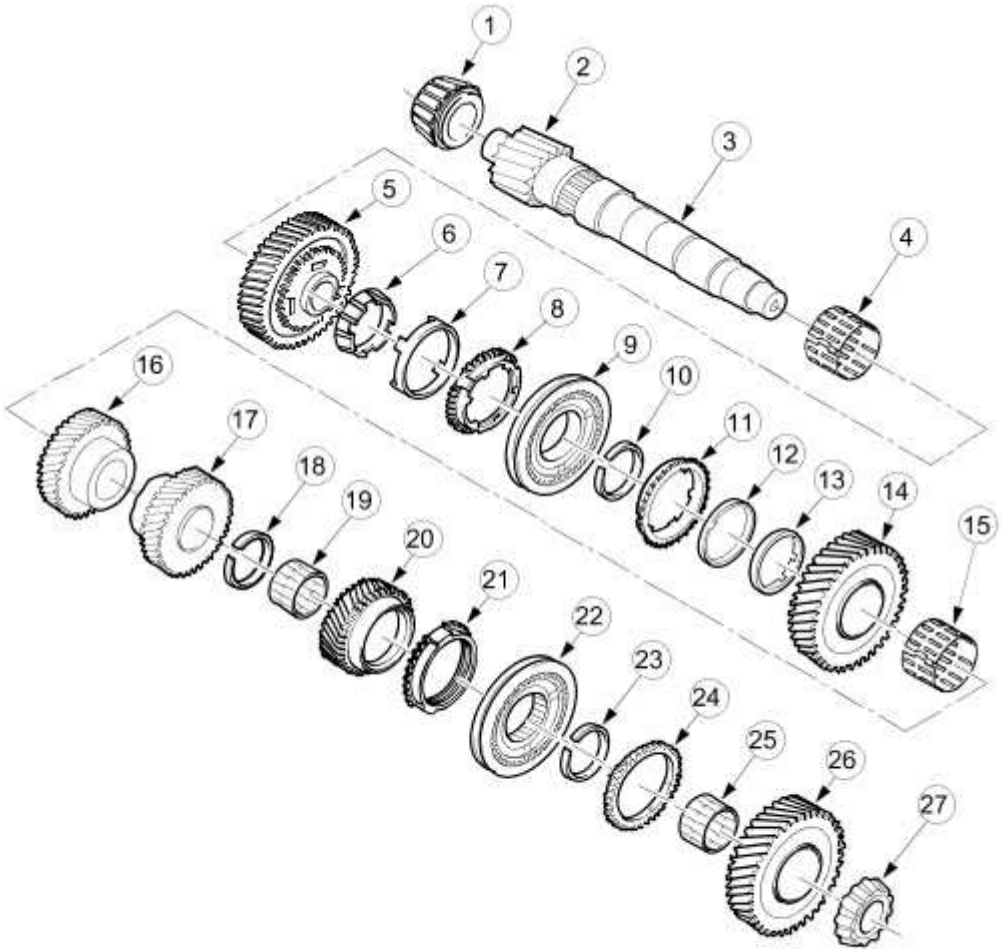

ELE0018461

Item	Part Number	Description
1	-	Tapered roller bearing (clutch side)
2	-	Teeth - output shaft
3	-	Output shaft
4	-	Needle roller bearing - 1st gear
5	-	Gear wheel - 1st gear
6	-	Inner synchroniser ring - 1st gear
7	-	Synchroniser cone - 1st gear
8	-	Outer synchroniser ring - 1st gear
9	-	1st/2nd gear synchroniser assembly
10	-	Snap ring
11	-	Outer synchroniser ring - 2nd gear
12	-	Synchroniser cone - 2nd gear
13	-	Inner synchronizer ring - 2nd gear
14	-	Gear wheel - 2nd gear
15	-	Needle roller bearing - 2nd gear
16	-	Gear wheel - 3rd gear
	-	

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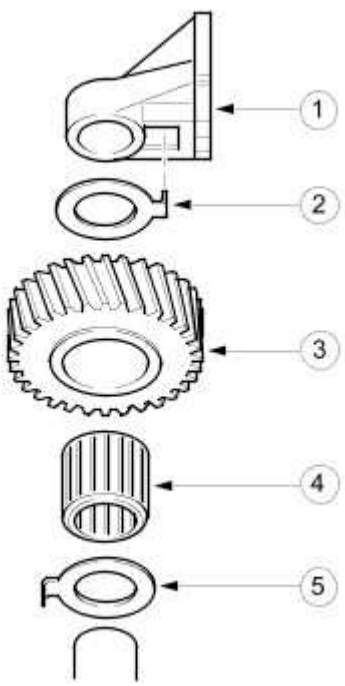
17		Gear wheel - 4th gear
	18 -	Snap ring
19	-	Needle roller bearing - 5th gear
20	-	Gear wheel - 5th gear
21	-	Synchroniser ring - 5th gear
22	-	5th/reverse gear synchronizer assembly
23	-	Snap ring
24	-	Reverse gear synchroniser ring
25	-	Reverse gear needle roller bearing
26	-	Gear wheel - reverse gear
27	-	Tapered roller bearing (transaxle side)

The reverse gear idler runs on a needle roller bearing on the reverse gear idler spindle.

The reverse gear idler is driven by the input shaft. Its function is to reverse the direction of rotation of the output shaft in reverse gear.

Reverse gear idler



Item	Part Number	Description
1	-	Mounting
2	-	Thrust washer
3	-	Reverse gear idler
4	-	Needle roller bearing
5	-	Thrust washer

Neutral position sensor

Vehicles with auto start/stop function

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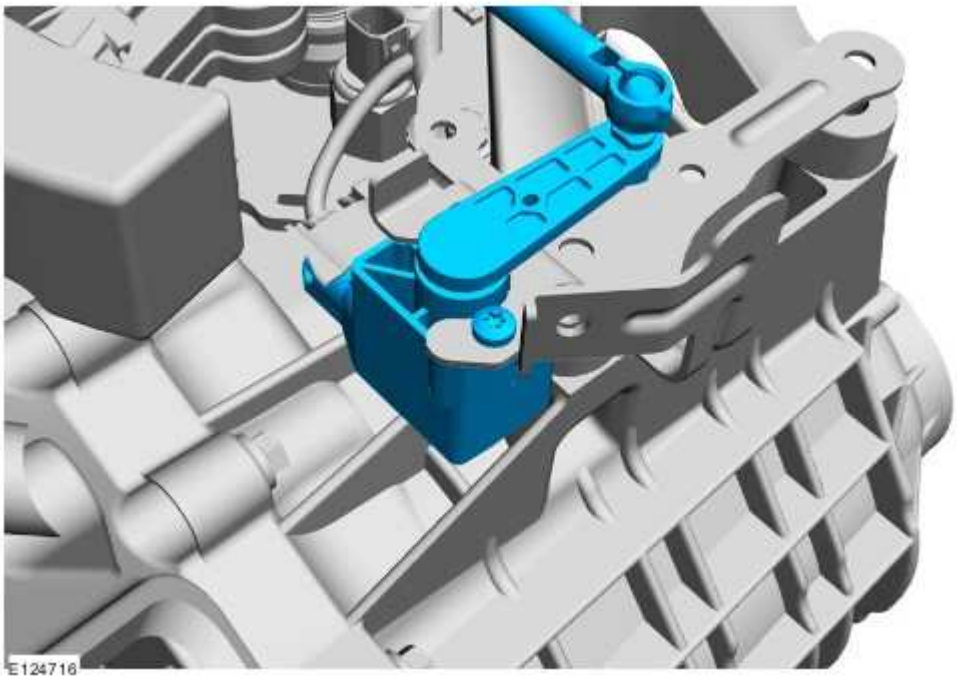

On vehicles with auto start/stop function, information is required about whether a gear is engaged or the transmission is in neutral. The neutral position sensor is located on the transmission housing for this purpose. This is connected to the shift linkage by an additional linkage on the transmission.

The neutral position sensor is a Hall sensor and is supplied with 5 Volt by the PCM. The signal voltage varies between 0.5 and 5 Volt when operating the linkage and is monitored by the PCM.

A fixed voltage value is stored in the PCM for each gear. All values lying between those for the individual gears are stored as values for the neutral position. The PCM therefore always detects whether or not a gear is engaged.

After replacing the sensor, the value from the old sensor is reset in the PCM using IDS. The vehicle must then be driven a certain distance so that the PCM can learn the new values for the relevant gears and neutral positions.

To do this, the vehicle must be driven a total of 5 times for 10 seconds each, alternately in 3rd and 4th gear with low acceleration.

NOTE: If a fault occurs on the neutral position sensor when the engine is stationary, the vehicle can still be started with the ignition key. In this case, a corresponding DTC is set in the PCM.

- no signal
- defective signal

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Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75 - Manual Transaxle—Vehicles With: Manual Transaxle	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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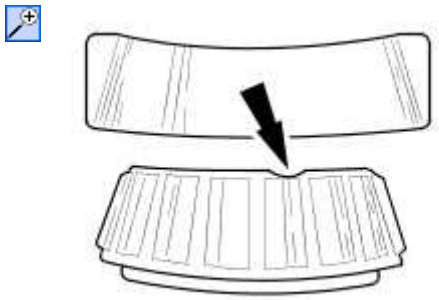
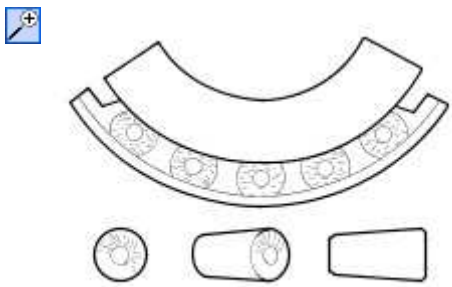
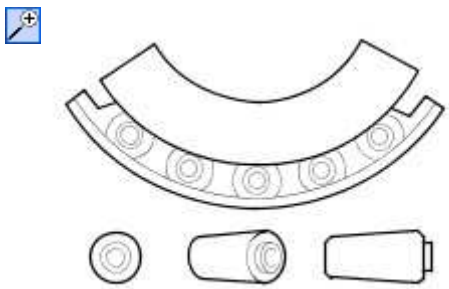
General Procedures


ELV1601171

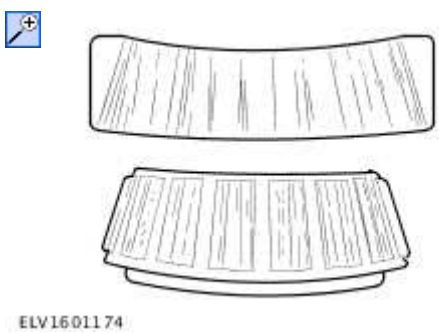
1. NOTE: Establish the cause of the damage and resolve it.
   - Check whether the bearing cage is damaged at the top, side or at the openings due to unprofessional use of a special tool or use of the wrong tool.
   - Install a new bearing if necessary.


ELV1601172

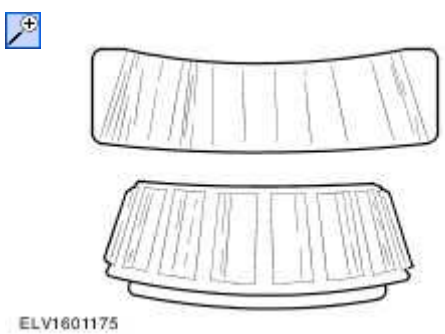
2.
   - Check whether the ends of the taper rollers are discolored as a result of inadequate lubrication or overheating, possibly through excessive pre-load.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601173

3.
   - Check whether the ends of the taper rollers are worn away due to incorrect installation, excessive pre-load or faulty bearing seating.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601174

4.
   - Check whether the bearing surfaces are gray or gray/black with deposits between the rollers.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601175

5.
   - Check whether the bearing ring surfaces are grooved caused by static impact.
   - Install a new bearing if its surface is rough, or if it is noisy.

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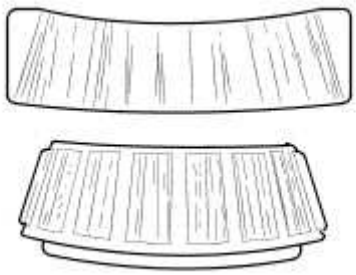
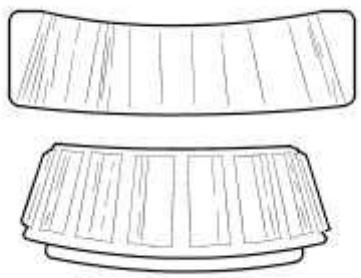


ELV1601174

6. NOTE: Overheating can cause loss of surface hardness.
   - Check for a dark blue colors caused by overheating (yellow or brown is normal) due to excessive pre-load or inadequate lubrication.
   - Install a new bearing, new seals and check other components as necessary.



ELV1601175

7.
   - Check the surfaces for abrasion due to metal fatigue.
   - Install a new bearing and clean all other affected components as necessary.

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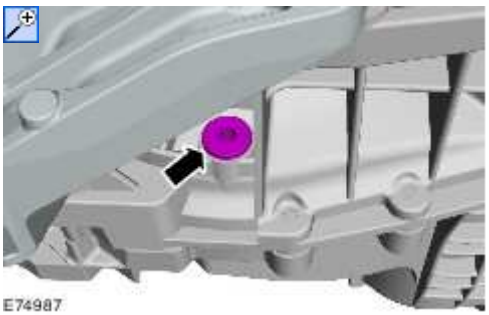
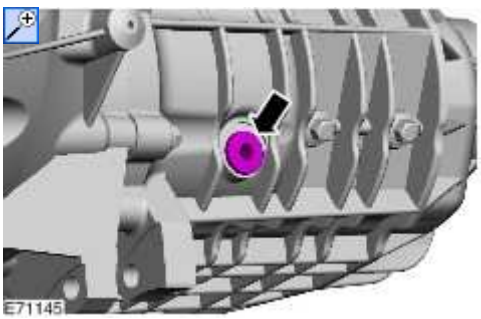
General Procedures

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA



1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. *Torque:* 35 Nm



3. Fill up with manual transmission fluid to underneath the lower edge of the filler hole.

   Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)
   Torque: 35 Nm

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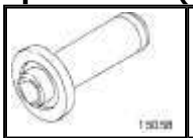
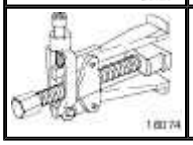
Removal and Installation

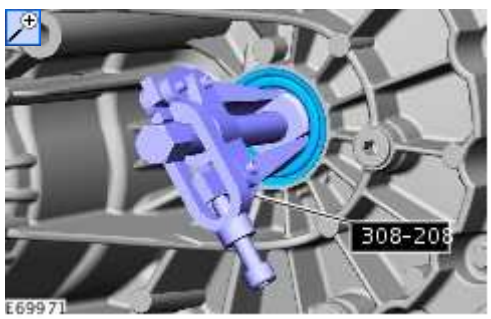
Special Tool(s)

	205-115 Installer, Drive Pinion Seal
	308-208 Remover, Halfshaft Seal

Removal

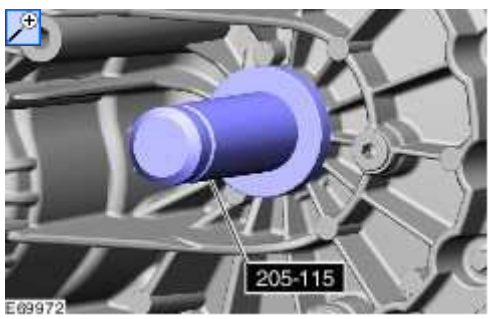
1. Remove the left-hand front driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).



2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 205-115

2. Install the left-hand front driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

3. Check the level of the transmission fluid.

   Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).
   Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).

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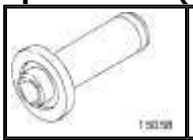
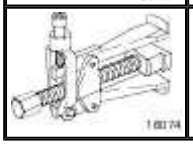
Removal and Installation

Special Tool(s)

	205-115 Installer, Drive Pinion Seal
	308-208 Remover, Halfshaft Seal

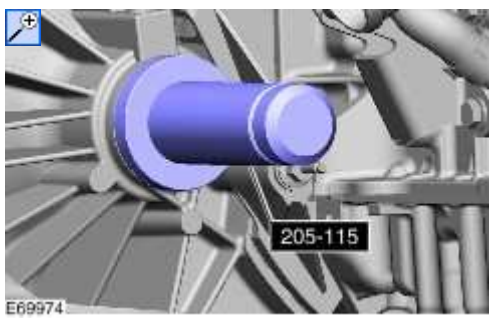
Removal

1. Remove the right-hand front driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 205-115

2. Install the right-hand front driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

3. Check the level of the transmission fluid.

   Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).
   Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).

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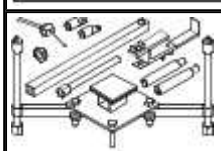
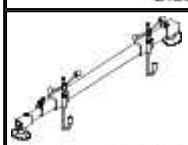
Removal

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
 E63418	303-290B-16 Adapter for 303-290B

General Equipment

Transmission jack

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the following items:
   1. Air filter

      Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   2. Battery carrier

      Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3. CAUTION: The gearshift cables must not be kinked or twisted.

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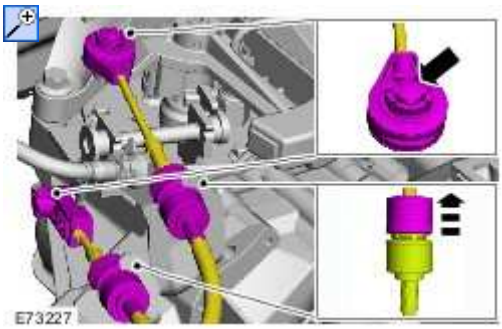
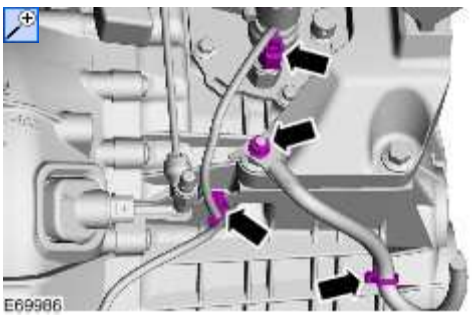
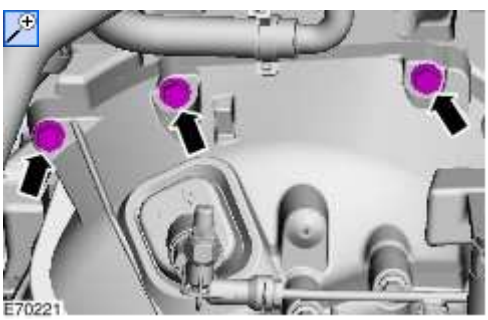


4.



5.



6. Remove the following items:
   1. Subframe

      Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
   2. Driveshafts

      Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
      Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

7. NOTE: The flexible exhaust pipe must not be twisted.

8.

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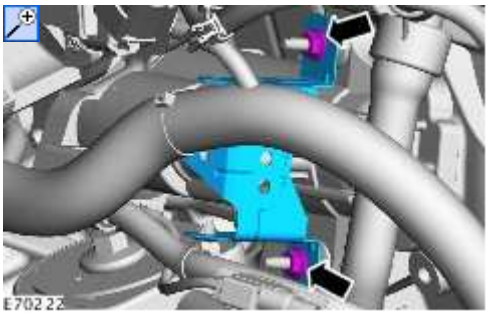
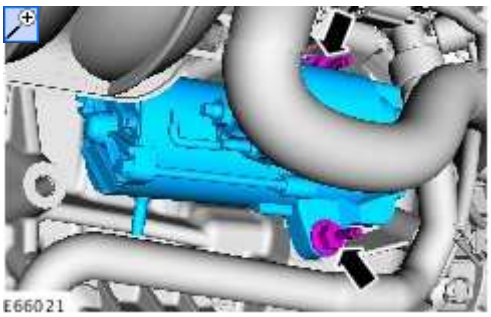
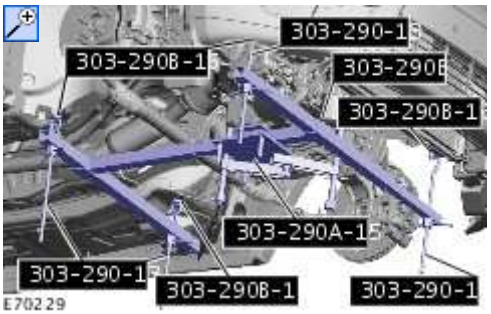
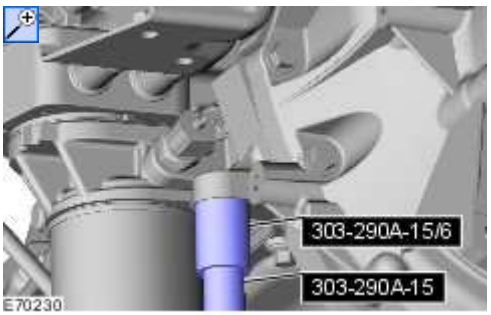




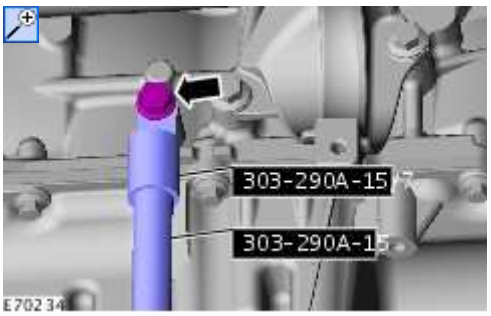
9. Detach the starter motor from the transmission and position it to one side.



10. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



11. *Special Tool(s):* 303-290A-15



12. *Special Tool(s):* 303-290A-15

13.

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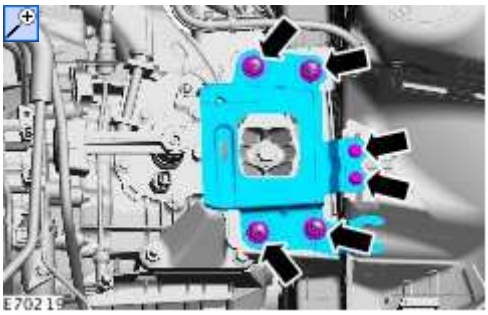
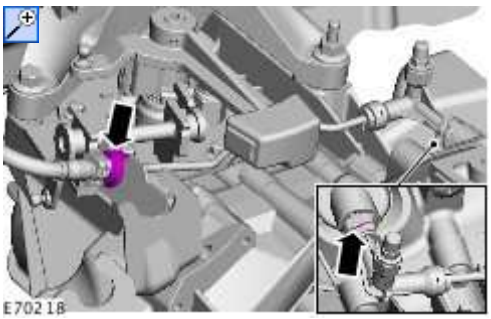
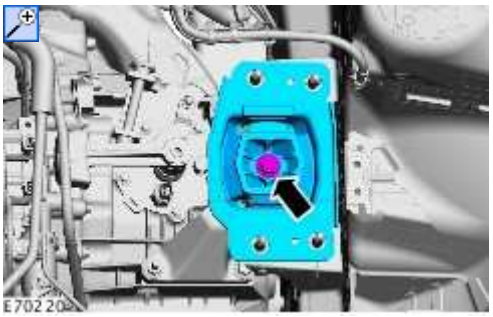




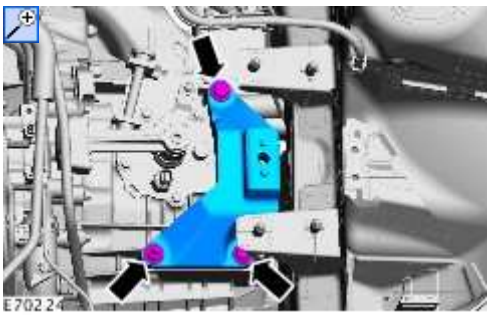
14. CAUTIONS:

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

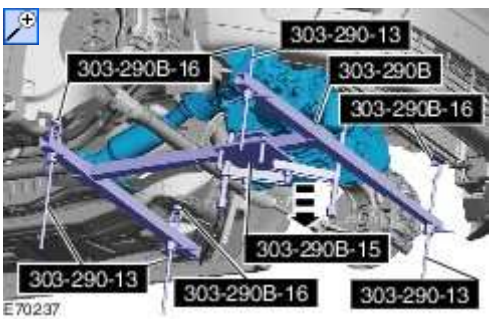
    Use suitable paper to absorb any escaping fluid.



15. Discard the rear engine mounting bolt.



16.



17. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

18. The lower right-hand transmission bolt remains in the engine.

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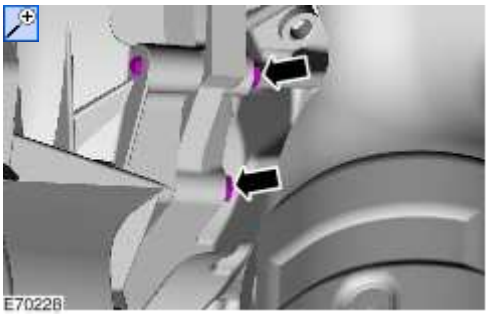
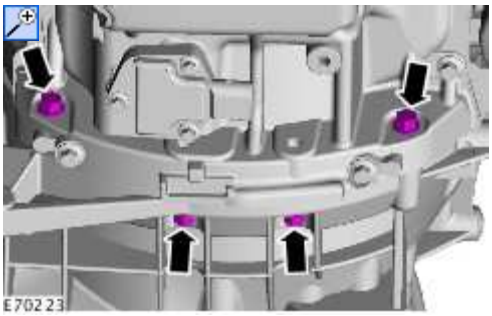
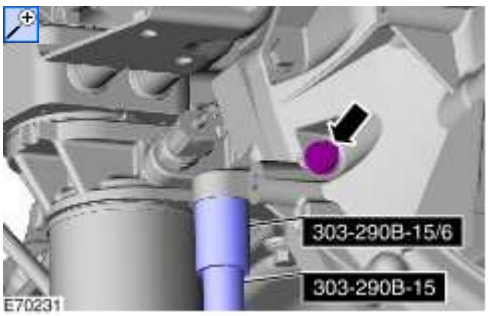




19.



20. *Special Tool(s):* 303-290A-15

21. Support the transmission with a wooden block and secure it to the transmission jack using a retaining strap.

General Equipment: Transmission jack

22. *Special Tool(s):* 303-290A-15

23. Support the transmission using the transmission jack and remove.

General Equipment: Transmission jack

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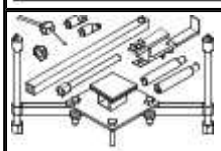
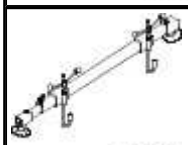
Removal

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
 E63418	303-290B-16 Adapter for 303-290B

General Equipment

Transmission jack

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the following items:
   1. Air filter

      Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
   2. Battery carrier

      Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3. CAUTION: The gearshift cables must not be kinked or twisted.

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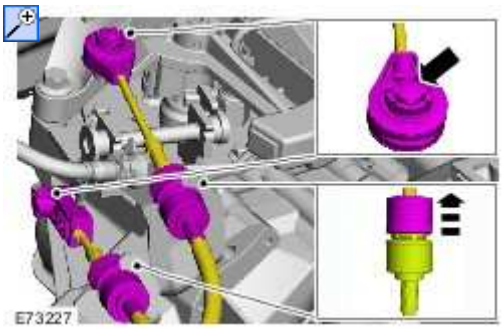
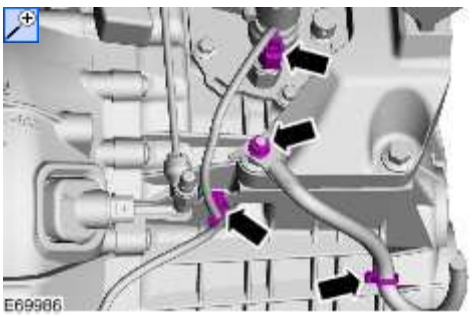
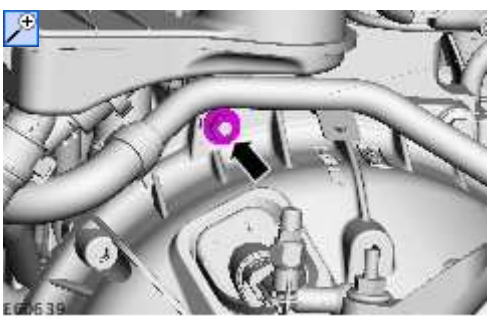


4.



5.



6. Remove the following items:
    1. Subframe

       Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
    2. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Catalyst

       Refer to: Catalytic Converter (309-00D Exhaust System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

7.

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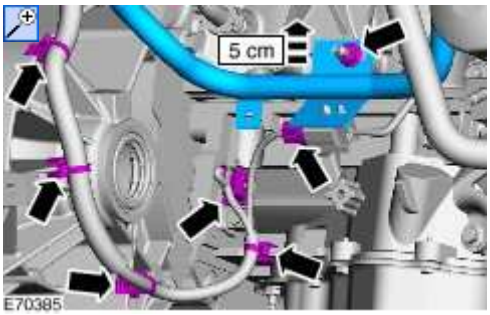

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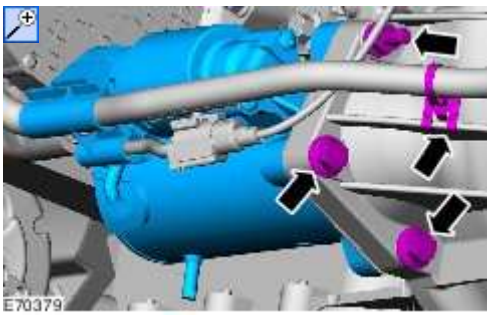
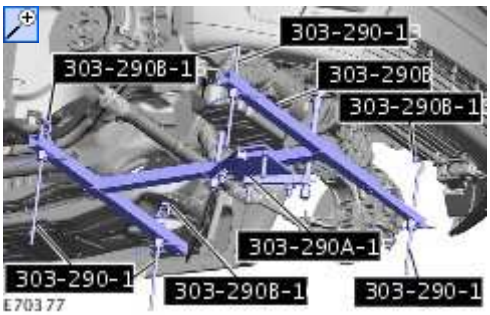
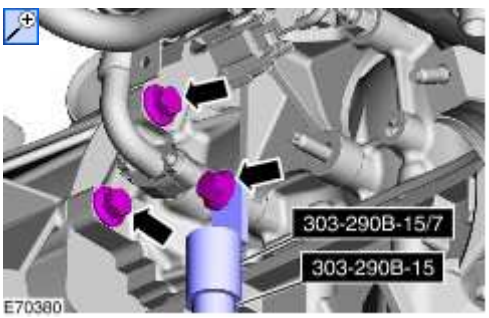


9. Detach the starter motor from the transmission and position it to one side.



10. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



11. *Special Tool(s):* 303-290A-15

12. *Special Tool(s):* 303-290A-15

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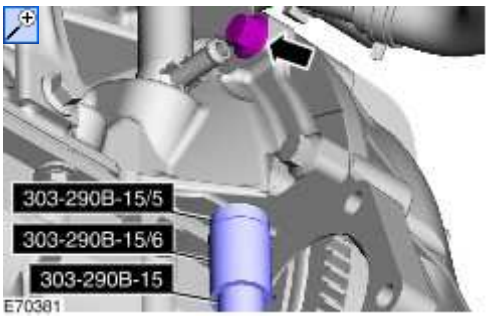
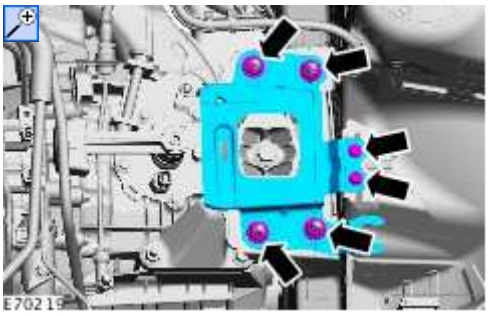
13. *Special Tool(s):* 303-290A-15



14.



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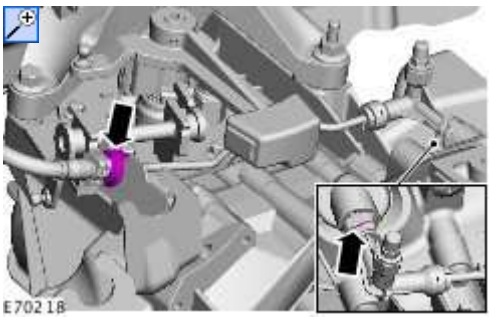
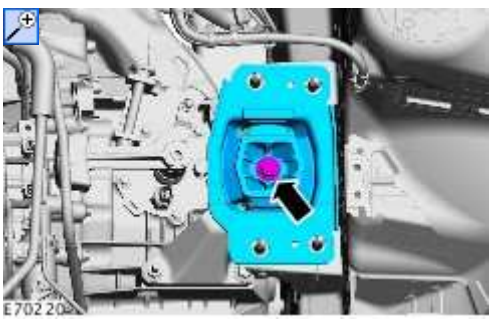


16. Discard the rear engine mounting bolt.



17.

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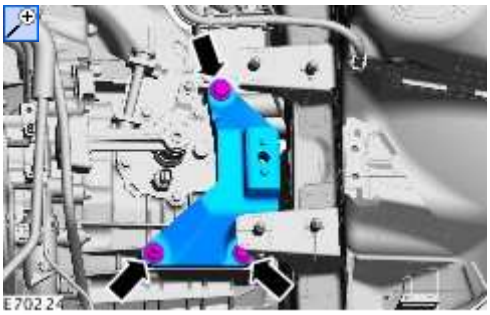
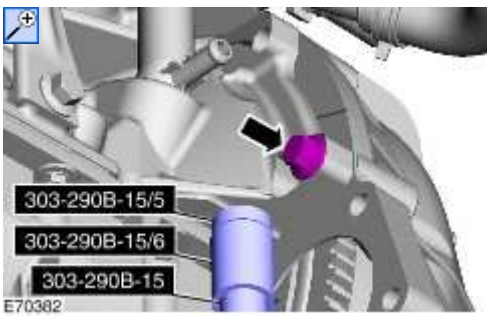


18. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

19. Support the transmission with a wooden block and secure it to the transmission jack using a retaining strap.

    General Equipment: Transmission jack



20. *Special Tool(s):* 303-290A-15

21. Support the transmission using the transmission jack and remove.

    General Equipment: Transmission jack

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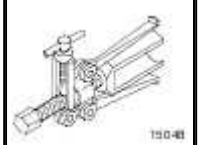
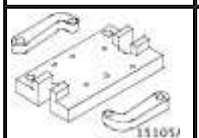
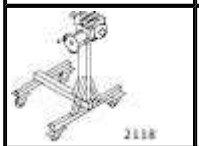
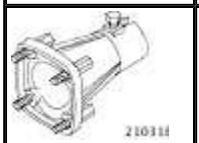
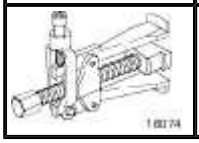
Disassembly

Special Tool(s)

	205-078 Remover, Drive Pinion Seal
	205-078-01 Adapter for 205-078 (Thrust Pad)
	205-176 Remover, Differential Bearing Cone
	205-329 Mounting Bracket, Engine/Differential
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	308-208 Remover, Halfshaft Seal

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      ma
      ins
      ea
   5. Oi

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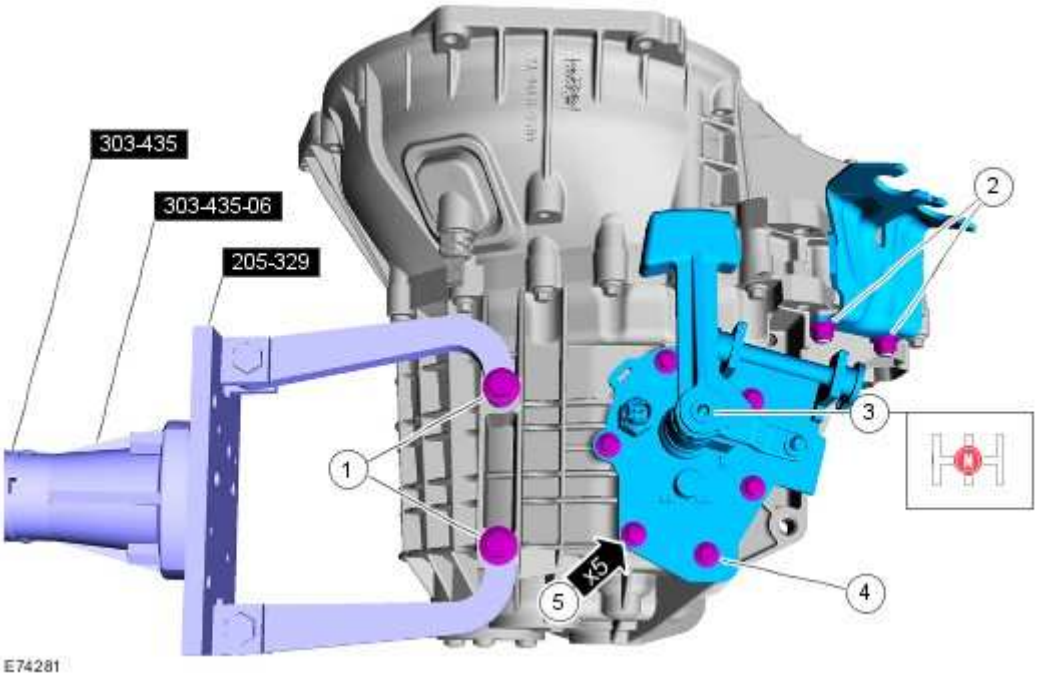
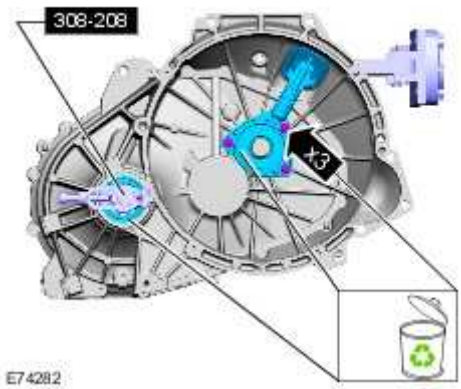
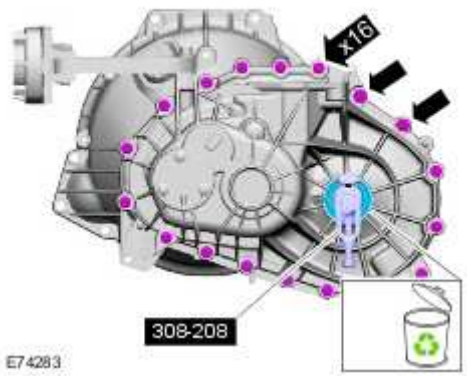


2. *Special Tool(s):* 308-208



3. *Special Tool(s):* 308-208



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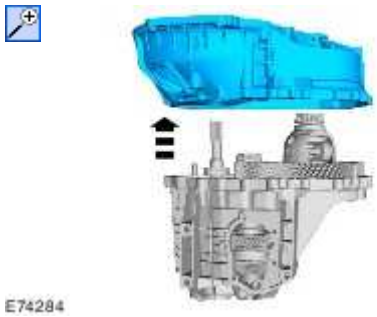
E74284

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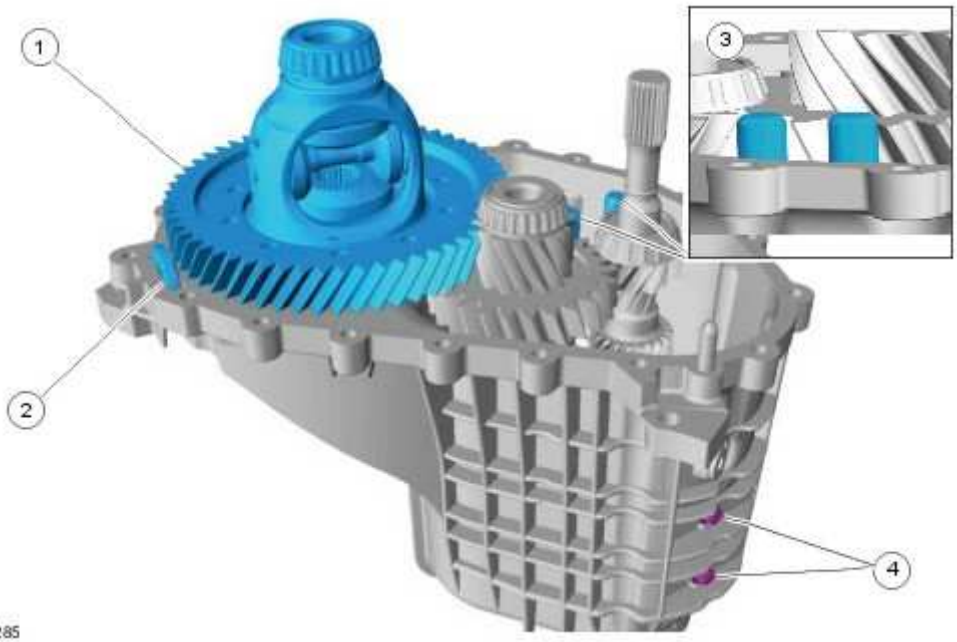
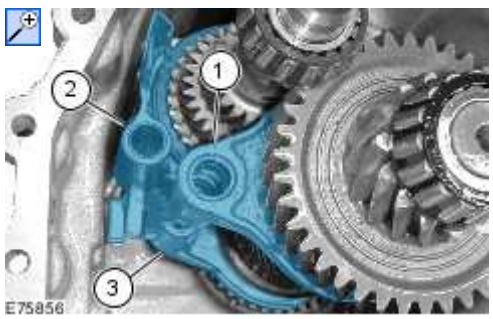
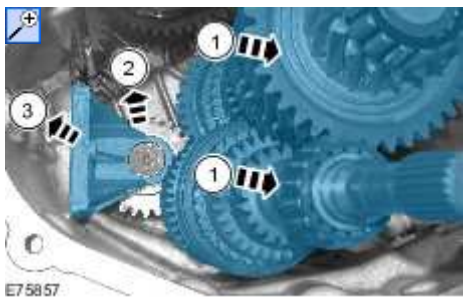


E74285



E75856

6. NOTE: Marking the components makes installation

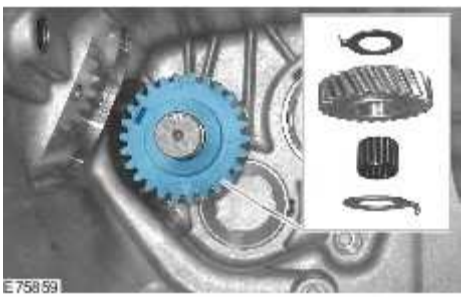


E75857

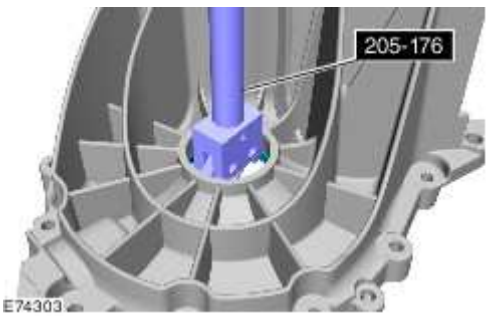
7.

8.

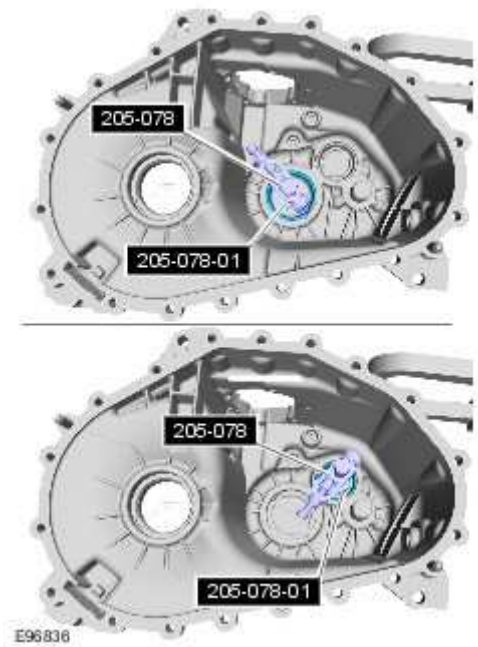
http://vnx.su



9. NOTE: Marking the components makes installation



10. *Special Tool(s):* 205-176



11. *Special Tool(s):* 205-078, 205-078-01

12. *Special Tool(s):* 205-176

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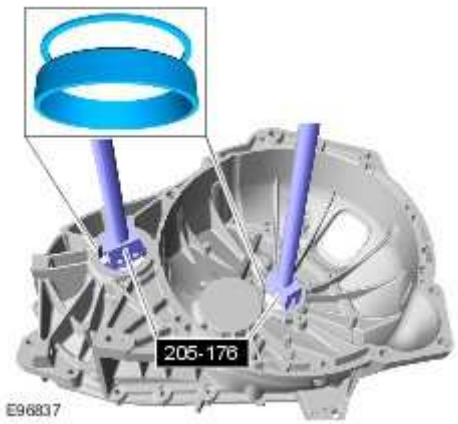
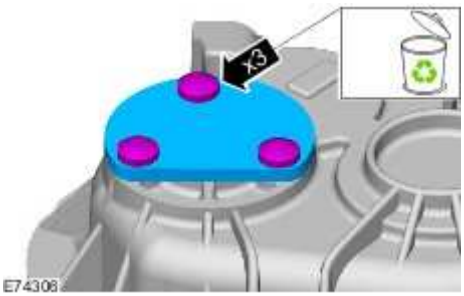
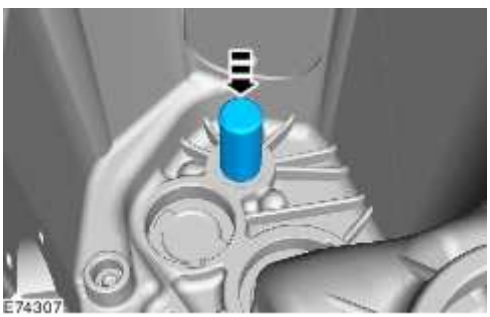


13. *Special Tool(s):* 205-078, 205-078-01

14. The following two steps should only be carried out if gear idler shaft is damaged.



15.



16.

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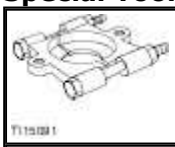
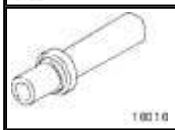
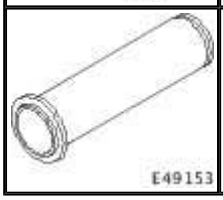
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-310 Remover, Bearing/Gear
	308-046 Installer, Transmission Extension Housing Bushing/Seal
	308-605 Installer, Input Shaft Seal

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Hydraulic press
Puller

Disassembly

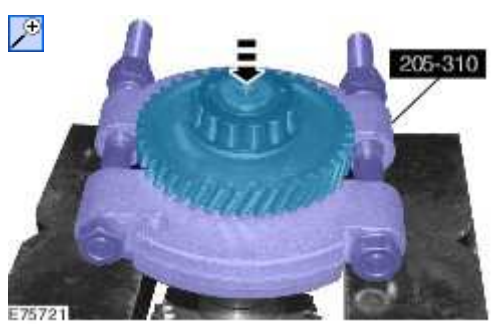
CAUTION: Use vise jaw protectors.

1. Clamp the output shaft in a vise.
2. Only remove the bearing if it is to be renewed.

   General Equipment: Puller

E75720

3. *Special Tool(s):* 205-310
   General Equipment: Hydraulic press



E75721

4. Discard the snap ring.

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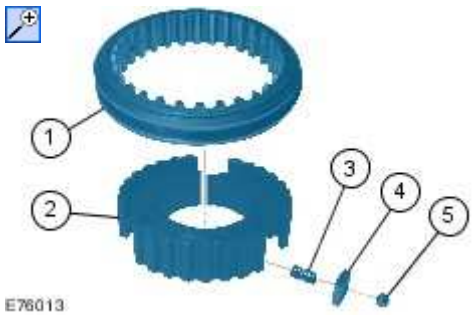
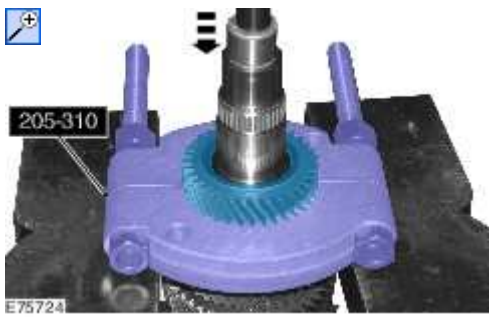
E75722



E76013

5. CAUTION: The detent balls are spring-loaded. Take care when removing the selector ring from the synchronizer hub.
NOTE: Note the position of each component before removal.
Disassemble the following items:
   1. Selector ring
   2. Synchronizer body
   3. Compression springs
   4. Blocker bars
   5. Detent balls
6. Discard the snap ring.

E75723

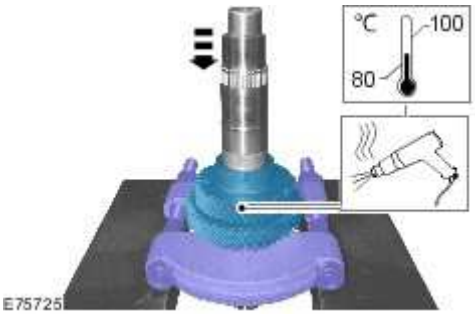


E75724

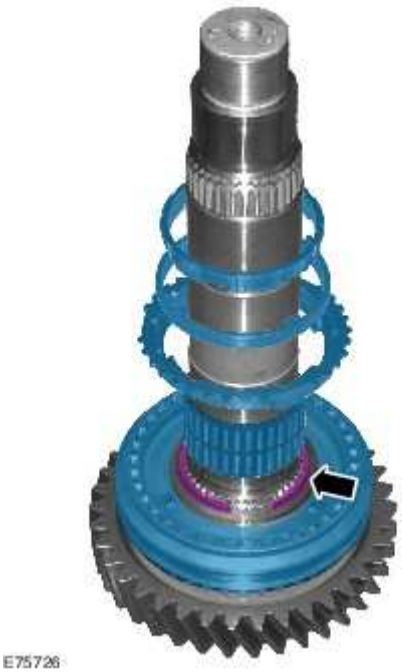
7. *Special Tool(s):* 205-310
General Equipment: Hydraulic press

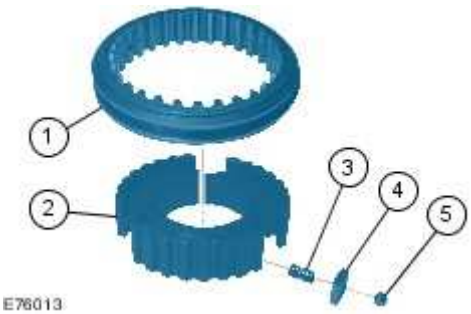
8. *General Equipment:* Hydraulic press
General Equipment: Puller

http://vnx.su



9. Discard the snap ring.





10. CAUTION: The detent balls are spring-loaded. Take care when removing the selector ring from the synchronizer hub.
NOTE: Note the position of each component before removal.
Disassemble the following items:
    1. Selector ring
    2. Synchronizer body
    3. Compression springs
    4. Blocker bars
    5. Detent balls
11.

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E75727

Assembly

CAUTION: Use vise jaw protectors.

12. Clamp the output shaft in a vise.
13. Lubricate the synchronizer rings with manual transmission fluid before assembly.

    Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)
14.

E75727

15. Assemble the following items:
    1. Compression springs
    2. Blocker bars and detent balls
    3. Selector ring

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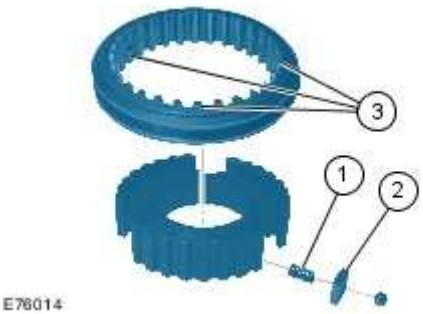
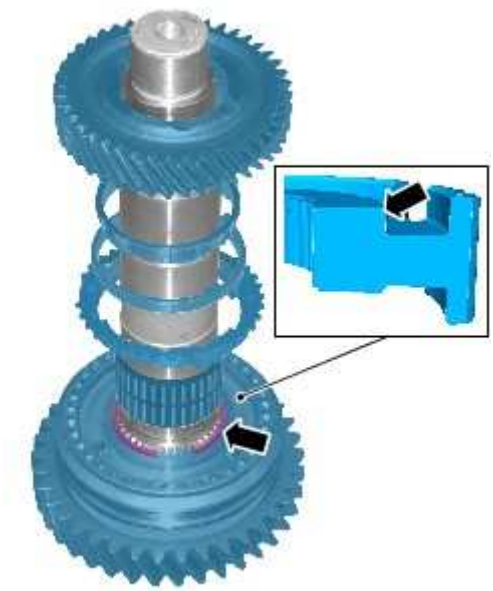
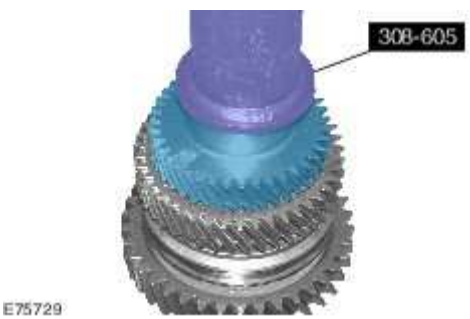


E76014

16. Install a new snap ring.

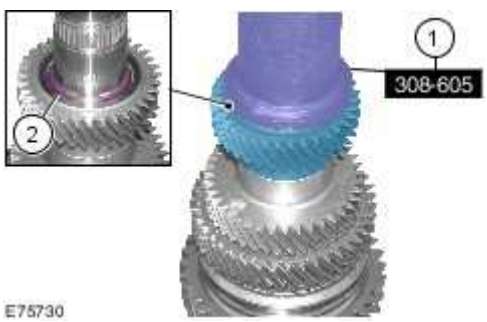

E75728

17. *Special Tool(s):* 308-605
General Equipment: Hydraulic press



E75729

18.
1. *Special Tool(s):* 308-605
General Equipment: Hydraulic press
2. Install a new snap ring.



E75730

19. Assemble the following items:
1. Compression springs
2. Blocker bars and detent balls
3. Selector ring

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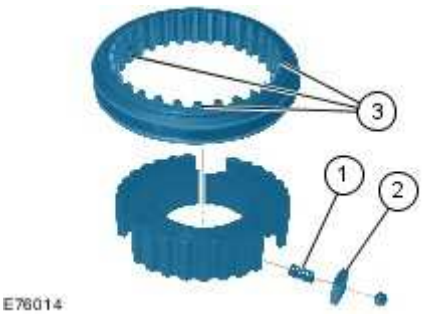
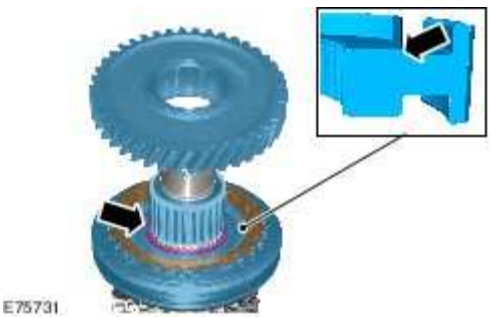
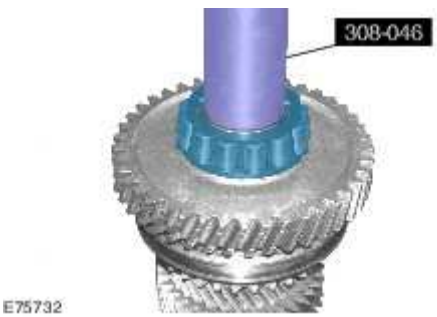


E76014


E75731

20. Install a new snap ring.



E75732

21. The roller bearing must not be lubricated.

Special Tool(s): 308-046

E75733

22. The roller bearing must not be lubricated.

Special Tool(s): 308-046

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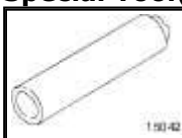
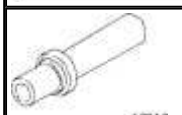
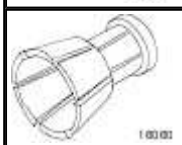
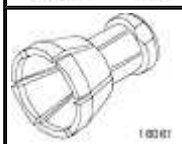
Print

Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-068 Installer, Drive Pinion Bearing
	205-295 Remover, Bearing (Main Tool)
	308-044 Installer, Transmission Extension Housing Bushing/Seal
	308-046 Installer, Transmission Extension Housing Bushing/Seal
	308-195 Collet for 205-295
	308-196 Collet for 205-295
	308-230 Support Plate, Gear Removal (Dia 85.1 mm)

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

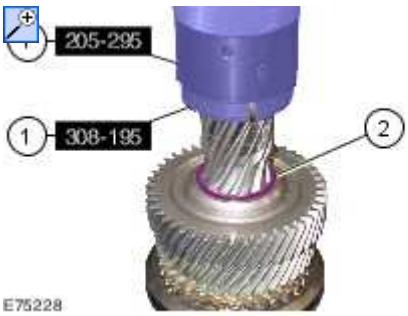
Hydraulic press

Disassembly

CAUTION: Use vise jaw protectors.

1. Clamp the input shaft in a vise.
2. *Special Tool(s):* 205-295, 308-196

http://vnx.su



3. Remove the following items:
   1. Roller bearing

      Special Tool(s): 205-295, 308-195
   2. Discard the snap ring.

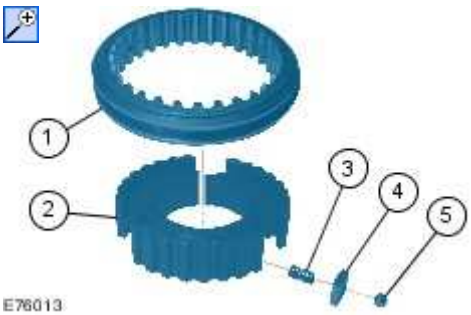
4. *Special Tool(s):* 308-230
   General Equipment: Hydraulic press

5. Discard the snap ring.

6.

http://vnx.su

E75254



E76013

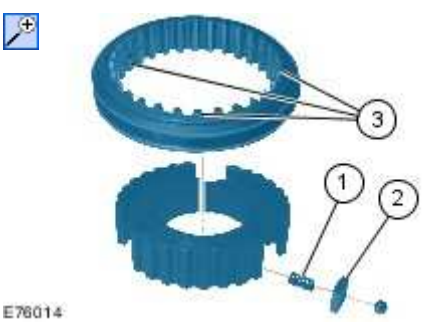
7. CAUTION: The detent balls are spring-loaded. Take care when removing the selector ring from the synchronizer hub.
   NOTE: Note the position of each component before removal.
   Disassemble the following items:
   1. Selector ring
   2. Synchronizer body
   3. Compression springs
   4. Blocker bars
   5. Detent balls

Assembly

CAUTION: Use vise jaws protectors.

8. Clamp the input shaft in a vise.
9. Lubricate the synchronizer rings with manual transmission fluid before assembly.

   Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)



E76014

10. Assemble the following items:
    1. Compression springs
    2. Blocker bars and detent balls
    3. Selector ring

11.

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E75227

12. Install a new snap ring.

E75231

13. *Special Tool(s):* 205-068
General Equipment: Hydraulic press

E75232

14. Install the following items:
    1. Install a new snap ring.
    2. The roller bearing must not be lubricated.

    Special Tool(s): 308-044

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E75229

E75226

15. The roller bearing must not be lubricated.

    Special Tool(s): 308-046

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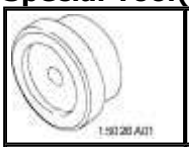
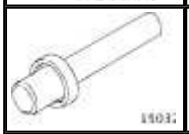
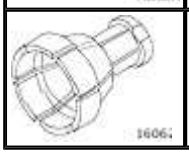
Print

Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-081 Installer, Differential Bearing
	205-295 Remover, Bearing (Main Tool)
	308-197 Collet for 205-295

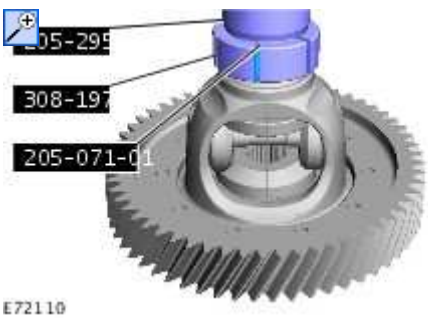
Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

Disassembly

CAUTION: Use vise jaws protectors.

1. Clamp the differential in a vise.
2. *Special Tool(s):* 205-071-01, 205-295, 308-197



E72110

3. *Special Tool(s):* 205-071-01, 205-295, 308-197

E75219

4. Remove the following items:
   1. *Loosen:* Four turn(s)
   2.
   3. Save three bolts for reassembly the ring gear.

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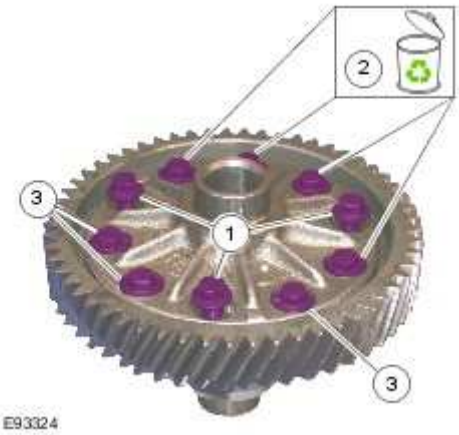
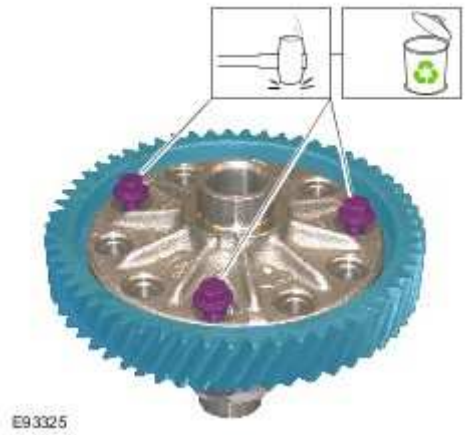


5.



Assembly

CAUTION: Use vise jaws protectors.

6. Clamp the differential in a vise.
7. Carefully clean and check all parts and coat with manual transmission fluid before assembly.

   Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

8. Install the three bolts saved during disassembly.

   Torque: 83 Nm

9.

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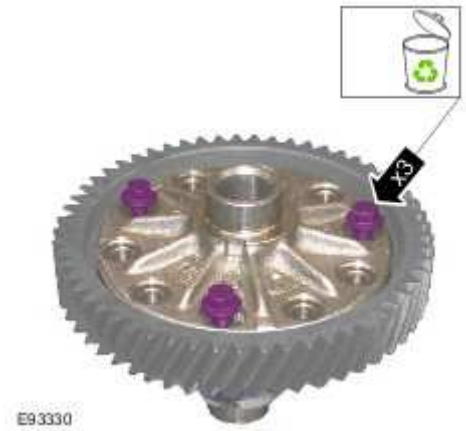

10. CAUTION: Make sure that new bolts are installed.
Torque: 83 Nm

11. The roller bearing must not be lubricated.

Special Tool(s): 205-081

12. The roller bearing must not be lubricated.

Special Tool(s): 205-081

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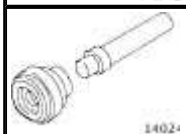
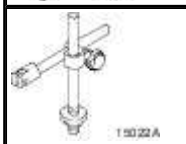
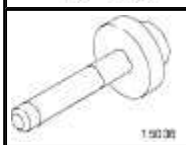
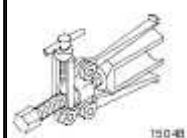
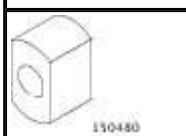
Assembly

Special Tool(s)

	204-017 Installer, Wheel Hub Bearing Cup
	204-050 Installer, Front Wheel Hub Bearing Cup/Seal
	205-067 Preload Gauge
	205-069 Dial Indicator Gauge (Metric)
	205-070 Holding Fixture, Dial Indicator Gauge
	205-075 Installer, Rear Wheel Hub Seal
	205-078 Remover, Drive Pinion Seal
	205-078-01 Adapter for 205-078 (Thrust Pad)
	205-115 Installer, Drive Pinion Seal
	205-175 Socket, Drive Pinion Nut
	205-176 Remover, Differential Bearing Cone
	205-329 Mounting Bracket, Engine/Differential

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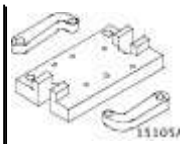
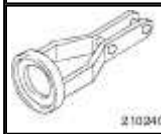
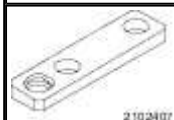
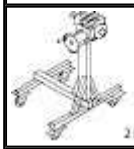
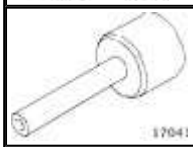
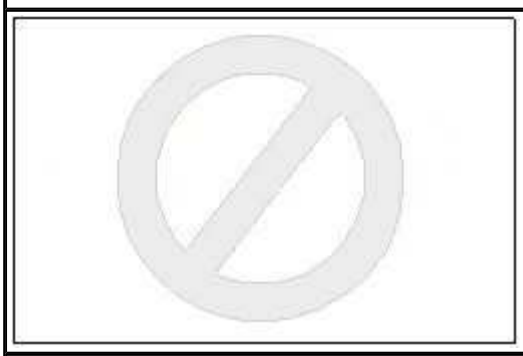
	
	303-060 Compressor, Valve Spring
	303-060-02 Adapter for 303-060
	303-060-07 Adapter for 303-060
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	307-210 Installer, Input Shaft Seal
	307-300 Gauge Bar, Shim Selection
	308-194B Holding Fixture, Dial Indicator Gauge (Output Shaft End F
	308-214 Remover, Hydraulic Line Spring Clip

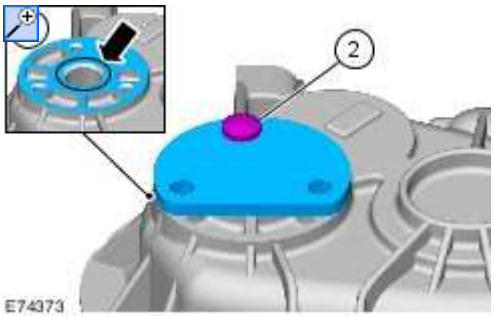
Materials

Name	Specification
Flange Sealant - Anaerobic LR	WSK-M2G348-A5 / 2U7J-M2G348-AA
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

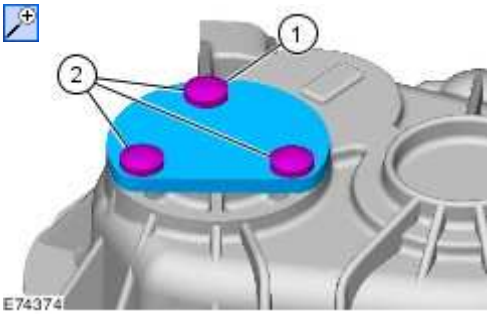
Hot air gun

http://vnx.su



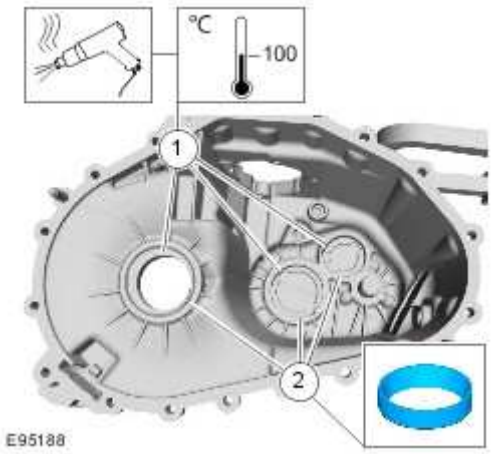
1.

1. *Material:* Flange Sealant - Anaerobic LR (WSK-M2G348-A5 / 2U7J-M2G348-AA)
2. Fit the temporary bolt.



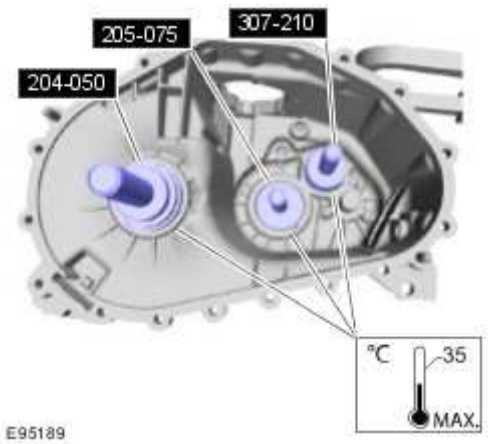
2.

1. Remove the temporary bolt.
2. NOTE: Make sure that new bolts are installe
   Torque: 24 Nm



3.

1. *General Equipment:* Hot air gun
2. Insert bearing outer rings manually.



4. *Special Tool(s):* 204-050, 205-075, 307-210

5.

1. *General Equipment:* Hot air gun
2. Install a 1.10 mm measuring shim.
3. Install 1.00 mm measuring shims.
4. Insert bearing outer rings manually.

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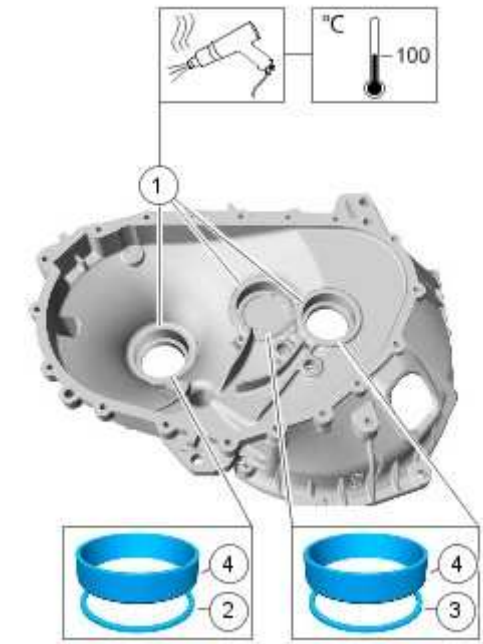
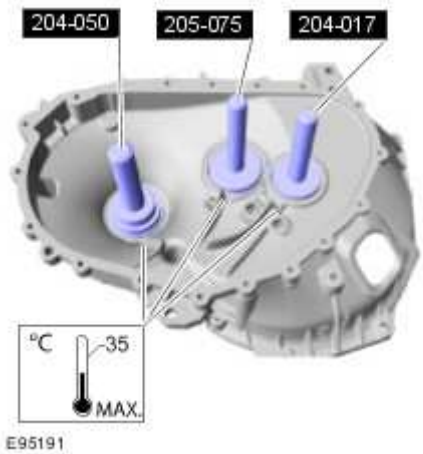
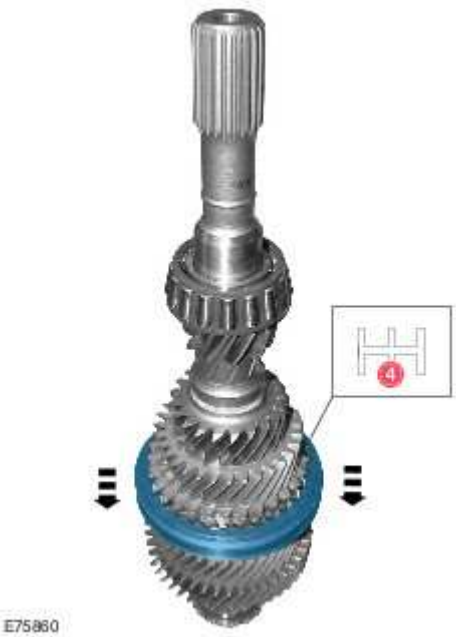


6. *Special Tool(s):* 204-017, 204-050, 205-075



7.



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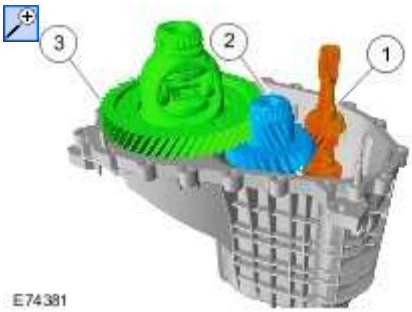
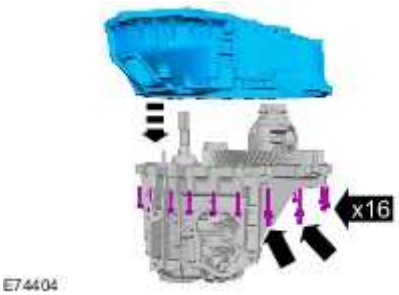
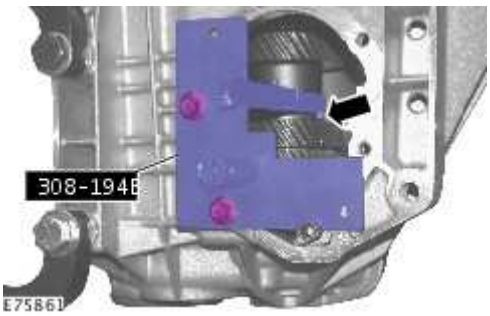


8. NOTE: Do not oil the taper roller bearing.
   Install the following items:
   1.
   2.
   3.

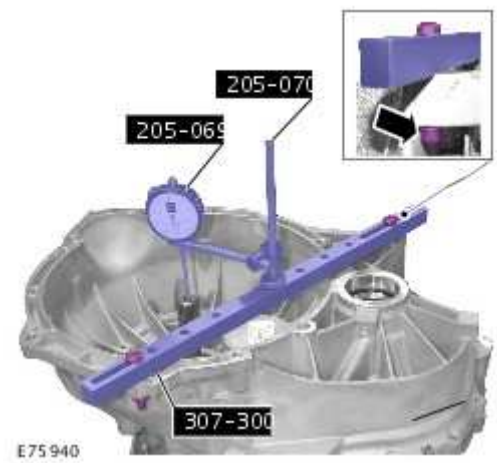


9. CAUTION: The guide pins must remain installe in the gearbox housing.
   NOTE: The mounting faces of the component must be clean and free from foreign bodies and lubrican
   Tighten the bolts in a crisscross sequence.

   Torque: 40 Nm



10. *Special Tool(s):* 308-194B



11. *Install the Special Tool(s):* 205-069, 205-070, 307-

12. Input shaft measurement: Carry out the following tw steps three times and calculate the average of the measurements. (Example: (0.22 mm + 0.23 mm + mm) / 3 = 0.22 mm)
13. *Special Tool(s):* 205-175

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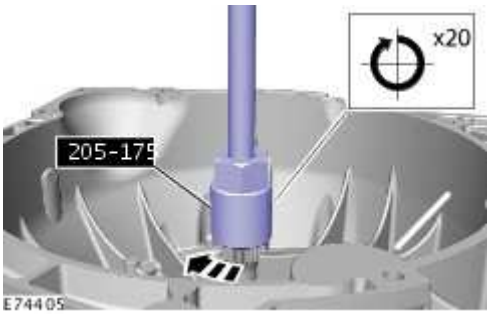

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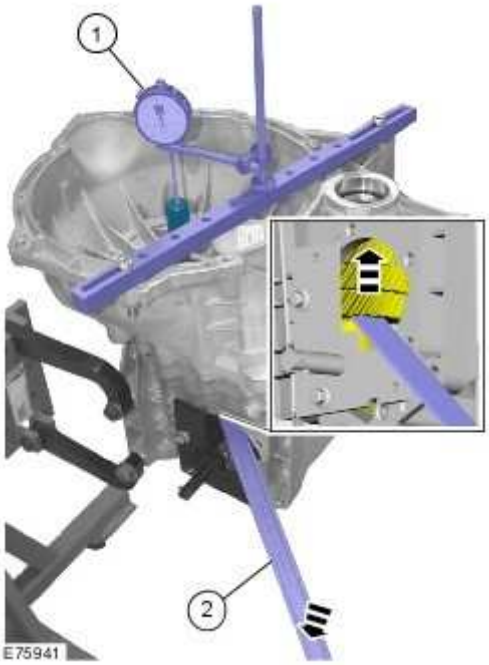
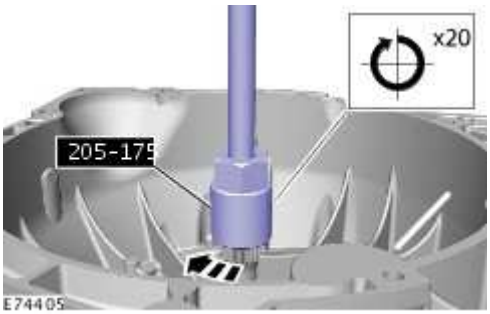


1. Pre-load the dial gauge to 1 mm and zero it.
2. Lift the input shaft with a suitable lever and n
   the resulting measurement.

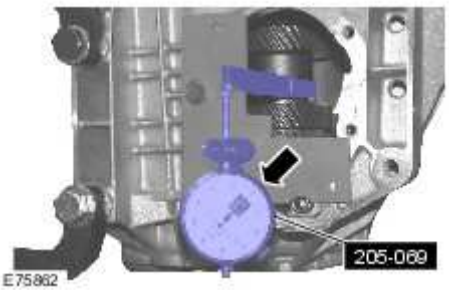
15. Output shaft measurement: Carry out the following
    steps three times and calculate the average of the
    measurements. (Example: (0.32 mm + 0.33 mm +
    mm) / 3 = 0.32 mm)

16. *Special Tool(s):* 205-175



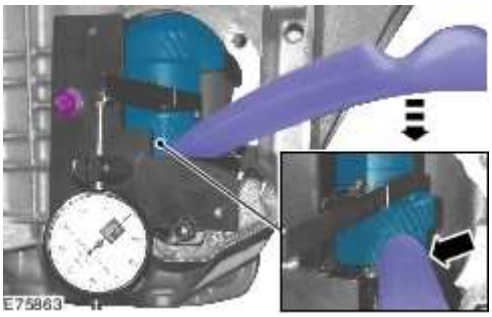
17. Attach the dial gauge, pre-load it to 1 mm and zero

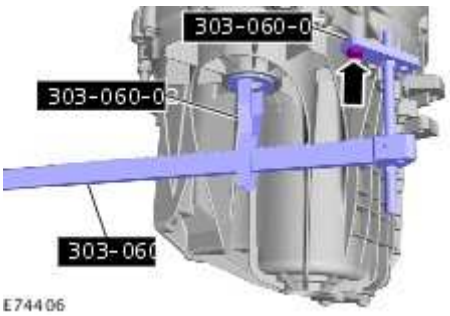
    Special Tool(s): 205-069



18. Lift the output shaft with a suitable lever and note th
    resulting measurement.

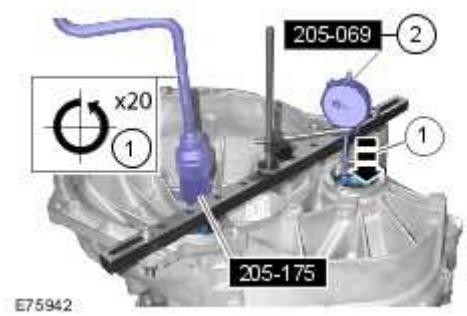
http://vnx.su





19. *Install the Special Tool(s):* 303-060, 303-060-02, 30 060-07

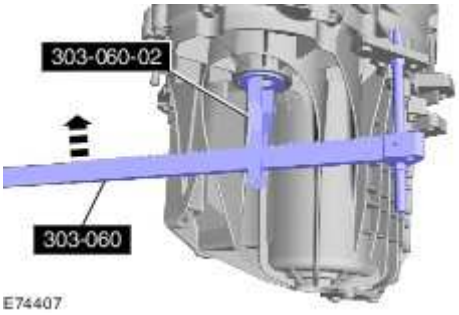
20. Differential measurement: Carry out the following tw steps three times and calculate the average of the measurements. (Example: (0.34 mm + 0.36 mm + mm) / 3 = 0.36 mm)



21.
    1. Press down the differential during rotation.

       Special Tool(s): 205-175
    2. Pre-load the dial gauge to 1 mm and zero it.

       Special Tool(s): 205-069



22. Lift the differential with the special tool and note the resulting measurement.

    Special Tool(s): 303-060, 303-060-02

23.
    - Calculate the required adjusting shim thicknes the input shaft:
    - Installed measuring shim thickness: 1.00 mm.
    - Calculated average input shaft end float e. g. (mm.
    - End float constant: -0.07 mm.
    - Shim thickness required: 1.00 mm +0.22 mm 0.07 mm = 1.15 mm

24.
    - Calculate the required adjusting shim thicknes the output shaft:
    - Installed measurement shim thickness: 1.00 r
    - Calculated average output shaft end float, e.g.

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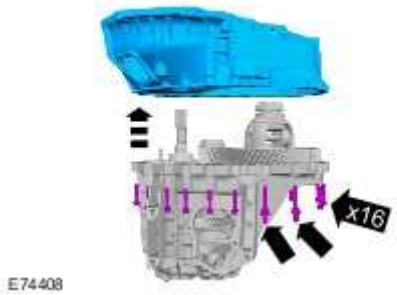
0.32 mm.
- Pre-load constant 0.13 mm.
- Shim thickness required: 1.00 mm +0.32 mm +0.13 mm = 1.45 mm.

25.
- Calculate the required adjusting shim thickness the differential:
- Installed measurement shim thickness: 1.10 m
- Calculated average differential end float e. g. mm.
- Pre-load constant 0.33 mm.
- Shim thickness required: 1.10 mm + 0.36 mm +0.33 mm = 1.79 mm.

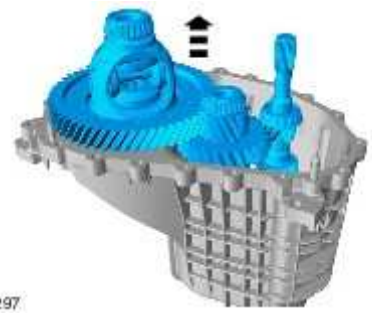
26. *Remove the Special Tool(s):* 205-069, 205-070, 303 303-060-02, 303-060-07, 307-300, 308-194B

27.

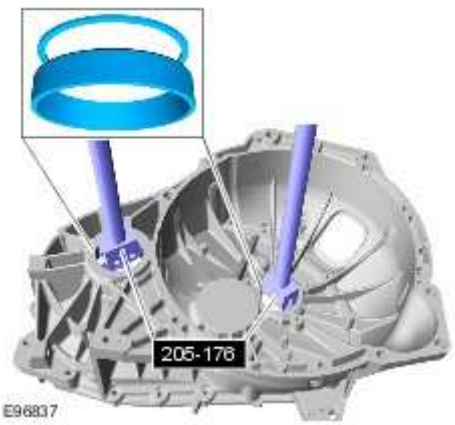


E74408

28.


E74297

29. *Special Tool(s):* 205-176



E96837

30. *Special Tool(s):* 205-078, 205-078-01

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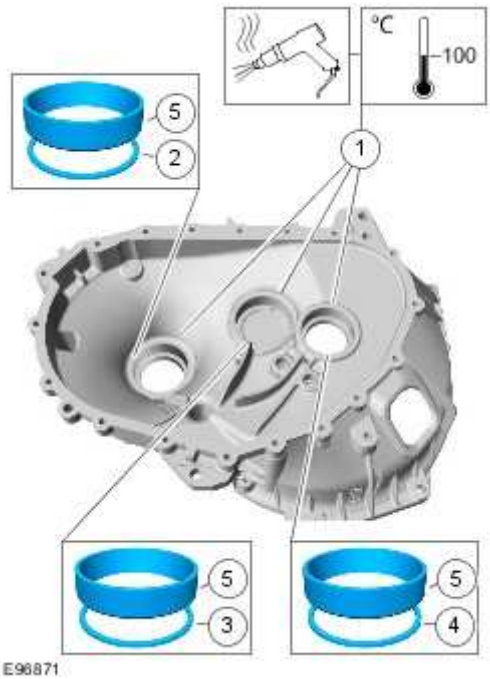
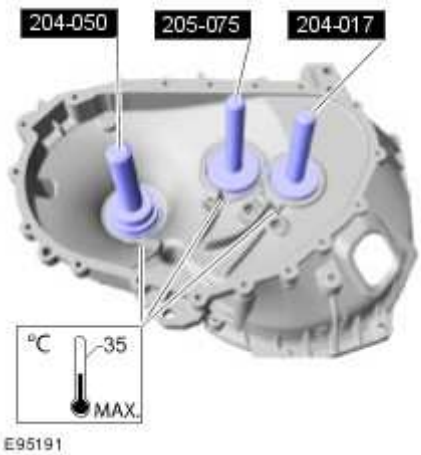
E74300



E96871

31.
1. *General Equipment:* Hot air gun
2. Install the measured adjusting shim.
3. Install the measured adjusting shim.
4. Install the measured adjusting shim.
5. Insert bearing outer rings manually.



E95191

32. *Special Tool(s):* 204-017, 204-050, 205-075

33. NOTE: Make sure that these components are installed to the noted removal position.

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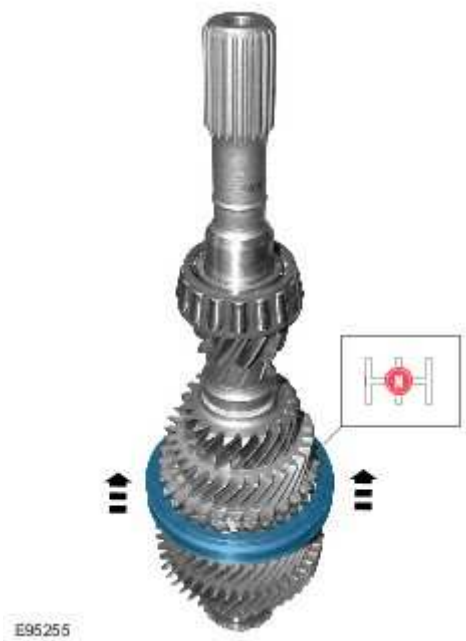
E75865

E75943

34. Keep the reverse gear idler shaft bearing block raise while installing the shaft.

    Special Tool(s): 308-214

35.


E95255

36. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 7U7J-M2C200-BA)

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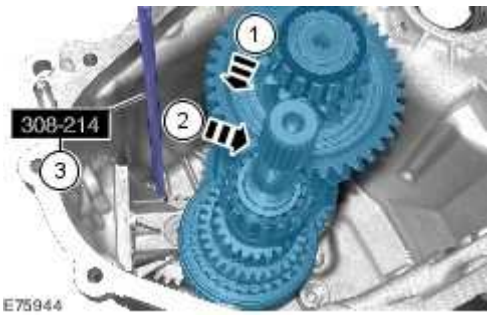
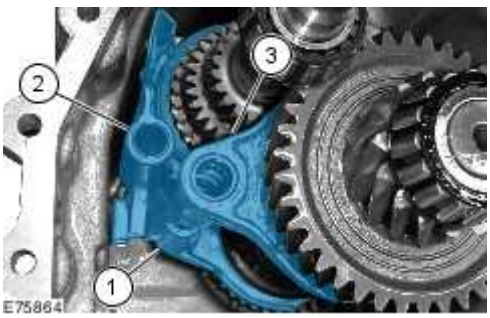
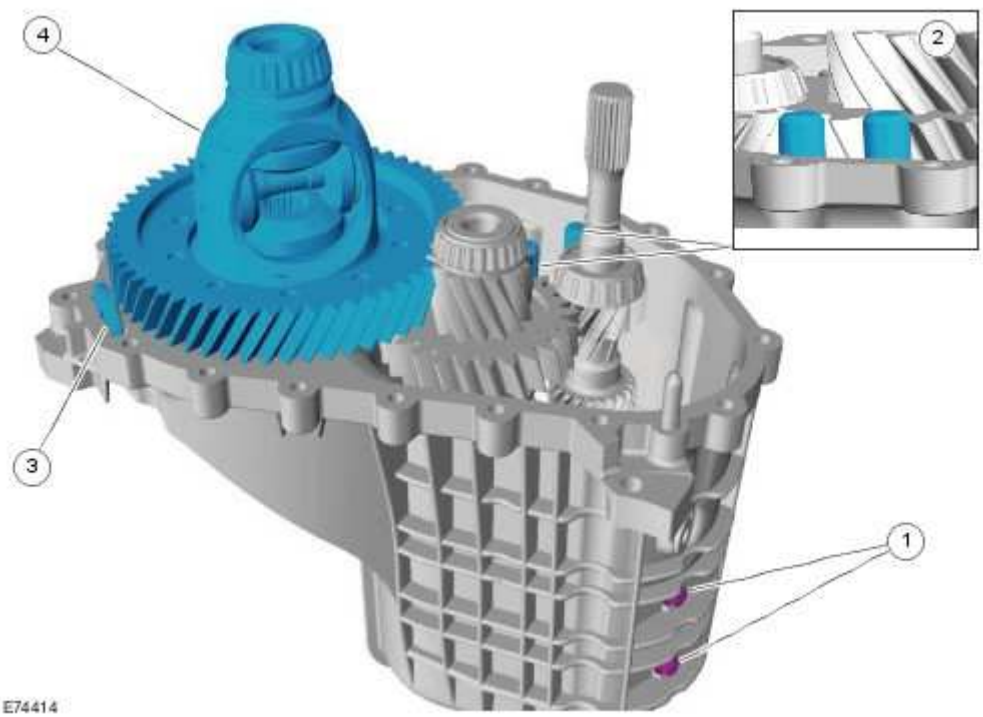


37.

1. Install the input and output shafts together.
2. Move the input and output shafts to one side.
3. *Remove the Special Tool(s):* 308-214



38. NOTE: Make sure that these components are installed to the noted removal position.
Install the following items:
    1.
    2.
    3.



39. Install the following iten
    1. *Materia* Flange Sealan Anaero LR (WS M2G34 A5 / 2U M2G34 AA) *Torque* Nm
    2.
    3.
    4.

40. *Material:* Flange Sealant - Anaerobic LR (WSK-M2G3

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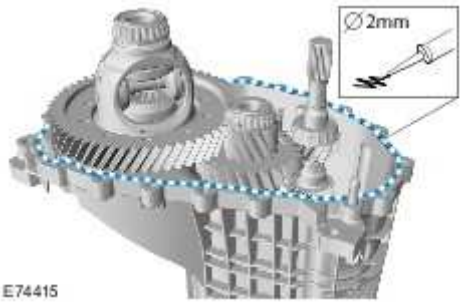
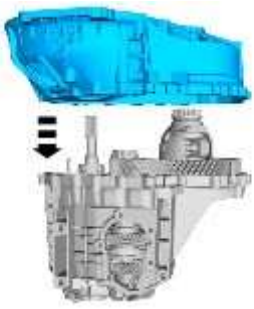
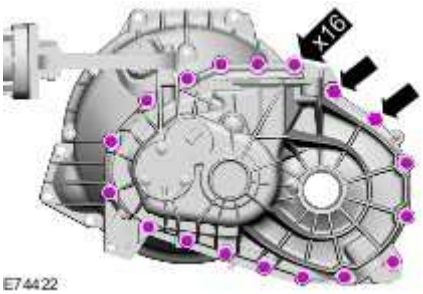


A5 / 2U7J-M2G348-AA)

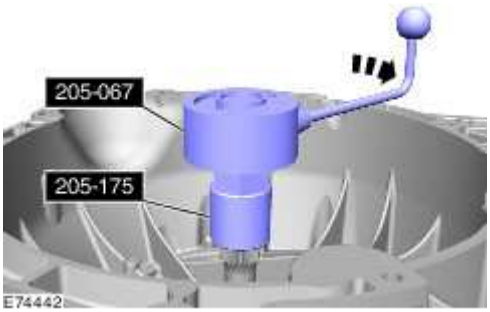


41. CAUTION: The guide pins must remain installe in the gearbox housing.



42. Tighten the bolts in a crisscross sequence.

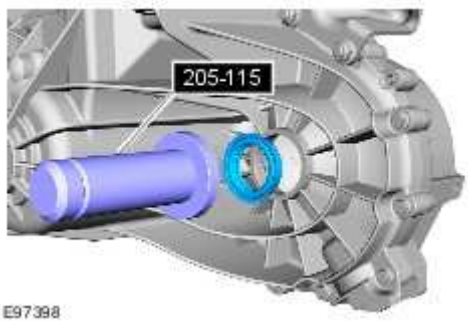
Torque: 40 Nm



43.

- If the starting torque is too high, all the measurements must be repeated.
- Engage fourth gear.

  Special Tool(s): 205-067, 205-175
- Starting torque 1 Nm.



44. *Special Tool(s):* 205-115

45. NOTE: Make sure that a new component is installe *Material:* Flange Sealant - Anaerobic LR (WSK-M2G3 A5 / 2U7J-M2G348-AA)

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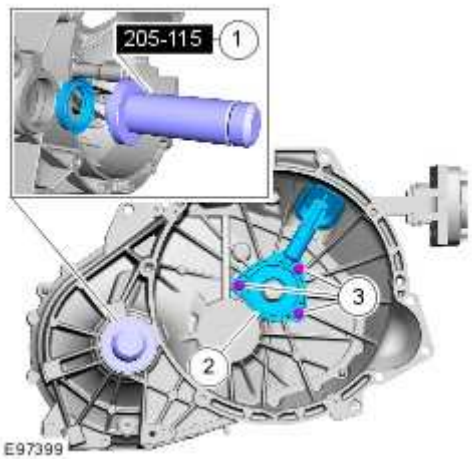
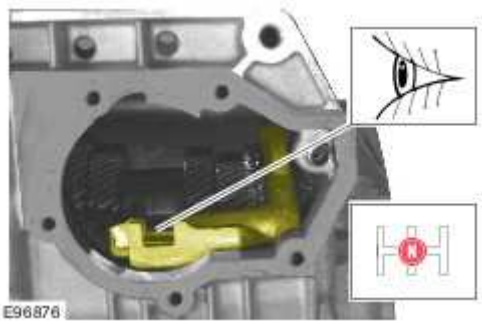
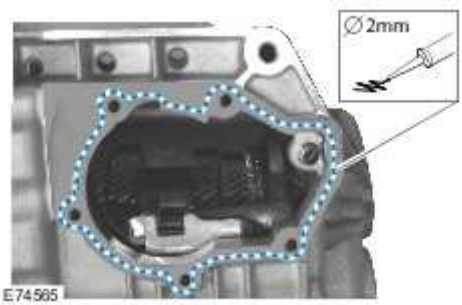


46. Install the following items:
    1. *Special Tool(s):* 205-115
    2. CAUTION: Cover the input shaft splines with adhesive tape to avoid damaging the input shaft oil seal.
       NOTE: Make sure that a new component is installed.
    3. NOTE: Make sure that new bolts are installe
       Torque: 11 Nm

47. Remove the adhesive tape from the input shaft splin

48.





49. *Material:* Flange Sealant - Anaerobic LR (WSK-M2G3 A5 / 2U7J-M2G348-AA)

50.
    2. *To* 26
    3. *To* 26
    4. *To* 40
    5. *Re th Sp To*

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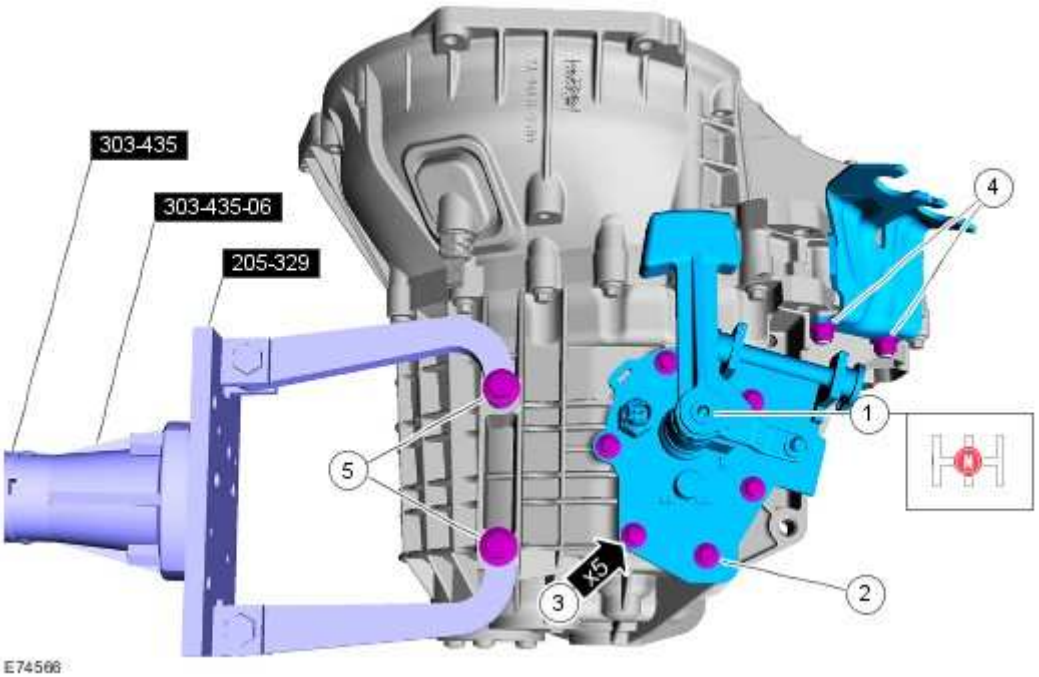
20
32
30
43
30
43



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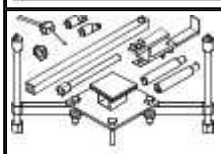
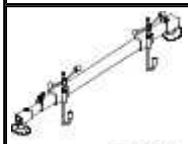
Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
 E63418	303-290B-16 Adapter for 303-290B

Materials

Name	Specification
Grease K-HT	ESD-M1C220-A / A88SX1C220AA
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

Transmission jack

CAUTION: Make sure that the two guide sleeves are installed.

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Apply a thin coating of grease to the input shaft splines.

   Material: Grease K-HT (ESD-M1C220-A / A88SX1C220AA)
3. *General Equipment:* Transmission jack

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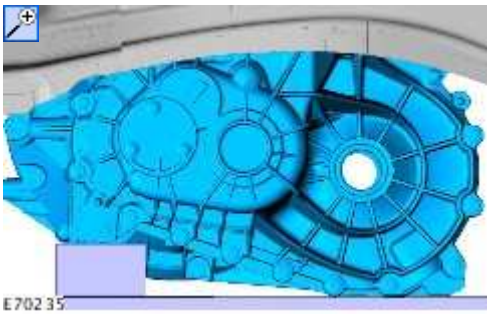
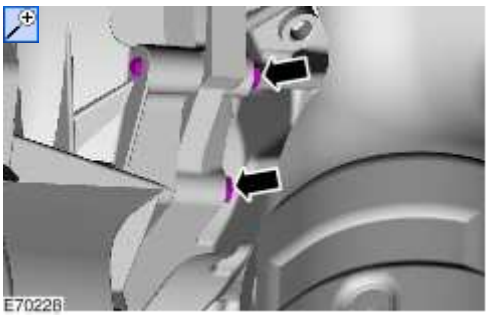


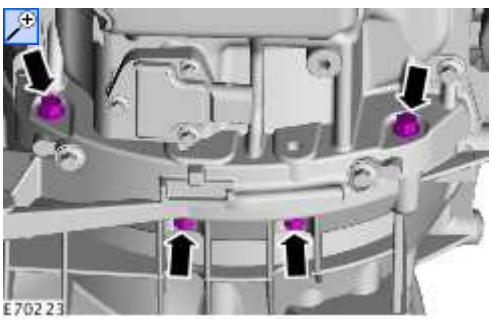
4. Perform this and the following operation simultaneously.

   Special Tool(s): 303-290A-15
   Torque: 48 Nm



5. *Torque:* 48 Nm

6. Remove the transmission jack.



7. *Torque:* 48 Nm

8. *Special Tool(s):* 303-290A-15
   Torque: 48 Nm

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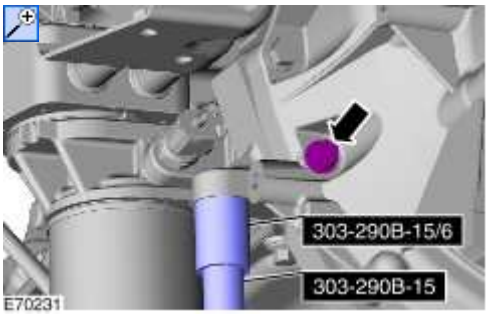
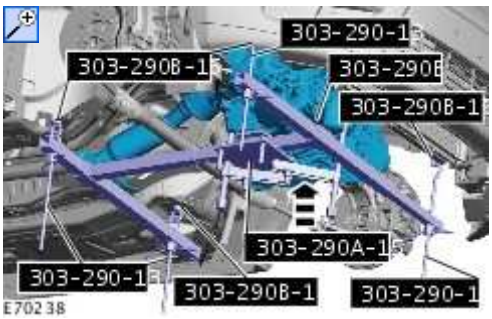
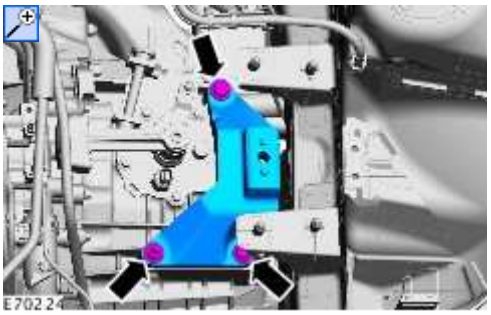
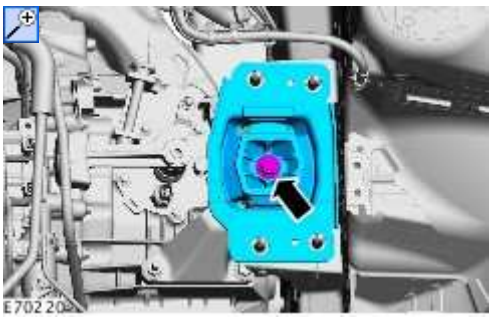




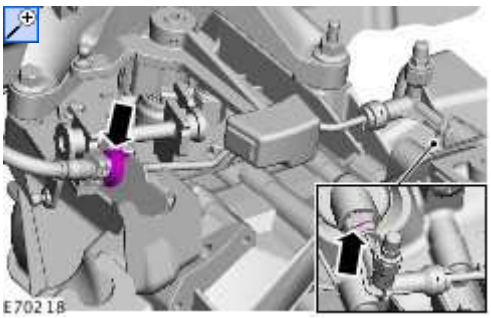
9. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



10. *Torque:* 80 Nm



11. Do not tighten the new bolt of the rear engine mounting yet.



12. Refer to: Kupplungssystem entlüften (308-00, General Procedures).

13. Remove the special tool.

    Special Tool(s): 303-290A-15
    Torque: 48 Nm

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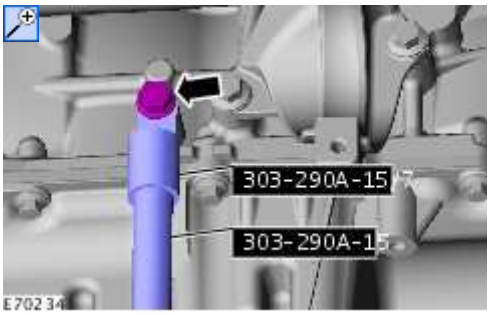
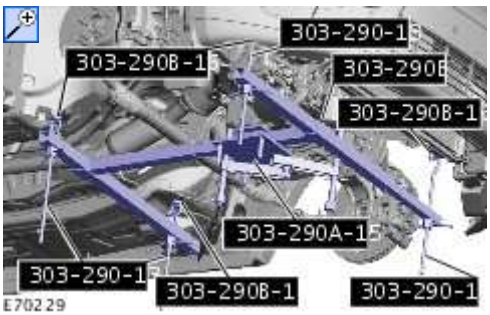
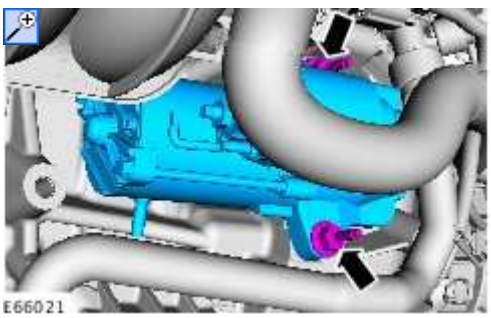


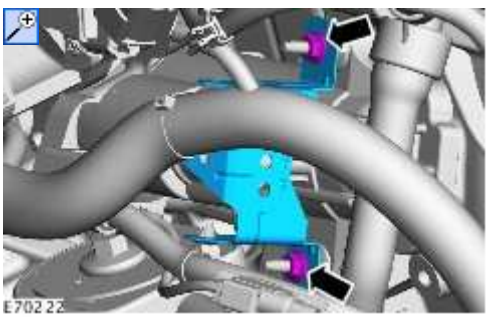


14. Remove the special tool.

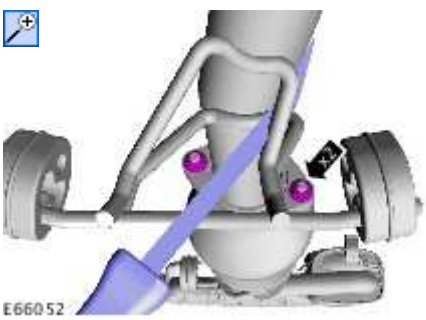
    Special Tool(s): 303-290B, 303-290-13, 303-290A-15, 303-290B-16



15. *Torque:* 40 Nm



16. *Torque:* 20 Nm



17. NOTE: The flexible exhaust pipe must not be twisted.
    Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
    Torque: 48 Nm

18. Install the following items:
    1. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and

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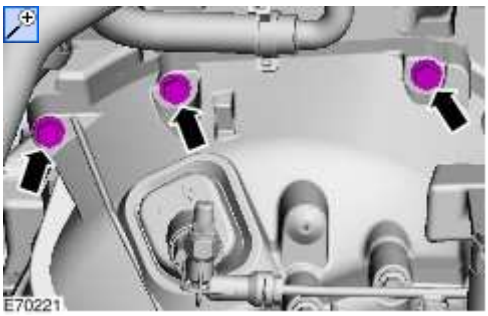
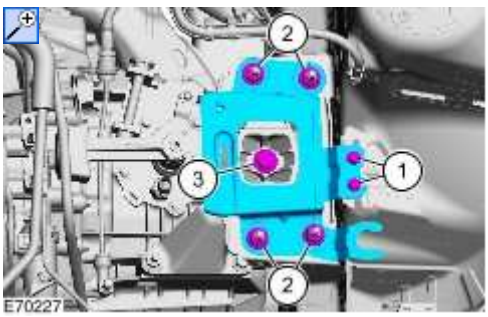
Installation).
2. Subframe

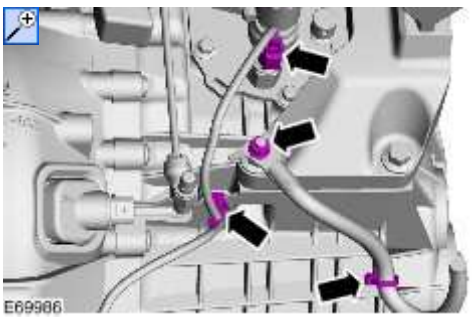
Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



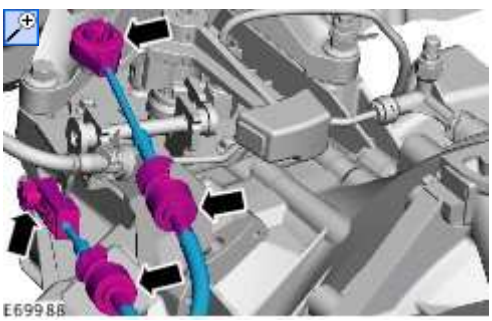
19. *Torque:* 48 Nm



20.
1. *Torque:* 25 Nm
2. *Torque:* 48 Nm
3. *Torque:* 148 Nm



21. *Torque:* 25 Nm



22.

23. Adjust the selector cable.

Refer to: Gearshift Cable Adjustment - Vehicles With: 5-Speed Manual Transaxle (MTX-75) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

24. Install the following items:
1. Battery carrier

Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and

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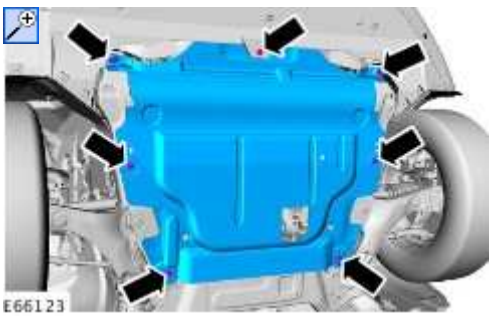
Installation).

2. Air filter

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).

25. Check the level of the transmission fluid.

    Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).



26.

27. Initialize the window regulator motors.

    Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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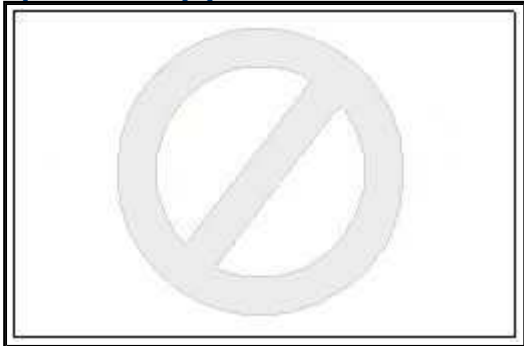
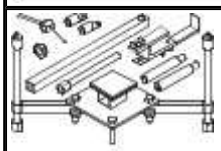
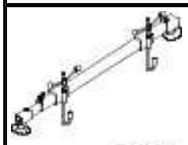
Print

Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
 E63418	303-290B-16 Adapter for 303-290B

Materials

Name	Specification
Grease K-HT	ESD-M1C220-A / A88SX1C220AA

General Equipment

Transmission jack

CAUTION: Make sure that the two guide sleeves are installed.

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Apply a thin coating of grease to the input shaft splines.

   Material: Grease K-HT (ESD-M1C220-A / A88SX1C220AA)
3. *General Equipment:* Transmission jack

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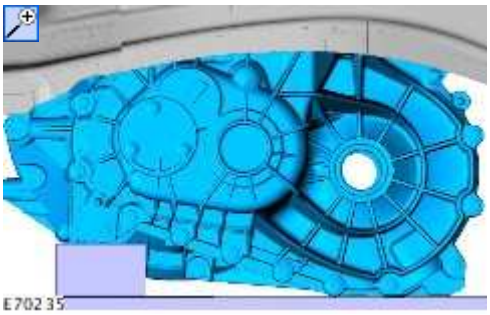
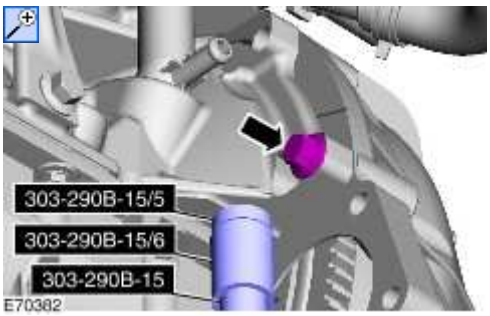
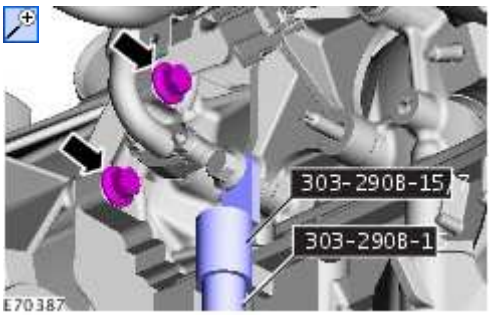




4. Perform this and the following operation simultaneously.

   Special Tool(s): 303-290A-15
   Torque: 48 Nm



5. *Special Tool(s):* 303-290A-15
   Torque: 48 Nm

6. Remove the transmission jack.

7. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

8. *Torque:* 80 Nm

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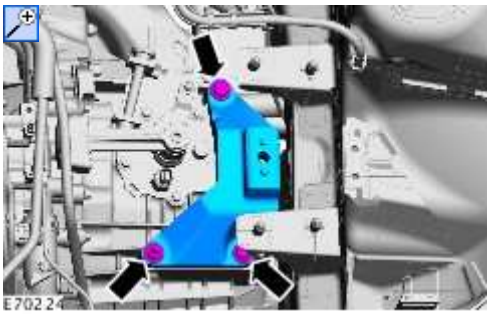
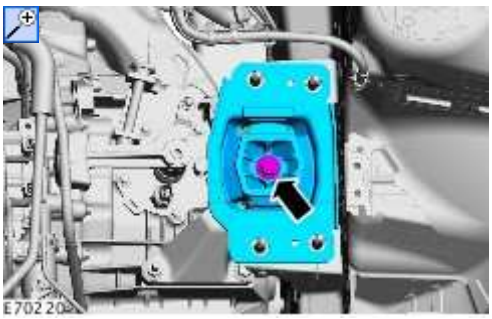
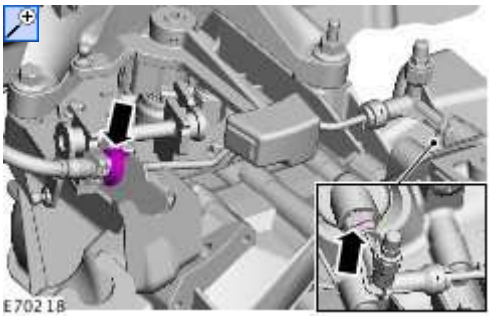
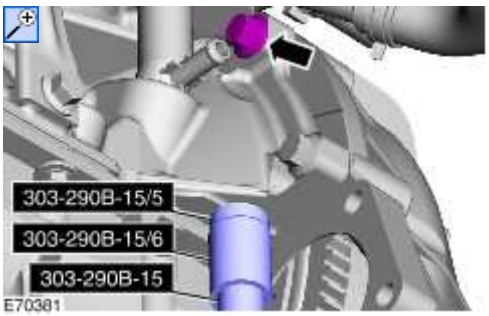




9. Do not tighten the new bolt of the rear engine mounting yet.



10. Refer to: Kupplungssystem entlüften (308-00, General Procedures).



11. *Special Tool(s):* 303-290A-15
Torque: 48 Nm

12. *Special Tool(s):* 303-290A-15
Torque: 48 Nm

13. *Special Tool(s):* 303-290A-15
Torque: 48 Nm

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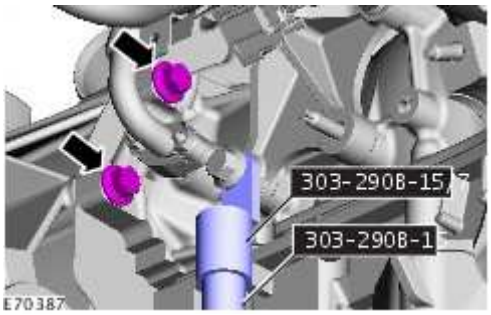
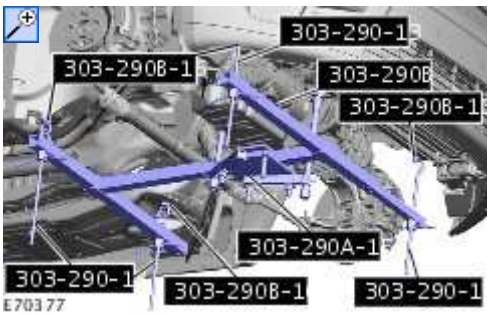




14. Remove the special tool.

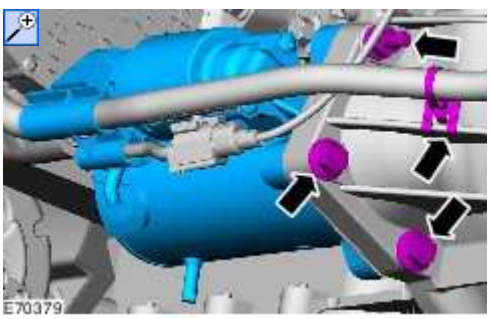
    Special Tool(s): 303-290B, 303-290-13, 303-290A-15, 303-290B-16

15. Install the following items:
    1. Catalyst

       Refer to: Catalytic Converter (309-00D Exhaust System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
    2. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Subframe

       Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



16. *Torque:* 40 Nm

17. *Torque:* 48 Nm

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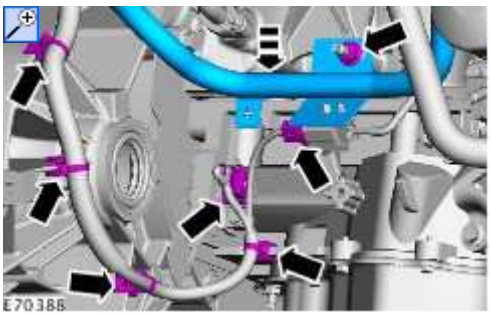
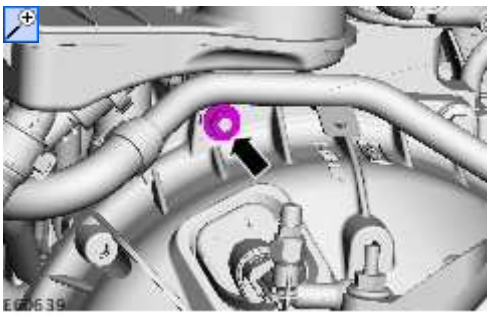
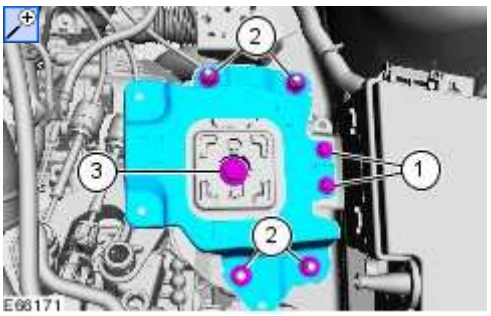


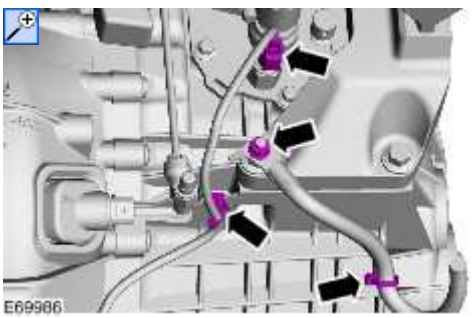
18. *Torque:* 25 Nm



19. *Torque:* 24 Nm



20.
1. *Torque:* 25 Nm
2. *Torque:* 48 Nm
3. *Torque:* 148 Nm



21. *Torque:* 25 Nm

22.

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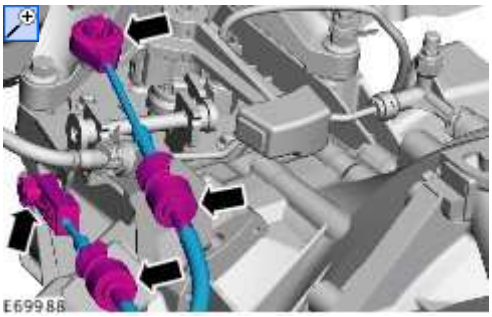


23. Adjust the selector cable.

    Refer to: Gearshift Cable Adjustment - Vehicles With: 5-Speed Manual Transaxle (MTX-75) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

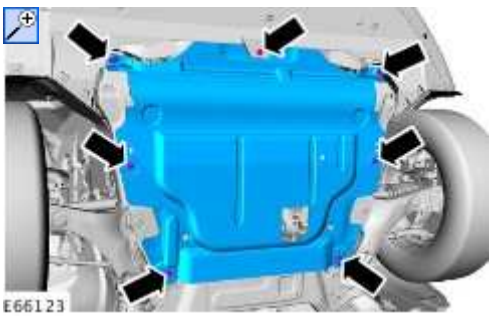
24. Install the following items:
    1. Battery carrier

       Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    2. Air filter

       Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

25. Check the level of the transmission fluid.

    Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).



26.

27. Initialize the window regulator motors.

    Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6 - Specifications

Capacities

Transmission fluid (0- 5 mm below the lower edge of the inspection hole)

Shim thickness calculations

Type	1st – 4th gear output
Measuring shims (mm)	-
Measured end float (example) (mm)	+1,56
Addition value (mm) to obtain correct bearing pre-load	+0,17
Required shim thickness (example) (mm)	= 1,73
Available shims (mm)	1.44 -2.16 (in 0.02 mm

Transmission Ratios

2.0L diesel engine	Internal Gearbox Ratio(s)
1. gear	3.583
2. gear	1.952
3. gear	1.241
4. gear	0.868
5. gear	0.943
6. gear	0.789
Reverse gear	1.423

*** The final drive ratio for reverse gear is calculated by multiplying the internal gearb**

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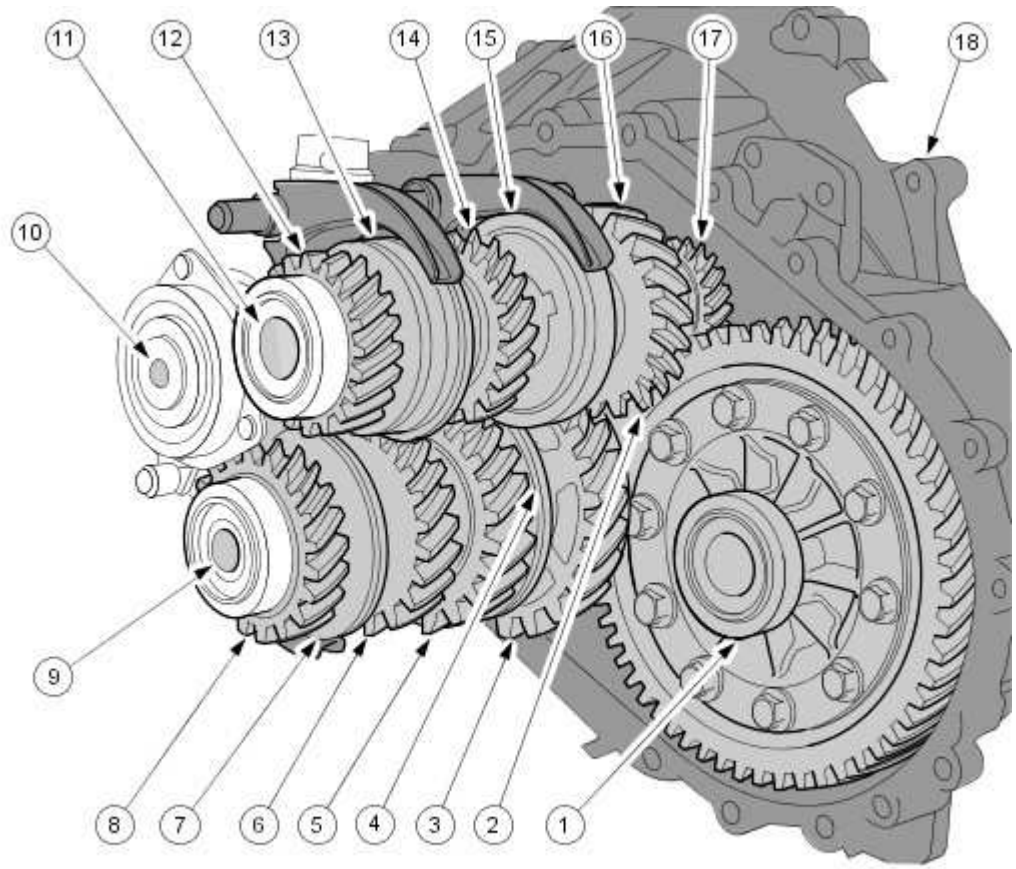
Description and Operation

Construction features on the differential side



E38730

Item	Part Number	Description
1	-	Differential
2	-	Reverse gear idler
3	-	1st gear wheel
4	-	1st/2nd gear synchronizer clutch
5	-	2nd gear wheel
6	-	3rd gear wheel
7	-	3rd/4th gear synchronizer clutch
8	-	4th gear wheel
9	-	Output shaft 1st/4th gear
10	-	Input shaft
11	-	Output shaft 5th/6th/reverse gear
12	-	6th gear wheel
13	-	5th/6th gear synchronizer clutch
14	-	5th gear wheel
	-	

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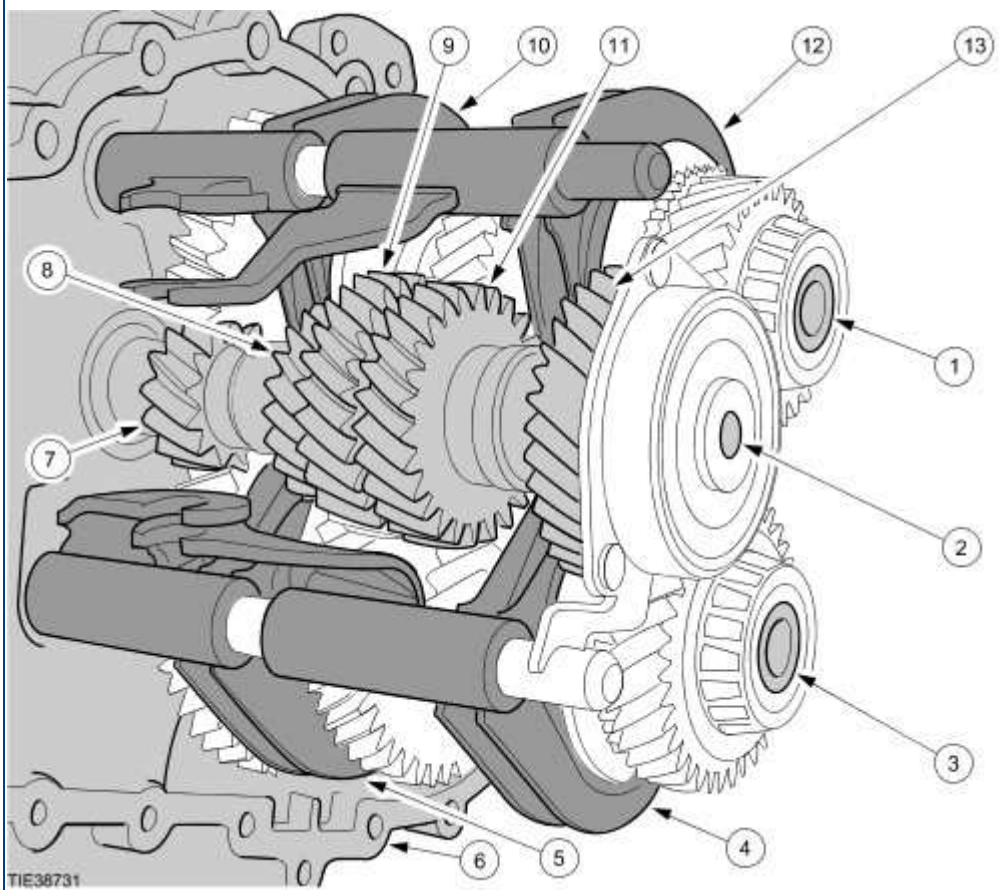
15		Reverse gear synchronizer clutch
	16 -	Reverse gear wheel
17	-	Output pinion – 5th/6th/reverse gear output shaft
18	-	Clutch housing

Construction features on the differential side

All gears have helical teeth and are permanently engaged.

5th, 6th and reverse gear have simple synchronisation. 1st to 4th gears are double synchronised.

Construction features on the input shaft side.



Item	Part Number	Description
1	-	Output shaft 5th/6th/reverse gear
2	-	Input shaft
3	-	Output shaft 1st/4th gear
4	-	3rd/4th gear synchronizer clutch selector fork
5	-	1st/2nd gear synchronizer clutch selector fork
6	-	Clutch housing
7	-	1st gear
8	-	2nd gear
9	-	5th gear
10	-	Reverse gear synchronizer clutch selector fork
11	-	3rd gear
	-	

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12			5th/6th gear synchronizer clutch selector fork
	13	-	4th/6th gear gearwheel

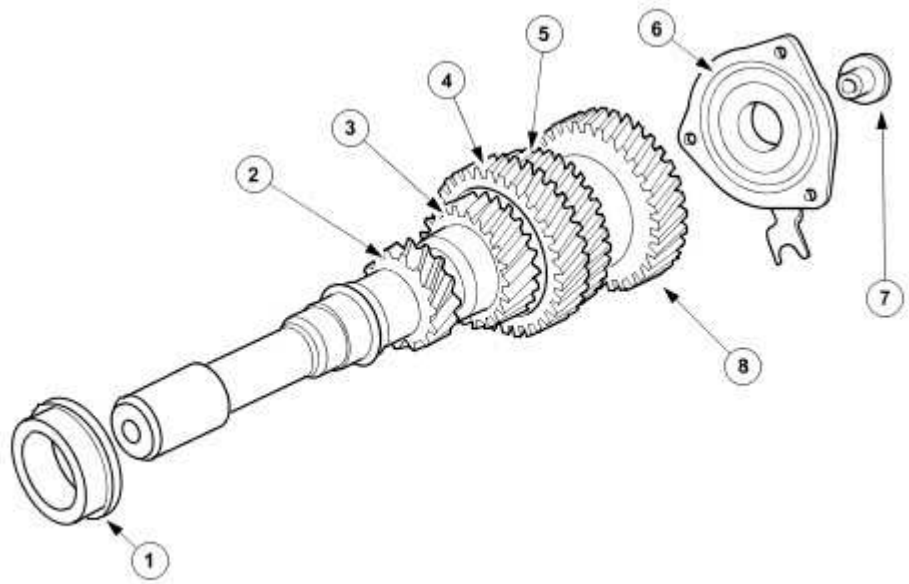
All driving gear wheels of the transmission are located on the input shaft.

The input shaft is a solid shaft and runs on one ball bearing and one roller bearing.

Because of this mounting the input shafts runs without preload and therefore needs no adjusting shims.

The input shaft seal nearest the clutch is pressed into the clutch housing.

Input shaft



E38768

Item	Part Number	Description
1	-	Clutch housing roller bearing
2	-	1st gear
3	-	2nd gear
4	-	5th gear
5	-	3rd gear
6	-	Input shaft ball bearing holder
7	-	Bearing retaining bolt
8	-	4th/6th gear wheel

Input shaft

The gear wheels for 1st and 2nd gear are an integral part of the input shaft. The gearwheels for 3rd and 5th gears and the gearwheel for 4th/6th gear are pressed on.

Because of the high force used to press on the components, the gear wheels cannot be pressed off in service. A faulty input shaft can only be replaced as a complete unit.

Defective bearings can be pressed off and changed.

Output shaft 1st/4th gear

The 1st/4th gear output shaft runs on tapered roller bearings.

This bearing arrangement requires the shaft to be preloaded. Please refer to the service literature for further information on how to measure the pre-load.

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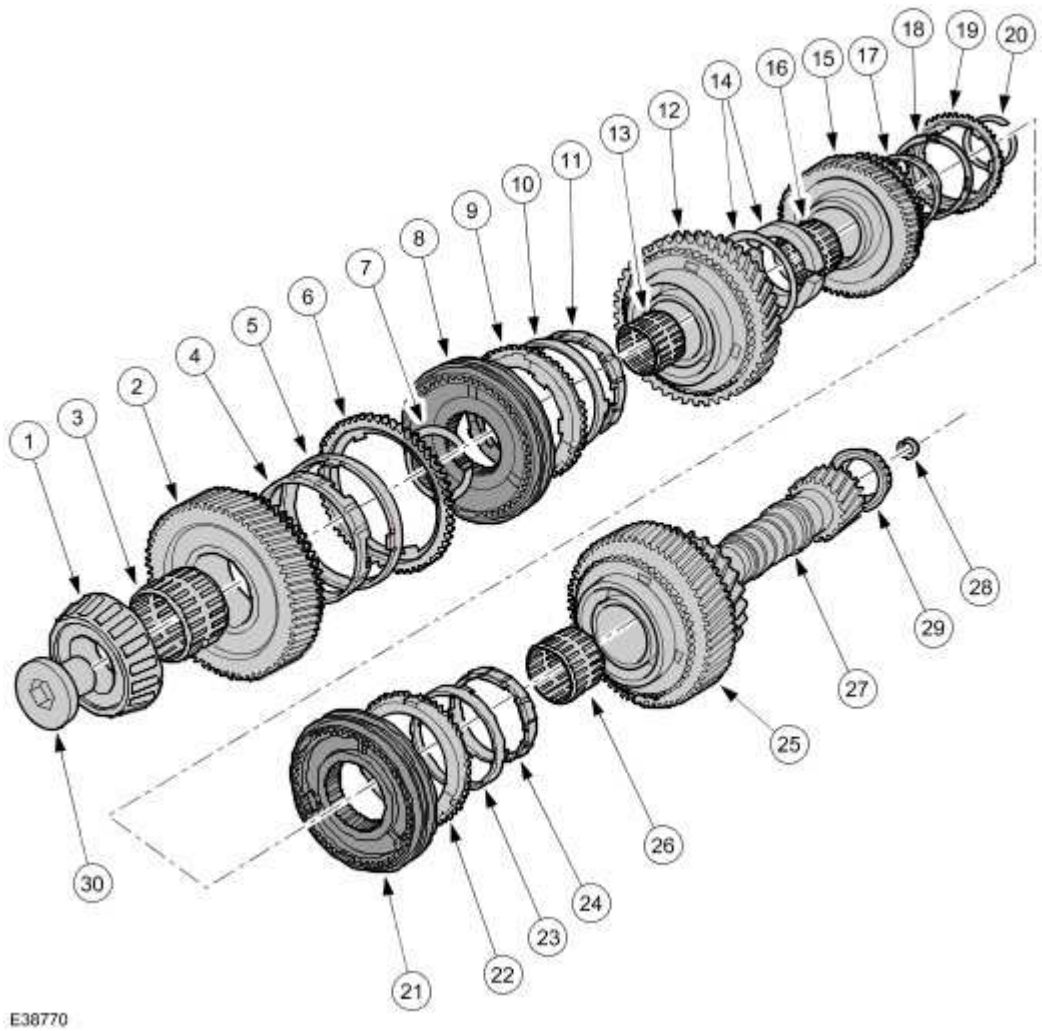
The output pinion of the 1st/4th gear output shaft is an integral part of the shaft.

The synchroniser assemblies of the 1st/2nd and the 3rd/4th gears are located on the output shaft.

The 1st to 4th gear output shaft is a hollow shaft; the oil is supplied to the internal oilways via oil funnels.

Internal oilways provide lubrication to the needle roller bearings and the synchroniser assemblies.



Item	Part Number	Description
1	-	Transmission housing taper roller bearing
2	-	4th gear wheel
3	-	Needle bearing
4	-	Inner synchroniser ring
5	-	4th gear synchronizer cone
6	-	Outer synchronizer ring (4th gear)
7	-	Snap ring
8	-	3rd/4th gear synchronizer
9	-	Outer synchronizer ring (3rd gear)
10	-	3rd gear synchronizer cone
11	-	Inner synchroniser ring
	-	

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12		3rd gear wheel
	13 -	Needle bearing
14	-	Stop disc unit
15	-	2nd gear wheel
16	-	Needle bearing
17	-	Inner synchroniser ring
18	-	2nd gear synchronizer cone
19	-	Outer synchronizer ring (2nd gear)
20	-	Snap ring
21	-	1st/2nd gear synchronizer
22	-	Outer synchronizer ring (1st gear)
23	-	1st gear synchronizer cone
24	-	Inner synchroniser ring
25	-	1st gear wheel
26	-	Needle bearing
27	-	Output shaft 1st/4th gear
28	-	Oil storage ring (until 10/2005)
29	-	Clutch housing taper roller bearing
30	-	Bearing retaining bolt (left-hand thread)

Output shaft 5th/6th/reverse gear

The 5th/6th/reverse gear output shaft runs on tapered roller bearings.

This bearing arrangement requires the shaft to be preloaded. Please refer to the service literature for further information on how to measure the pre-load.

The output pinion is an integral part of the shaft.

The 5th/6th and reverse gear synchronizer assemblies are located on the shaft.

The 5th/6th/reverse gear output shaft is a hollow shaft; the oil is supplied to the internal oilways via oil funnels.

Internal oil passages provide lubrication to the needle roller bearings and the synchronizer assemblies.

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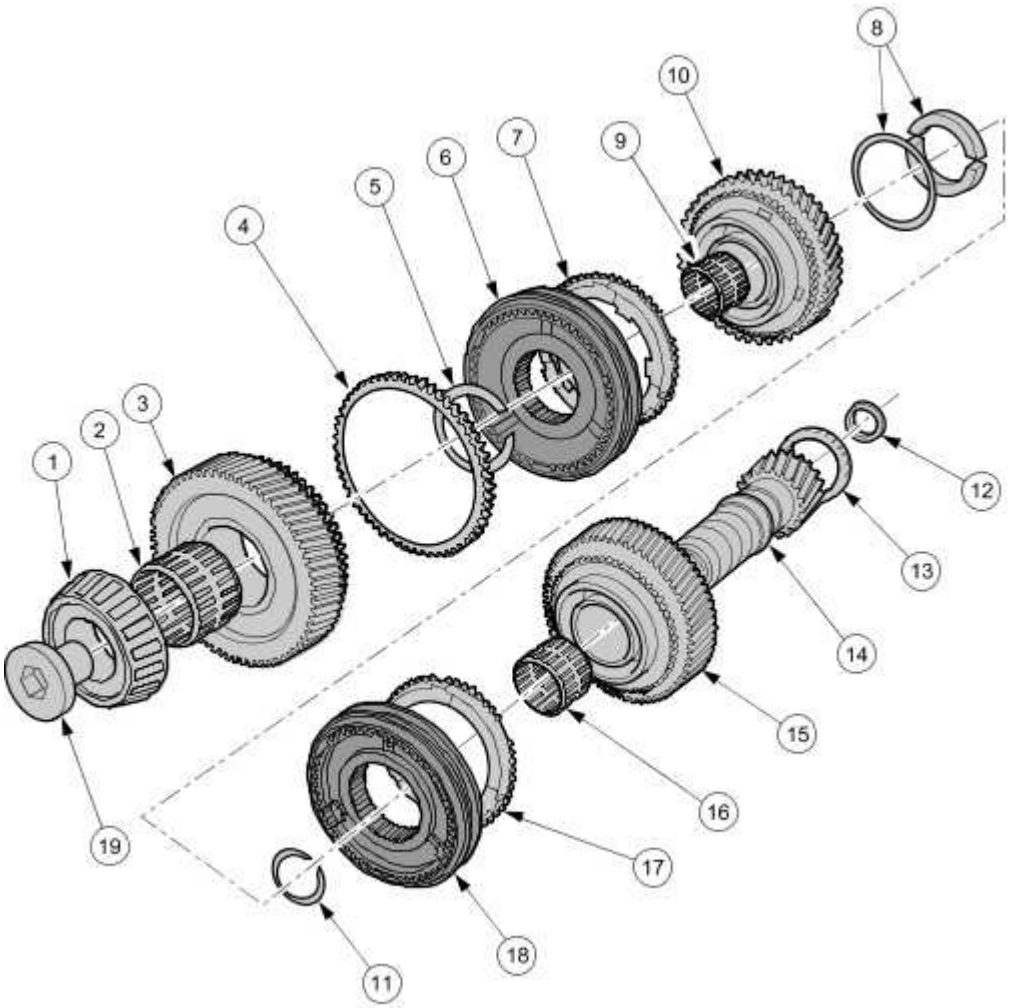

E38769

Item	Part Number	Description
1	-	Transmission housing taper roller bearing
2	-	Needle bearing
3	-	6th gear wheel
4	-	6th gear synchronizer ring
5	-	Snap ring
6	-	5th/6th gear synchronizer
7	-	Synchronizer ring (5th gear)
8	-	Stop disc unit
9	-	Needle bearing
10	-	5th gear wheel
11	-	Snap ring
12	-	Oil storage ring (until 10/2005)
13	-	Clutch housing taper roller bearing
14	-	Output shaft 5th/6th/reverse gear
15	-	Reverse gear wheel
16	-	Needle bearing
17	-	Reverse gear synchronizer ring
18	-	Reverse gear synchronizer
	-	

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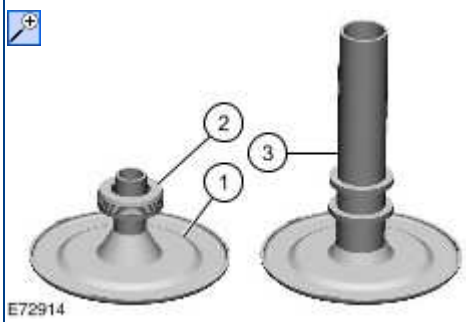
19		Bearing retaining bolt (left-hand thread)

Oil funnel and oil storage ring

Until 10/2005 an oil storage ring was installed on the clutch side in each of the two output shafts.

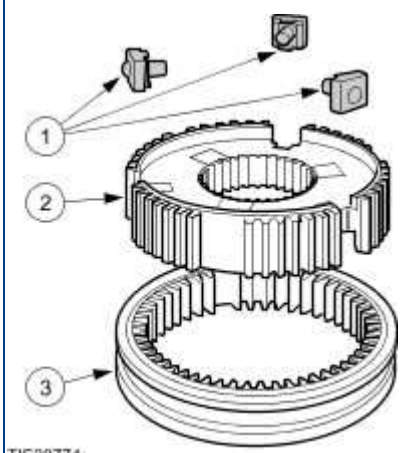


E72914

Item	Part Number	Description
1	-	Oil funnel until 10/2005
2	-	Oil storage ring until 10/2005
3	-	Oil funnel from 11/2005

When installing a new oil funnel, from 11/2005 onwards, an oil storage ring is no longer permitted, as this could lead to a loss of transmission fluid pressure in the output shaft and therefore to a loss of lubrication.

Synchroniser assembly



TIE38774

Item	Part Number	Description
1	-	Sliding block assembly
2	-	Synchroniser hub
3	-	Sliding collar

The (MMT6) synchroniser assemblies have been reworked for the 6-speed manual transmission.

The detent balls, springs and sliding blocks form one unit.

This arrangement makes it easier to service the synchroniser assembly.

Differential

Because the Vehicle Speed Sensor (VSS) is discontinued, so is the sender wheel.

The ABS wheel speed sensors send the current wheel speed to the powertrain control module (PCM).

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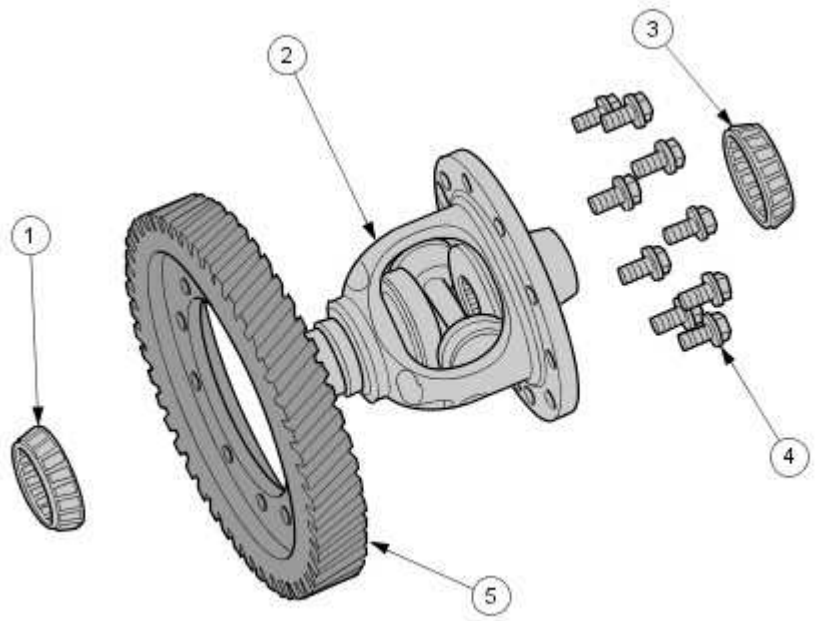
The differential has taper roller bearings.

This bearing arrangement requires the shaft to be preloaded. Please refer to the service literature for further information on how to measure the pre-load.



E38773

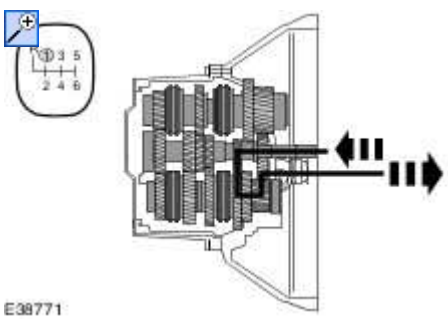
Item	Part Number	Description
1	-	Transmission housing taper roller bearing
2	-	Differential
3	-	Clutch housing taper roller bearing
4	-	Crown wheel bolts
5	-	Crown wheel

Power transmission in the individual gears

The following diagrams show a schematic representation of the power flow.

Power is transmitted via the non-positive gear pair to the output pinion of the output shaft (s) and thus to the differential ring gear.

NOTE: The three shafts are shown away from their real positions for clarity.
Power transmission route in 1st gear



E38771

The 1st gear wheel is positively connected to the 1st to 4th gear output shaft by the 1st/2nd gear synchroniser assembly.

Power transmission route in second gear

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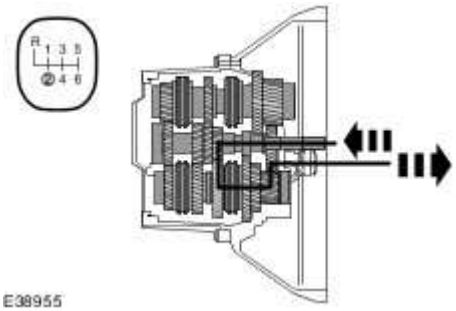
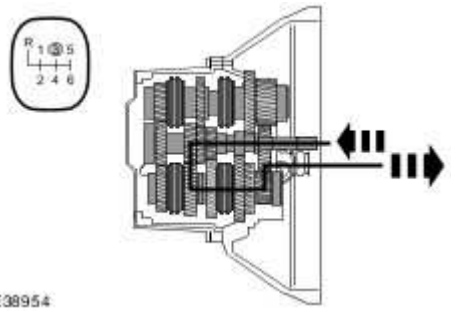


E38955

The 2nd gear wheel is positively connected to the 1st to 4th gear output shaft by the 1st/2nd gear synchroniser assembly.

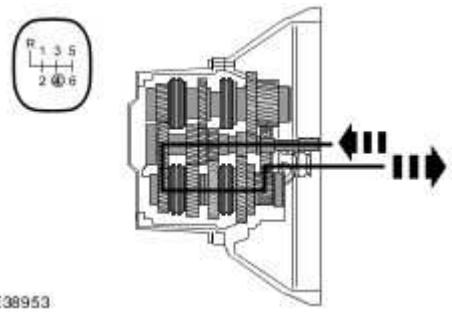
Power transmission route in 3rd gear



E38954

The 3rd gear wheel is positively connected to the 1st to 4th gear output shaft by the 3rd/4th gear synchroniser assembly.

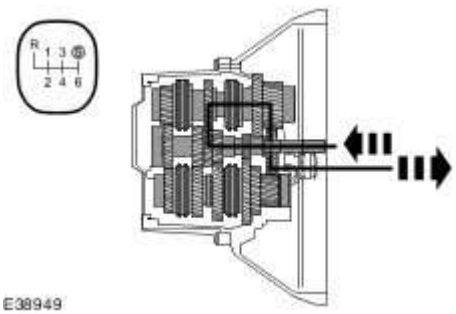
Power transmission route in 4th gear



E38953

The 4th gear wheel is positively connected to the 1st to 4th gear output shaft by the 3rd/4th gear synchroniser assembly.

Power transmission route in 5th gear



E38949

The 5th gear wheel is positively connected to the 5th/6th/reverse gear output shaft by the 5th/6th gear synchroniser assembly.

Power transmission route in 6th gear

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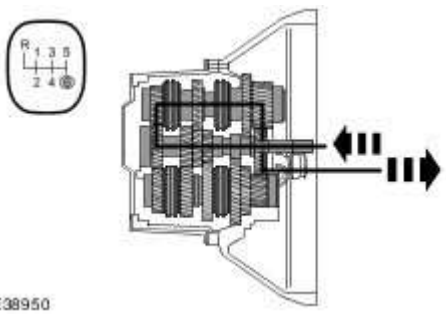
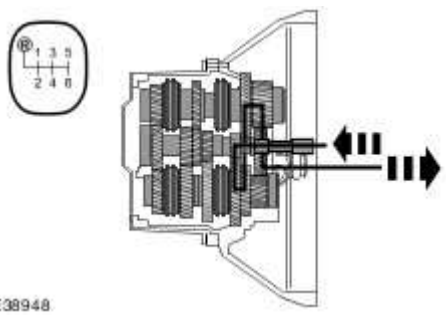


E38950

The gear wheel of the 4th/6th gear drives not only the gear wheel of the 4th gear but also of the 6th gear.

The 6th gear wheel is positively connected to the 5th/6th/reverse gear output shaft by the 5th/6th gear synchroniser assembly.

Power transmission route in reverse gear



E38948

The reverse gear idler is welded to the 1st gear wheel. It is constantly engaged with the reverse gear wheel (shown separated for clarity).

The reverse gear wheel is positively connected to the 5th/6th/reverse gear output shaft by the reverse gear synchroniser assembly.

Internal shift mechanism

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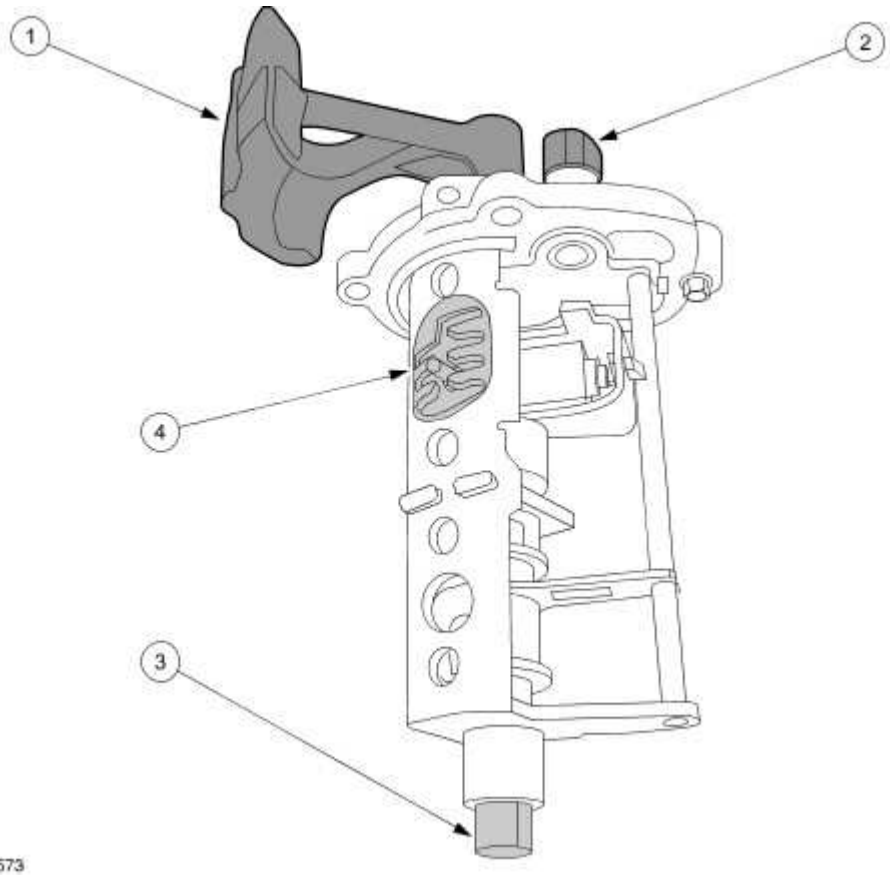

TIE38573

Item	Part Number	Description
1	-	Counterbalance
2	-	Reverse gear switch
3	-	Selector shaft
4	-	Selector gate

Internal shift mechanism

The internal shift mechanism has been newly developed for this transmission.

The reverse gear switch is located on the housing cover of the internal shift mechanism.

The counterbalance improves the smoothness of the gear shifting. Due to its mass, the synchronization shift resistances that can be felt during shifting are reduced. The gear shifting process becomes smoother.

The internal shift mechanism can only be changed as a complete unit in service.

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Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6 - Manual Transaxle—Vehicles With: Manual Transaxle	S-MAX/Galaxy 2006.5 (02/2006-)

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Diagnosis and Testing

REFER to: Manual Transaxle and Clutch (308-00 Manual Transmission/Transaxle and Clutch - General Information, Diagnosis and Testing).

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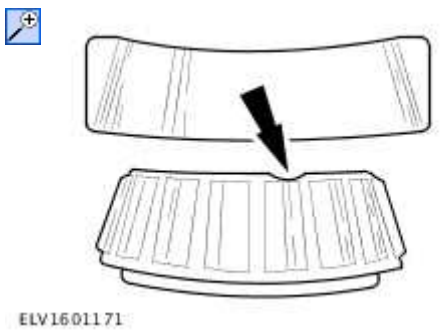
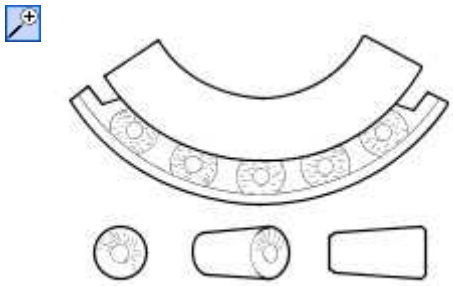
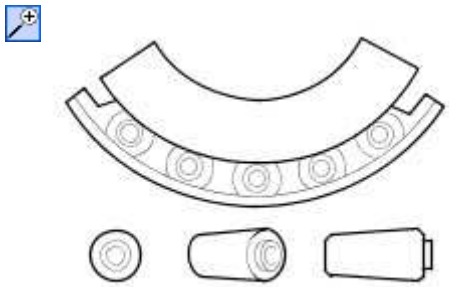
General Procedures


ELV1601171

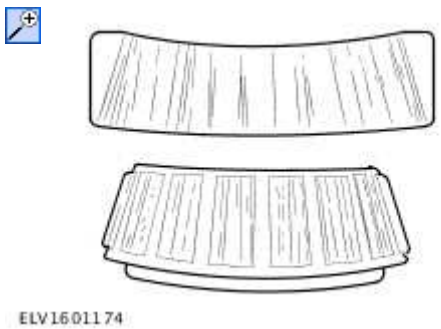
1. NOTE: Establish the cause of the damage and resolve it.
   - Check whether the bearing cage is damaged at the top, side or at the openings due to unprofessional use of a special tool or use of the wrong tool.
   - Install a new bearing if necessary.


ELV1601172

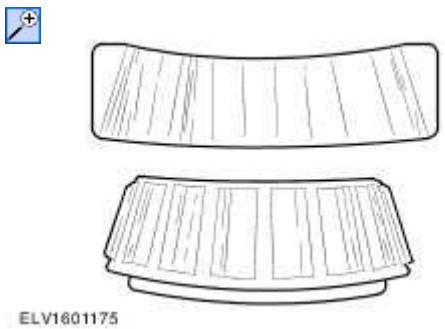
2.
   - Check whether the ends of the taper rollers are discolored as a result of inadequate lubrication or overheating, possibly through excessive pre-load.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601173

3.
   - Check whether the ends of the taper rollers are worn away due to incorrect installation, excessive pre-load or faulty bearing seating.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601174

4.
   - Check whether the bearing surfaces are gray or gray/black with deposits between the rollers.
   - Install a new bearing and new seals if necessary.
   - Check the bearing is correctly lubricated.


ELV1601175

5.
   - Check whether the bearing ring surfaces are grooved caused by static impact.
   - Install a new bearing if its surface is rough, or if it is noisy.

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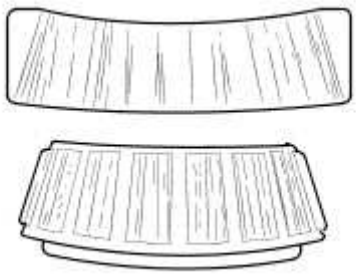
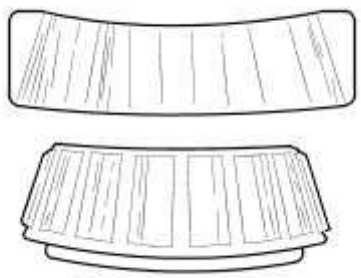


ELV1601174

6. NOTE: Overheating can cause loss of surface hardness.
   - Check for a dark blue colors caused by overheating (yellow or brown is normal) due to excessive pre-load or inadequate lubrication.
   - Install a new bearing, new seals and check other components as necessary.



ELV1601175

7.
   - Check the surfaces for abrasion due to metal fatigue.
   - Install a new bearing and clean all other affected components as necessary.

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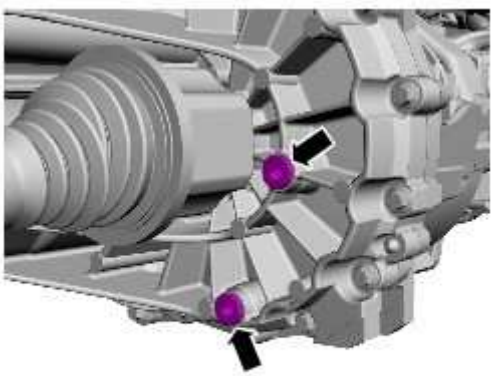
General Procedures

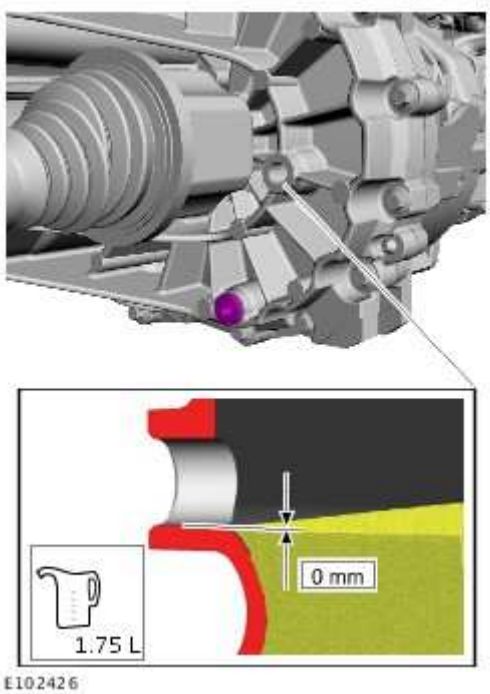
Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

1. Refer to: Allgemeine Informationen zur Service Literatur (100-00, Description and Operation).
2. 

E102726

3. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)
   Torque: 35 Nm



E102426

4. *Torque:* 35 Nm

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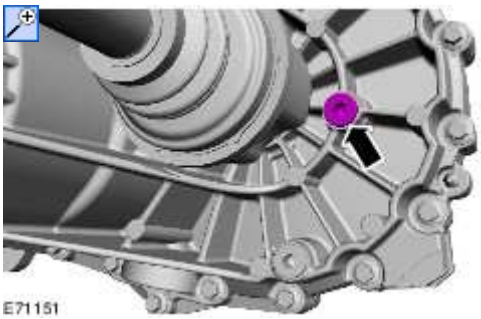

E71151

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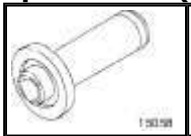
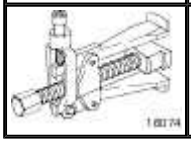
Removal and Installation

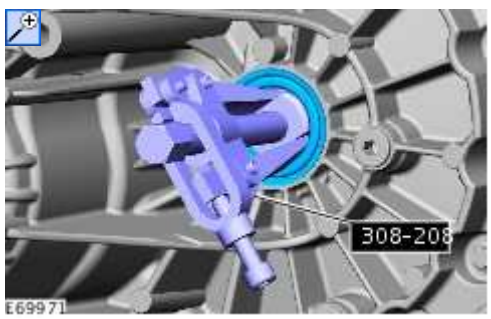
Special Tool(s)

	205-115 Installer, Drive Pinion Seal
	308-208 Remover, Halfshaft Seal

Removal

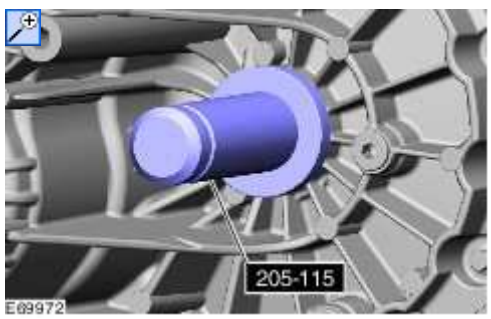
1. Remove the left-hand front driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).



2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 205-115

2. Install the left-hand front driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

3. Check the level of the transmission fluid.

   Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).
   Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).

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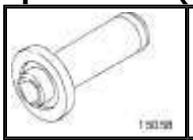
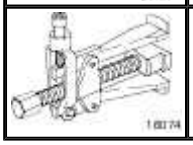
Removal and Installation

Special Tool(s)

	205-115 Installer, Drive Pinion Seal
	308-208 Remover, Halfshaft Seal

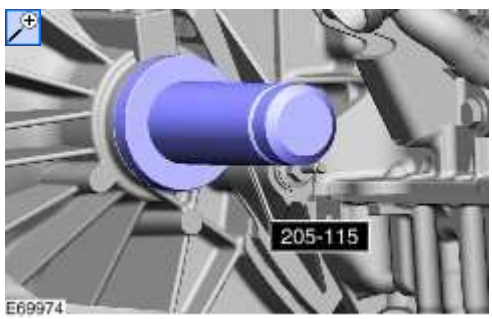
Removal

1. Remove the right-hand front driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 205-115

2. Install the right-hand front driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

3. Check the level of the transmission fluid.

   Refer to: Transmission Draining and Filling (308-03A Manual Transmission/Transaxle - Vehicles With: 5-Speed Manual Transaxle - MTX75, General Procedures).
   Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).

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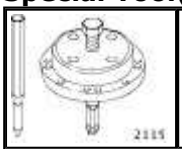
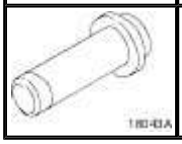
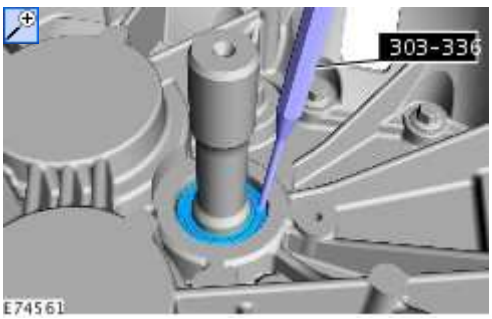
Removal and Installation

Special Tool(s)

	303-336 Remover, Crankshaft Rear Seal
	308-112 Installer, Output Drive Flange Seal

Removal

1. Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal).
   Refer to: Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, 2.0L Duratorq-TDCi (DW) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal).
   Refer to: Getriebe - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Abgasnorm: Abgasnormstufe V (308-03C, Removal).
2. Refer to: Clutch Slave Cylinder (308-02B Clutch Controls - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal and Installation).



3. CAUTION: Take special care to avoid damaging the bearing.
   Special Tool(s): 303-336

4.
   1. Self-cutting screw, 2.5 x 15 mm

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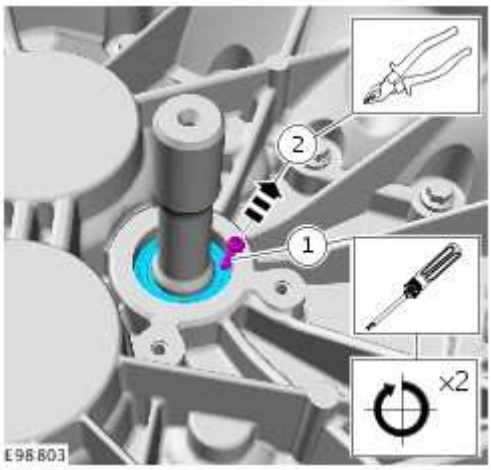
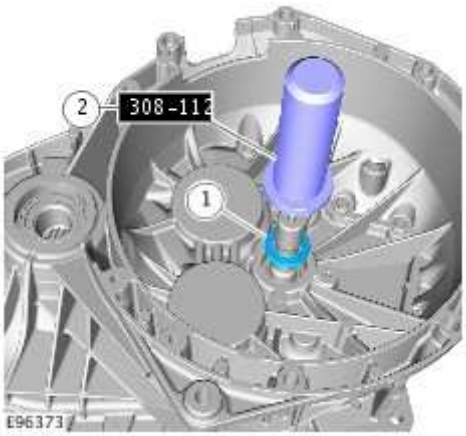


Installation



1.
    1. CAUTION: Apply adhesive tape to the splines on the shaft so that the oil seal does not become damaged.
    2. *Special Tool(s):* 308-112
2. Remove the adhesive tape from the input shaft splines.
3. Refer to: Clutch Slave Cylinder (308-02B Clutch Controls - Vehicles With: 6-Speed Manual Transaxle - MMT6, Removal and Installation).
4. Refer to: Transmission - 1.8L Duratorq-TDCi (Lynx) Diesel (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation).
   Refer to: Transmission - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, Installation).
   Refer to: Getriebe - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Abgasnorm: Abgasnormstufe V (308-03C, Installation).
5. Refer to: Kupplungssystem entlüften - Fahrzeuge ausgestattet mit 6-Gang Schaltgetriebe - M66 (308-00 Schaltgetriebe und Kupplung - Allgemeine Informationen, General Procedures).

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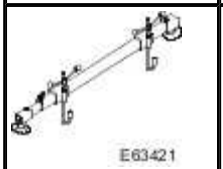
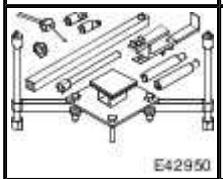
Removal

Special Tool(s)

	303-290-13 Adapter for 303-290A
	303-290B Support Bar, Engine
	303-290B-15 Zusatzstück für 303-290B
	303-290B-16 Adapter for 303-290B

General Equipment

Transmission jack

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the following items:
   1. Air Filtering

      Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
   2. Battery

      Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
3.

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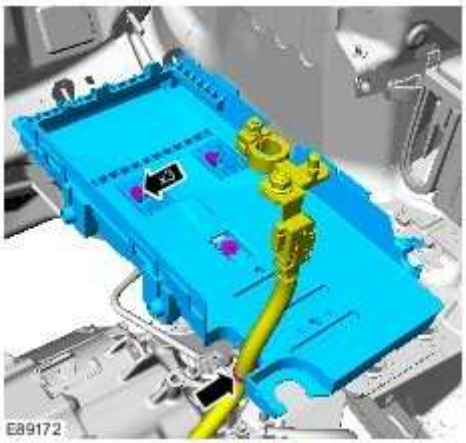
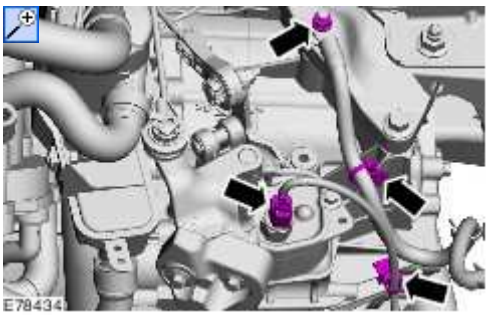
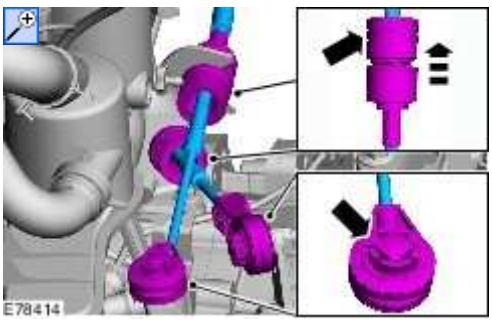
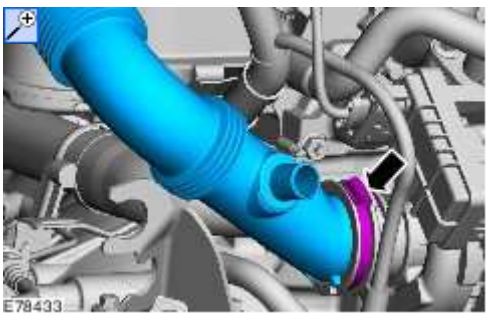




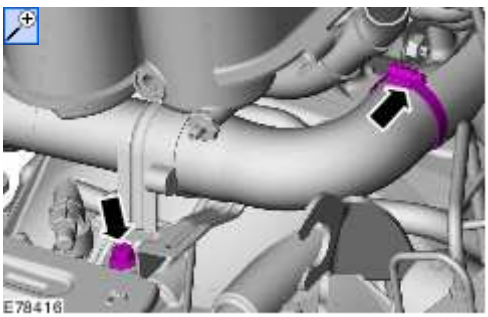
4.



5. CAUTION: The gearshift cables must not be kinked or twisted.



6.



7.

8. Remove the following items:
    1. Subframe

    Refer to: Front Subframe (502-00 Uni-

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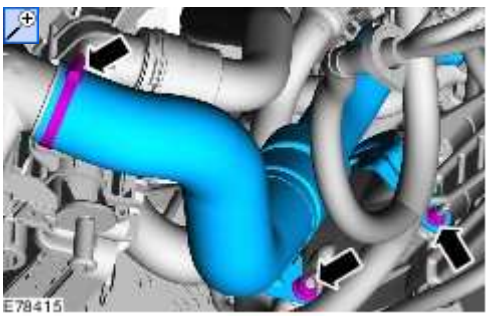
Body, Subframe and Mounting System, Removal and Installation).

2. Driveshafts

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

3. catalytic converter

   Refer to: Catalytic Converter (309-00D Exhaust System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



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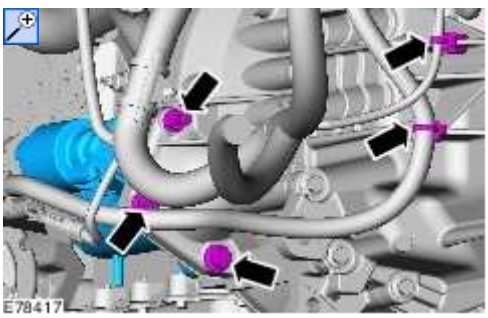
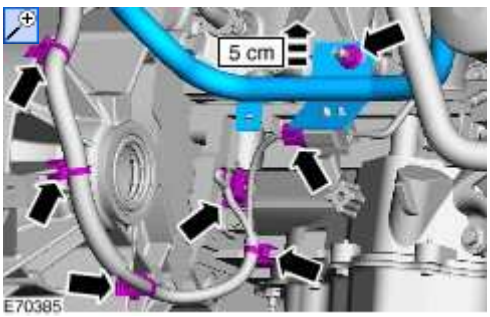


10. Detach the starter motor from the transmission and position it to one side.



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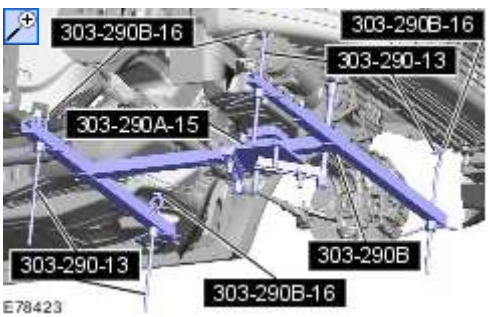

12. *Install the Special Tool(s):* 303-290B, 303-290-13, 303-290B-15, 303-290B-16

13. *Install the Special Tool(s):* 303-290B-15

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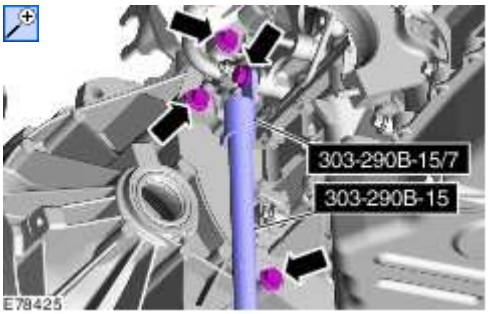
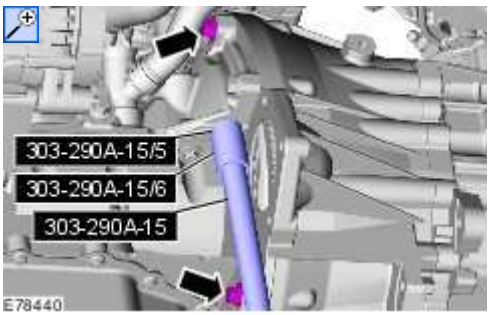
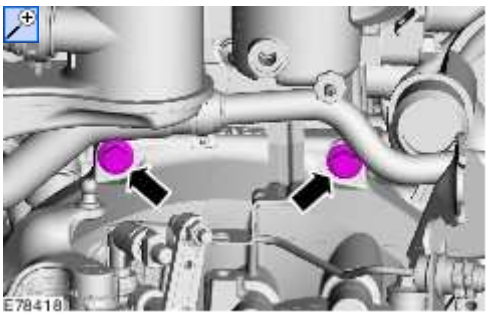


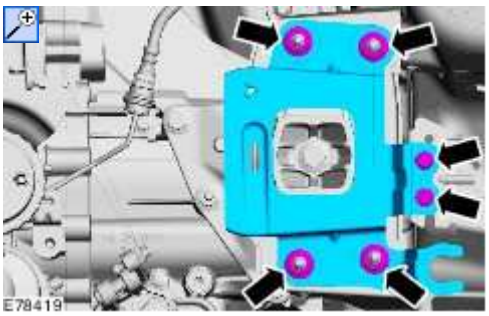
14. *Install the Special Tool(s):* 303-290B-15



15.



16.



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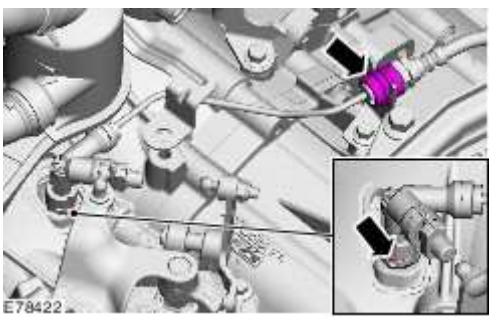

18. Discard the rear engine mounting bolt.

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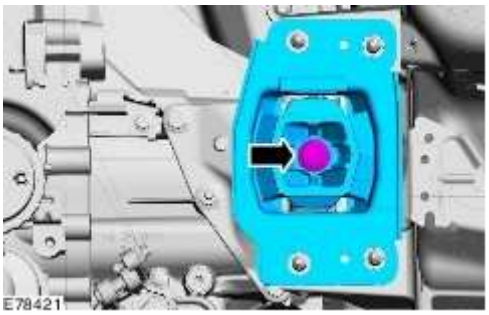
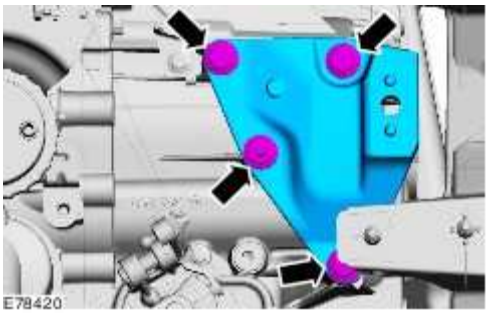
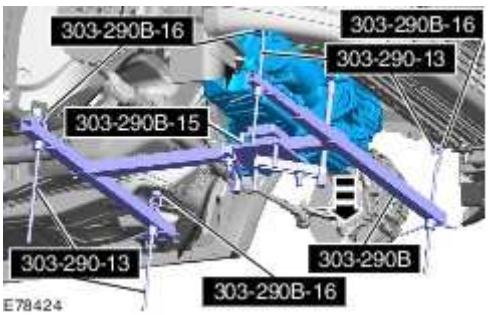
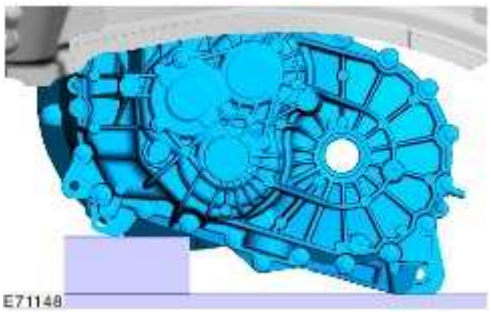




19.

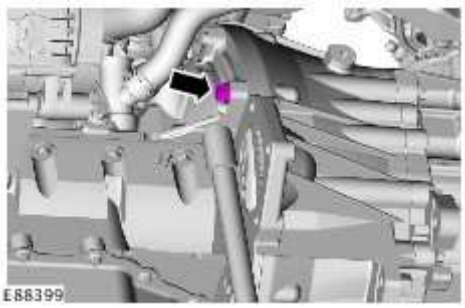


20. *Special Tool(s):* 303-290B, 303-290-13, 303-290B-15, 303-290B-16



21. Support the transmission with a wooden block and secure it to the transmission jack using a retaining strap.

General Equipment: Transmission jack



22.

23. Support the transmission using the transmission jack and remove.

General Equipment: Transmission jack

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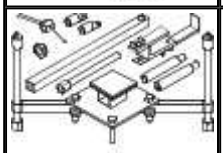
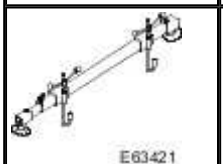
Removal

Special Tool(s)

	303-290-03A Adapter for 303-290A
	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
	303-290B Support Bar, Engine
	303-290B-16 Adapter for 303-290B

General Equipment

Transmission jack

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2.
3. Remove the following items:
   1. Air filter

      Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-

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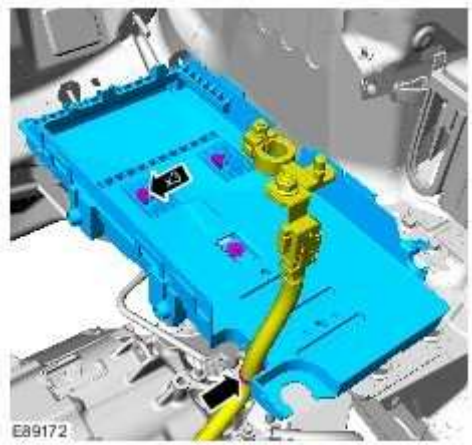
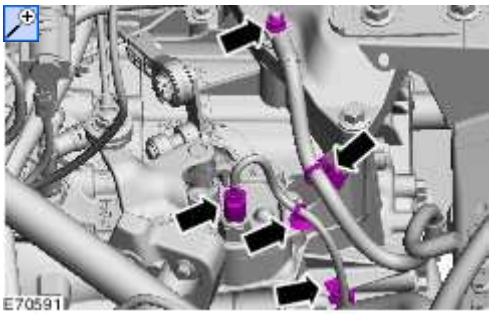
TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

2. Battery

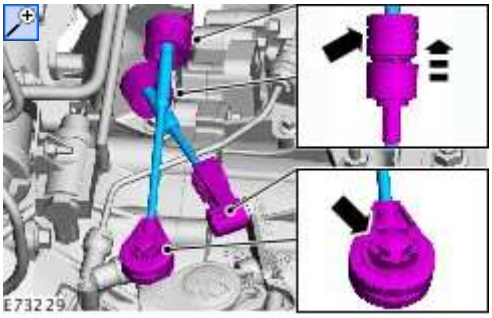
   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).



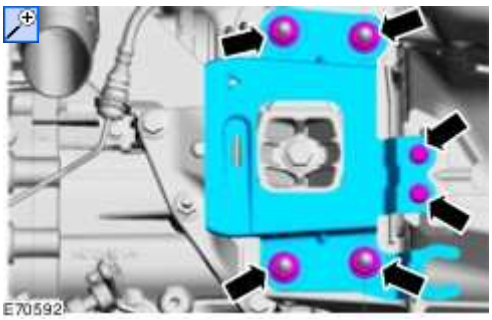
4.



5.



6. CAUTION: The gearshift cables must not be kinked or twisted.



7.

8.

- Detach the starter motor from the transmission and position it to one side.

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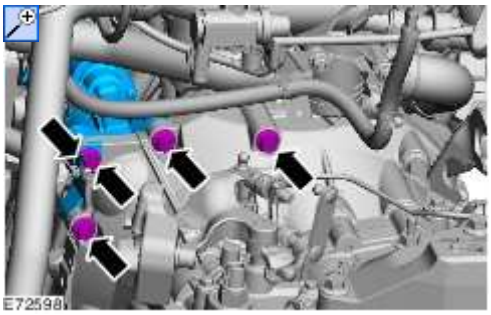
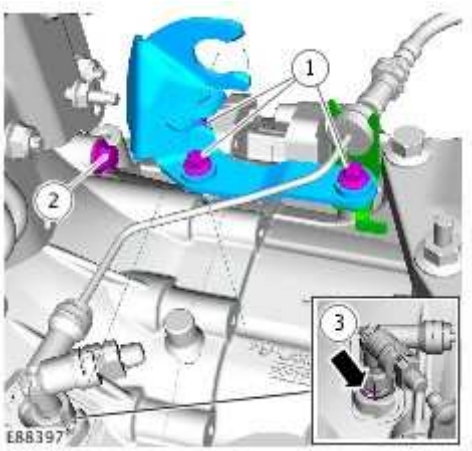
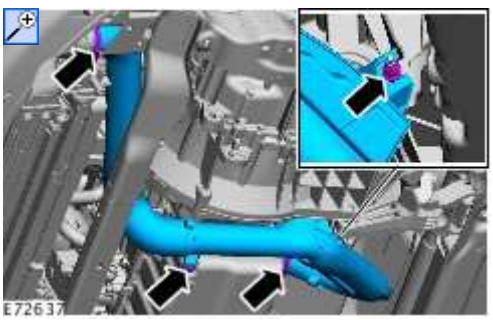


9.



10. Remove the sub-frame.

    Refer to: Front Subframe - 2.0L Duratorq-TDCi (118kW/160PS) - DW (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



11.

12. Remove the following items:
    1. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    2. Catalyst

       Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

13. *Install*

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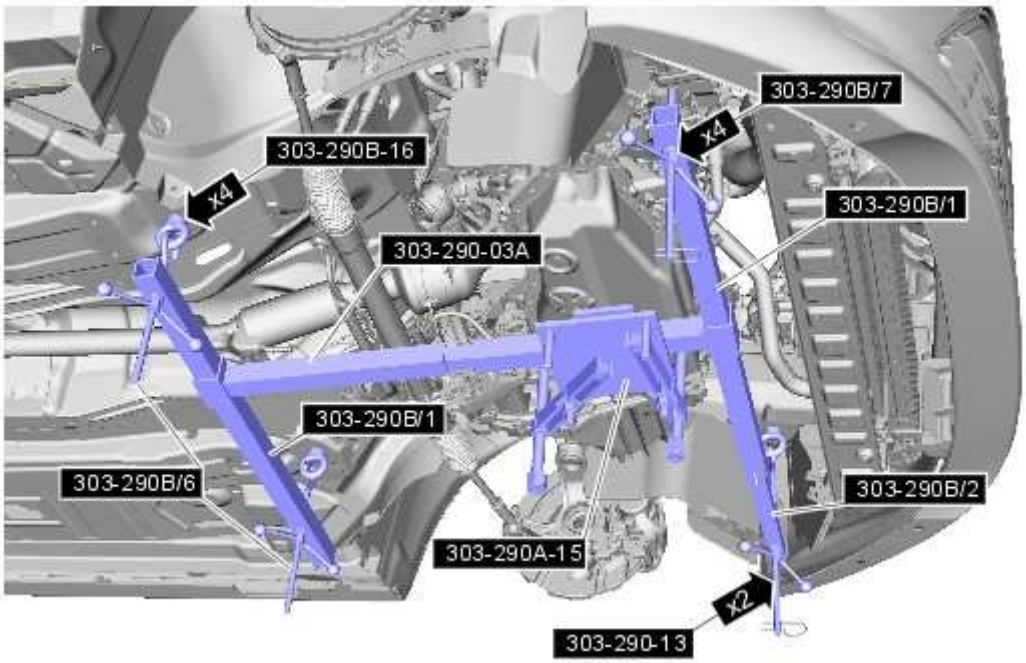
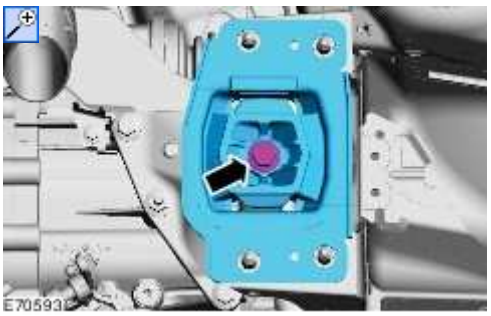


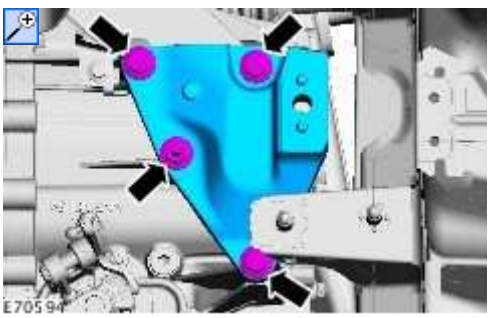
E127482

the Special Tool (s): 303-290B, 303-290-03A, 303-290-13, 303-290A-15, 303-290B-16



E70593

14.



E70594

15.

16. *Special Tool (s):* 303-290B

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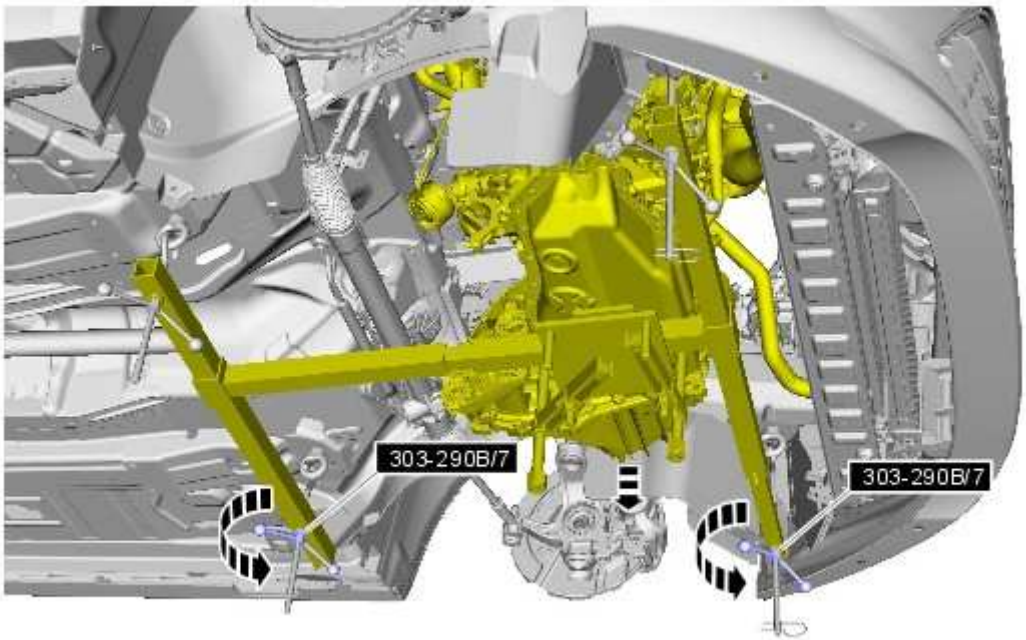
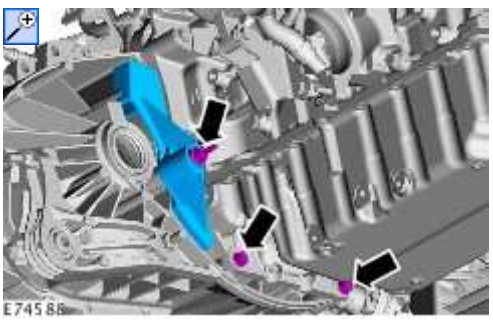
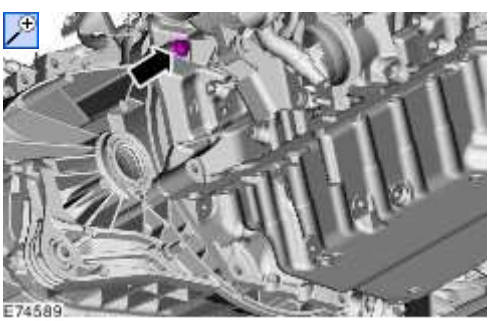


E127483



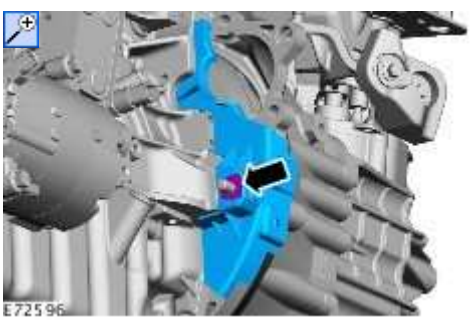
E74588

17.



E74589

18.



E72596

19.

20.

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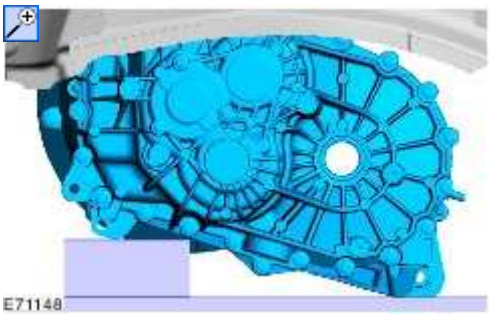

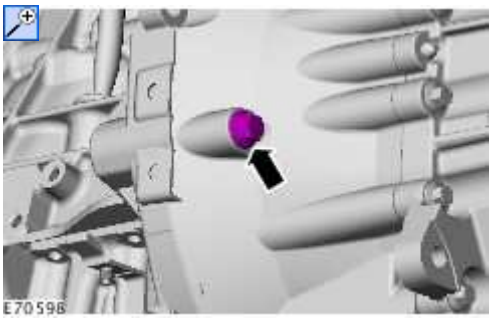

21.

22. Support the transmission using the transmission jack and remove.

General Equipment: Transmission jack

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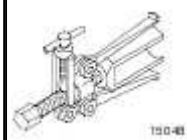
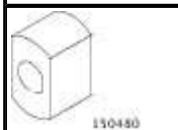
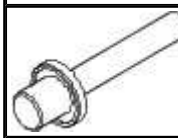
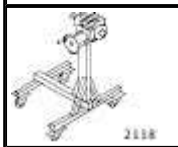
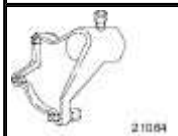
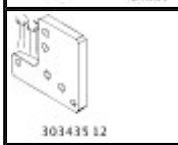
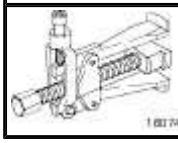
Disassembly

Special Tool(s)

	205-078 Remover, Drive Pinion Seal
	205-078-01 Adapter for 205-078 (Thrust Pad)
	205-080 Installer, Differential Bearing
	205-176 Remover, Differential Bearing Cone
	303-435 Mounting Stand
	303-435-04 Mounting Bracket for 303-435
	303-435-12A Mounting Plate for 303-435-04
	308-208 Remover, Halfshaft Seal

All vehicles

1.
   1. Mount transax on the mounti stand.

      Special Tool(s) 303-43 303-43 04, 30 435-12
   2. NOTE:

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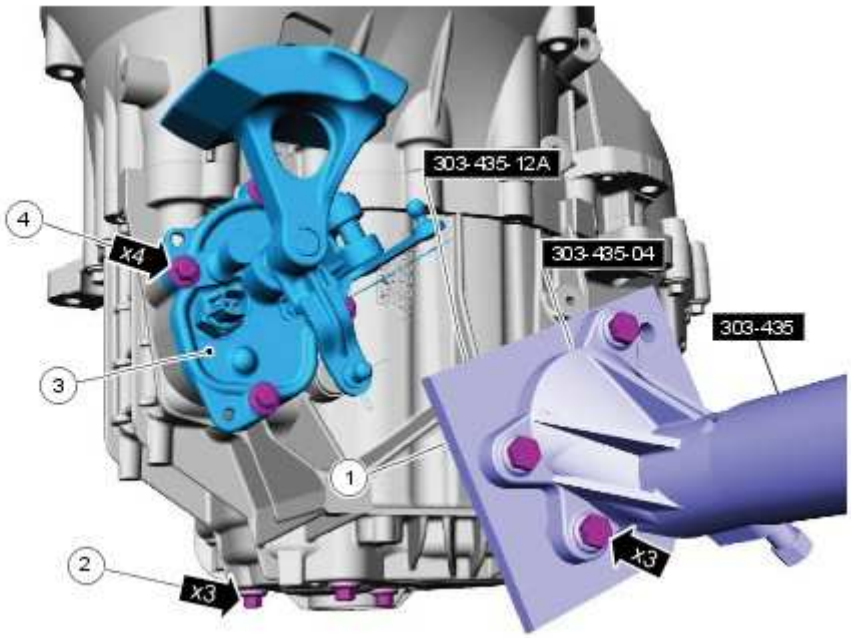
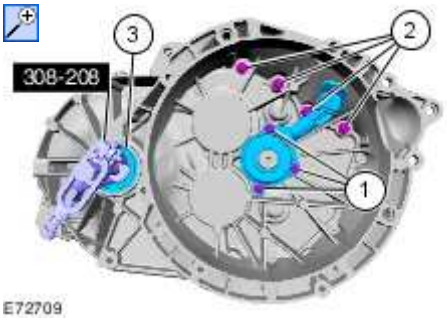


E72910

Use suitabl paper t absorb any escapi fluid.

Discarc input s bearing retaine bolts.

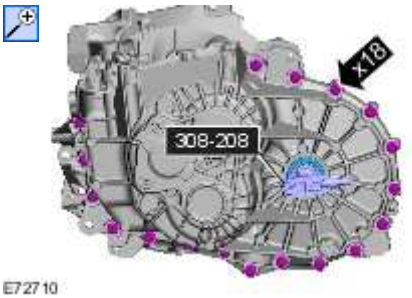
3. Shift th gearsh mecha to neut positio
4. Remov the gearsh linkage



E72709

2. Remove the following items:
   1. Remove the clutch slave cylinder. Check the clutch slave cylinder for damage or leaks.
   2. Transmission housing retaining bolts
   3. Discard the input shaft seal.

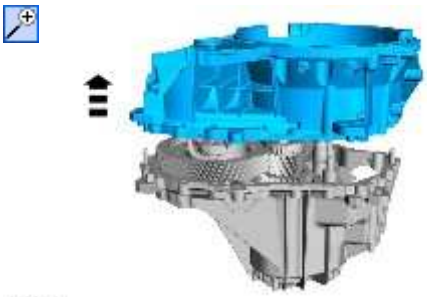
   Special Tool(s): 308-208



E72710

3. Discard the input shaft seal.

   Special Tool(s): 308-208


E73761

4. Ensure that the guide pins remain installed.

5.

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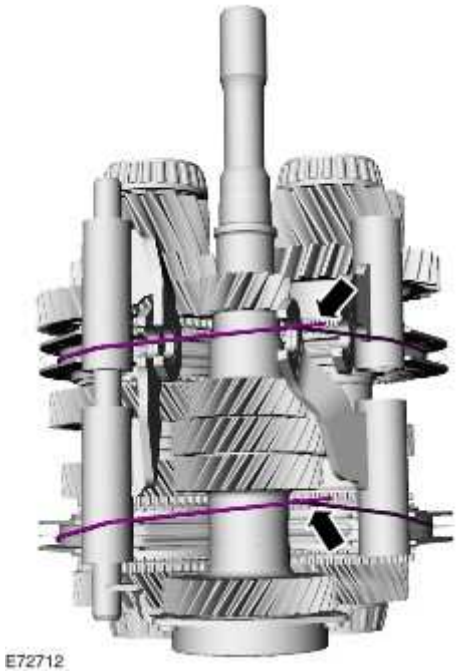
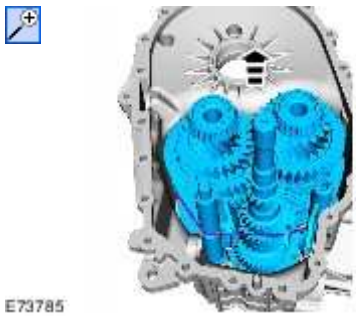
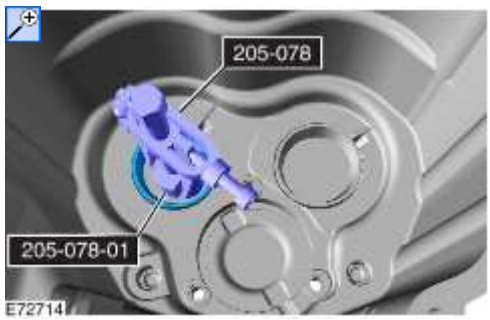
6.





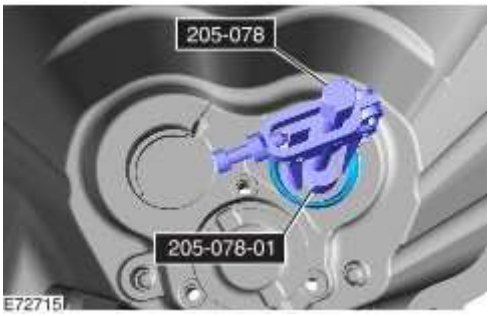
7.

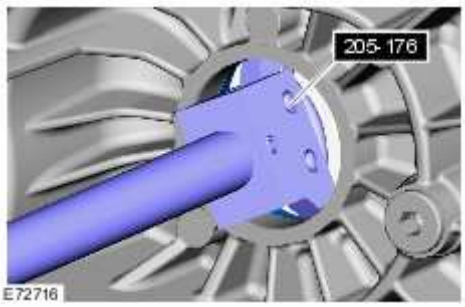


8. *Special Tool(s):* 205-078, 205-078-01

9. *Special Tool(s):* 205-078, 205-078-01

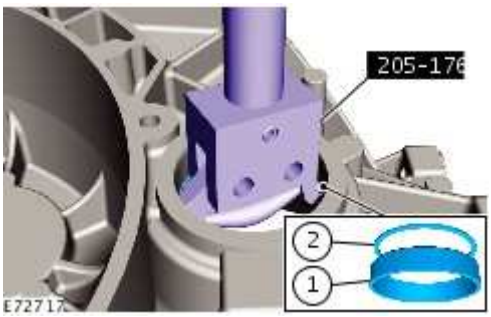
http://vnx.su





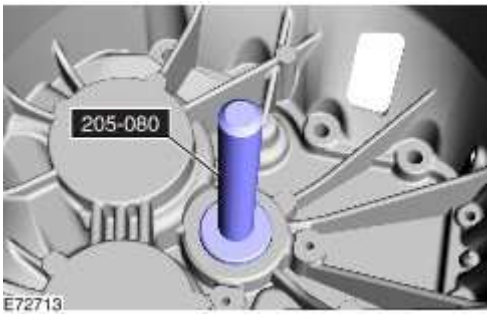
10. Remove the differential bearing outer race.

    Special Tool(s): 205-176



11. Remove the following items:
    1. Differential bearing outer race

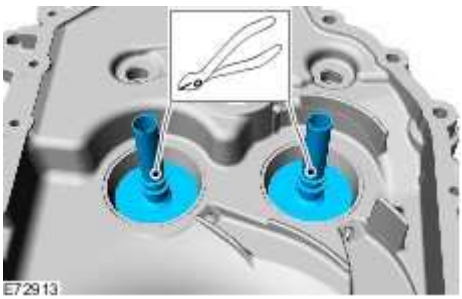
       Special Tool(s): 205-176
    2. Differential adjusting shim



12. Remove the following items:
    - Parallel roller bearing - input shaft

      Special Tool(s): 205-080
    - Discard the input shaft radial oil seal.

Vehicles built from 11/2005



13. Cut off the oil thrower.

All vehicles

14.
    1. Use a suitable socket wrench.
    2. Remove the output shaft bearing outer race.

       Special Tool(s): 205-078, 205-078-01

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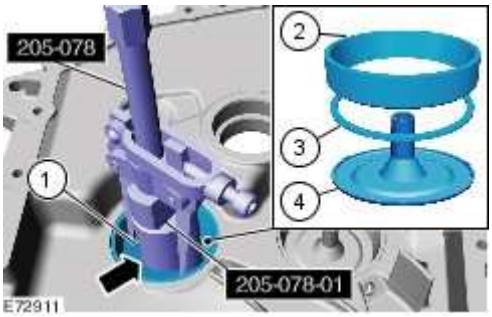
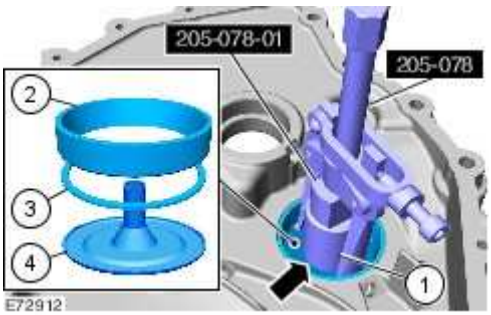


3. Remove the shim.
4. Discard the output shaft oil thrower.



15.

1. Use a suitable socket wrench.
2. Remove the output shaft bearing outer race.

Special Tool(s): 205-078, 205-078-01

3. Remove the shim.
4. Discard the output shaft oil thrower.

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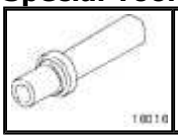
Disassembly and Assembly of Subassemblies

Special Tool(s)

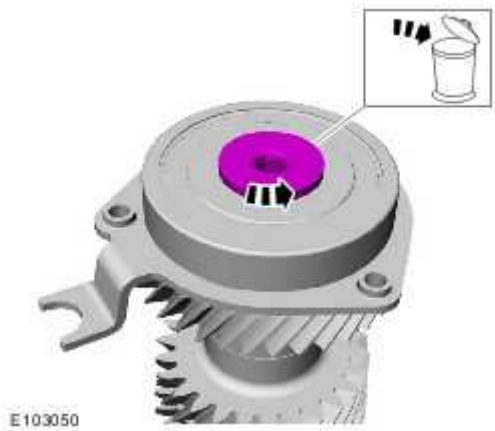
	308-046 Installer, Transmission Extension Housing Bushing/Seal

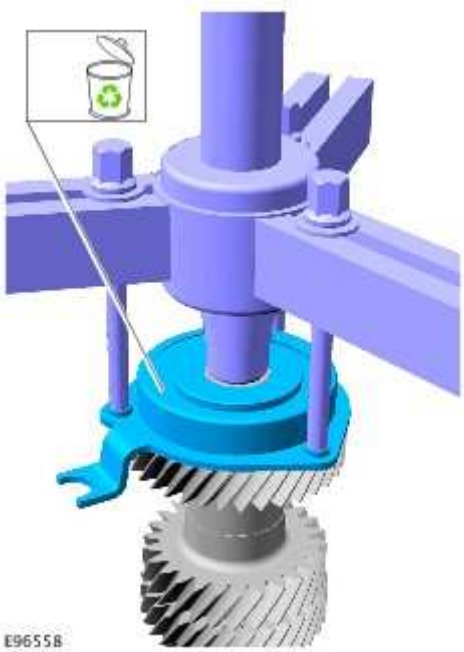
General Equipment

Bearing separator
Hydraulic press
Puller

Disassembly

CAUTION: Make sure vice jaw protectors are used.

1. Clamp the input shaft in a clamp.
2. 

3. *General Equipment:* Puller


4. *General Equipment:* Hydraulic press

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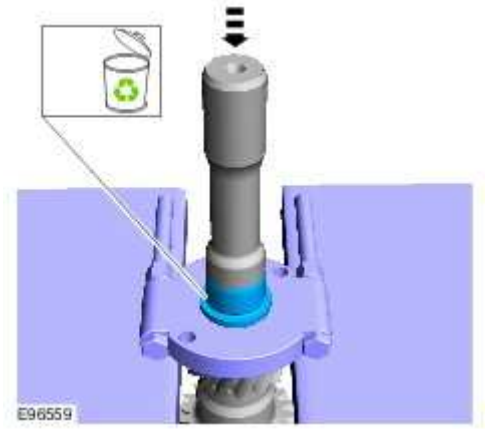
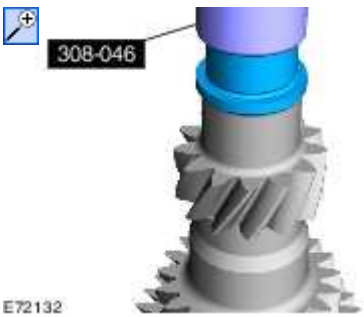


General Equipment: Bearing separator

Assembly



5. NOTE: Make sure a new component is installed.
   Special Tool(s): 308-046
   General Equipment: Hydraulic press

6. NOTE: Make sure a new component is installed.
   General Equipment: Hydraulic press

7. CAUTION: Make sure vice jaw protectors are used.
   Clamp the input shaft in a clamp.

8. CAUTION: Make sure that a new bolt is installed.
   NOTE: Make sure that the component is clean and free of foreign material.
   Torque: 100 Nm

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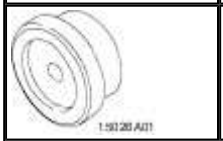
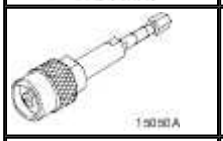
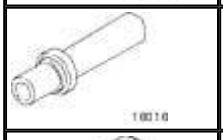
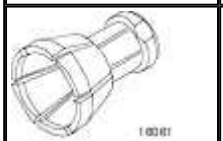
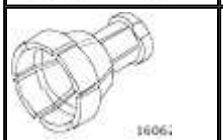
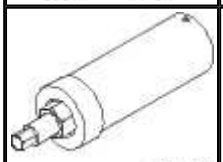
Disassembly and Assembly of Subassemblies

Special Tool(s)

	204-050 Installer, Front Wheel Hub Bearing Cup/Seal
	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-295 Remover, Bearing (Main Tool)
	308-046 Installer, Transmission Extension Housing Bushing/Seal
	308-196 Collet for 205-295
	308-197 Collet for 205-295
	308-604 Installer, Output Drive Flange Seal

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Hot air gun

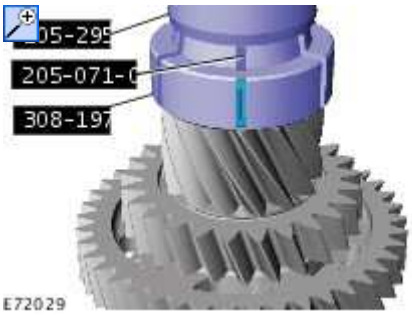
Disassembly

CAUTION: Make sure vice jaw protectors are used.

All vehicles

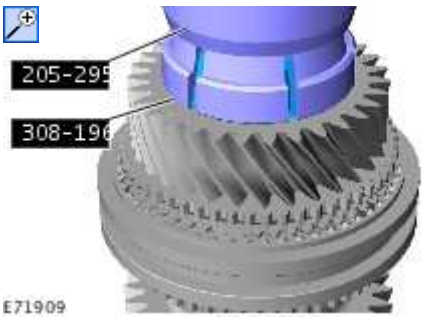
1. Clamp the output shaft in the vice.
2. *Special Tool(s):* 205-071-01, 205-295, 308-197

http://vnx.su



3. NOTE: Left-hand thread
   Heat the transmission-side taper roller bearing retaining bolt to approx. 90 °C using a hot air gun and discard.

   General Equipment: Hot air gun

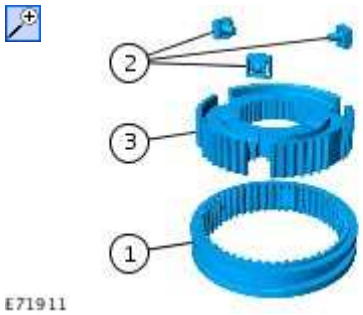


4. NOTE: Use a suitable washer as a thrust element.
   Special Tool(s): 205-295, 308-196

5. Discard the snap ring.

6. NOTE: Make a note of/mark the installed positions of the components before removal.
   1. Sliding collar
   2. Blocker bars
   3. Synchronizer hub

http://vnx.su

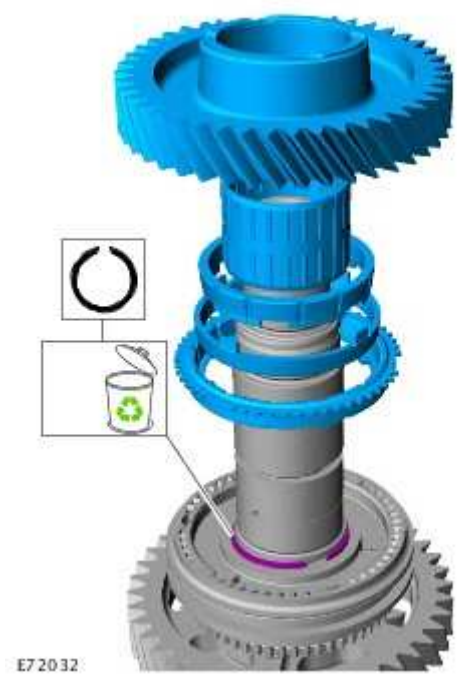


E71911

7.

E72031

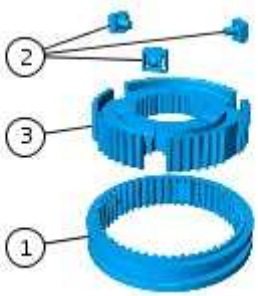
8. Discard the snap ring.


E72032

9.

http://vnx.su

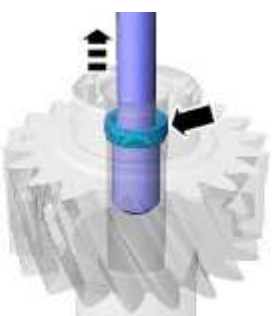
E72033



E71911

10. NOTE: Make a note of/mark the installed positions of the components before removal.
    1. Sliding collar
    2. Blocker bars
    3. Synchronizer hub

Vehicles built up to 10/2005 inclusive



E71915

11. This step is only necessary if the oil ring is damaged.

Vehicles built from 11/2005

12. Ensure that no oil ring is installed.

Assembly

All vehicles

CAUTION: Make sure vice jaw protectors are used.

13. Clamp the output shaft in the vice.
14. Coat all running surfaces with clean transmission fluid before assembly.

    Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

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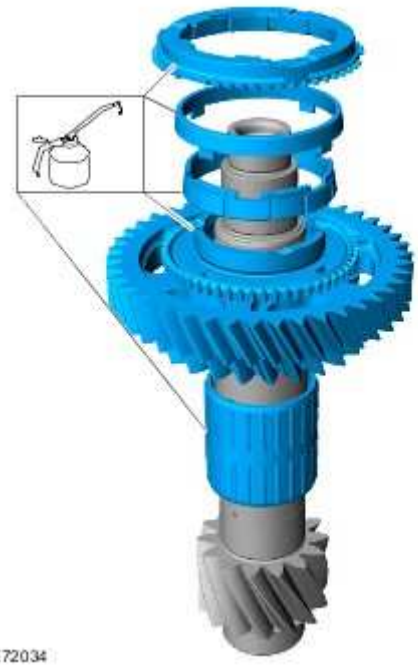
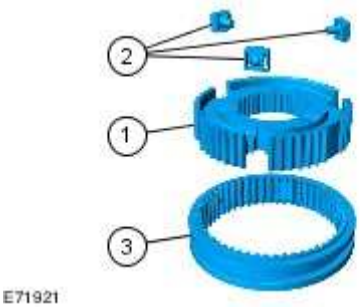
All vehicles

15. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)


E72034



E71921

16. NOTE: Make sure that the installation marks are aligned.
    1. Synchronizer hub
    2. Blocker bars
    3. Sliding collar

E72035

17. *Special Tool(s):* 308-604

18. Fit a new snap-ring.

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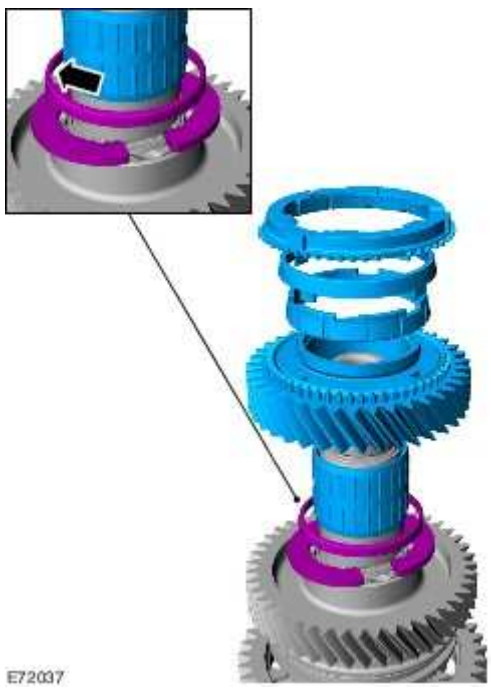
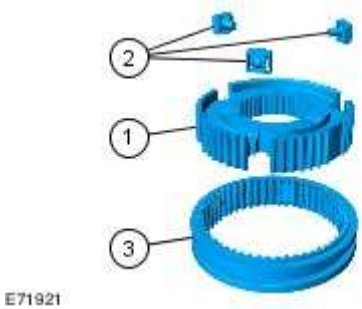
E72036


E72037

19. The collar on the retaining ring must face upward.

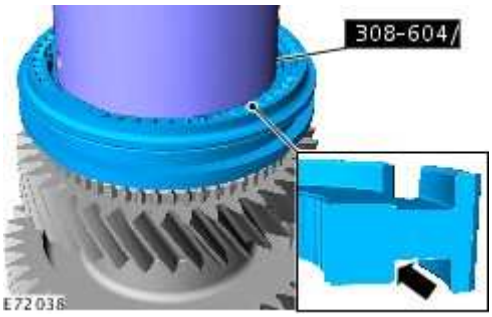


E71921

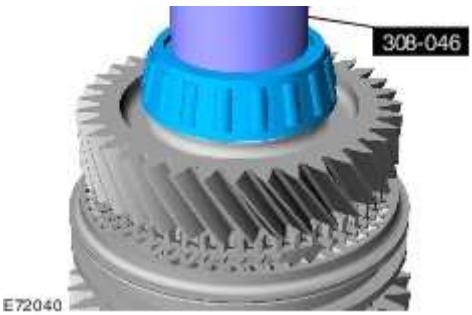
20. NOTE: Make sure that the installation marks are aligned.
    1. Synchronizer hub
    2. Blocker bars
    3. Sliding collar

21. *Special Tool(s):* 308-604

http://vnx.su



22. Fit a new snap-ring.



23. NOTE: Do not oil the taper roller bearing.
Install a new transmission-side taper roller bearing on the output shaft.

Special Tool(s): 308-046

24. CAUTION: Make sure that a new bolt is installed.
NOTE: Make sure that the component is clean and free of foreign material.
NOTE: Left-hand thread.
Torque: 100 Nm

25. NOTE: Do not oil the taper roller bearing.
Install a new clutch-side taper roller bearing on the output shaft.

Special Tool(s): 204-050

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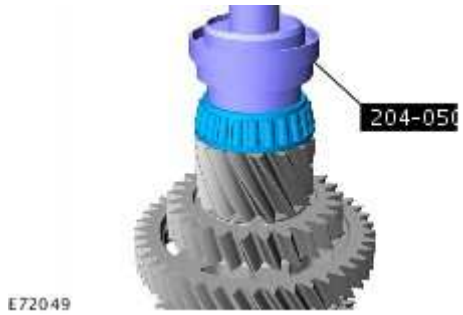

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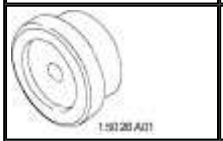
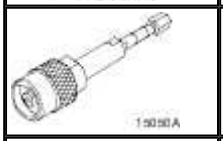
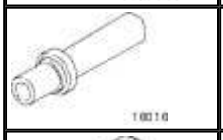
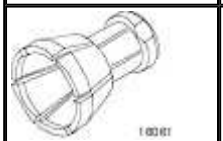
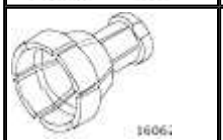
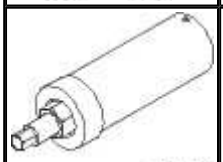
Print

Disassembly and Assembly of Subassemblies

Special Tool(s)

	204-050 Installer, Front Wheel Hub Bearing Cup/Seal
	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-295 Remover, Bearing (Main Tool)
	308-046 Installer, Transmission Extension Housing Bushing/Seal
	308-196 Collet for 205-295
	308-197 Collet for 205-295
	308-604 Installer, Output Drive Flange Seal

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Hot air gun

Disassembly

CAUTION: Use protective covers.

All vehicles

1. Clamp the output shaft in a vise.
2. *Special Tool(s):* 205-071-01, 205-295, 308-197

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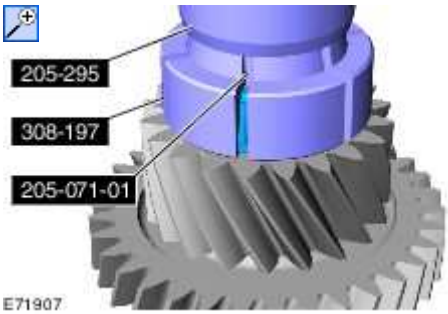
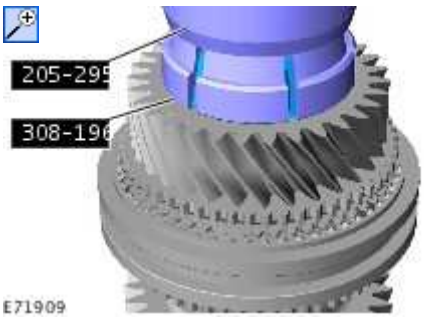


3. NOTE: Left-hand thread
   Heat the transmission-side taper roller bearing retaining bolt to approx. 90 °C using a hot air gun and discard.

   General Equipment: Hot air gun



4. NOTE: Use a suitable washer as a thrust element.
   Special Tool(s): 205-295, 308-196

5. Discard the snap ring.

6. NOTE: Make a note of/mark the installed positions of the components before removal.
   1. Sliding collar
   2. Blocker bar
   3. Synchronizer hub

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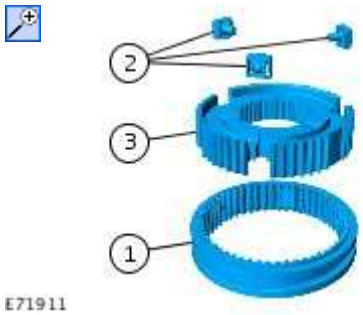


E71911

7. Discard the snap ring.

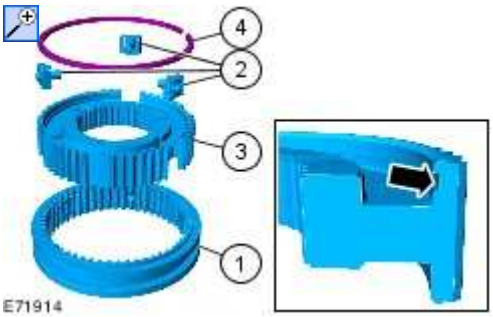
E71912

8.

E71913

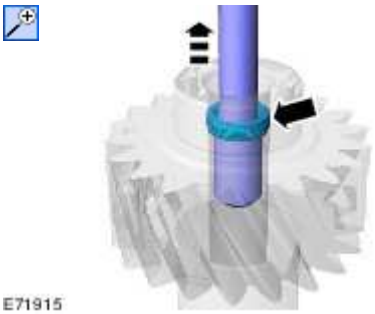
9. NOTE: Make a note of/mark the installed positions of the components before removal.
    1. Sliding collar
    2. Blocker bar
    3. Synchronizer hub
    4. Snap ring

http://vnx.su



Vehicles built up to 10/2005 inclusive

10. This step is only necessary if the oil ring is damaged.



Vehicles built from 11/2005

11. Ensure that no oil ring is installed.

Assembly

All vehicles

CAUTION: Use protective covers.

12. Clamp the output shaft in a vise.
13. Coat all running surfaces with clean transmission fluid before assembly.

    Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

All vehicles

14.

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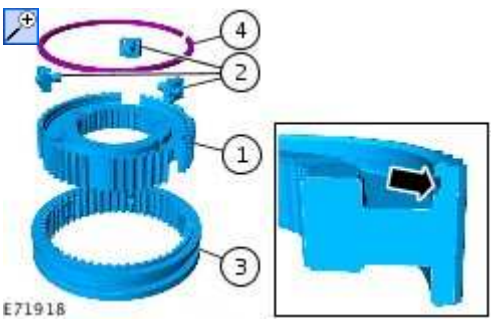
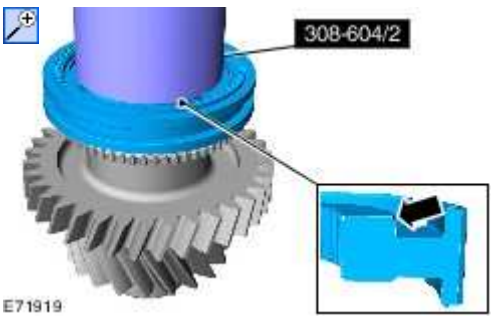
E71917



E71918

15. NOTE: Make sure that the installation marks are aligned.
    1. Synchronizer hub
    2. Blocker bar
    3. Sliding collar
    4. Snap ring



E71919

16. *Special Tool(s):* 308-604

17.
    - Fit a new snap ring.
    - The collar on the retaining ring must face upward.

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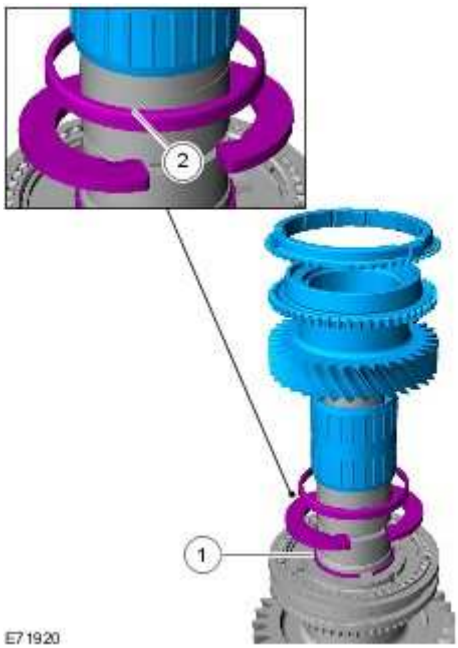
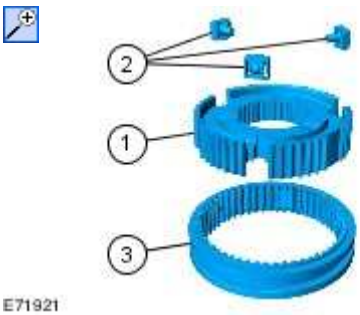
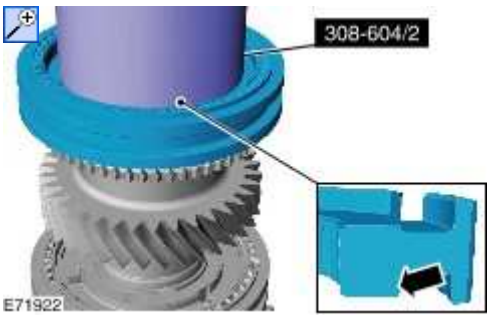


E71920



E71921

18. NOTE: Make sure that the installation marks are aligned.
    1. Synchronizer hub
    2. Blocker bar
    3. Sliding collar



E71922

19. *Special Tool(s):* 308-604

20. Fit a new snap ring.

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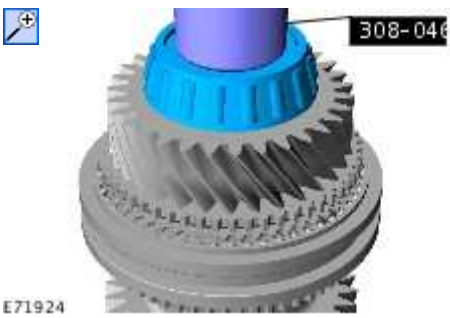
E71923



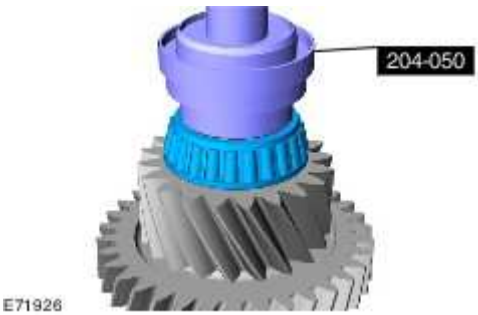
E71924

21. NOTE: Do not oil taper roller bearings.
Install a new transmission-side taper roller bearing on the output shaft.

Special Tool(s): 308-046

E71925

22. CAUTION: Make sure that a new bolt is installed.
NOTE: Make sure that the component is clean and free of foreign material.
NOTE: Left-hand thread.
Torque: 100 Nm



E71926

23. NOTE: Do not oil taper roller bearings.
Install a new clutch-side taper roller bearing on the output shaft.

Special Tool(s): 204-050

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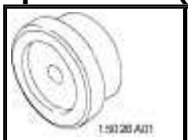
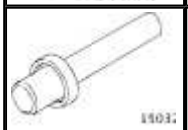
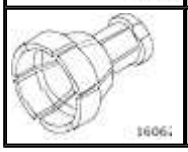
Print

Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-081 Installer, Differential Bearing
	205-295 Remover, Bearing (Main Tool)
	308-197 Collet for 205-295

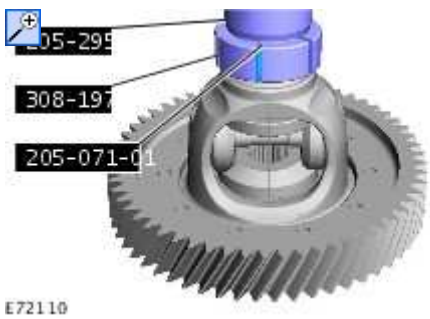
General Equipment

Hydraulic press

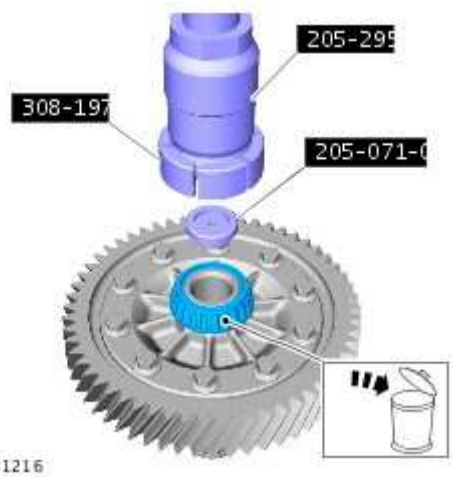
Disassembly

CAUTION: Make sure vice jaw protectors are used.

1. Clamp the differential in the vice.
2. *Special Tool(s):* 205-071-01, 205-295, 308-197



3. *Special Tool(s):* 205-071-01, 205-295, 308-197



4. Remove the following items:
   1. *Loosen:* Four turn(s)

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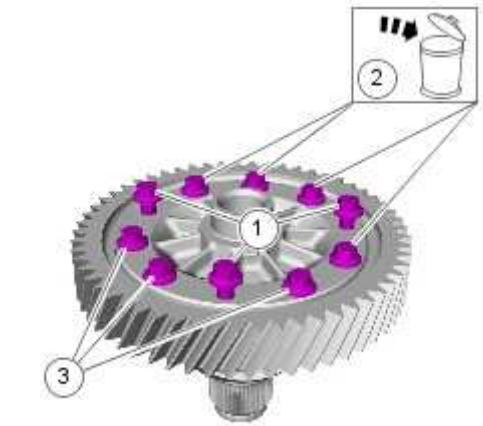
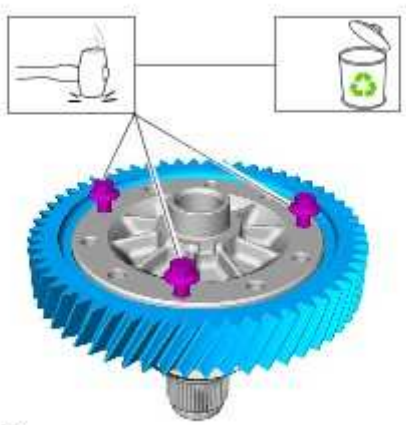


E101217

2.
3. Save three bolts for reassembly the ring gear.

5.


E101218

Assembly

CAUTION: Make sure vice jaw protectors are used.

6. Clamp the differential in the vice.
7. Install the three bolts saved during disassembly.

   Torque: 82 Nm

E101219

8.

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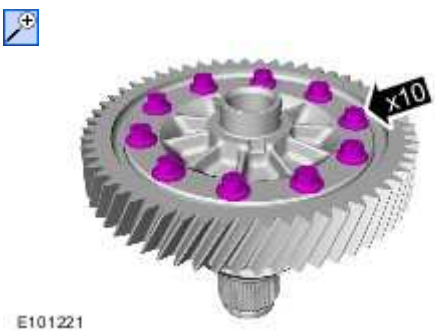
E101220



E101221

9. CAUTION: Make sure that new bolts are installed.
Torque: 82 Nm

E101215

10. NOTE: Make sure a new component is installed.
Do not oil the taper roller bearing.

Special Tool(s): 205-081
General Equipment: Hydraulic press

E72115

11. NOTE: Make sure a new component is installed.
Do not oil the taper roller bearing.

Special Tool(s): 205-081
General Equipment: Hydraulic press

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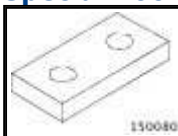
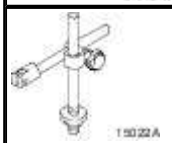
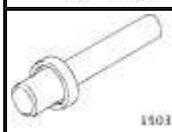
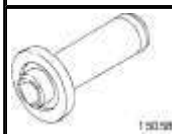
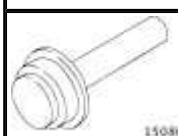
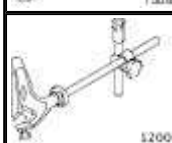
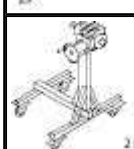
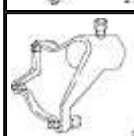
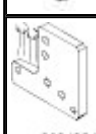
Assembly

Special Tool(s)

	205-044-01 Adapter for 205-044
	205-070 Holding Fixture, Dial Indicator Gauge
	205-081 Installer, Differential Bearing
	205-115 Installer, Drive Pinion Seal
	205-176 Remover, Differential Bearing Cone
	205-217 Installer, Rear Wheel Hub Bearing Cone/Seal
	205-296 Installer, Wheel Hub Bearing Cone/Seal
	206-003 Holding Fixture, Dial Indicator Gauge (Disc Brake)
	303-435 Mounting Stand
	303-435-04 Mounting Bracket for 303-435
	303-435-12A Mounting Plate for 303-435-04
	307-300-02 Depth Gauge, Shim Selection

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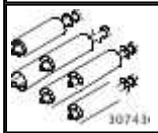
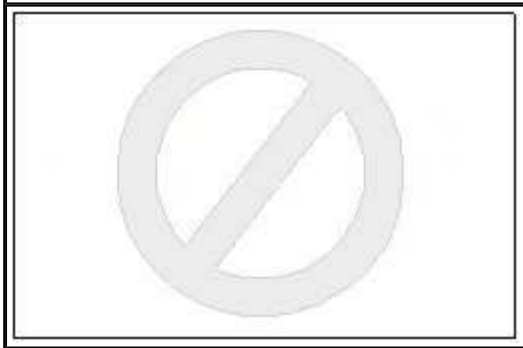
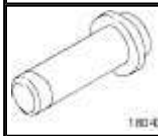
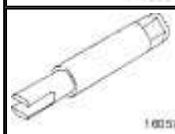
	307-300-03 Adapter for 307-300-02
	307-430 Gauge, Transmission End Play
	308-095 Installer, Input Shaft Bearing
	308-112 Installer, Output Drive Flange Seal
	308-192 Remover, Halfshaft
	308-603 Gauge, Differential/Transfer Gear Bearing Shim

Materials

Name	Specification
Flange Sealant - Anaerobic LR	WSK-M2G348-A5 / 2U7J-M2G348-AA

General Equipment

Hot air gun

NOTE: The transmission must cool to room temperature before performing measurer

All vehicles

1.
   1. Heat the transmission housing to approx. 90 ° a hot air gun.

      General Equipment: Hot air gun
   2. Insert the output shaft bearing outer race by h and after the transmission housing has cooled using the special tool.

      Special Tool(s): 205-217
2.
   1. Heat the transmission housing to approx. 90 ° a hot air gun.

      General Equipment: Hot air gun
   2. Insert the output shaft bearing outer race by h

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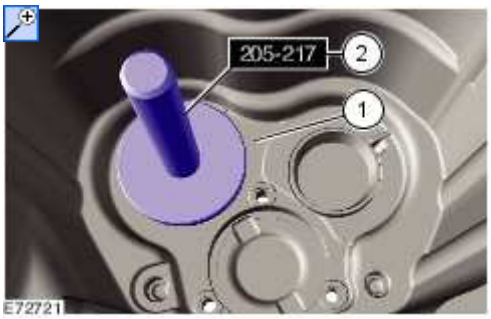


and after the transmission housing has cooled using the special tool.

Special Tool(s): 205-217

3.

1. Heat the transmission housing to approx. 90 ° a hot air gun.

   General Equipment: Hot air gun
2. Insert the differential bearing outer race by ha after the transmission housing has cooled, inst using the special tool.

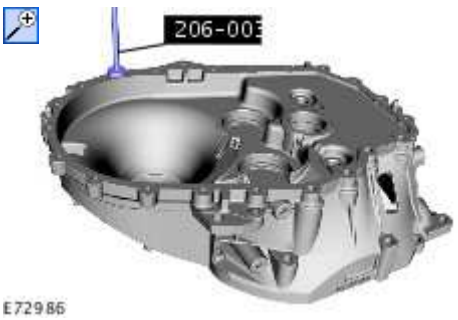
   Special Tool(s): 205-296

4.

1. Heat the clutch housing with a hot air gun to a 90°C.

   General Equipment: Hot air gun
2. Install a 1.10 mm measuring shim.
3. Insert the differential bearing outer race by ha after the clutch housing has cooled, install usi special tool.

   Special Tool(s): 205-296



5. *Special Tool(s):* 206-003

6. CAUTIONS:

   Take sp care to avoic damaging th bearing.

   Extreme cleanliness n be exercised handling the components.

   - Install output in the transm

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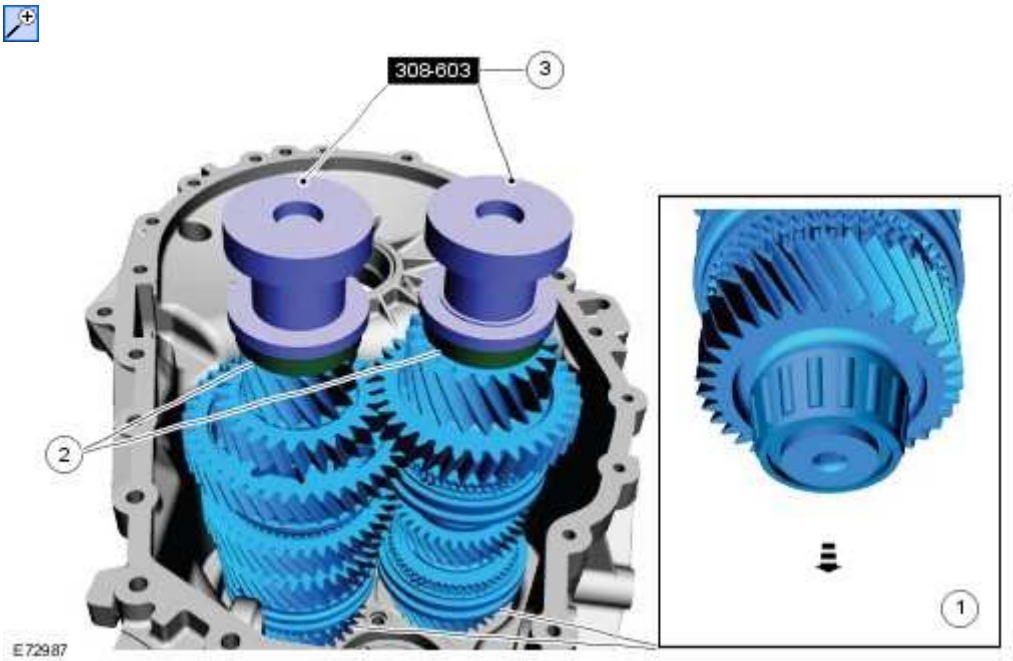
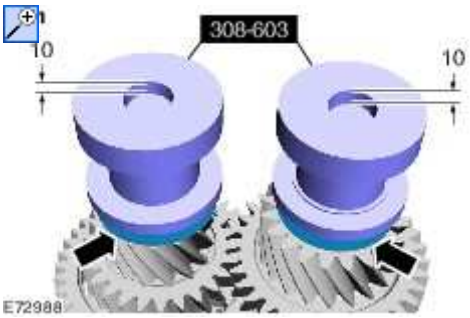


housing
togethe

*Special
(s):* 30

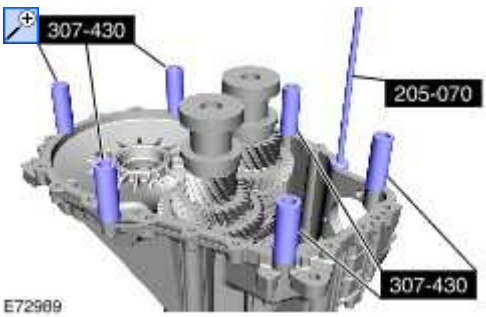
- Place t
bearing
races i
positio
output
tapere
bearing



7.

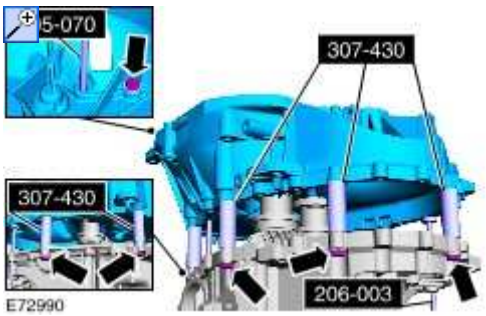
- Repeat this and the following four steps three
and determine the average values.
- Pull out the measuring rings to approx. 10 mm
- Hold the bearing outer races, turn the output
times while pressing down at the same time,
the bearings settle.

Special Tool(s): 308-603



8. NOTE: The mounting faces must be clean and free
foreign bodies.
Install the special tools.

Special Tool(s): 205-070, 307-430



9.

- Make certain that the clutch housing does not
skewed.
- Make certain that the special tools are inserte
correctly in the clutch housing bearing outer r
seats.
- Attach the clutch housing.

Special Tool(s): 205-070, 206-003, 307-430
Torque: 32 Nm

10.

- Make certain that the clutch housing does not
skewed.
- Detach the special tools.

Special Tool(s): 205-070, 206-003, 307-430

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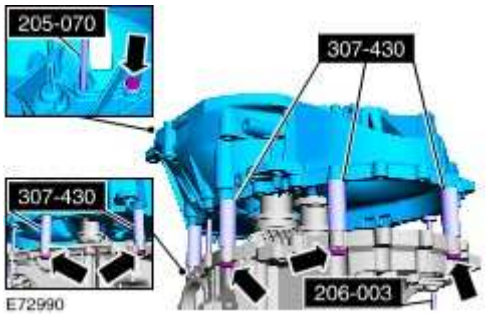
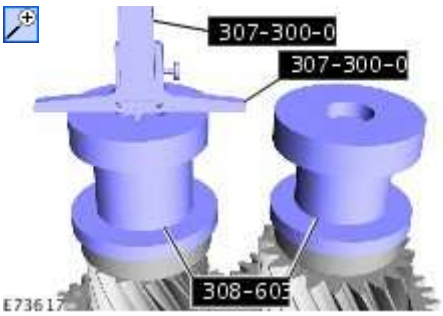




11.

- While taking the measurements, only press lig the special tool, to avoid incorrect readings.
- Record the measurement results.

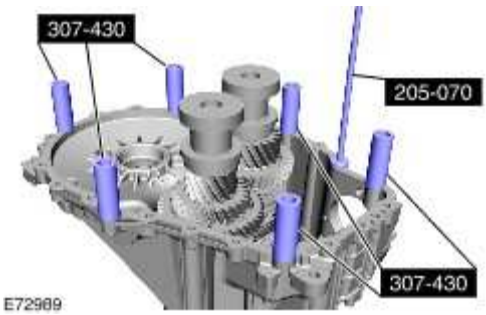
Special Tool(s): 307-300-02, 307-300-03, 308

12.

- Measure the required thickness of the 1st - 4t output shaft adjustment shim:
- Add the measured values, divide by three and add the value for the bearing pre-load.
- 1st - 4th gear output shaft bearing pre-load: 0 mm.
- Example: 1.56 mm +1.57 mm +1.55 mm, div 3 = 1.56 mm. 1.56 mm +0.17 mm = 1.73 mr
- Determined adjusting shim thickness: 1.73 mr

13.

- Measure the required thickness of the 5th/6th gear/reverse gear output shaft adjustment shi
- Add the measured values, divide by three and add the value for the bearing pre-load.
- Bearing pre-load - output shaft - 5th/6th/reve gear: 0.15 mm.
- Example: 1.51 mm + 1.52 mm + 1.50 mm, di by 3 = 1.51 mm. 1.51 mm + 0.15 mm = 1.66
- Determined adjusting shim thickness: 1.66 mr



14. Remove the special tools.

Special Tool(s): 205-070, 307-430

15. Remove the f items:
    1. *Special (s):* 30
    2. Output bearing races
    3. Output

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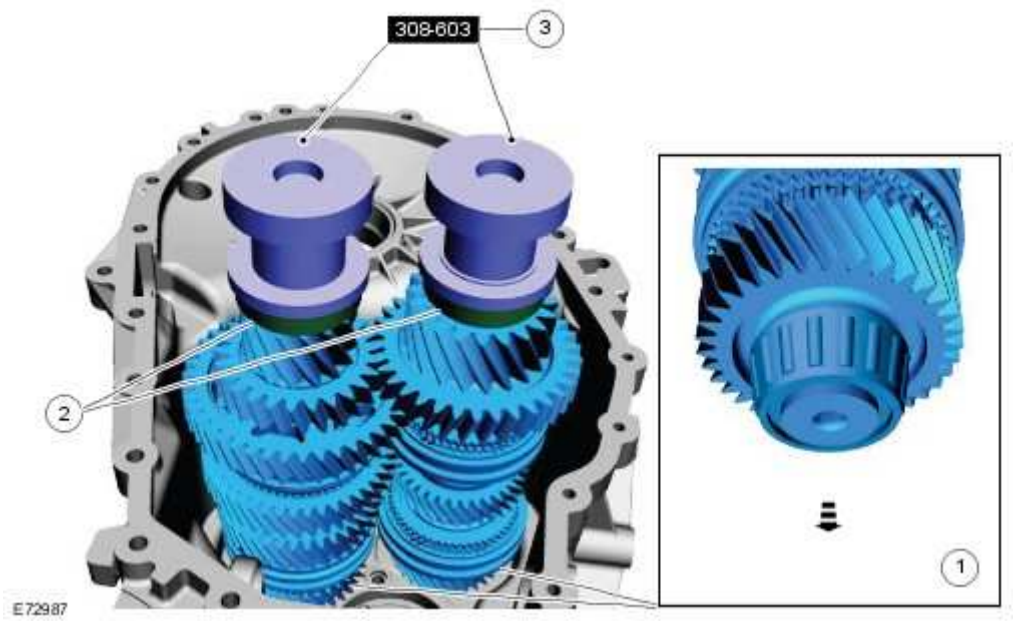
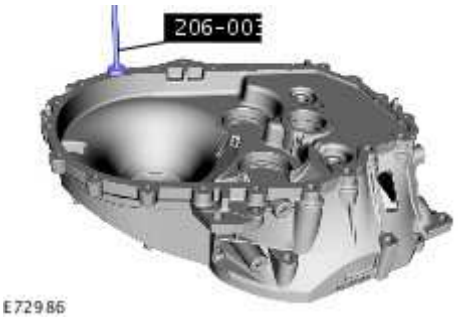
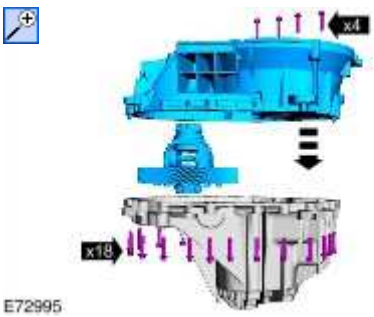
Special
(s): 30



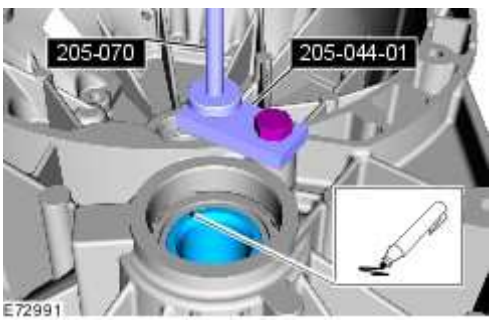


16. Remove the following items:
    - *Special Tool(s):* 206-003



17. CAUTION: Extreme cleanliness must be exerci
when handling these components.
Tighten the transmission housing bolts, working diag

Torque: 32 Nm



18. Clean the end face of the differential assembly and r
at one place.

Special Tool(s): 205-044-01, 205-070

19.
    - Repeat this and the following three steps three
and determine the average values.
    - To measure the bearing pre-load turn the diffe
20 times while pressing down at the same tim
that the bearings settle.

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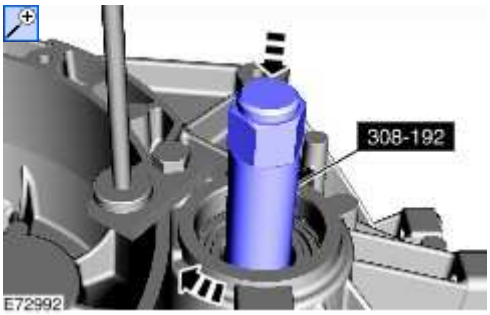
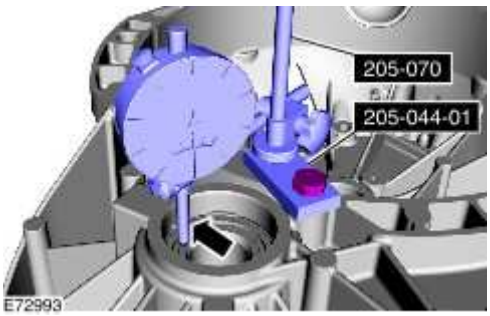


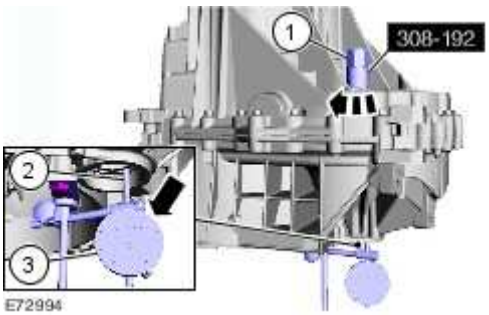
Special Tool(s): 308-192



20.
- Attach the dial gauge to the special tool and a the mark.

  Special Tool(s): 205-044-01, 205-070
- Pre-load the dial gauge to 1 mm and zero it.

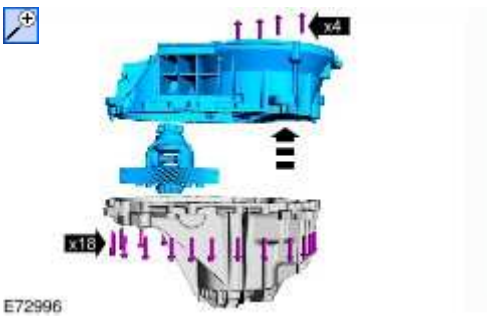
21. Turn the transmission through 180 degrees with the side downwards.



22.
1. To measure the bearing pre-load turn the diffe 20 times while pressing down at the same tim that the bearings settle.

   Special Tool(s): 308-192
2. Turn the differential until the measuring pin is marked spot.
3. Measure the differential end float: Make a note measurement, e.g. 0.34 mm. Example: 0.34 r +0.36 mm +0.38 mm, divided by 3 = 0.36 mı

23.
- Determine the thickness of the differential adj shim:
- Installed measuring shim thickness: 1.10 mm.
- Determined differential end float 0.36 mm
- Differential bearing pre-load 0.20 mm
- Required adjusting shim thickness: 1.10 mm - mm +0.20 mm = 1.66 mm.
- Determined adjusting shim thickness: 1.66 mı



24.

25. Remove the following items:
1. Differential bearing outer race

   Special Tool(s): 205-176
2. Measuring shim

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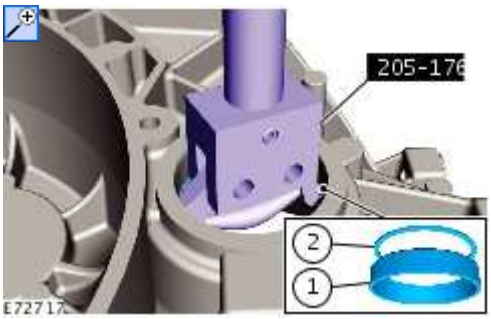


26.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Install the measured adjusting shim.
3. Insert the differential bearing outer race by ha after the clutch housing has cooled, install usi special tool.

   Special Tool(s): 205-296

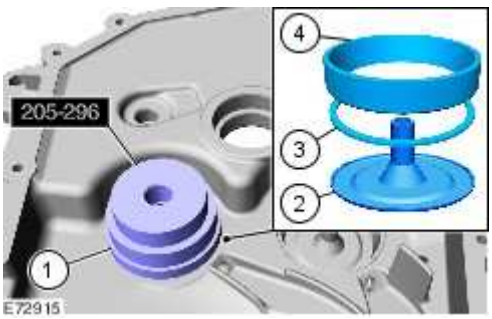
Vehicles built up to 10/2005 inclusive

27.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Install a new output shaft oil thrower.
3. Install the measured adjusting shim.
4. Insert the output shaft bearing outer race by h and after the clutch housing has cooled, instal the special tool.

   Special Tool(s): 205-296



28.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Install a new output shaft oil thrower.
3. Install the measured adjusting shim.
4. Insert the output shaft bearing outer race by h and after the clutch housing has cooled, instal the special tool.

   Special Tool(s): 205-296

Vehicles built from 11/2005

29.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Install a new output shaft oil thrower.
3. Install the measured adjusting shim.
4. Insert the output shaft bearing outer race by h and after the clutch housing has cooled, instal

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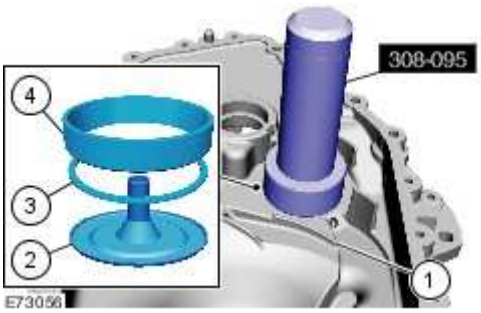
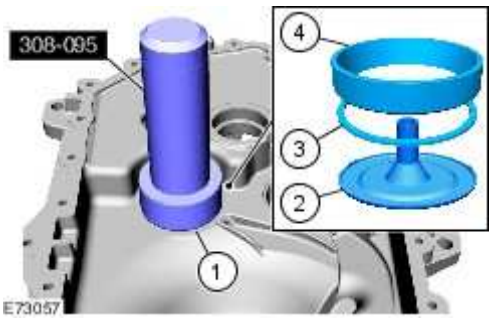


the special tool.

Special Tool(s): 308-095



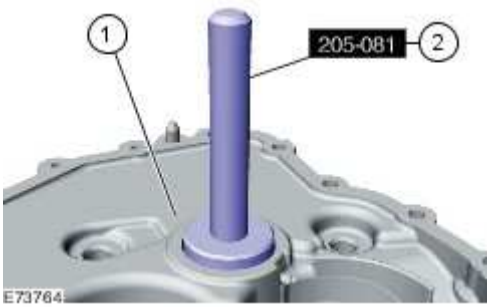
30.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Install a new output shaft oil thrower.
3. Install the measured adjusting shim.
4. Insert the output shaft bearing outer race by h and after the clutch housing has cooled, instal the special tool.

   Special Tool(s): 308-095

All vehicles

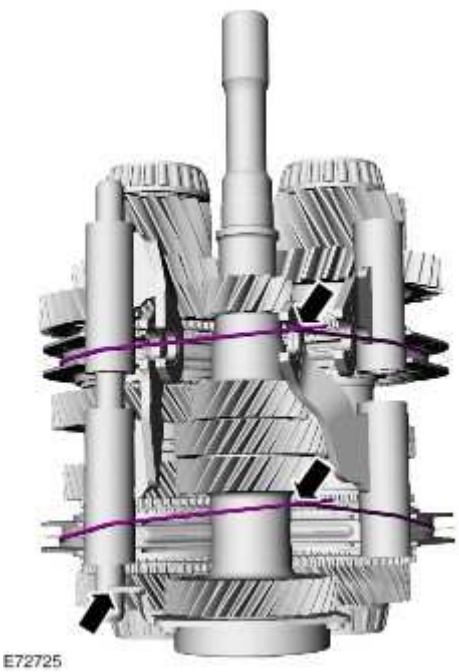


31.

1. Heat the clutch housing with a hot air gun to a 90 °C.

   General Equipment: Hot air gun
2. Insert the input shaft parallel roller bearing by and after the clutch housing has cooled, instal the special tool.

   Special Tool(s): 205-081



32. Pay attention to the installation position of the input ball bearing retainer. The retainer of the input shaft bearing must be held in place by the 1st - 4th gear s shaft.

33. CAUTION: Take special care to avoid damagin bearing.

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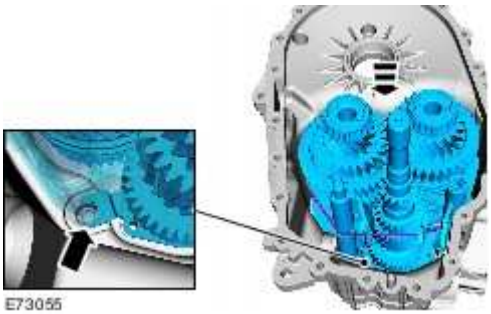
E73055

Make certain that the retainer of the input shaft ball is placed in the groove of the transmission housing. the cable ties.

E72711

34.

E73763

35.

- Apply sealant centrally on the transmission ma face and past the threaded holes on the inside diameter: 3 mm).

  Material: Flange Sealant - Anaerobic LR (WSK· M2G348-A5 / 2U7J-M2G348-AA)
- Ensure that the threaded holes are free of sea

E73765

36.

E72719

37. Install the following items:
    - Tighten the transmission housing bolts in two working diagonally.

      Torque: 32 Nm
    - Install a new halfshaft seal.

      Special Tool(s): 205-115

38. CAUTION: Cover the input shaft splines with adhesive tape to avoid damaging the input shaft o seal.
    Install a new input shaft oil seal.

    Special Tool(s): 308-112

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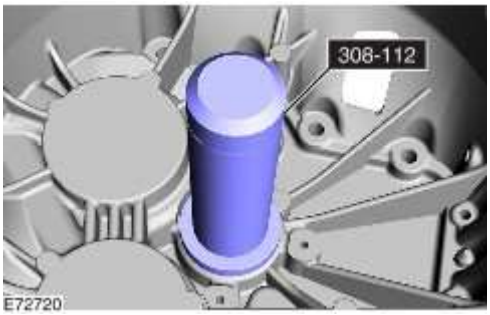
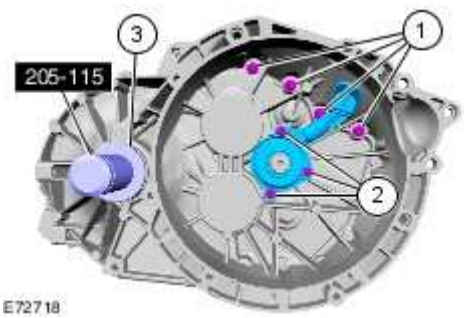


39. Remove the adhesive tape from the input shaft splin
40. Install the following items:
    1. Transmission housing retaining bolts

       Torque: 32 Nm
    2. Clutch slave cylinder

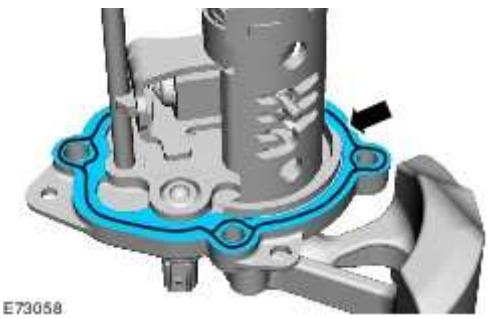
       Torque: 11 Nm
    3. Install a new halfshaft seal.

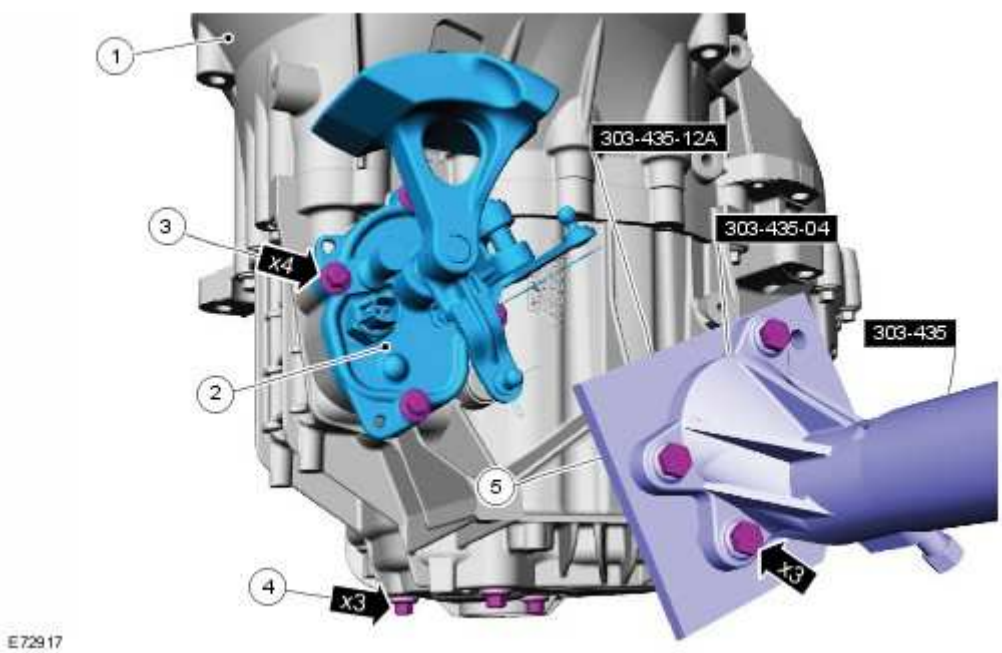
       Special Tool(s): 205-115



41.
- Apply sealant centrally on the mating face and the threaded holes on the outside (bead diame mm).

  Material: Flange Sealant - Anaerobic LR (WSK- M2G348-A5 / 2U7J-M2G348-AA)
- Ensure that the threaded holes are free of sea





42.
1. Ensure gear is engage
2. Ensure the sel mechar in the r positio
3. Install mechar

   Torque
4. Install input s bearing retaine

   Torque
5. Remov transax the mo stand.

   Specia (s): 30 303-43

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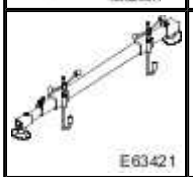
Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
	303-290B Support Bar, Engine
	303-290B-16 Adapter for 303-290B

Materials

Name	Specification
Grease K-HT	ESD-M1C220-A / A88SX1C220AA

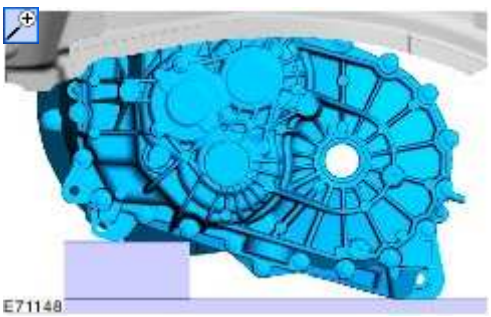
General Equipment

Transmission jack

CAUTION: Make sure that the two guide sleeves are installed.

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Coat the input shaft splines with a thin coating of grease.

   Material: Grease K-HT (ESD-M1C220-A / A88SX1C220AA)
3. *General Equipment:* Transmission jack



4. Perform this and the following operation simultaneously.

   Torque: 48 Nm

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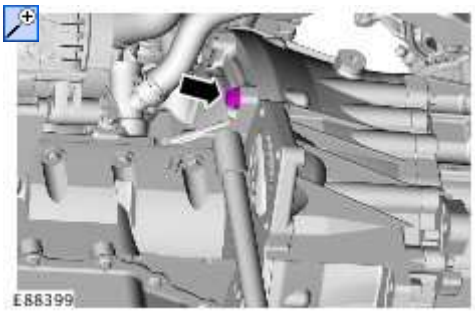
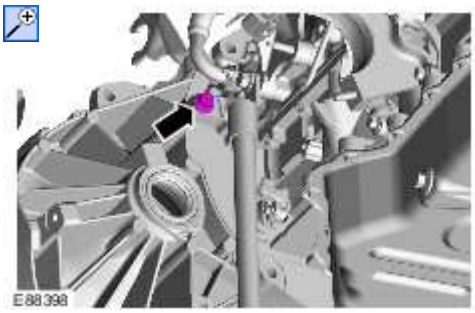
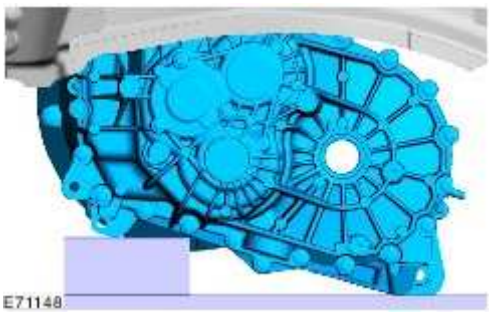
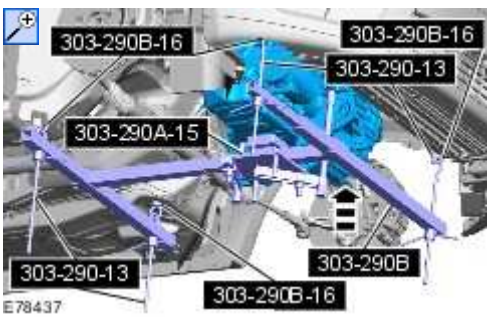




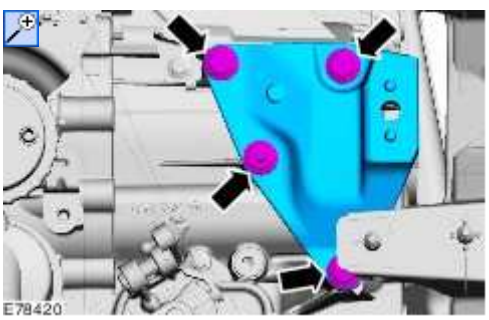
5. *Torque:* 48 Nm



6. Remove the jack.



7. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



8. *Torque:* 80 Nm

9. CAUTION: Make sure that a new bolt is installed.
Torque: 133 Nm

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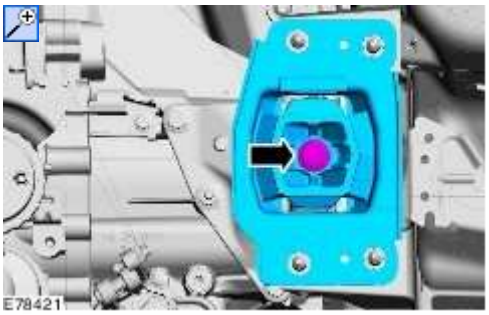
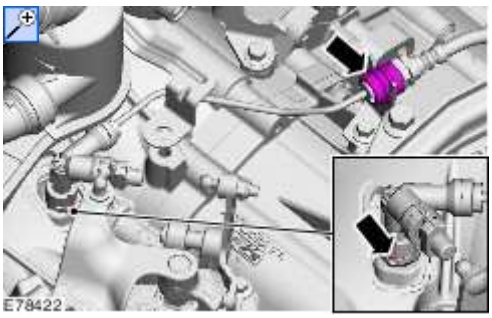
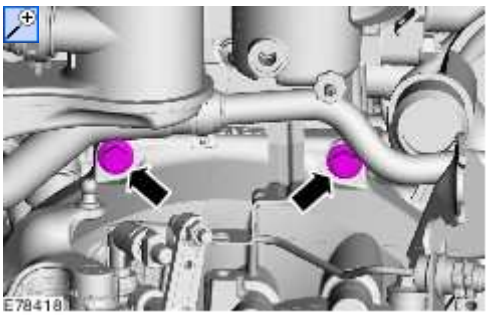
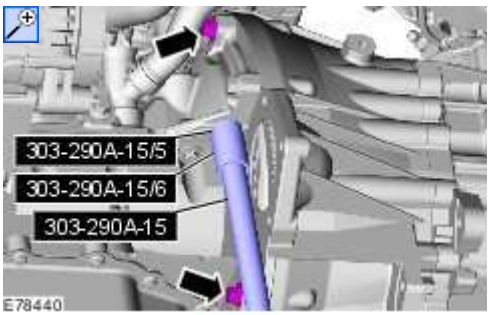




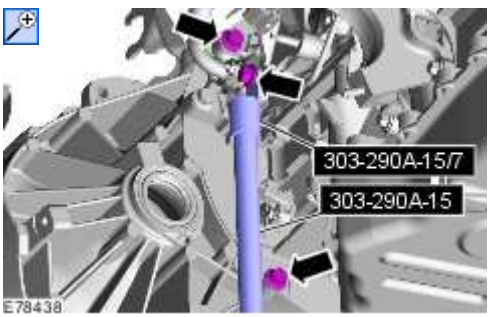
10. Refer to: Kupplungssystem entlüften (308-00 Schaltgetriebe und Kupplung - Allgemeine Informationen, General Procedures).



11. *Torque:* 48 Nm



12. *Remove the Special Tool(s):* 303-290A-15
Torque: 48 Nm



13. *Remove the Special Tool(s):* 303-290A-15
Torque: 48 Nm

14. *Remove the Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

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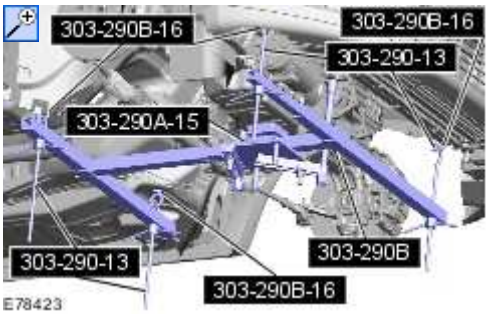
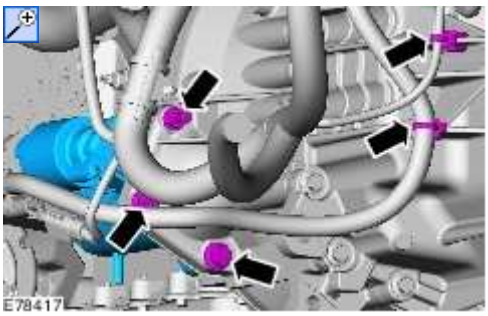


15. Install the following items:
    1. catalytic converter

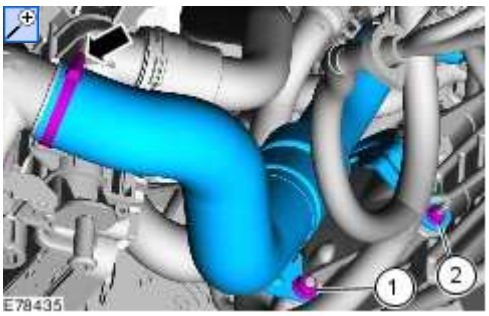
       Refer to: Catalytic Converter (309-00D Exhaust System - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
    2. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Subframe

       Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



16. *Torque:* 40 Nm



17.
    1. *Torque:* 25 Nm
    2. *Torque:* 10 Nm

18. *Torque:* 25 Nm

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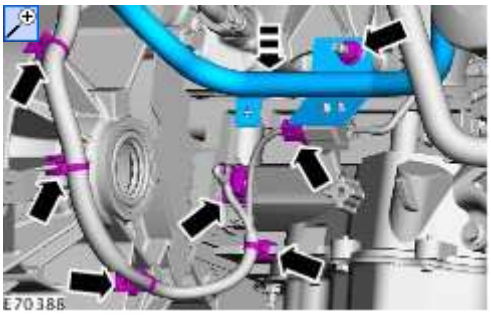
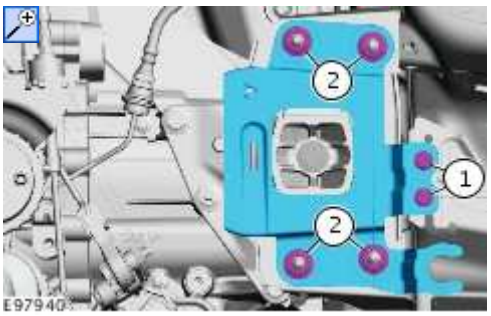
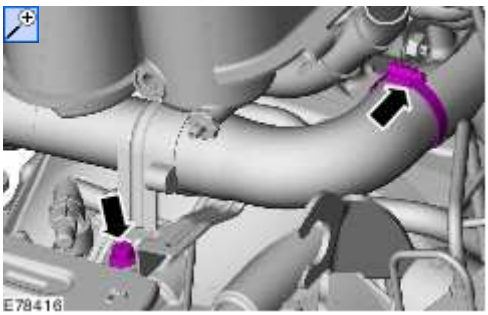
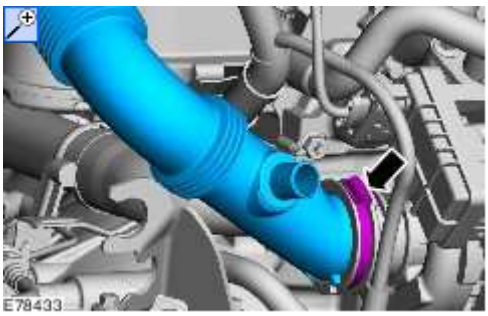




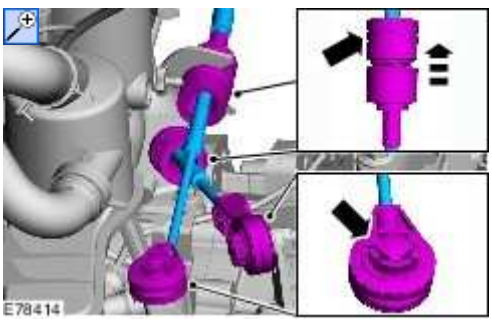
19.
1. *Torque:* 25 Nm
2. *Torque:* 80 Nm



20. *Torque:* 24 Nm



21.



22.

23. Adjust the selector cable.

    Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (MMT6) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

24. *Torque:* 25 Nm

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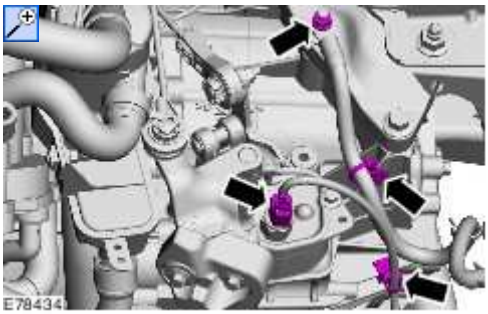
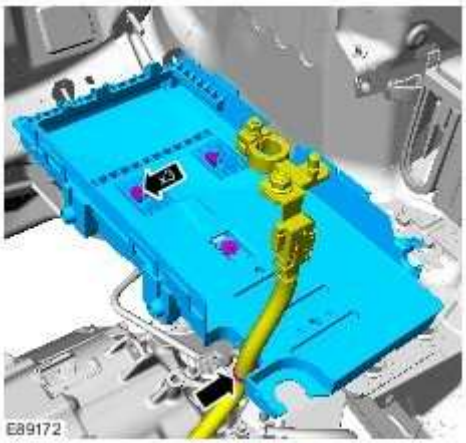




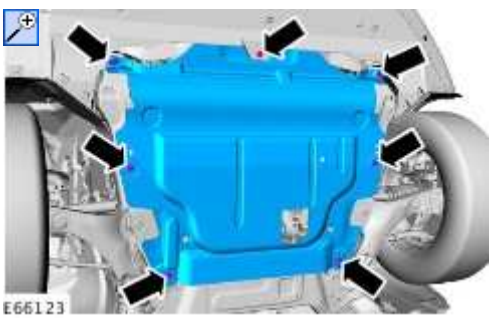
25. *Torque:* 10 Nm

26. Install the following items:
    1. Battery

       Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    2. Air Filtering

       Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
27. Check the transmission fluid fill level.

    Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).



28.

29. Initialize the window regulator motors.

    Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General

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Procedures).

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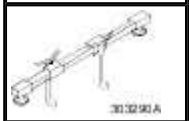
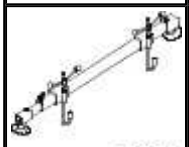
Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
E63418	303-290B-16 Adapter for 303-290B

Materials

Name	Specification
Grease K-HT	ESD-M1C220-A / A88SX1C220AA

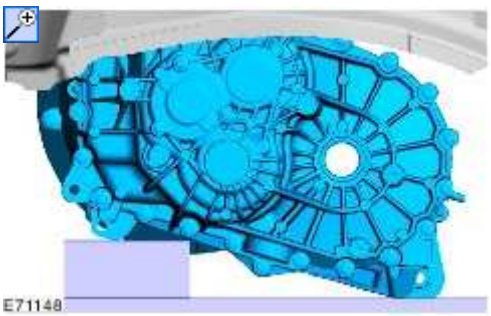
General Equipment

Transmission jack

CAUTION: Make sure that the two guide sleeves are installed.

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Coat the input shaft splines with a thin coating of grease.

   Material: Grease K-HT (ESD-M1C220-A / A88SX1C220AA)
3. *General Equipment:* Transmission jack


E71148

4. Perform this and the following operation simultaneously.

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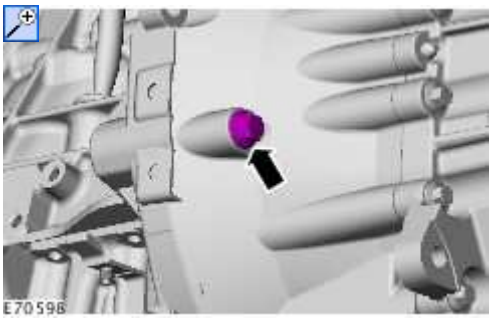
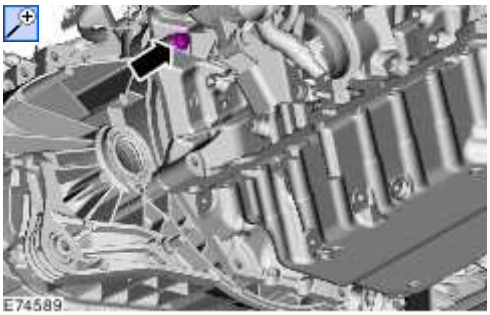
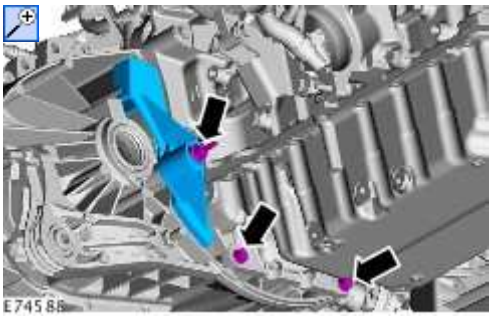


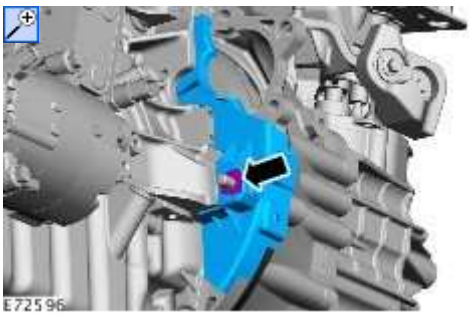
Torque: 48 Nm



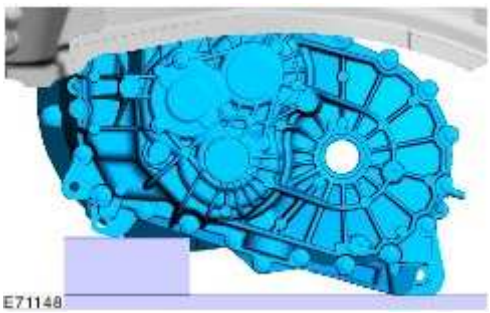
5. *Torque:* 48 Nm



6. *Torque:* 48 Nm



7.



8. Remove the transmission jack.

9. *Special Tool(s):* 303-290B, 303-290-13, 303-290B-16, 303-290A-15

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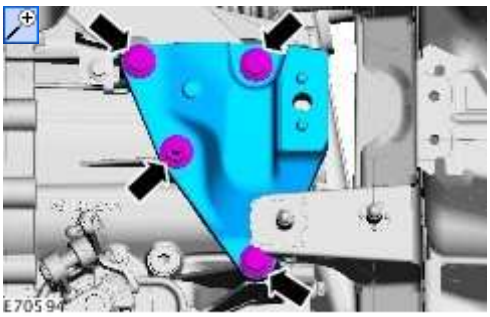
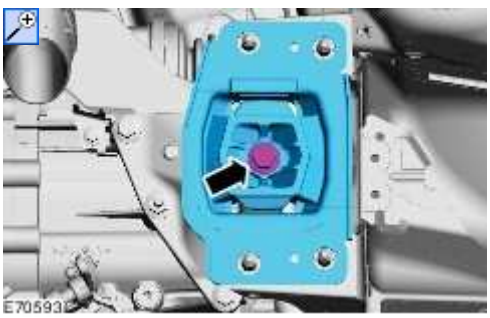
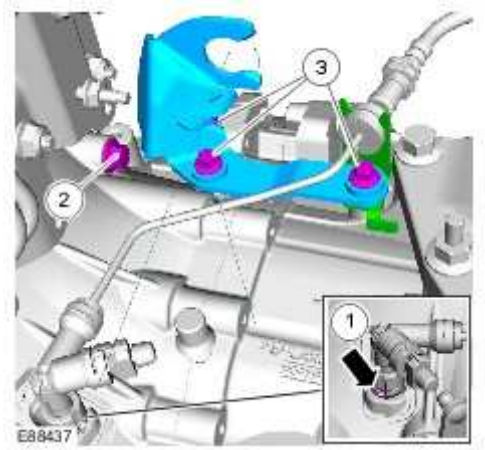


10. *Torque:* 80 Nm

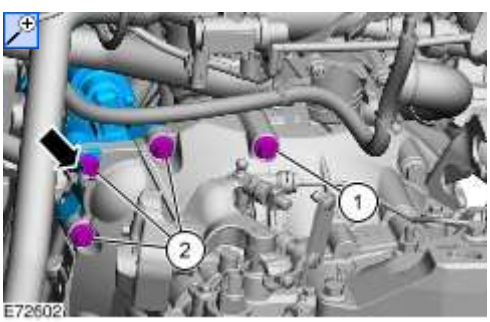


11. CAUTION: Make sure that a new bolt is installed.
Torque: 133 Nm



12.
2. *Torque:* 48 Nm
3. *Torque:* 25 Nm

13. Refer to: Kupplungssystem entlüften (308-00 Schaltgetriebe und Kupplung - Allgemeine Informationen, General Procedures).



14.
1. *Torque:* 48 Nm
2. *Torque:* 40 Nm

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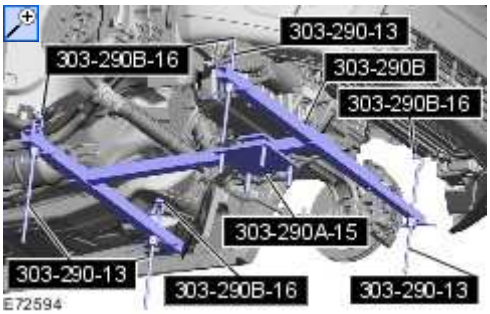
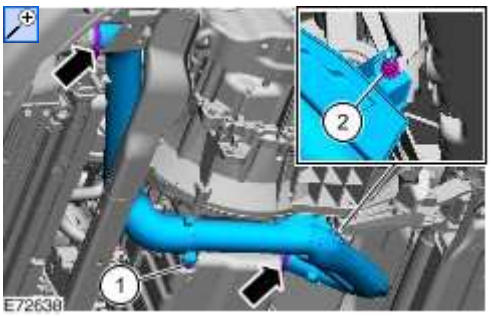


15. *Remove the Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

16. Install the catalytic converter.

    Refer to: Catalytic Converter (309-00E Exhaust System - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

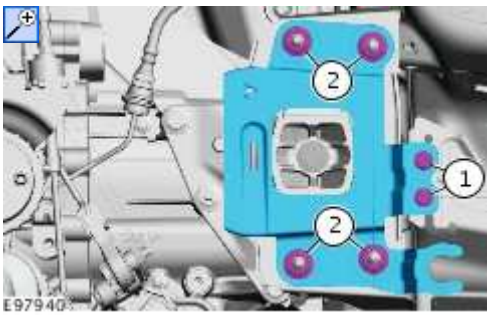


17.
    1. *Torque:* 10 Nm
    2. *Torque:* 10 Nm

18. Install the following items:
    1. Driveshafts

       Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
       Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    2. Subframe

       Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).



19.
    1. *Torque:* 25 Nm
    2. *Torque:* 80 Nm

20.

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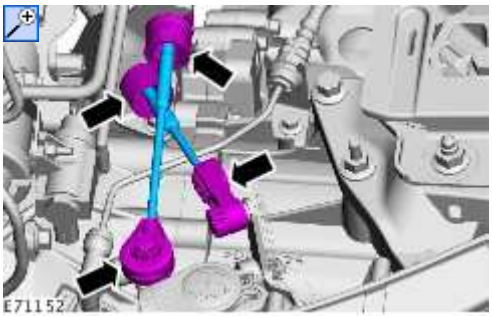
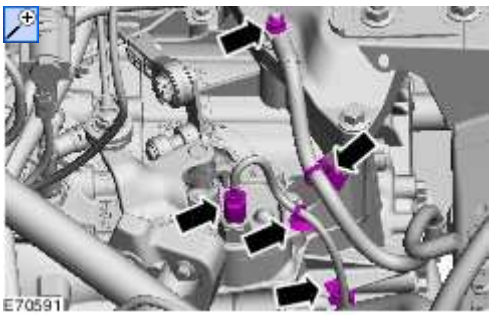
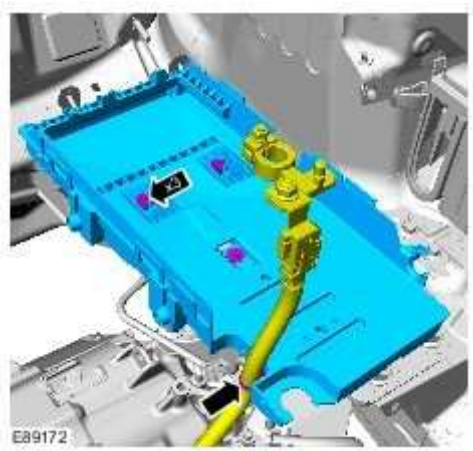


21. Adjust the selector cable.

    Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (MMT6) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).



22. *Torque:* 25 Nm



23. *Torque:* 10 Nm

24. Install the following items:
    1. Battery

       Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    2. Air filter

       Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

25.

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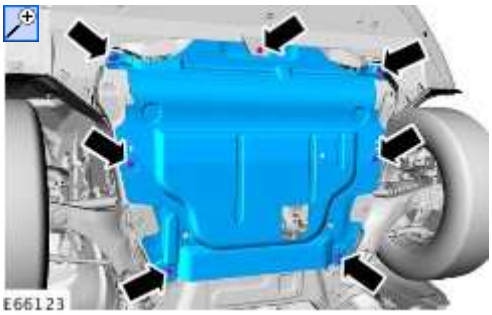
26. Check the transmission fluid fill level.

    Refer to: Transmission Draining and Filling (308-03B Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - MMT6, General Procedures).



27.

28. Initialize the window regulator motors.

    Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Filling Capacities

Transmission fluid	

Shim thickness calculations

Type	Input shaft	1st-2nd and 5th-6th gear output shaft	3rd-4th gear output shaft	Reverse gear output shaft
Measuring shims (mm)	-	-	-	-
Measured end float (example) (mm)	+1.12	+1.13	+1.27	+1.40
Addition value (mm) to obtain correct bearing pre-load	+0.03	+0.20	+0.15	+0.11
Required shim thickness (example) (mm)	= 1.15	= 1.33	= 1.42	= 1.51
Available shims (mm)	0.60 - 1.17 (in 0.03 mm steps)*	0.93 - 1.74 (in 0.03 mm steps)*	0.60 - 1.17 (in 0.03 mm steps)*	0.57 - 1.11 (in 0.03 mm steps)*

*** If the thickness of the measured shim is odd, select the shim with the next higher**

Transmission Ratios

gear	2.2L diesel engine
1st gear	3.385
2nd gear	1.905
3rd gear	1.194
4th gear	0.838
5th gear	0.652
6th gear	0.540
Reverse	0.773
Final drive ratio - forwards	4.267
Final drive ratio - reverse	5.333

Torque Specifcations

Description	Nm	lb-ft
Reversing lamp switch	24	18
Shaft detent mechanism	30	22
Selector mechanism bolts	25	18

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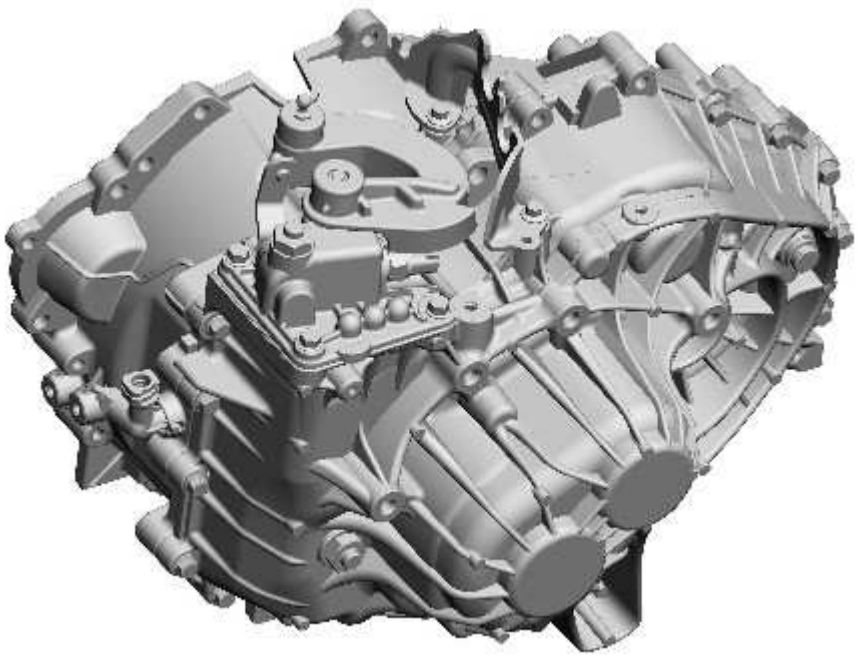
Description and Operation

Overview



E68455

The manual transaxle (M66) was designed for use in front-wheel and four-wheel drive vehicles and for high torques.

Its compact design enables transverse installation in conjunction with 2.5L Duratec-ST (VI5) engine (and 2.2L Duratorq-TDCi (DW) Diesel engine).

The transaxle is equipped with six forward gears.

The benefits:

- Optimized graduation of speed stages
- Lower fuel consumption
- Less noise emission due to lower engine speeds

The transaxle design is based on four shafts (one input shaft and three output shafts. See also illustration on next page).

All the gears, including the reverse gear, are synchronized:

- Single synchronization - 4th/5th/6th and reverse gear
- Dual synchronization - 3rd gear
- Triple synchronization - 1st/2nd gear

The transaxle has a lifetime filling of synthetic oil.

An aperture is provided for checking the level and topping up.

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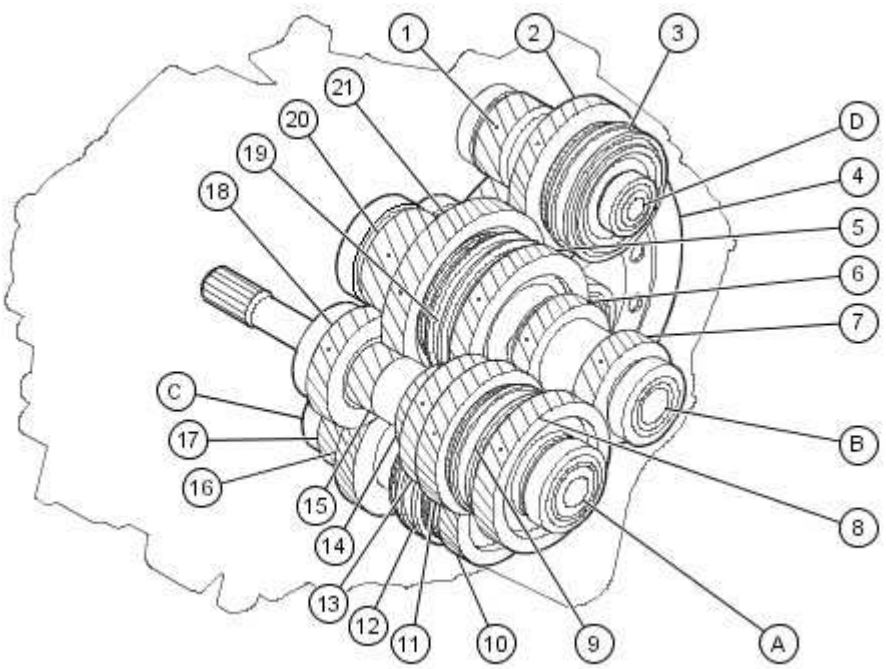
Ford transmission fluid with specification WSS-M2C200-D2 is used.

The total filling capacity is 2.0 liters.

After production startup, the transaxle undergoes a "Black Box Phase" which has been ended. Since 06/2009 the transaxle can be full serviced except the "1st-2nd and 5th-6th Gear Output Shaft". The press capacities of this Output Shaft are higher than 60 tons and can therefore not be serviced. Only the outer bearings can be renewed.

Internal Components



E80031

Item	Part Number	Description
A	-	Input shaft
B	-	1st-2nd and 5th-6th gear output shaft
C	-	3rd-4th gear output shaft
D	-	Reverse gear output shaft
1	-	Output pinion - reverse gear output shaft
2	-	Gear wheel - reverse gear
3	-	Synchronizer hub - reverse gear
4	-	Ring gear
5	-	Gear wheel - 2nd gear
6	-	Toothed wheel - 5th gear
7	-	Toothed wheel - 6th gear
8	-	Gear wheel - 6th gear
9	-	Synchronizer hub - 5th/6th gear
10	-	Gear wheel - 4th gear
11	-	Gear wheel - 5th gear
12	-	Synchronizer hub - 3rd/4th gear
13	-	Toothed wheel - 4th gear
14	-	Toothed wheel - 2nd gear
15	-	Toothed wheel - 1st gear
	-	

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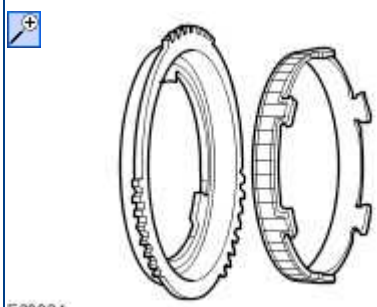
16			Gear wheel - 3rd gear
	17	-	Output pinion - 3rd-4th gear output shaft
18		-	Toothed wheel - 3rd gear
19		-	Synchronizer hub - 1st/2nd gear
20		-	Output pinion - 1st-2nd and 5th-6th gear output shaft
21		-	Gear wheel - 1st gear

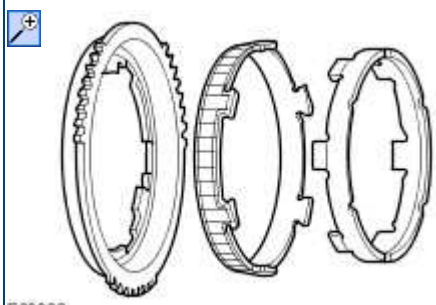
Synchronizer rings

Synchronizer ring (Reverse, 4th, 5th, 6th gear)



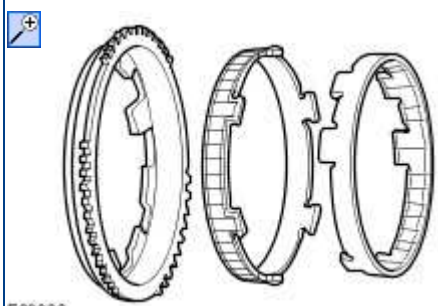
E80034

Double synchronizer ring (3rd gear)



E80033

Triple synchronizer ring (1st and 2nd gear)



E80032

Triple synchronization is provided for the 1st and 2nd gears.

This synchronization, which is subject to a greater load because of the tractive power, achieves a higher service life and a reduction in the shift force required.

Synchronization is intended to bring the synchronizer hubs with synchronizer clutch and the gear wheel to the same rotational speed. Only then is positive engagement possible.

To achieve this, sloped faces have been provided on all the illustrated components. Until synchronism is achieved, the synchronizer clutch is blocked from engaging with the external splines by a further ring gear on the outer synchronizer ring.

The basis for triple synchronization is a gear wheel with external splines. Its diameter is much larger than that of the friction cone. This creates space for the first synchronizer ring

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with two friction surfaces and the synchronizer cone also with two friction surfaces. The outer synchronizer cone is virtually unchanged. It is fitted into the synchronizer hub with its recesses in such a way that it can only turn by half a tooth in both directions.

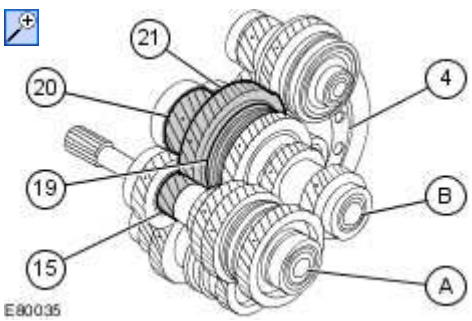
An important aspect for the action of the two friction surfaces is the torque proof connection between the gear wheel and the intermediate ring. At the same time, the two synchronizer rings are also connected together in a torque proof manner via pawls. The synchronizer therefore operates like a multiple wet clutch.

Power flow

When a gear is to be selected, the synchronizing sleeve in question located on the relevant shaft is moved by its selector fork along the synchronizing hub towards the trailing wheel of the desired gear. The synchronizing sleeve and synchronizing hub engage and lock the trailing wheel to the hub and the relevant countershaft.

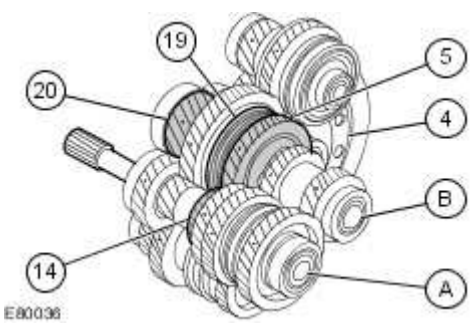
The power flow is transferred from the clutch to the input shaft. The power flow travels from the input shaft to a countershaft via a pair of drives consisting of a gear and a trailing wheel. The trailing wheel is locked to the hub by means of the synchronizing unit, which allows the power flow to be transferred. The power flow is transferred from the countershaft via the final drive pinion to the final drive (ring gear) mounted on the differential.

1st gear



Item	Part Number	Description
A	-	Input shaft
B	-	1st-2nd and 5th-6th gear output shaft
4	-	Ring gear
15	-	Toothed wheel - 1st gear
19	-	Synchronizer hub - 1st/2nd gear
20	-	Output pinion - 1st-2nd and 5th-6th gear output shaft
21	-	Gear wheel - 1st gear

2nd gear



Item	Part Number	Description
A	-	Input shaft

-

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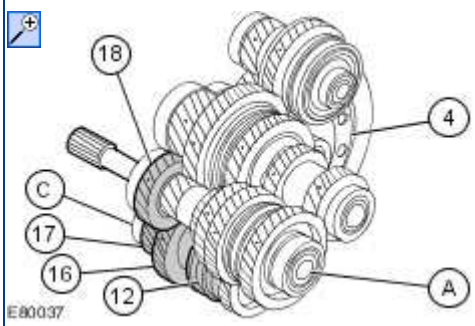
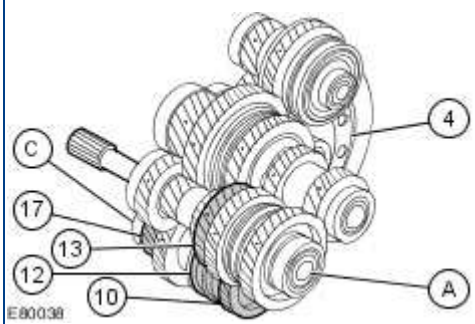
B			1st-2nd and 5th-6th gear output shaft
	4	-	Ring gear
5		-	Gear wheel - 2nd gear
14		-	Toothed wheel - 2nd gear
19		-	Synchronizer hub - 1st/2nd gear
20		-	Output pinion - 1st-2nd and 5th-6th gear output shaft

3rd gear



Item	Part Number	Description
A	-	Input shaft
C	-	3rd-4th gear output shaft
4	-	Ring gear
12	-	Synchronizer hub - 3rd/4th gear
16	-	Gear wheel - 3rd gear
17	-	Output pinion - 3rd-4th gear output shaft
18	-	Toothed wheel - 3rd gear

4th gear



Item	Part Number	Description
A	-	Input shaft
C	-	3rd-4th gear output shaft
4	-	Ring gear
10	-	Gear wheel - 4th gear
12	-	Synchronizer hub - 3rd/4th gear
13	-	Toothed wheel - 4th gear
17	-	Output pinion - 3rd-4th gear output shaft

5th gear

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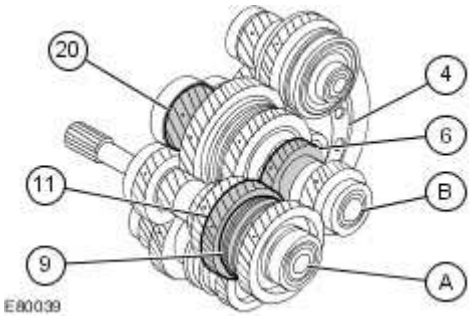
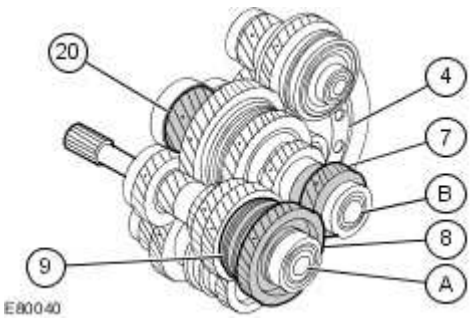


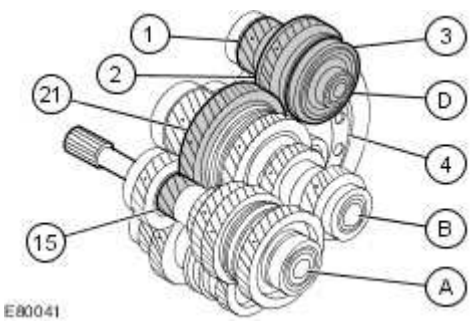
Item	Part Number	Description
A	-	Input shaft
B	-	1st-2nd and 5th-6th gear output shaft
4	-	Ring gear
6	-	Toothed wheel - 5th gear
9	-	Synchronizer hub - 5th/6th gear
11	-	Gear wheel - 5th gear
20	-	Output pinion - 1st-2nd and 5th-6th gear output shaft

6th gear



Item	Part Number	Description
A	-	Input shaft
B	-	1st-2nd and 5th-6th gear output shaft
4	-	Ring gear
7	-	Toothed wheel - 6th gear
8	-	Gear wheel - 6th gear
9	-	Synchronizer hub - 5th/6th gear
20	-	Output pinion - 1st-2nd and 5th-6th gear output shaft

Reverse gear



Item	Part Number	Description
	-	

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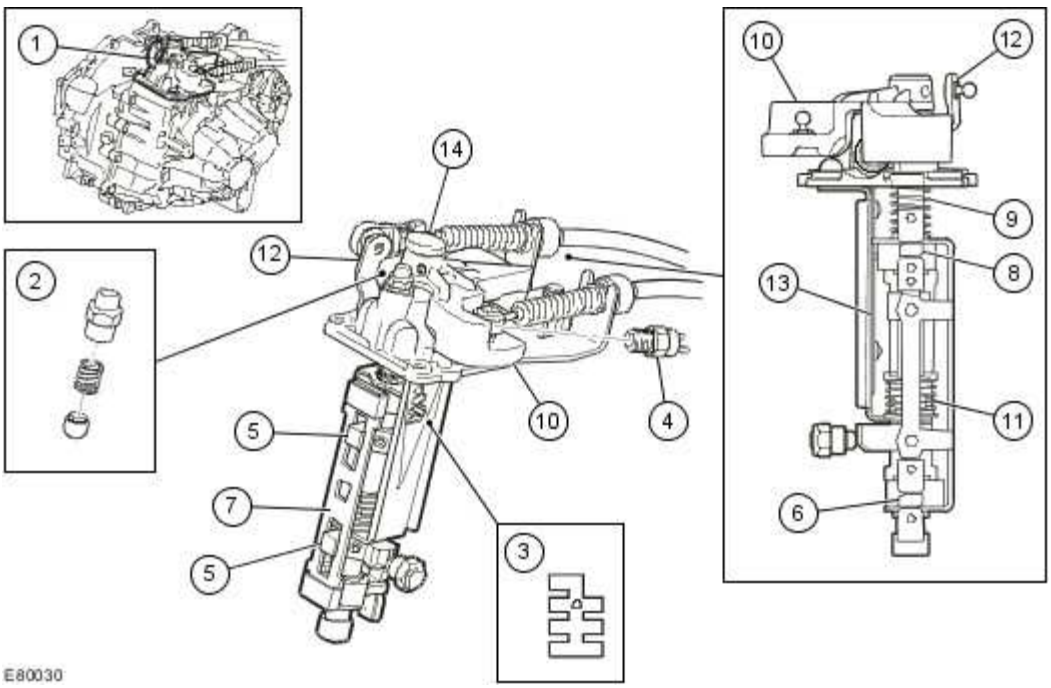
A		Input shaft
	B -	1st-2nd and 5th-6th gear output shaft
D	-	Reverse gear output shaft
1	-	Output pinion - reverse gear output shaft
2	-	Gear wheel - reverse gear
3	-	Synchronizer hub - reverse gear
4	-	Ring gear
15	-	Toothed wheel - 1st gear
21	-	Gear wheel - 1st gear

Internal control



Item	Part Number	Description
1	-	Shift unit
2	-	5th/6th gear governor
3	-	Carrier plate with gearshift gate
4	-	Switch for reverse gear signal
5	-	Shift guide
6	-	Lower shift finger
7	-	Guide plate
8	-	Upper shift finger
9	-	Spring
10	-	Shift arm with damping weight
11	-	Spring
12	-	Selector lever
13	-	Carrier plate with gearshift gate
14	-	Vent cap

The gearshift mechanism is secured to the transaxle housing by four bolts and may only be replaced as a complete unit in the event of a fault.

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Two alignment pins inserted loose in the transaxle housing facilitate installation of the shift unit and hold it in position.

CAUTION: Caution: When disassembling, the inserted alignment pins may fall out of the transaxle housing and into the transaxle when removing the shift unit.
A silicon-like sealing compound is used for the seals.

For the exact procedure, please refer to the current workshop literature.

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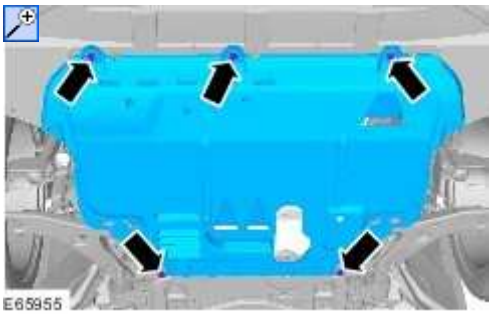
General Procedures

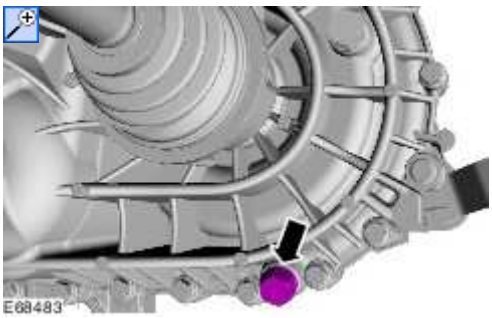
Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

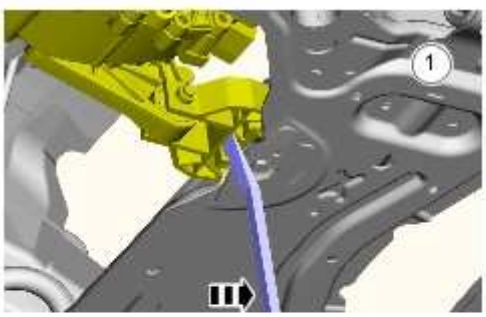
1. Refer to: Gesundheits- und Sicherheitsvorkehrungen (100-00 Allgemeine Informationen, Description and Operation).



2.

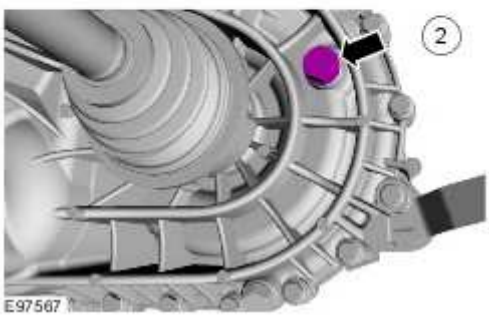


3. *Torque:* 35 Nm



4. Fill up with manual transmission fluid to below the bottom edge of the filler hole.

   Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)
   Torque: 35 Nm



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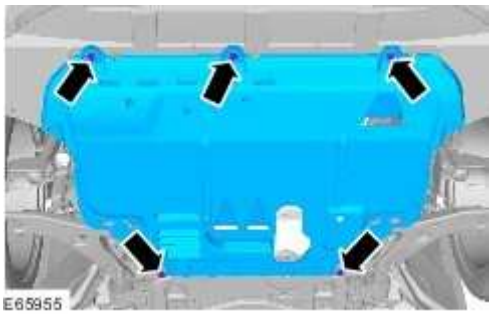

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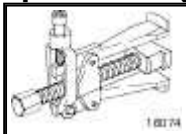
Removal and Installation

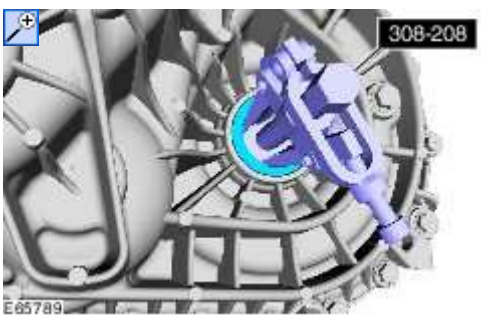
Special Tool(s)

	308-208 Remover, Halfshaft Seal
	308-789 Installer, Driveshaft Seal

Removal

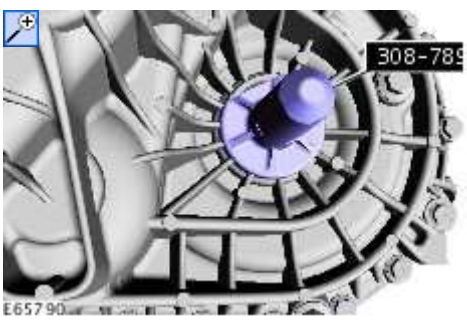
1. Remove the left-hand front axle driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).



2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 308-789

2. Install the left-hand front axle driveshaft.

   Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).

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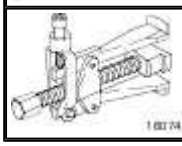
Removal and Installation

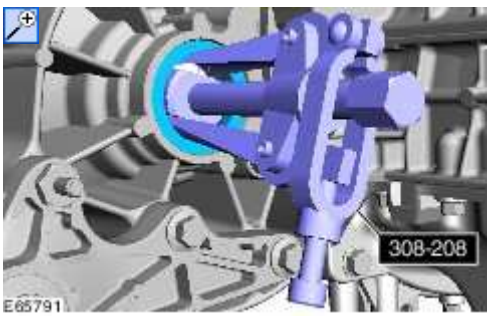
Special Tool(s)

	308-119 Installer, Halfshaft Seal
	308-208 Remover, Halfshaft Seal

Removal

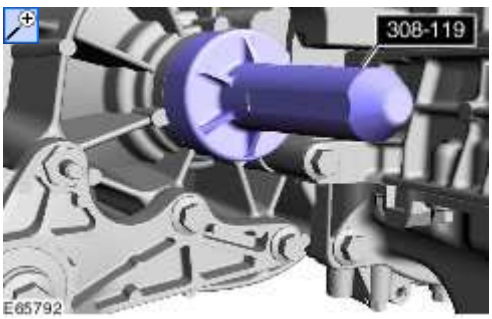
1. Remove the right-hand front axle driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).



2. *Special Tool(s):* 308-208

Installation



1. *Special Tool(s):* 308-119

2. Install the right-hand front axle driveshaft.

   Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

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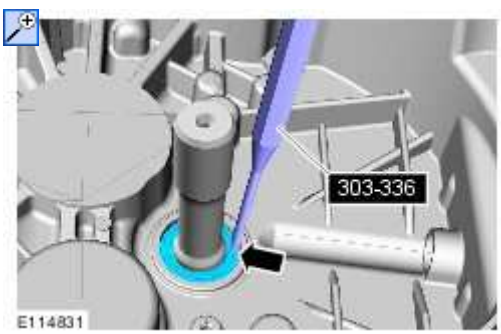
Removal and Installation

Special Tool(s)

	303-336 Remover, Crankshaft Rear Seal
	308-643 Installer, Input Shaft Seal

Removal

1. Refer to: Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
   Refer to: Transmission - 2.2L Duratorq-TDCi (DW) Diesel (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Removal).
   Refer to: Clutch Slave Cylinder (308-02C Clutch Controls - Vehicles With: 6-Speed Manual Transaxle - M66, Removal and Installation).



2. CAUTION: Take extra care not to damage the bearing.
   Special Tool(s): 303-336

3.
   1. 2.5 x 15 mm self-tapping screw

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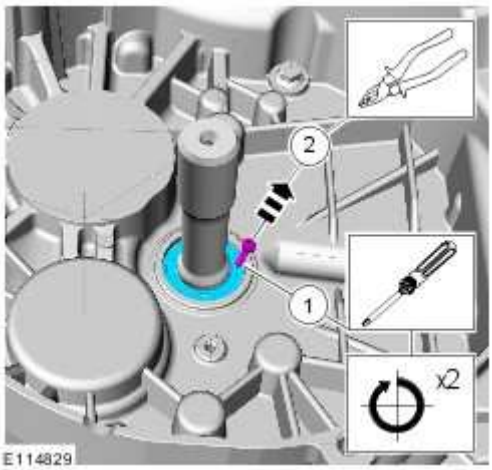
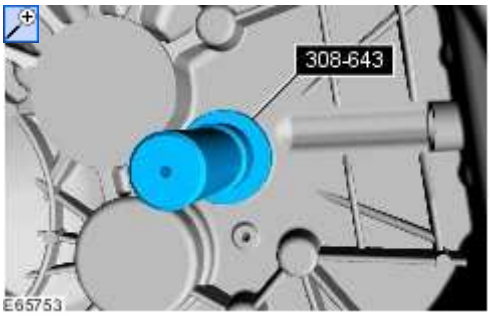


Installation



1. CAUTION: Use adhesive tape to cover the input shaft splines to prevent damage to the input shaft seal.
   Special Tool(s): 308-643
2. Remove the adhesive tape.
3. Refer to: Clutch Slave Cylinder (308-02C Clutch Controls - Vehicles With: 6-Speed Manual Transaxle - M66, Removal and Installation).
   Refer to: Transmission - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Installation).
   Refer to: Transmission - 2.2L Duratorq-TDCi (DW) Diesel (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, Installation).

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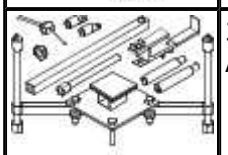
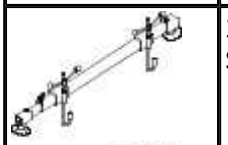
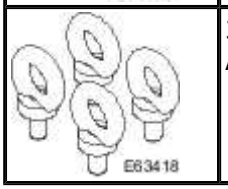
Removal

Special Tool(s)

	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
 E63418	303-290B-16 Adapter for 303-290B

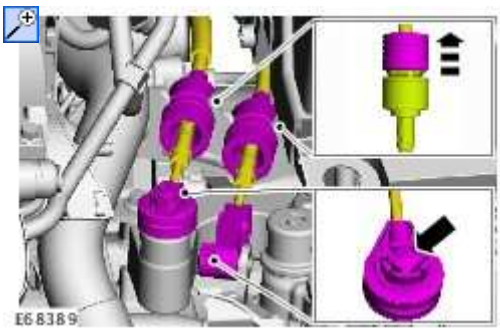
General Equipment

Transmission jack

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. Remove the battery carrier.

   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).


E68389

4. CAUTION: The gearshift cables must not be kinked or twisted.
5.

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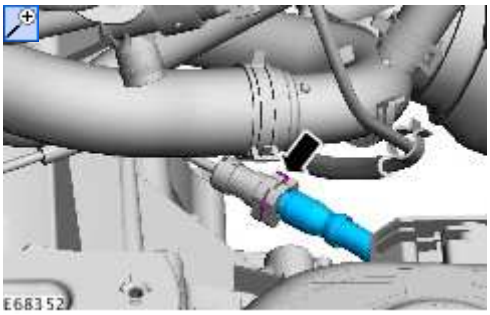

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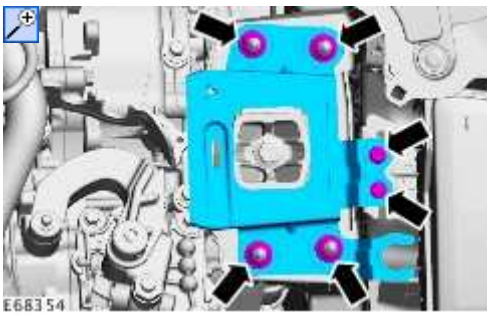

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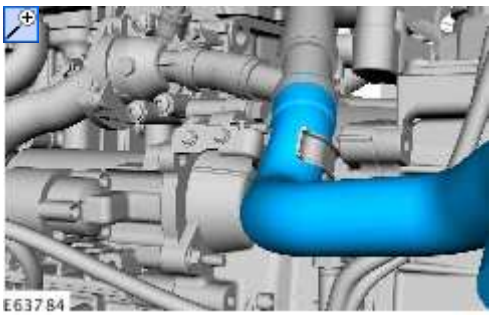

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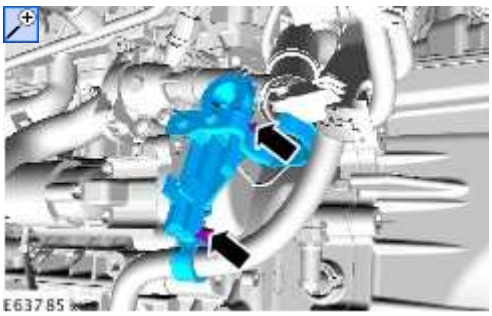
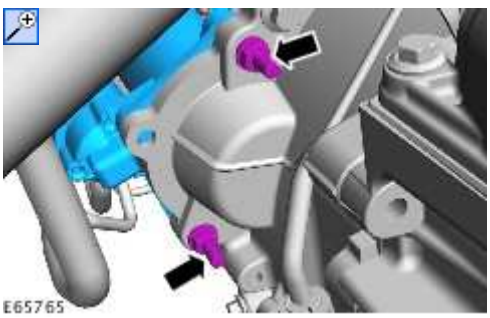


9. Detach and secure to one side.



10. CAUTION: Make sure that all openings are sealed.

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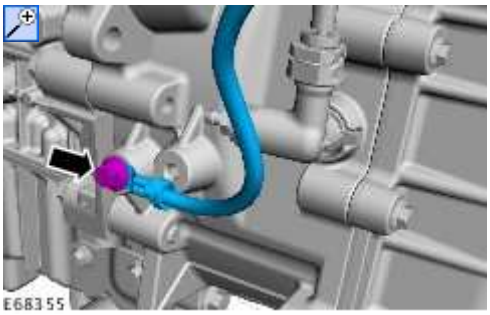
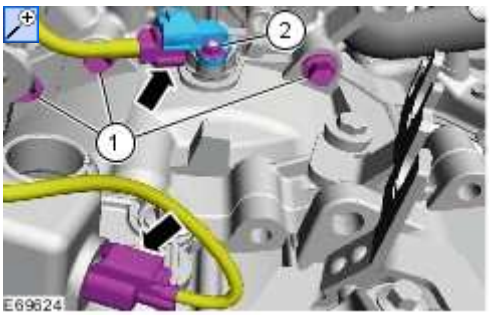




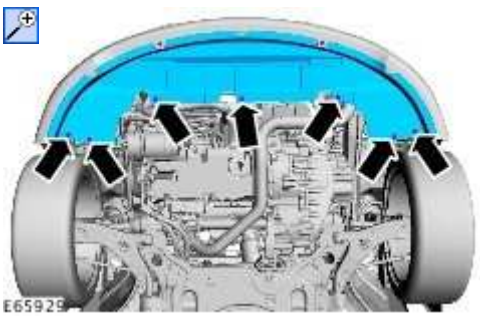
11.

12. Remove subframe from vehicle.

    Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

13. Remove the axle shafts.

    Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).



14.

15.

16. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

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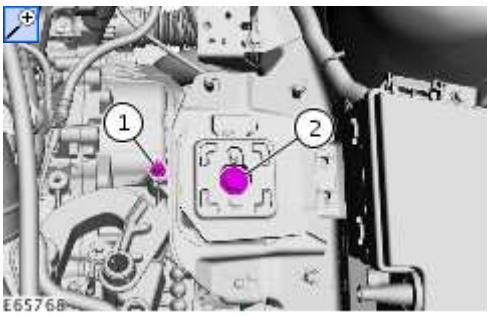
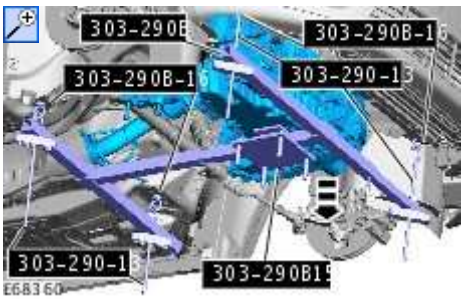
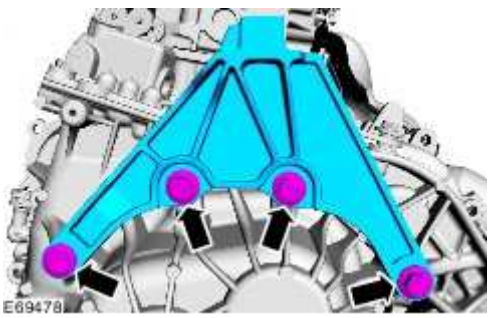


17.

2. Discard the bolt.



18. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



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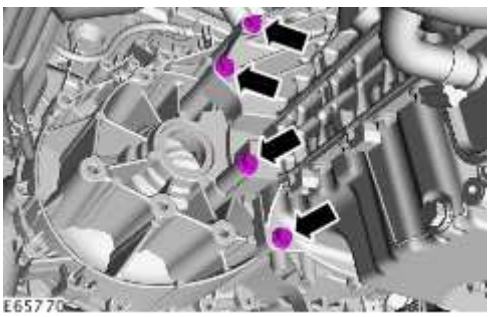

20.

21.

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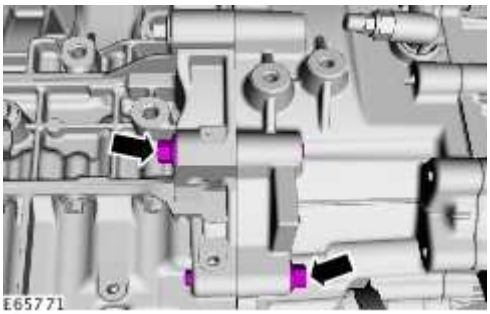
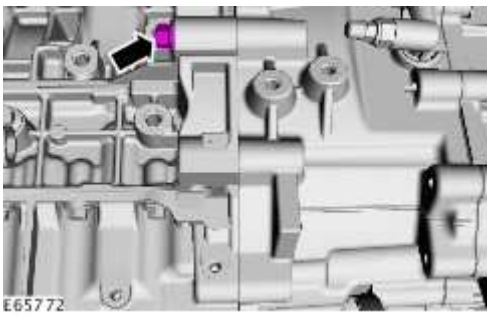


22. Support the transmission with wooden blocks.

    General Equipment: Transmission jack



23.

24.
- Support the transmission using the transmission jack and remove.
- Rotate the transmission approximately 30 degrees counterclockwise during removal.

  General Equipment: Transmission jack

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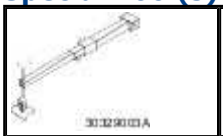
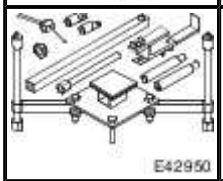
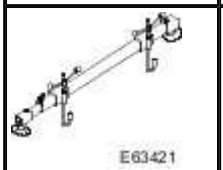
Removal

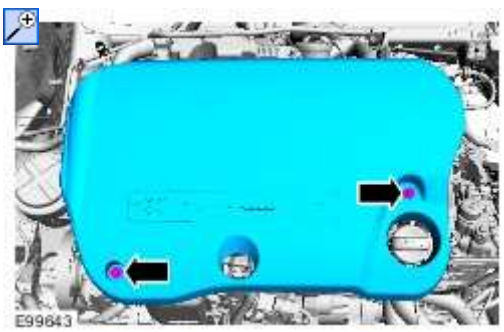
Special Tool(s)

	303-290-03A Adapter for 303-290A
	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
	303-290B Support Bar, Engine
	303-290B-16 Adapter for 303-290B

General Equipment

Cable ties
Retaining Strap
Transmission jack
Wooden Block

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2.



3. Remove the following items:
   1. Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).
   2. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

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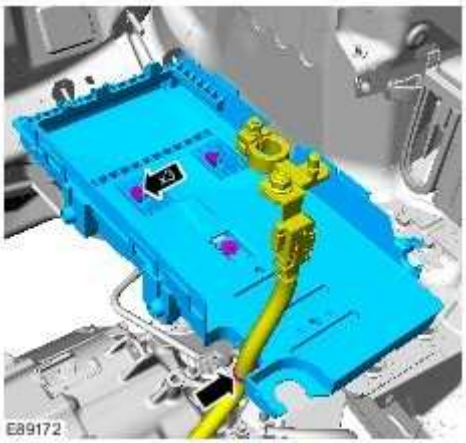
4.



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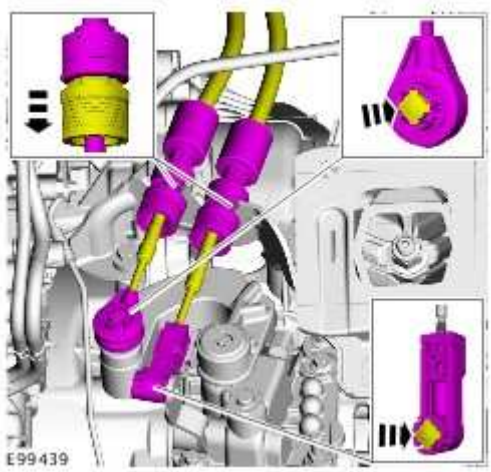

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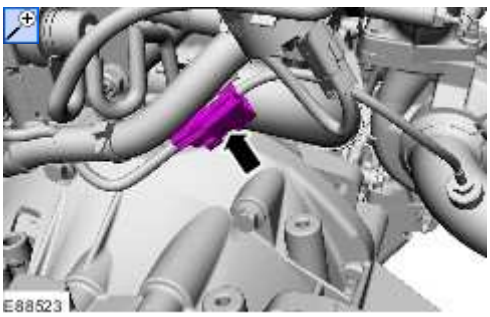

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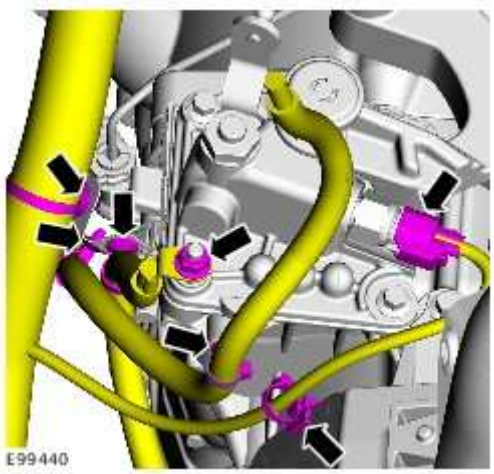

8.

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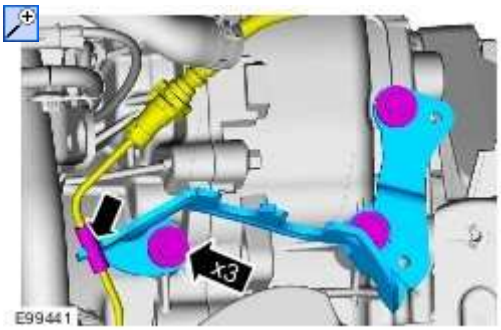

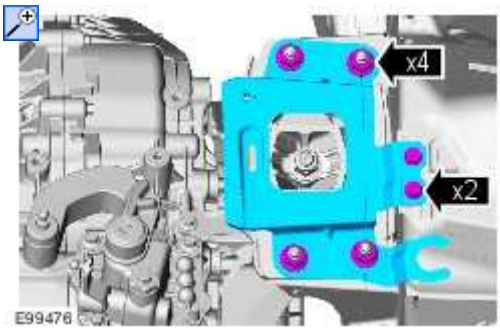

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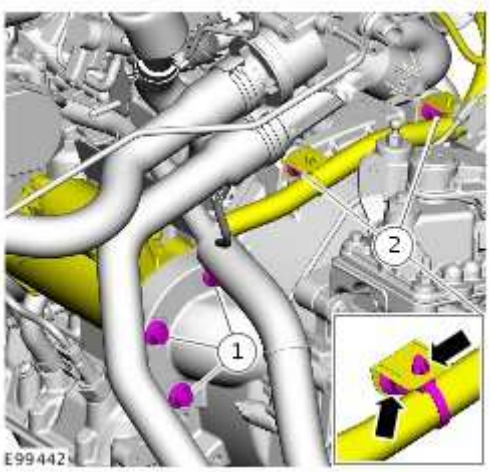

10. Secure the starter to one side.

11. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

12. Remove the following items:
    1. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
    2. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

13.

14.

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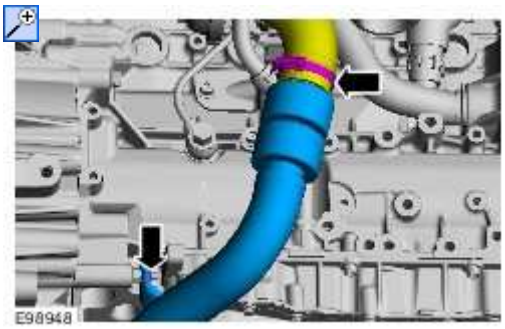
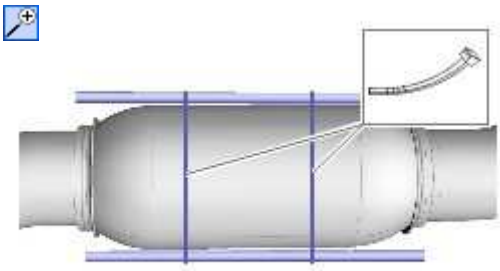
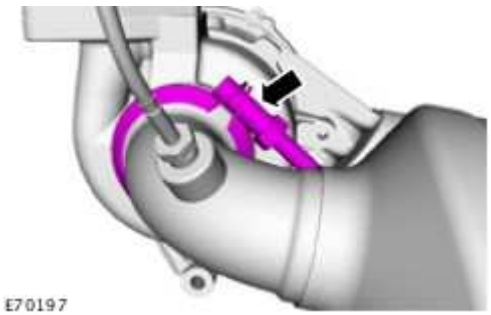
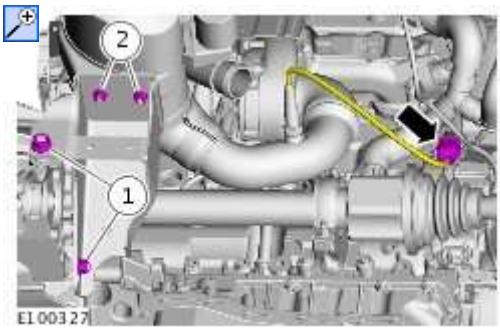




15. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.
General Equipment: Cable ties



16. NOTE: Note the position of the component before removal.



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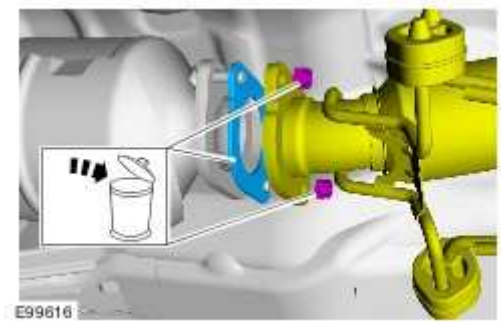

18. NOTE: Make sure that the exhaust flexible pipe is not twisted.

19.

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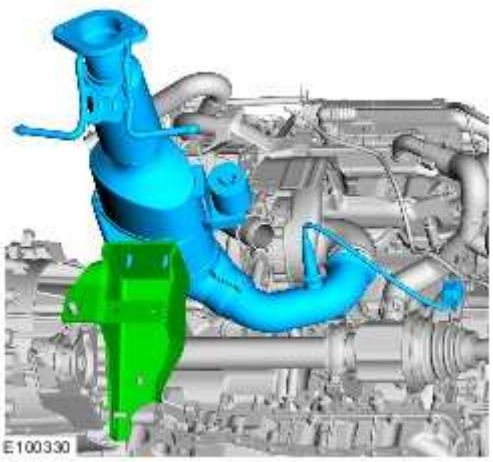
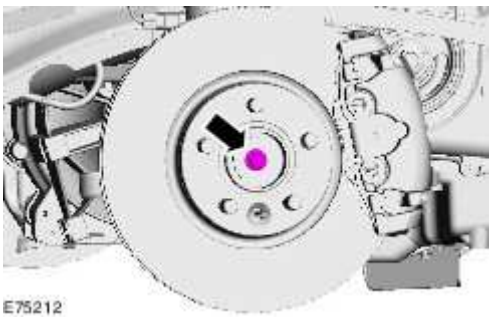
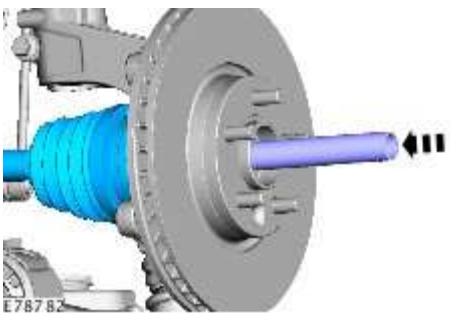
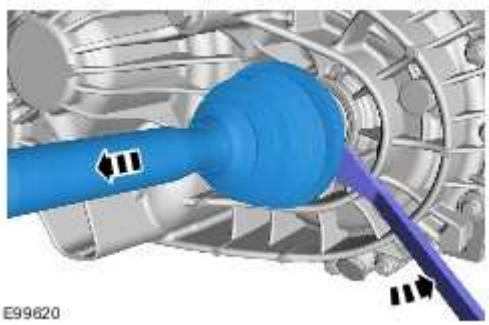




20. On both sides.



21. On both sides.



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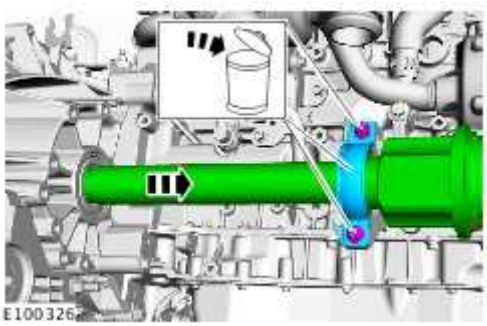

23.

24.

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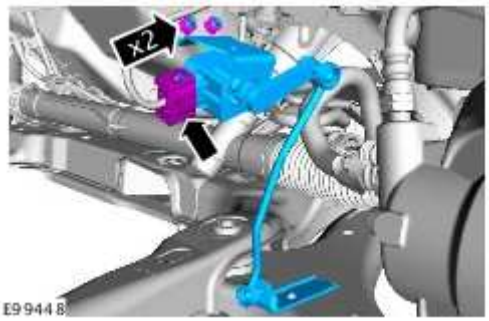
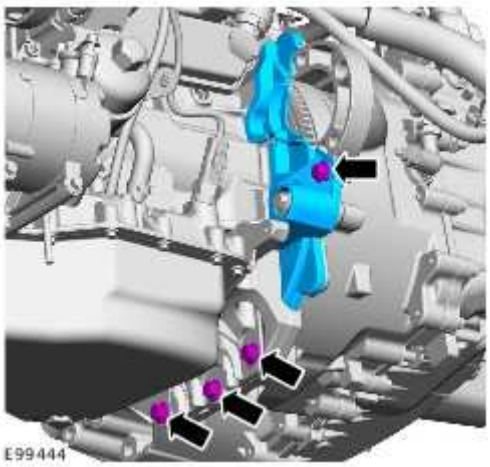
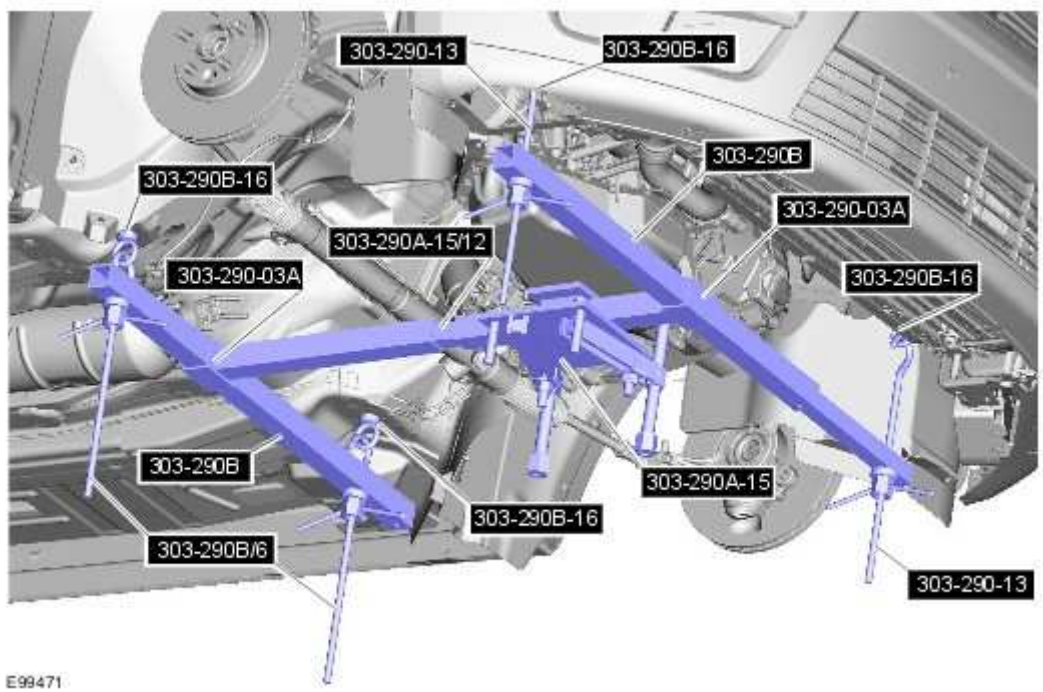
25.



26.



27. *Install the Special Tool (s):* 303-290B, 303-290-03A, 303-290-13, 303-290A-15, 303-290B-16



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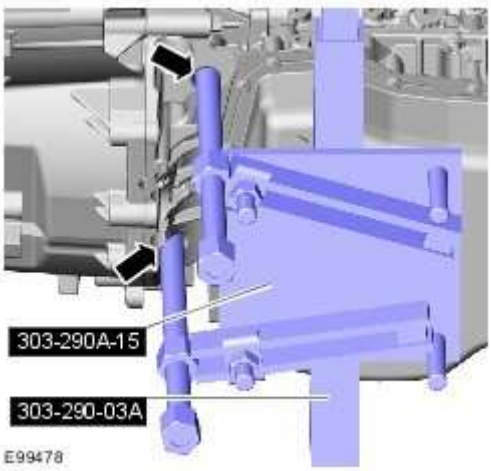
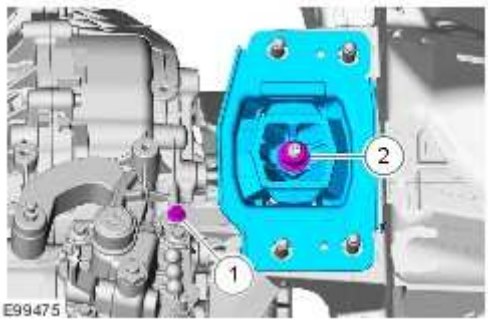
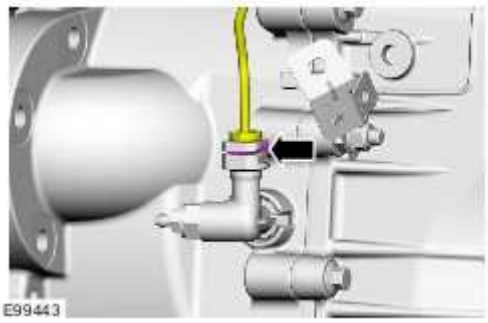


28. *Special Tool(s):* 303-290A-15, 303-290-03A

29. Lower the vehicle.



30.



31.

32. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

33. *Special Tool (s):* 303-290B

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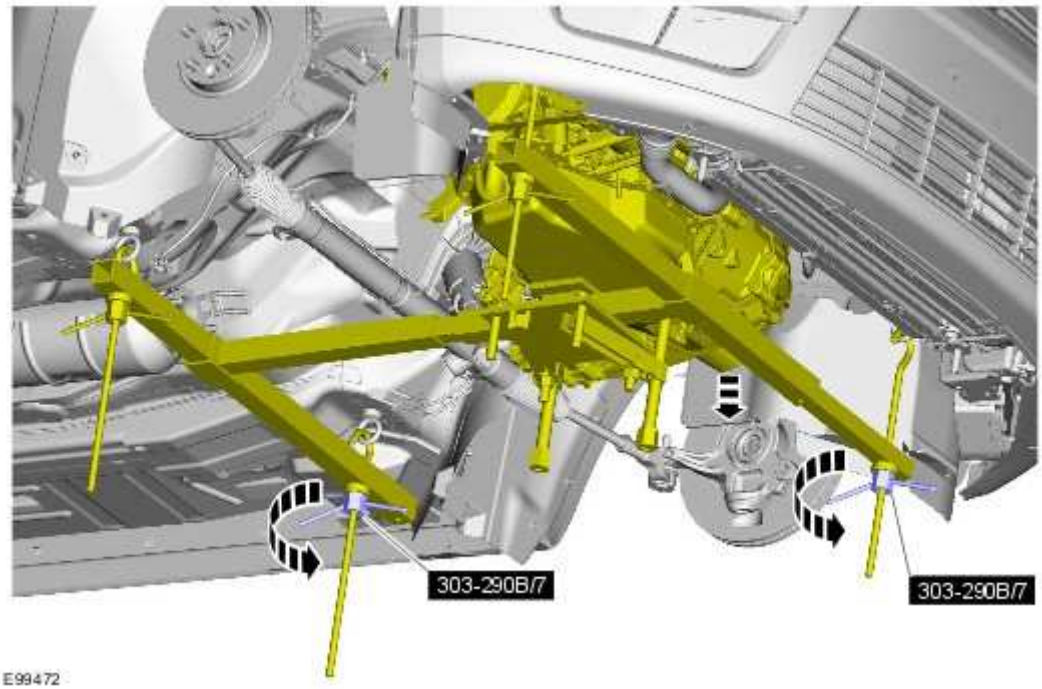

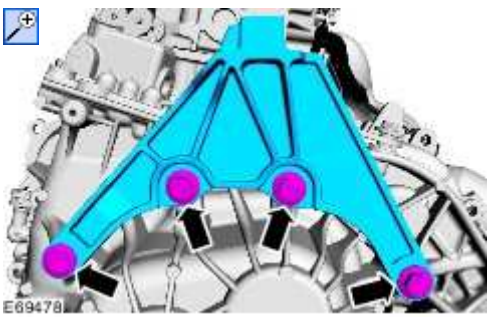

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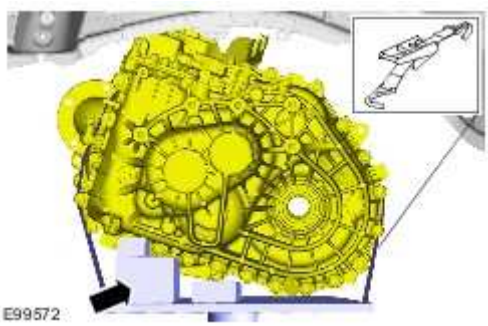
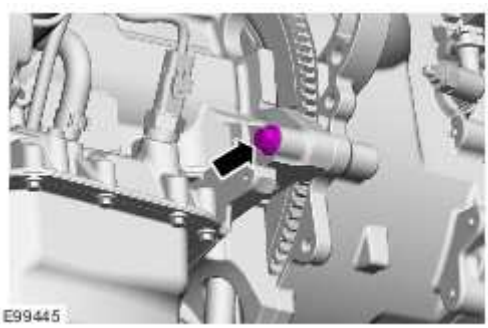


35. *General Equipment:* Transmission jack
General Equipment: Wooden Block
General Equipment: Retaining Strap



36.

37.

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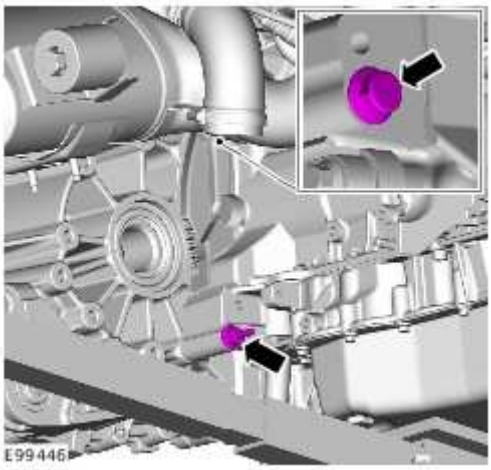

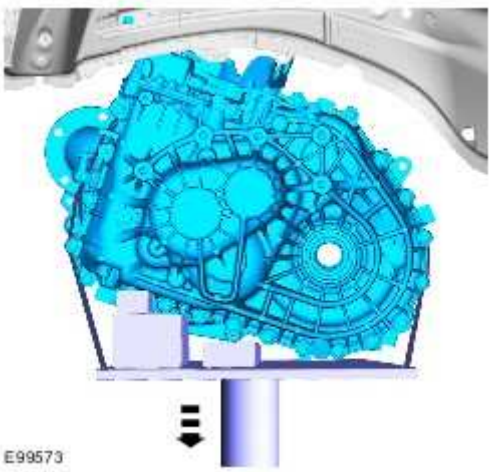

38. *General Equipment:* Transmission jack

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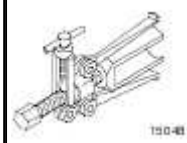
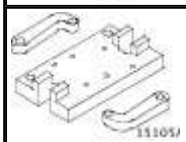
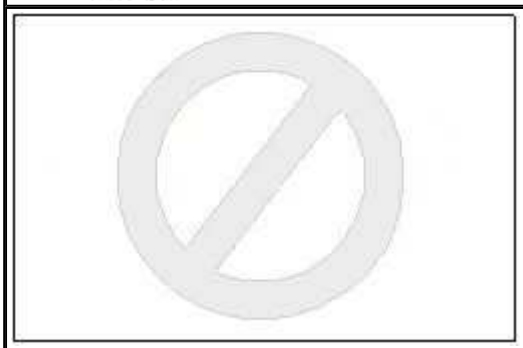
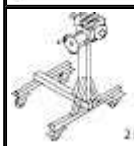
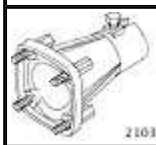
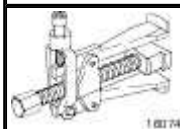
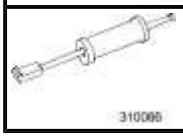
Disassembly

Special Tool(s)

	205-078 Remover, Drive Pinion Seal
	205-078-01 Adapter for 205-078 (Thrust Pad)
	205-329 Mounting Bracket, Engine/Differential
	205-517 Remover Rubber Bearing
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	308-208 Remover, Halfshaft Seal
	310-086 Remover, Fuel Injector

General Equipment

Cable ties
Puller
Punch
Tire lever

1.

1. *In*
   To
   30
   43

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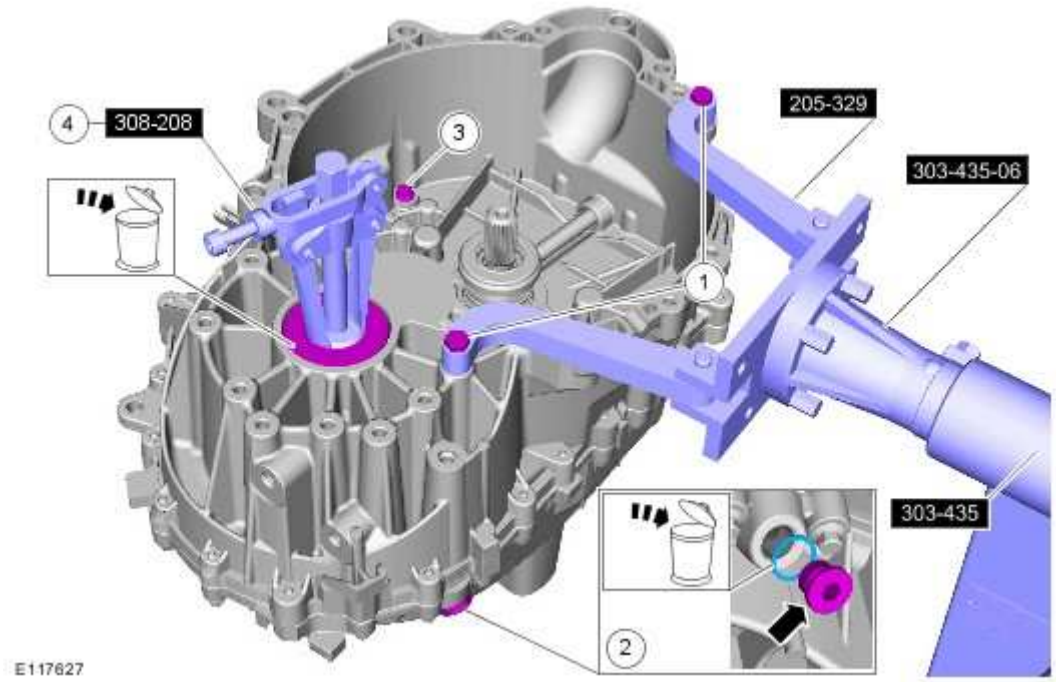

2. Be
co
es

4. *Sp*
30

2.

3.

4. *Special Tool(s):* 308-208

5.

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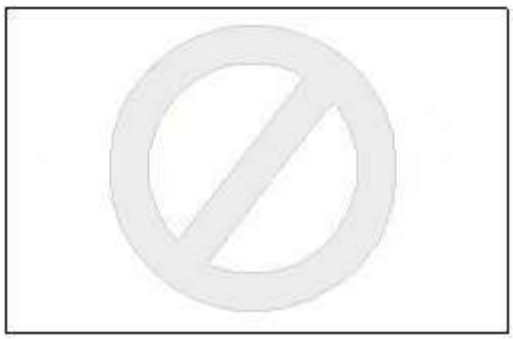
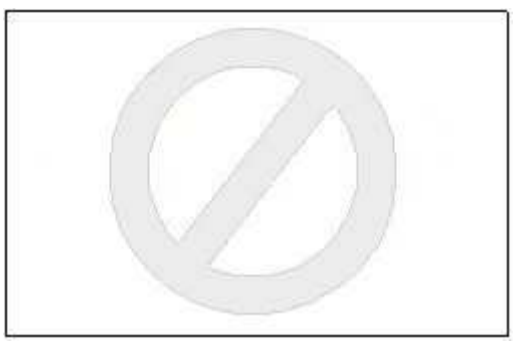
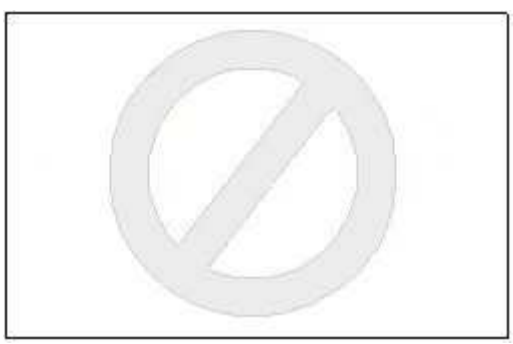
6.



7.

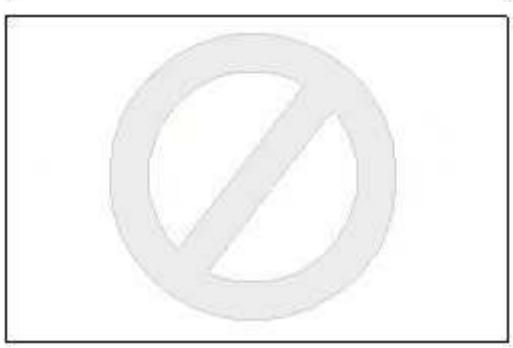


8. *General Equipment:* Cable ties



9.

1. *General Equipment:* Tire lever



10.

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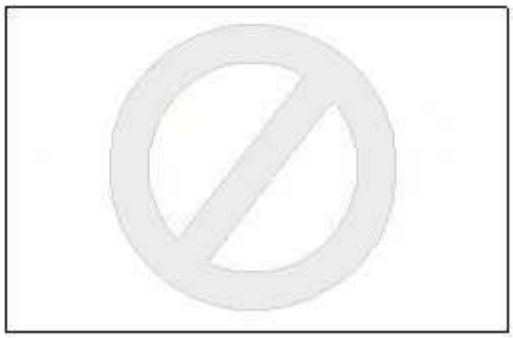
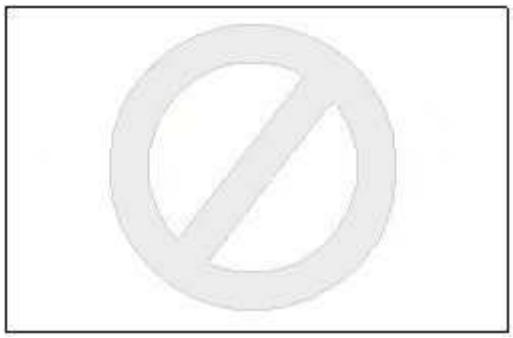
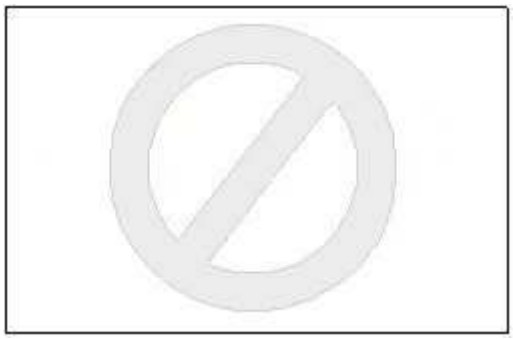
11. NOTE: This step requires the aid of another techn



12.
    1. Use a suitable socket.
    2. *Special Tool(s):* 205-078



13. *Special Tool(s):* 205-078, 205-078-01



14. *Special Tool(s):* 205-078, 205-078-01, 205-517

15. *General Equipment:* Punch

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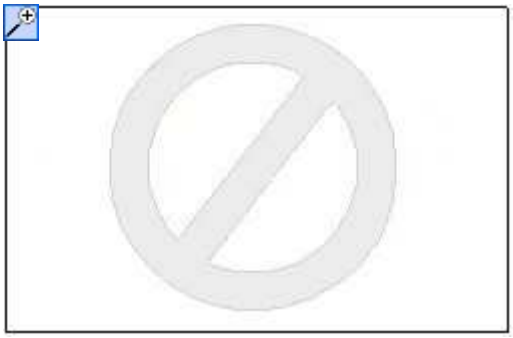
16. *General Equipment:* Punch



17. *Special Tool(s):* 310-086
General Equipment: Puller

18.
1. *Special Tool(s):* 205-078, 205-078-01

19.
1. Use a suitable socket.
2. *Special Tool(s):* 205-078

20.
1. *General Equipment:* Punch

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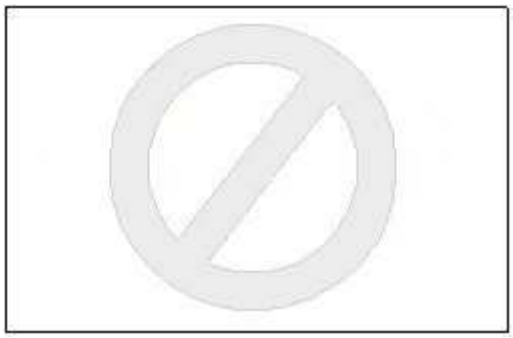
21. *Special Tool(s):* 310-086
General Equipment: Puller



22. *Special Tool(s):* 310-086
General Equipment: Puller

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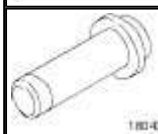
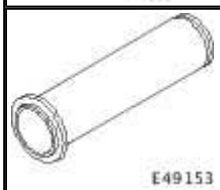
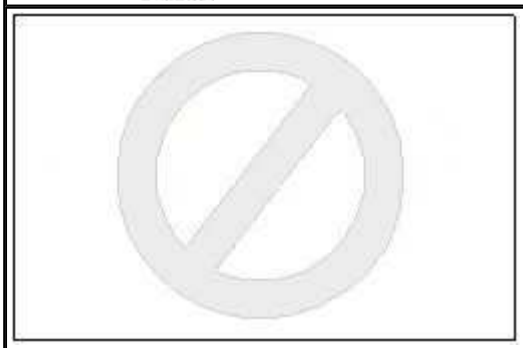
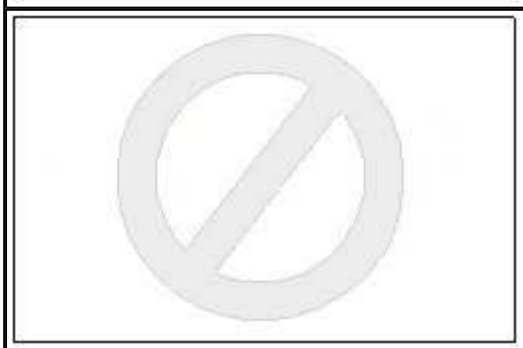
Disassembly and Assembly of Subassemblies

Special Tool(s)

	308-095 Installer, Input Shaft Bearing
	308-112 Installer, Output Drive Flange Seal
	308-605 Installer, Input Shaft Seal
	308-643 Installer, Input Shaft Seal
	308-798 Installer Bearing Cup

Materials

Name	Specification
Sealant LGN	WSK-M2G349-A8 / 9U7J-M2G349-AA
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Bearing separator
Hydraulic press

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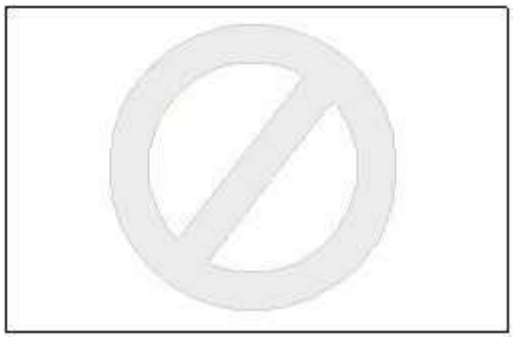
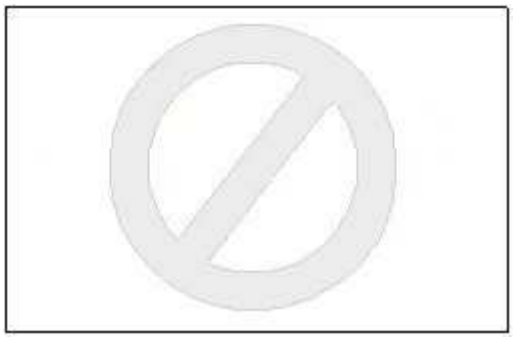
Disassembly

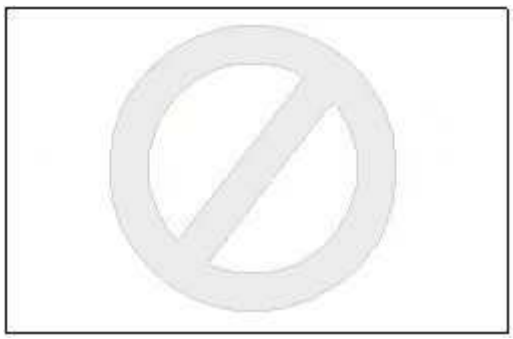
1.



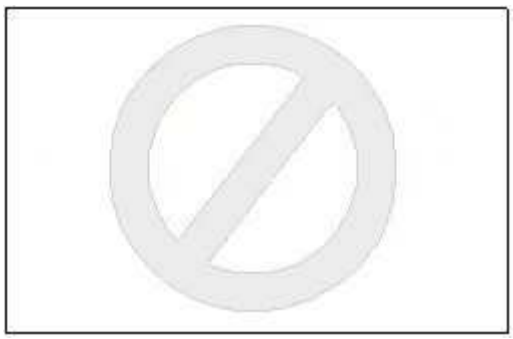
2. *Special Tool(s):* 308-798
   General Equipment: Hydraulic press
   General Equipment: Bearing separator



3.



4. *Special Tool(s):* 308-798
   General Equipment: Hydraulic press
   General Equipment: Bearing separator



5.

6.
   1. *General Equipment:* Bearing separator
   2. *General Equipment:* Hydraulic press

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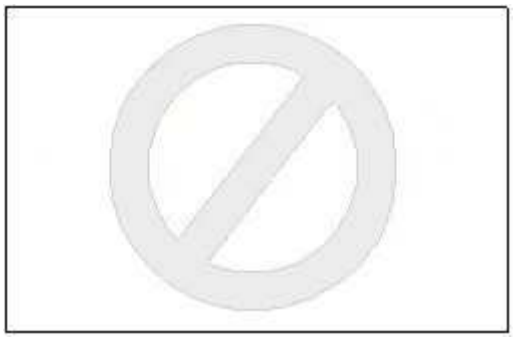
3. Save the component for reassembly the input shaft.

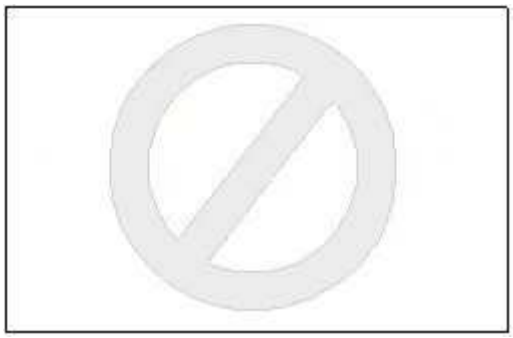
Assembly

7.
   1. NOTE: Make sure that a new component is installed.
      The roller bearing must not be lubricated.
   2. Use the component saved during disassembly.
   3. *Special Tool(s):* 308-643

8. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)



9. *Special Tool(s):* 308-605
   Material: Sealant LGN (WSK-M2G349-A8 / 9U7J-M2G349-AA)



10. *Special Tool(s):* 308-095

11.

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12. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

13. The roller bearing must not be lubricated.

    Special Tool(s): 308-112

E118727

14. NOTE: Make sure that new components are installed.
    2. *Torque:*
       Stage 1: 20 Nm
       Stage 2: 42°

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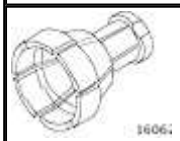
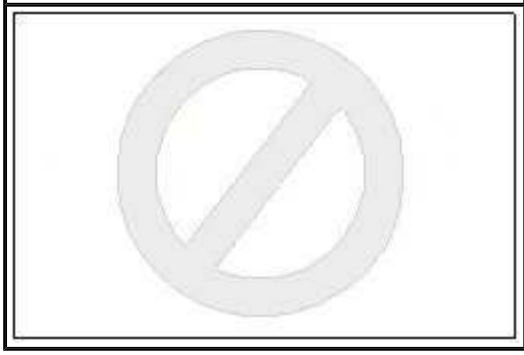
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-295 Remover, Bearing (Main Tool)
	308-197 Collet for 205-295
	308-774 Insertion Tool

Materials

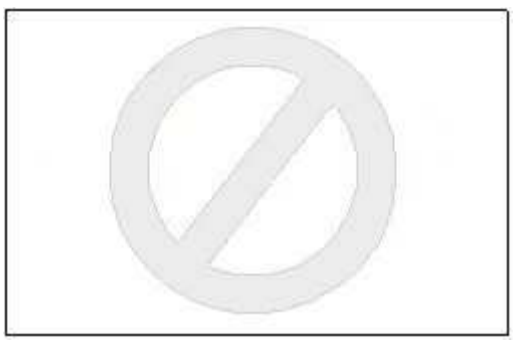
Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Hydraulic press

Disassembly

CAUTION: Use vise jaw protectors.



1. Clamp the differential in a vise.
2. *Special Tool(s):* 205-071-01, 205-295, 308-197

3. *Special Tool(s):* 205-071-01, 205-295, 308-197

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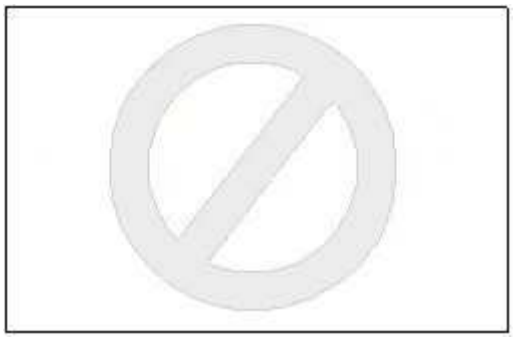
4. Remove the following items:
    1. *Loosen:* Four turn(s)
    2.
    3. Save four bolts for reassembly the ring gear.

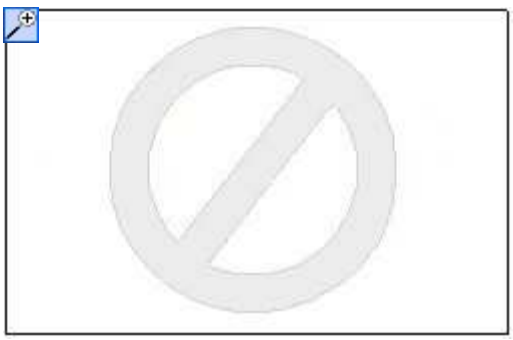


5.

Assembly

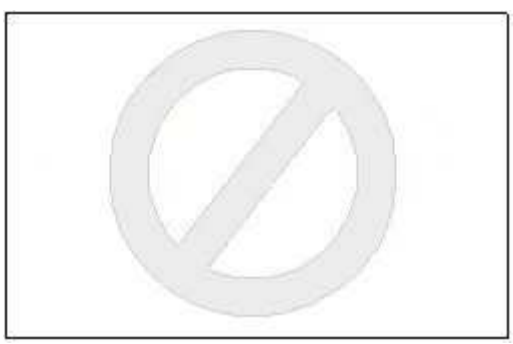
CAUTION: Use vise jaws protectors.

6. Clamp the differential in a vise.



7. NOTE: Make sure that the mating faces are clean and free of foreign material.
   Install the four bolts saved during disassembly.

   Torque: 40 Nm



8.

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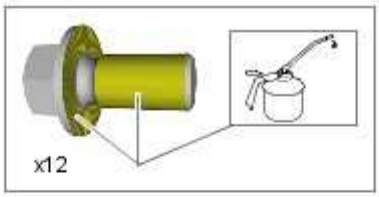

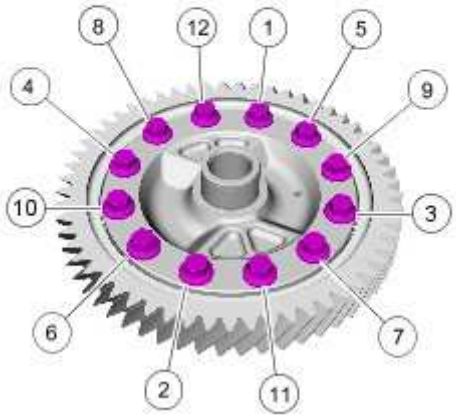

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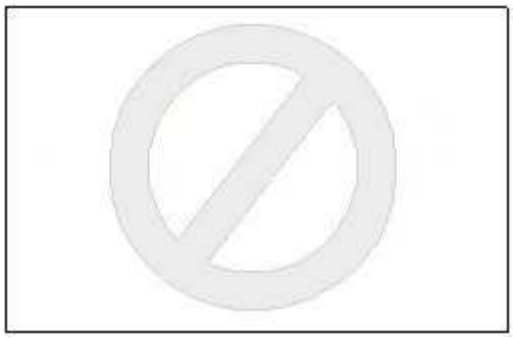
9. CAUTION: Make sure that new bolts are installed.
Material: Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)
Torque:
Stage 1: 40 Nm
Stage 2: 70°



10. NOTE: Make sure that a new component is installed.
The roller bearing must not be lubricated.

Special Tool(s): 308-774
General Equipment: Hydraulic press

11. NOTE: Make sure that a new component is installed.
The roller bearing must not be lubricated.

Special Tool(s): 308-774
General Equipment: Hydraulic press

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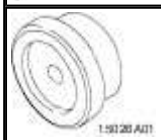
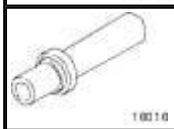
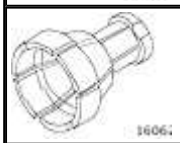
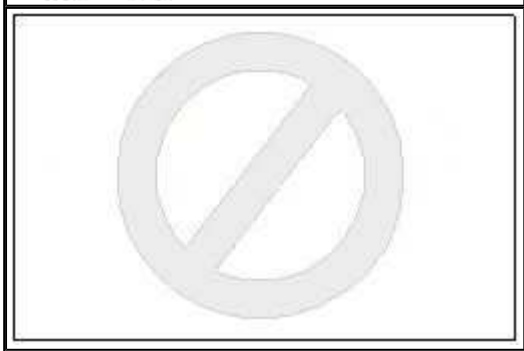
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-046 Installer, Drive Pinion Seal
	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-295 Remover, Bearing (Main Tool)
	308-046 Installer, Transmission Extension Housing Bushing/Seal
	308-197 Collet for 205-295
	308-798 Installer Bearing Cup

General Equipment

Bearing separator
Hot air gun
Hydraulic press

Disassembly

1.

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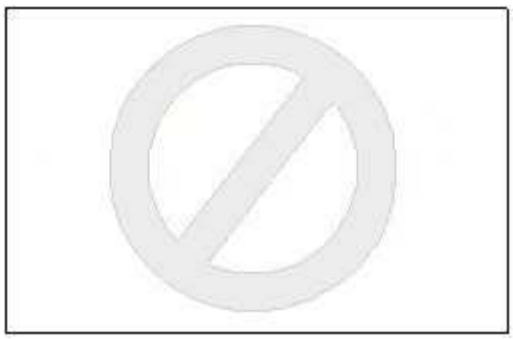
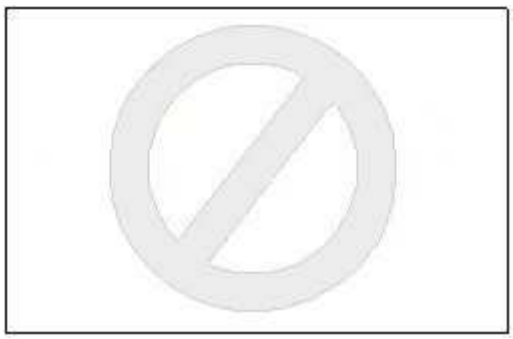
2. *Special Tool(s):* 308-798
   General Equipment: Hot air gun



3. *Special Tool(s):* 308-798
   General Equipment: Hydraulic press
   General Equipment: Bearing separator

4. *Special Tool(s):* 205-295, 308-197

Assembly



5. NOTE: Make sure that a new component is installed.
   The roller bearing must not be lubricated.

   Special Tool(s): 205-046
   General Equipment: Hydraulic press

6.
   1. CAUTION: Take extra care not to

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damage the bearing.
Special Tool(s): 205-071-01

2. NOTE: Make sure that a new component is installed.
   The roller bearing must not be lubricated.
3. *Special Tool(s):* 308-046
   General Equipment: Hydraulic press

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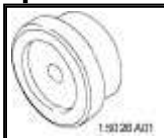
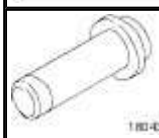
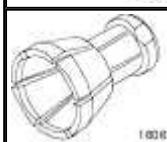
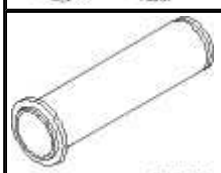
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-295 Remover, Bearing (Main Tool)
	308-095 Installer, Input Shaft Bearing
	308-112 Installer, Output Drive Flange Seal
	308-196 Collet for 205-295
	308-605 Installer, Input Shaft Seal
	308-798 Installer Bearing Cup

Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Bearing separator
Hydraulic press

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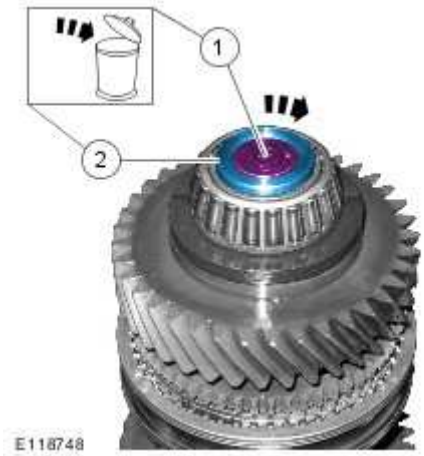
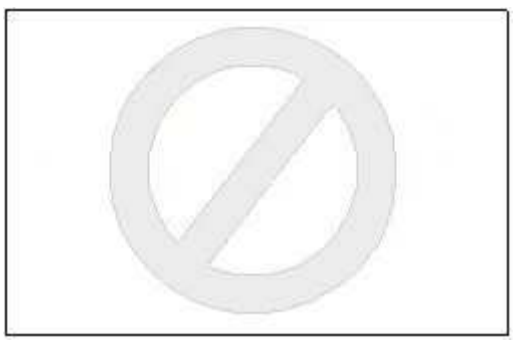
Puller

Disassembly

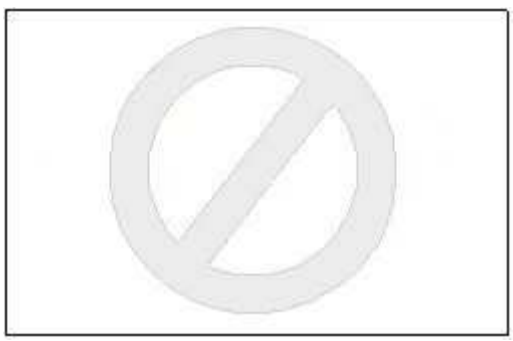
1. *Special Tool(s):* 205-295, 308-196



2.
   1. NOTE: The component has a left-hand thread.



3. *General Equipment:* Puller
   General Equipment: Bearing separator



4.

5. *Special Tool(s):* 308-798
   General Equipment: Hydraulic press

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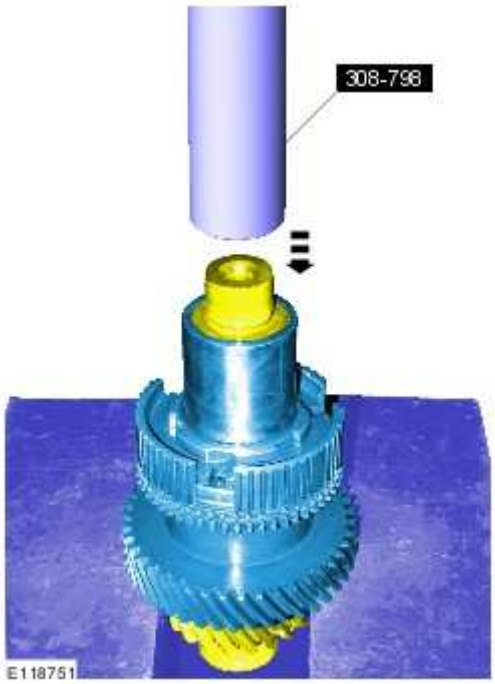

6.

Assembly

7. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

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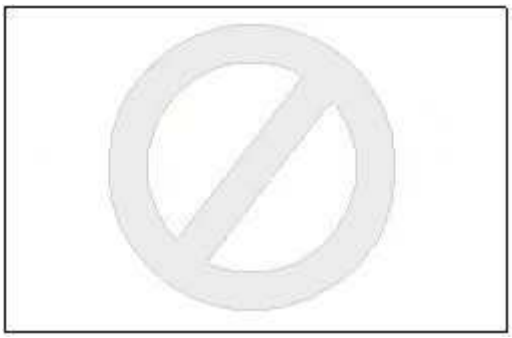
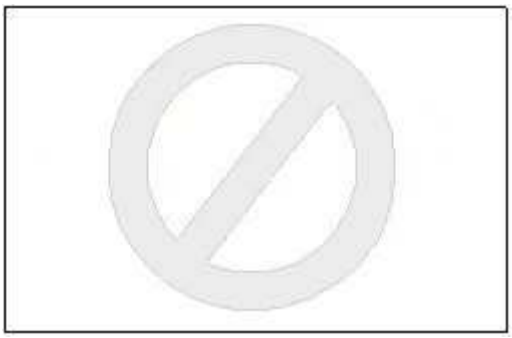


8. *Special Tool(s):* 308-605
   General Equipment: Hydraulic press

9. *Special Tool(s):* 308-095



10.

11. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

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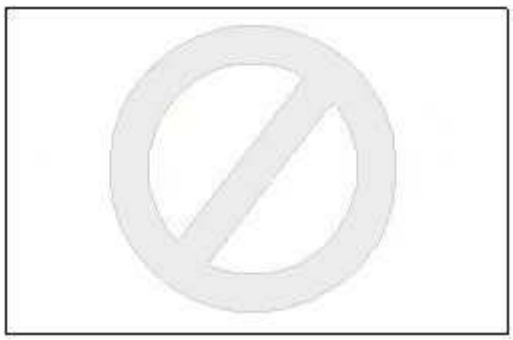
12. The roller bearing must not be lubricated.

    Special Tool(s): 205-071-01

13. NOTE: Make sure that new components are installed.
    2. NOTE: The component has a left-hand thread.
       Torque: 25 Nm



14. The roller bearing must not be lubricated.

    Special Tool(s): 308-112

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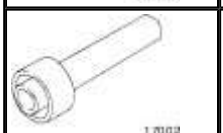
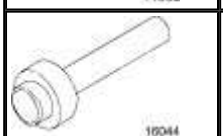
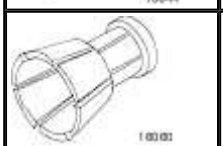
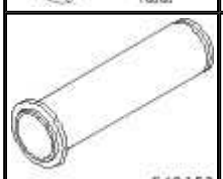
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-295 Remover, Bearing (Main Tool)
	307-028 Installer, Transmission Extension Housing Seal
	308-113 Installer, Input Shaft Seal
	308-195 Collet for 205-295
	308-605 Installer, Input Shaft Seal

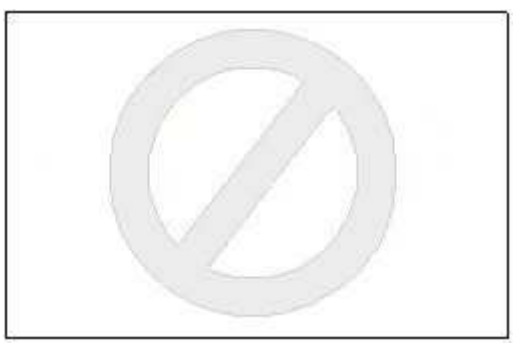
Materials

Name	Specification
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Hydraulic press

Disassembly



1. *Special Tool(s):* 205-295, 308-195

2.
   1. NOTE: The component has a left-hand thread.

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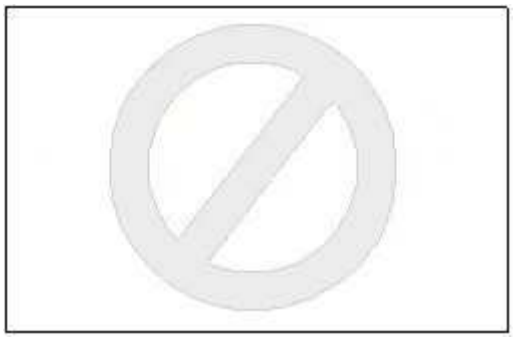
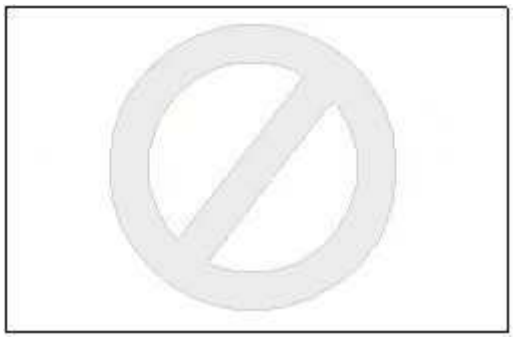


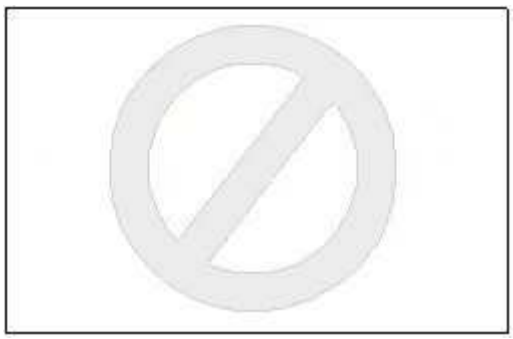
3. Use a suitable socket.

   General Equipment: Hydraulic press



4.

Assembly



5. *Material:* Transmission Oil 75W FE (WSS-M2C200-D2 / 7U7J-M2C200-BA)

6. *Special Tool(s):* 308-605
   General Equipment: Hydraulic press

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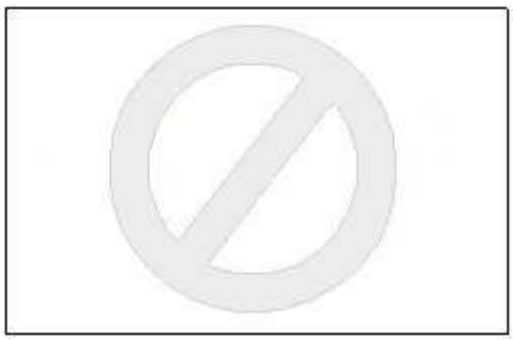
7. The roller bearing must not be lubricated.

   Special Tool(s): 308-113

8. NOTE: Make sure that new components are installed.
   2. NOTE: The component has a left-hand thread.
      Torque: 25 Nm



9. The roller bearing must not be lubricated.

   Special Tool(s): 307-028

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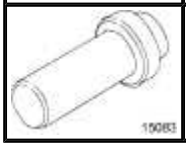
Disassembly and Assembly of Subassemblies

Special Tool(s)

	205-071-01 Adapter for 205-071 (Thrust Pad)
	205-252 Installer, Wheel Hub Seal

Materials

Name	Specification
Grease CB-CS	WSD-M1C234-A / 4U7J-M1C234-AA

General Equipment

Bearing separator
Hydraulic press

Disassembly

CAUTION: Use vise jaw protectors.

1. Clamp the differential in a vise.
2. *Special Tool(s):* 205-071-01
   General Equipment: Bearing separator

3. *Special Tool(s):* 205-071-01
   General Equipment: Bearing separator

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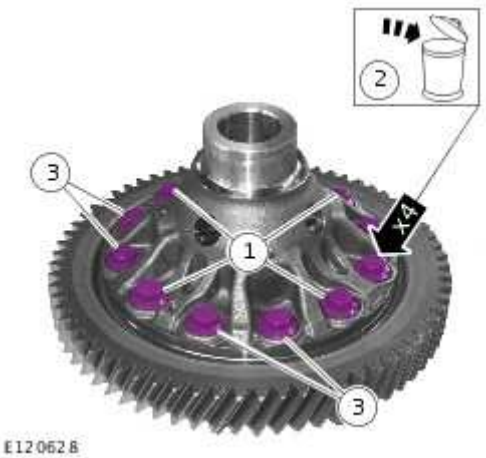
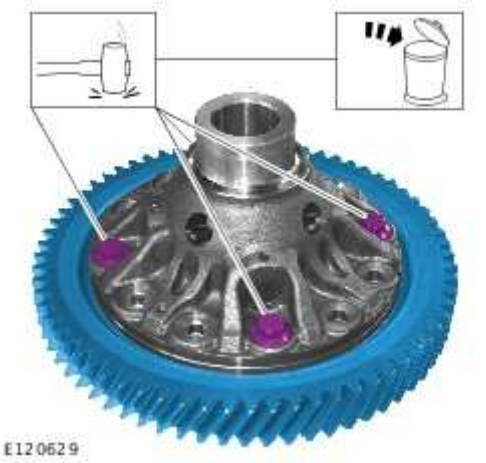
4. Remove the following items:
   1. *Loosen:* Four turn(s)
   2.
   3. Save four bolts for reassembly the ring gear.



5.



Assembly

CAUTION: Use vise jaws protectors.

6. Clamp the differential in a vise.
7. NOTE: Make sure that the mating faces are clean and free of foreign material.
   Install the four bolts saved during disassembly.

   Torque: 50 Nm

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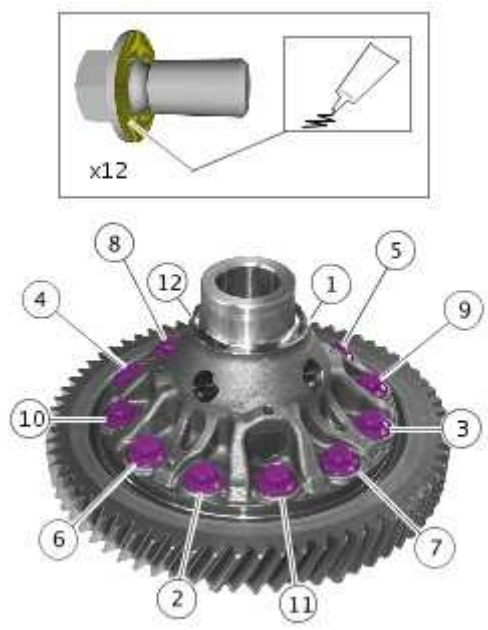
8.



9. CAUTION: Make sure that new bolts are installed.
Material: Grease CB-CS (WSD-M1C234-A / 4U7J-M1C234-AA)
Torque:
Stage 1: 50 Nm
Stage 2: 90°

10. NOTE: Make sure that a new component is installed.
The roller bearing must not be lubricated.

Special Tool(s): 205-252
General Equipment: Hydraulic press

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E120633

E120634

11. NOTE: Make sure that a new component is installed.
The roller bearing must not be lubricated.

Special Tool(s): 205-252
General Equipment: Hydraulic press

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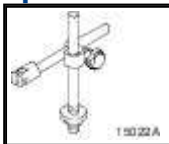
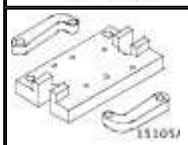
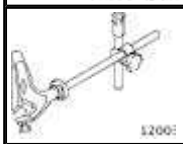
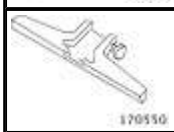
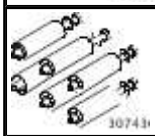
Assembly

Special Tool(s)

	205-070 Holding Fixture, Dial Indicator Gauge
	205-329 Mounting Bracket, Engine/Differential
	206-003 Holding Fixture, Dial Indicator Gauge (Disc Brake)
	303-132 Installer/Aligner, Pilot Bearing/Clutch Plate
	303-435 Mounting Stand
	303-435-06 Mounting Bracket for 303-435
	307-300-02 Depth Gauge, Shim Selection
	307-300-03 Adapter for 307-300-02
	307-430 Gauge, Transmission End Play
	308-119 Installer, Halfshaft Seal

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	308-789 Installer, Driveshaft Seal
 E116733	308-796 Gauge
	308-798 Installer Bearing Cup

Materials

Name	Specification
Silicone Sealant DCW	9U7J-99J9624-AA
Transmission Oil 75W FE	WSS-M2C200-D2 / 7U7J-M2C200-BA

General Equipment

Cable ties
Hot air gun
Tire lever

All vehicles

1. *Special Tool(s):* 308-798
   Material: Transmission Oil 75W FE (WSS-M2C200-D M2C200-BA)

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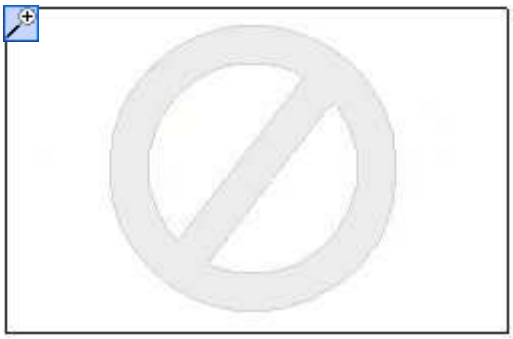
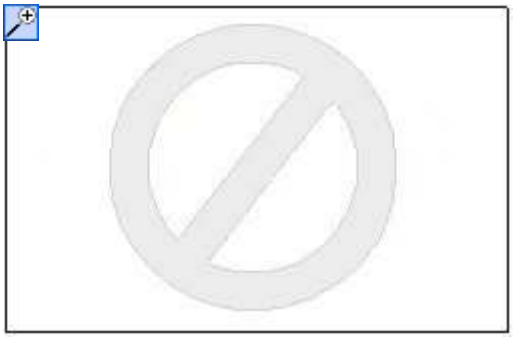
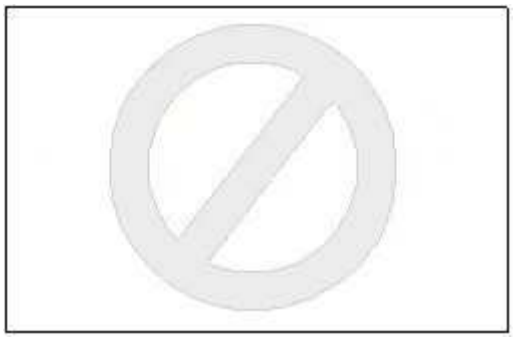
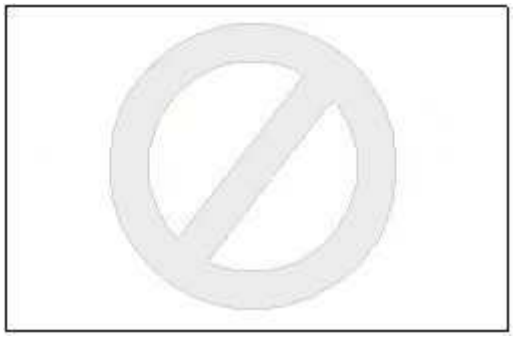




2. NOTE: Make sure that new components are instal
   Special Tool(s): 303-132



3. NOTE: Make sure that new components are instal
   Special Tool(s): 303-132



4.
   1. *General Equipment:* Hot air gun
   2. NOTE: Make sure that new components are installed.

5. *Special Tool(s):* 308-798

6. *Special Tool(s):* 308-798

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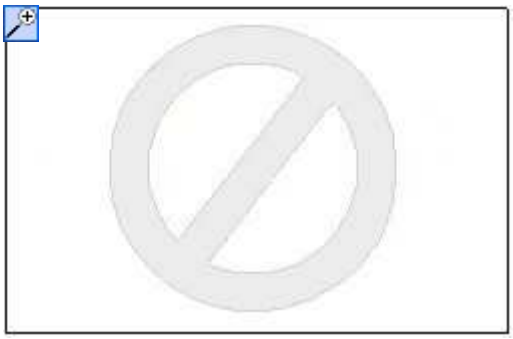
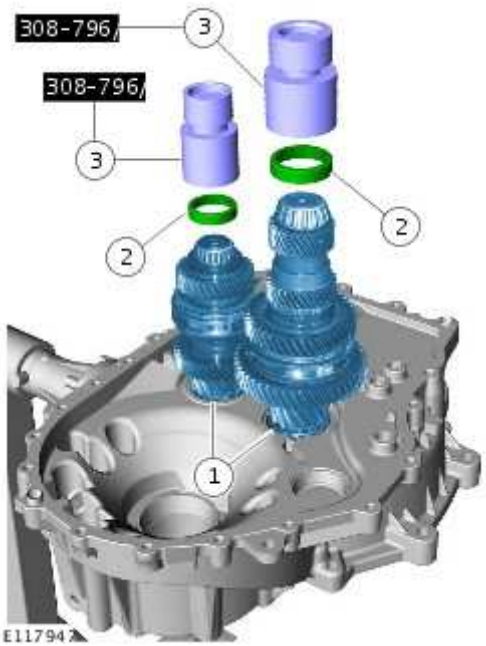


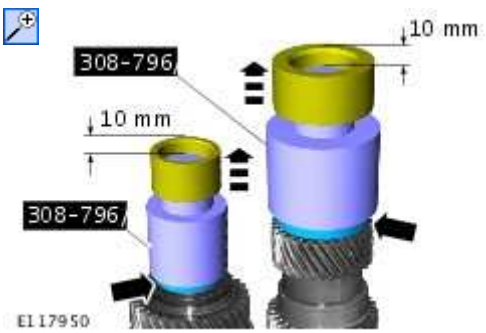


7. Install the following items:
   1. CAUTIONS:

      Take extra care not to damage the bea

      Extreme cleanliness must be exercised handling the components.
   2. NOTE: Make sure that new components are installed.
   3. *Special Tool(s):* 308-796

8. *Special Tool(s):* 205-070, 206-003, 307-430



9.
   - Repeat this and the following five steps three determine the average values.
   - Lift the measuring rings to approx. 10 mm.

     Special Tool(s): 308-796

10. Hold the bearing cup and press down on the special simultaneously.

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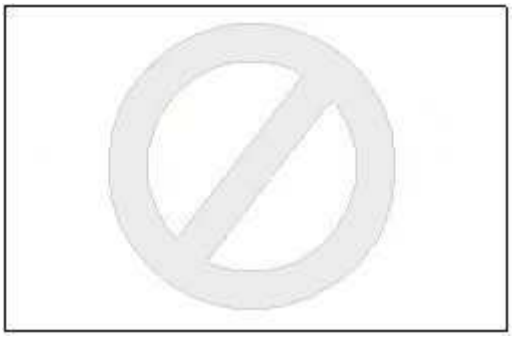
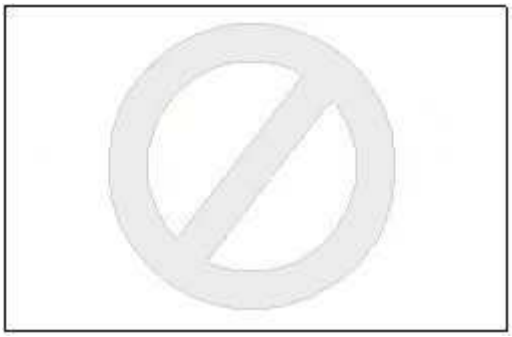
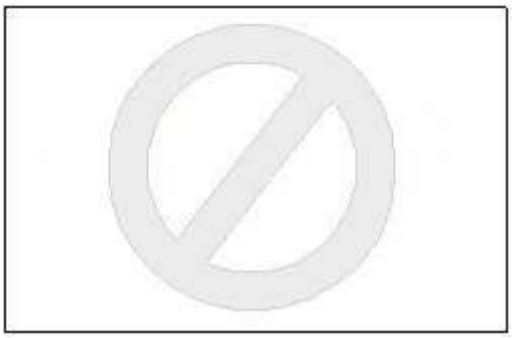


11. Hold the bearing cup and press down on the special simultaneously.



12. *Torque:* 10 Nm



13.

14.

- Only press lightly on the special tool to avoid readings.

  Special Tool(s): 307-300-02, 307-300-03
- Record the measurement results.

  Special Tool(s): 308-796

15.

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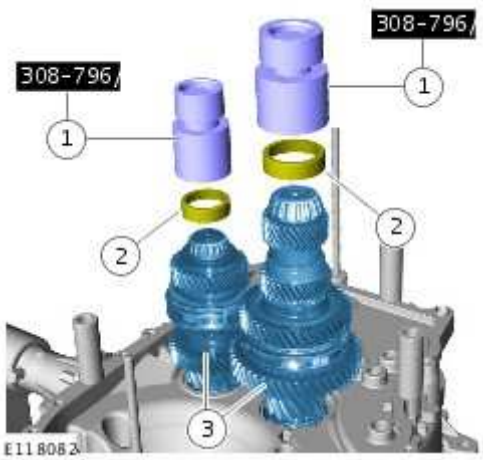
- Measure the required thickness of the 1st-2nd 6th gear output shaft adjustment shim:
- Add the measured values, divide by three and the value for the bearing pre-load.
- 1st-2nd and 5th-6th gear output shaft bearing 0.20 mm.
- Example: 1.11 mm + 1.16 mm + 1.15 mm, di = 1.13 mm. 1.13 mm + 0.20 mm = 1.33 mm
- Determined shim thickness: 1.33 mm.
- If the calculated shim thickness is an odd num the shim with the next higher number.

16.

- Measure the required thickness of the 3rd-4th output shaft adjustment shim:
- Add the measured values, divide by three and the value for the bearing pre-load.
- 3rd-4th gear output shaft bearing pre-load: 0.
- Example: 1.27 mm + 1.28 mm + 1.27 mm, di = 1.27 mm. 1.27 mm + 0.15 mm = 1.42 mm
- Determined shim thickness: 1.42 mm.
- If the calculated shim thickness is an odd num the shim with the next higher number.

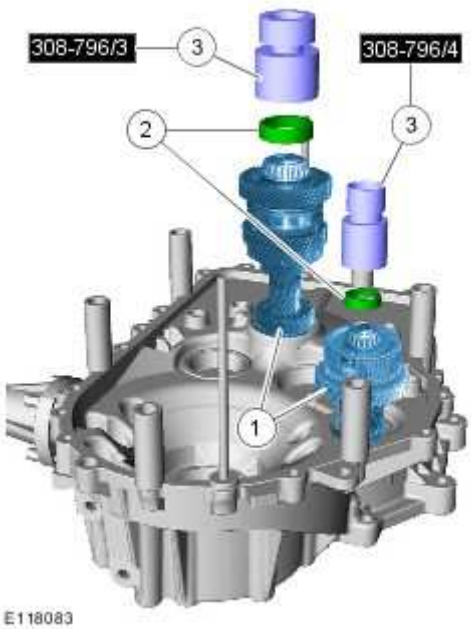
17. Remove the following items:
    1. *Special Tool(s):* 308-796
    2.
    3.



18. Install the following items:
    1. CAUTIONS:

       Take extra care not to damage the bea

       Extreme cleanliness must be exercised handling the components.
    2. NOTE: Make sure that new components are installed.
    3. *Special Tool(s):* 308-796



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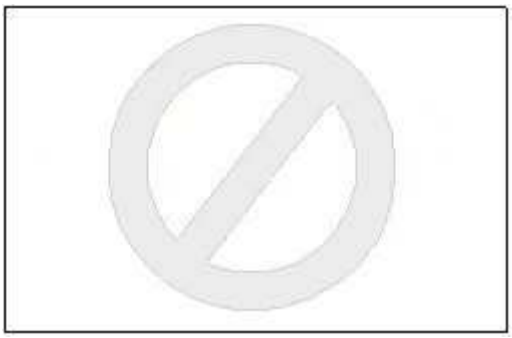
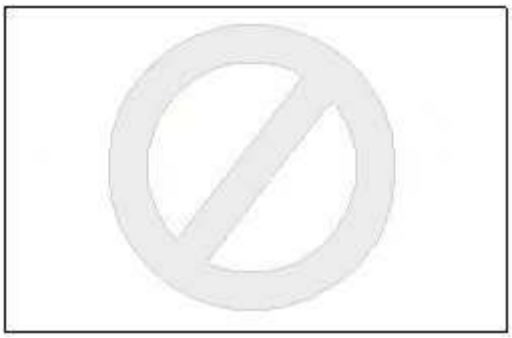
19.

- Repeat this and the following five steps three determine the average values.
- Lift the measuring rings to approx. 10 mm.

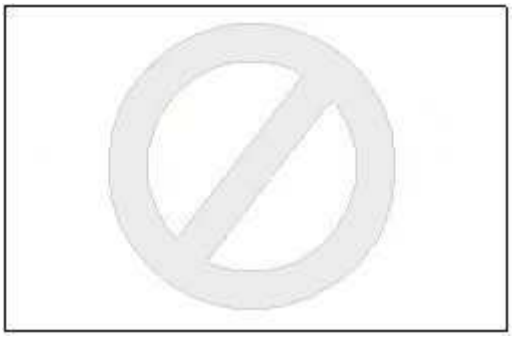
Special Tool(s): 308-796



20. Hold the bearing cup and press down on the special simultaneously.



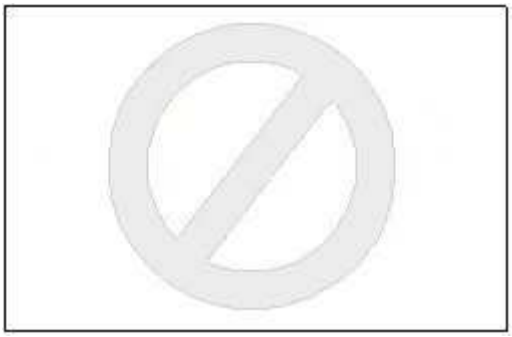
21. Hold the bearing cup and press down on the special simultaneously.



22. *Torque:* 10 Nm

23.

http://vnx.su



24.

- Only press lightly on the special tool to avoid readings.

  Special Tool(s): 307-300-02, 307-300-03
- Record the measurement results.

  Special Tool(s): 308-796

25.

- Measure the required thickness of the input sh adjustment shim:
- Add the measured values, divide by three and the value for the bearing pre-load.
- Input shaft bearing pre-load: 0.03 mm.
- Example: 1.10 mm + 1.12 mm + 1.14 mm, di = 1.12 mm. 1.12 mm + 0.03 mm = 1.15 mm
- Determined shim thickness: 1.15 mm.
- If the calculated shim thickness is an odd num the shim with the next higher number.

26.

- Measure the required thickness of the reverse output shaft adjustment shim:
- Add the measured values, divide by three and the value for the bearing pre-load.
- Reverse gear output shaft bearing pre-load: 0
- Example: 1.40 mm + 1.40 mm + 1.40 mm, di = 1.40 mm. 1.40 mm + 0.11 mm = 1.51 mm
- Determined shim thickness: 1.51 mm.
- If the calculated shim thickness is an odd num the shim with the next higher number.

27. Remove the following items:
    1. *Special Tool(s):* 308-796
    2.
    3.

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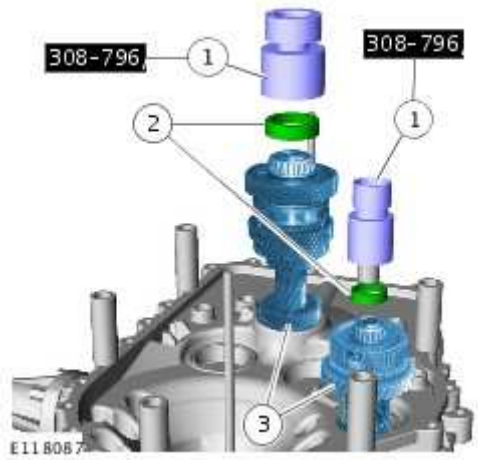
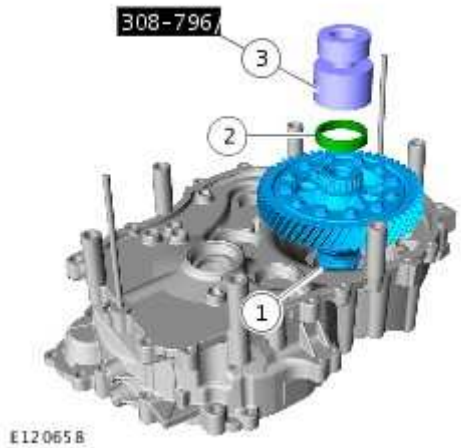


Vehicles with 2.5L engine

28. Install the following items:
    1. CAUTIONS:

       Take extra care not to damage the bea

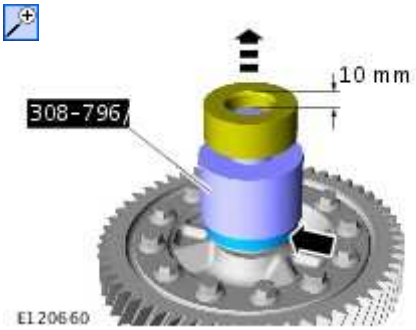
       Extreme cleanliness must be exercised handling the components.
    2. NOTE: Make sure that new components are installed.
    3. *Special Tool(s):* 308-796



29.

- Repeat this and the following four steps three determine the average values.
- Lift the measuring rings to approx. 10 mm.

Special Tool(s): 308-796



Vehicles with 2.2L diesel engine

30. Install the following items:
    1. CAUTIONS:

       Take extra care not to damage the bea

       Extreme cleanliness must be exercised handling the components.
    2. NOTE: Make sure that new components are installed.
    3. *Special Tool(s):* 308-796

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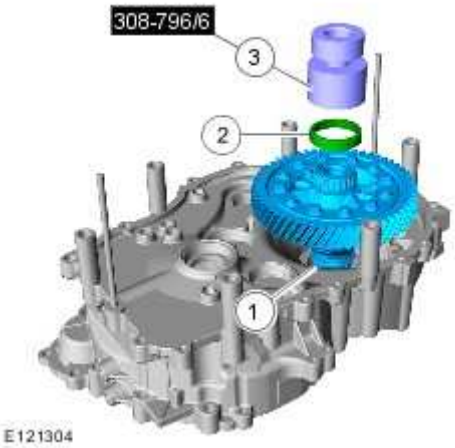

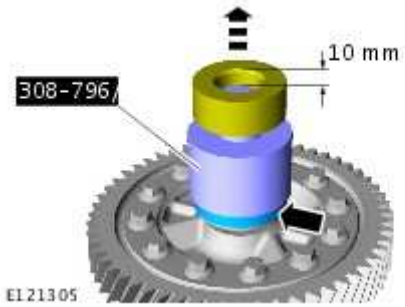

31.

- Repeat this and the following four steps three determine the average values.
- Lift the measuring rings to approx. 10 mm.

Special Tool(s): 308-796

All vehicles

32. Hold the bearing cup and press down on the special simultaneously.

33. *Torque:* 10 Nm

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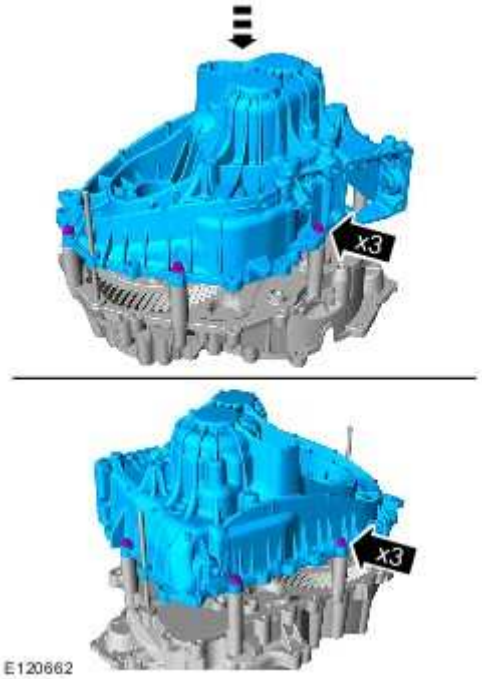
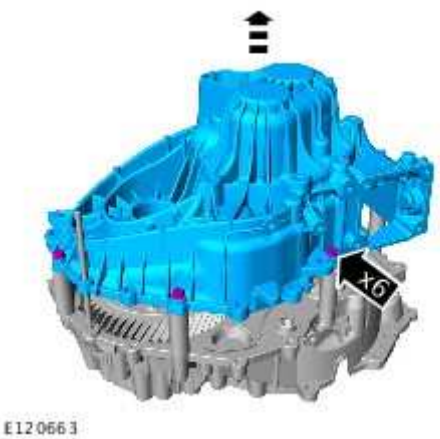


34.



Vehicles with 2.5L engine

35.

- Only press lightly on the special tool to avoid readings.

  Special Tool(s): 307-300-02, 307-300-03
- Record the measurement results.

  Special Tool(s): 308-796

Vehicles with 2.2L diesel engine

36.

- Only press lightly on the special tool to avoid

http://vnx.su

readings.

Special Tool(s): 307-300-02, 307-300-03

- Record the measurement results.

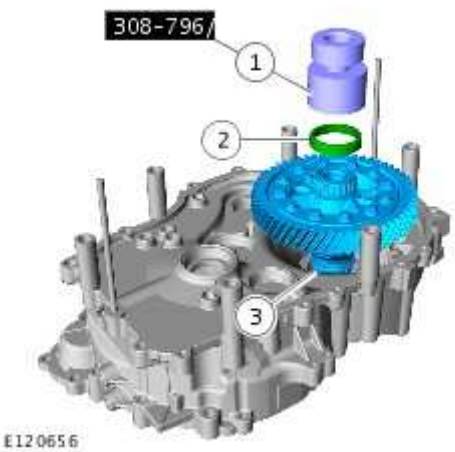
Special Tool(s): 308-796

All vehicles

37.

- Measure the required thickness of the differen adjustment shim:
- Add the measured values, divide by three and the value for the bearing pre-load.
- Differential bearing pre-load: 0.18 mm.
- Example: 1.56 mm + 1.57 mm + 1.55 mm, di = 1.56 mm. 1.56 mm + 0.18 mm = 1.74 mm
- Determined shim thickness: 1.74 mm.
- If the calculated shim thickness is an odd num the shim with the next higher number.

Vehicles with 2.5L engine



38. Remove the following items:
    1. *Special Tool(s):* 308-796
    2.
    3.

Vehicles with 2.2L diesel engine

39. Remove the following items:
    1. *Special Tool(s):* 308-796
    2.
    3.

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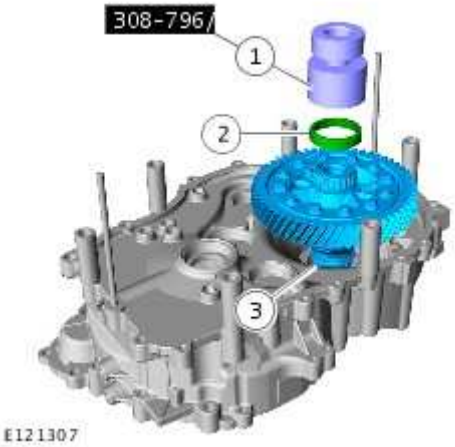
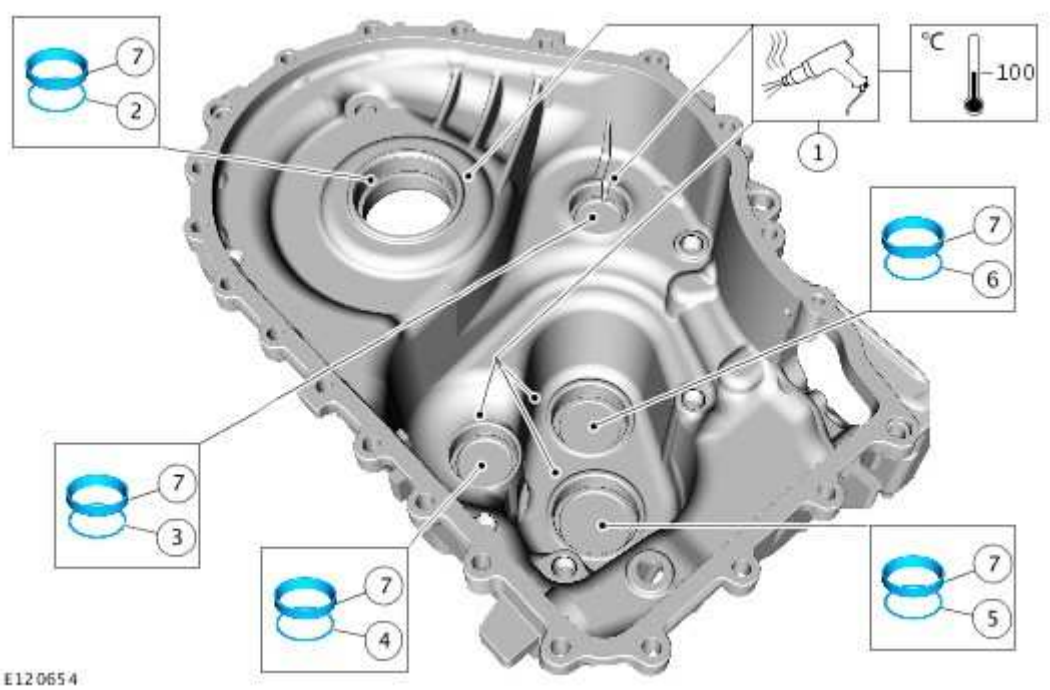


All vehicles

40. *Remove the Special Tool(s):* 205-070, 206-003, 307

41.

1. *Ge Eq Hc*
2. Me ad sh
3. Me ad sh
4. Me ad sh
5. Me ad sh
6. Me ad sh



42. *Special Tool(s):* 308-798

43. *Special Tool(s):* 308-798

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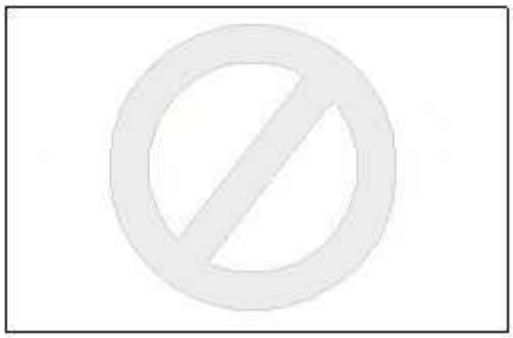
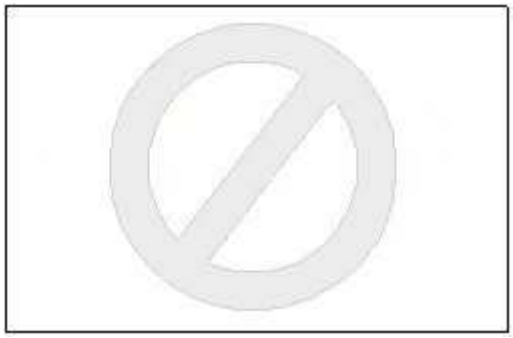
44. Install the following items:
    1. *General Equipment:* Cable ties



45. NOTE: This step requires the aid of another techn
    1. *Material:* Transmission Oil 75W FE (WSS-M2C 7U7J-M2C200-BA)

46. *Material:* Transmission Oil 75W FE (WSS-M2C200-D M2C200-BA)



47.
    1. *General Equipment:* Tire lever
    2. *Material:* Transmission Oil 75W FE (WSS-M2C 7U7J-M2C200-BA)

48. Remove the following items:
    1. *General Equipment:* Cable ties

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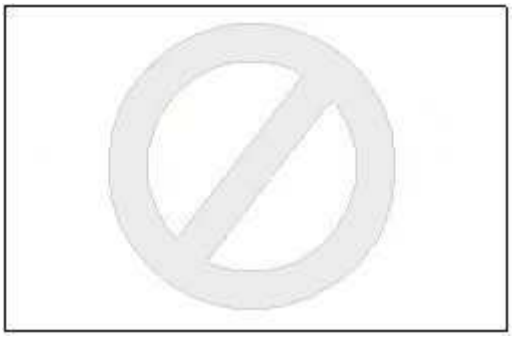
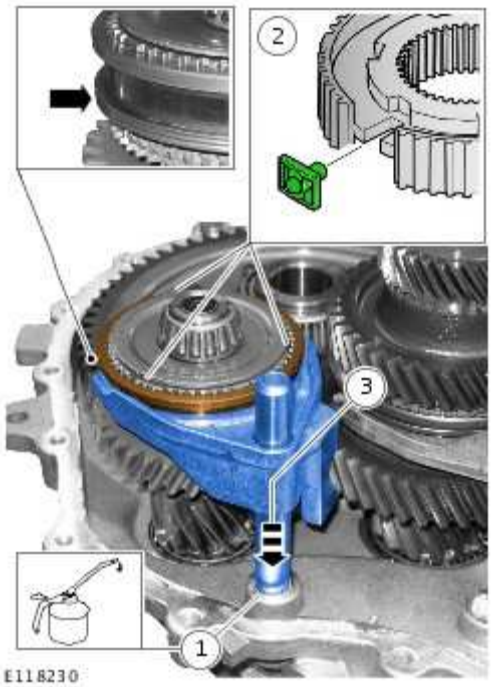
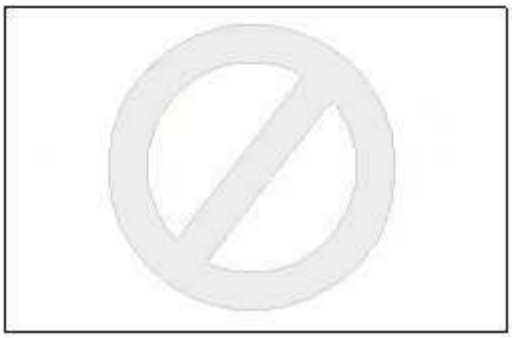


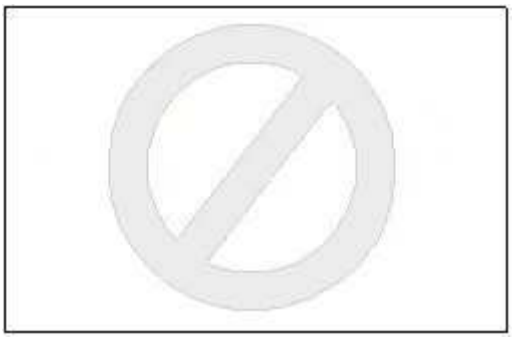


49.

1. *Material:* Transmission Oil 75W FE (WSS-M2C 7U7J-M2C200-BA)



50. *Torque:* 25 Nm



51. CAUTION: Make sure that the surface is clear free of foreign material.
Material: Silicone Sealant DCW (9U7J-99J9624-AA)

52.

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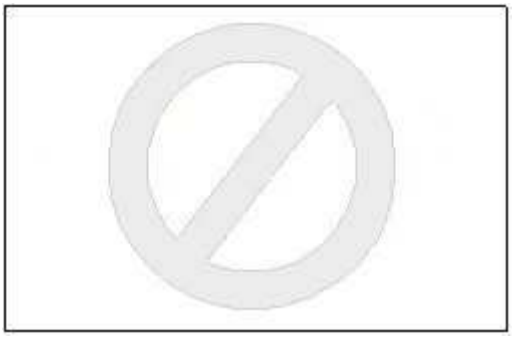
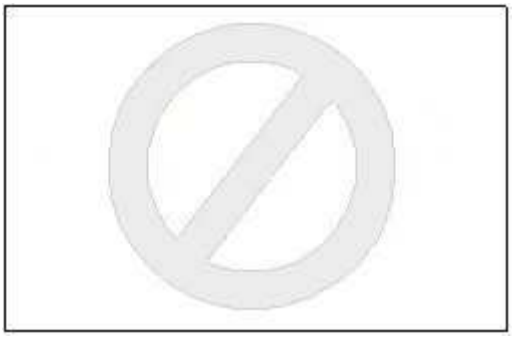
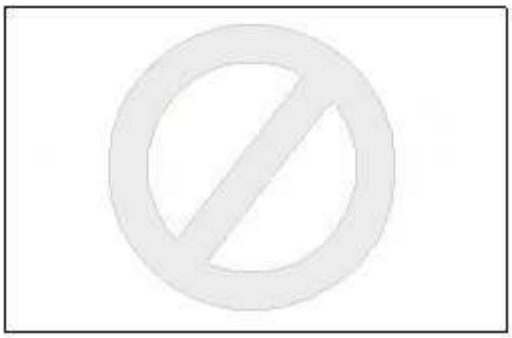


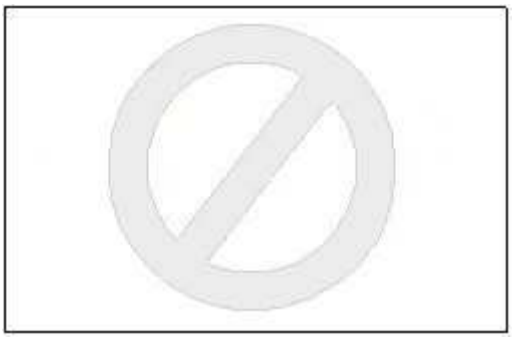


53.

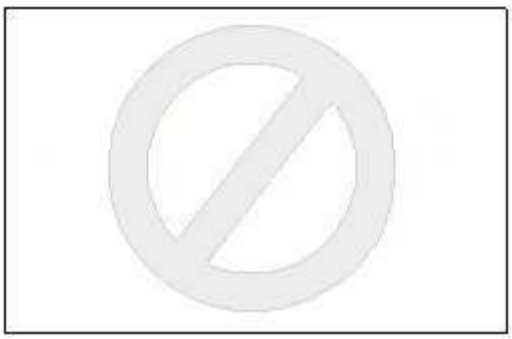
1. *Torque:*
   Stage 1: 18 Nm
   Stage 2: 90°
2. NOTE: Make sure that a new component is i
3. *Special Tool(s):* 308-789



54. CAUTION: Make sure that the locating dowels installed.



55.



56. CAUTION: Make sure that the surface is clear free of foreign material.
Material: Silicone Sealant DCW (9U7J-99J9624-AA)

57.

2. *Torque:* 25 Nm
3. *Torque:* 30 Nm
4. *Torque:* 25 Nm

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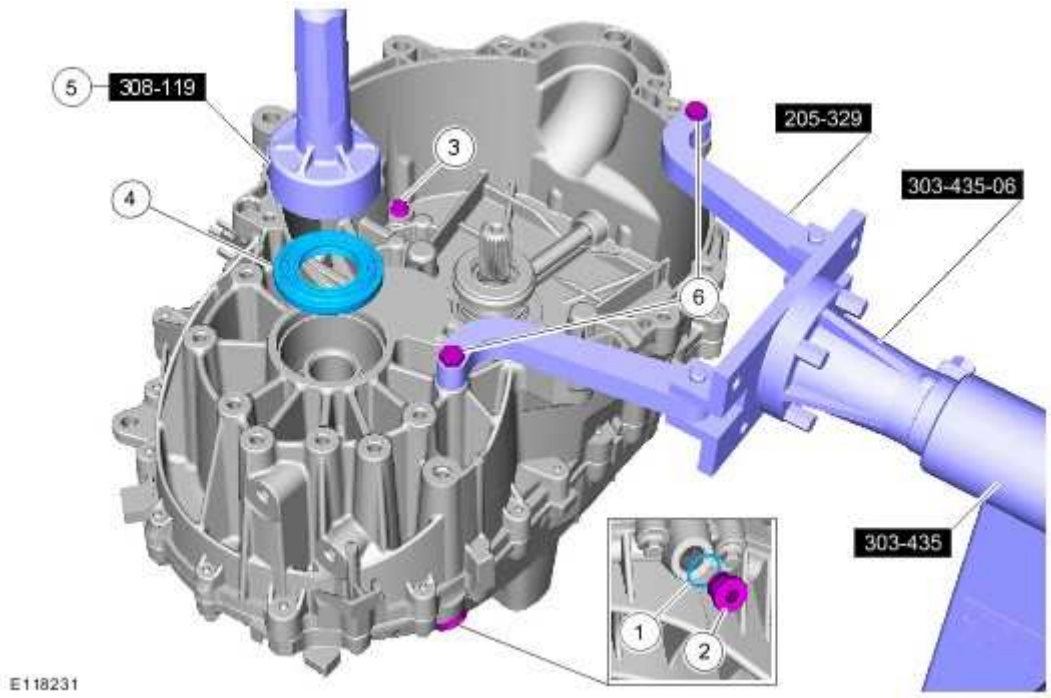
58. *Torque:* 10 Nm

59.



1. NO
   Ma
   tha
   co
   is
2. *To*
   Nm
3. *To*

   18

   90
4. NO
   Ma
   tha
   co
   is
5. *Sp*
   (s)
6. *Re*
   Sp
   (s)
   30
   30

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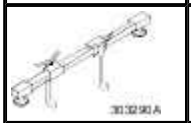
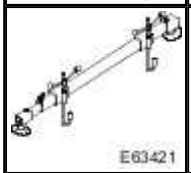
Installation

Special Tool(s)

	303-290-13 Adapter for 303-290A
	303-290A-15 Adapter für 303-290A
	303-290B Support Bar, Engine
	303-290B-16 Adapter for 303-290B

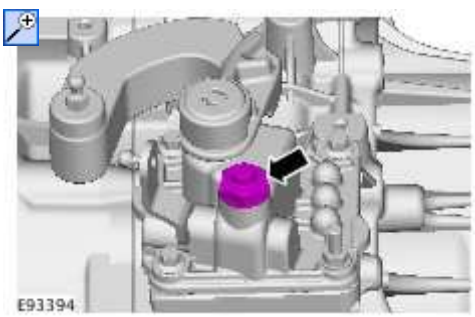
Materials

Name	Specification
Grease K-HT	ESD-M1C220-A / A88SX1C220AA
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

Transmission jack

CAUTION: Ensure that the two guide sleeves are installed.



1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. NOTE: This step is only required when replacing the transmission.
   Torque: 32 Nm
3. Coat the input shaft splines with a thin coating of grease.

   Material: Grease K-HT (ESD-M1C220-A / A88SX1C220AA)
4. *General Equipment:* Transmission jack

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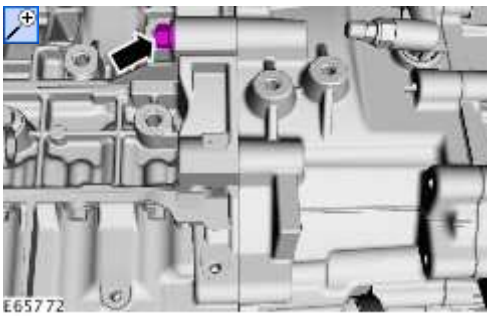
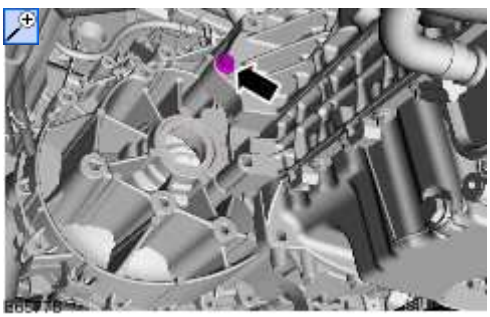
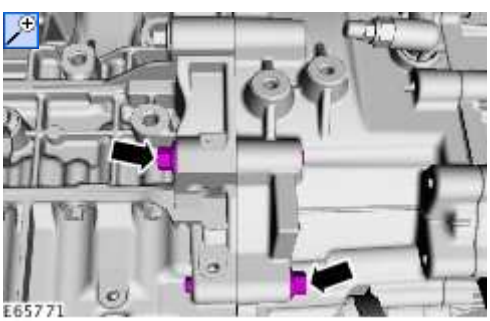


5. *Torque:* 48 Nm



6. *Torque:* 48 Nm

7. Remove the transmission jack.



8. *Torque:* 48 Nm

9. *Torque:* 48 Nm

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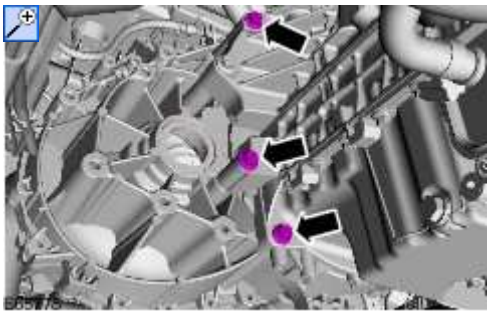
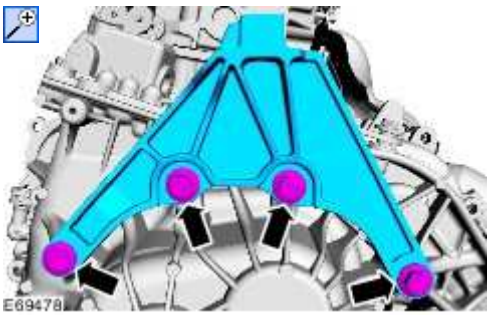
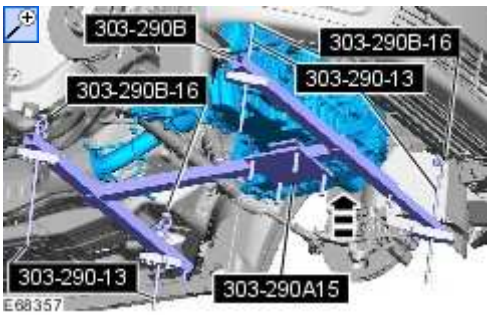
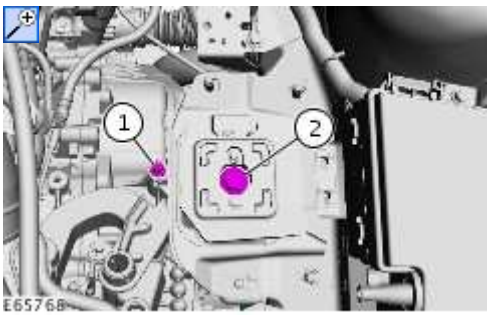




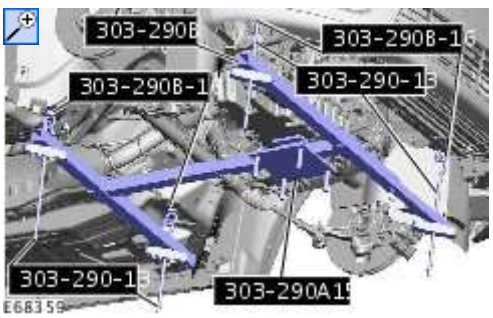
10. *Torque:* 80 Nm



11. *Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16



12.
    1. *Torque:* 24 Nm
    2. CAUTION: Make sure that a new bolt is installed.
       Torque: 133 Nm



13. *Remove the Special Tool(s):* 303-290B, 303-290-13, 303-290A-15, 303-290B-16

14. Install the following items:
    1. Refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
    2. Refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
    3. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System,

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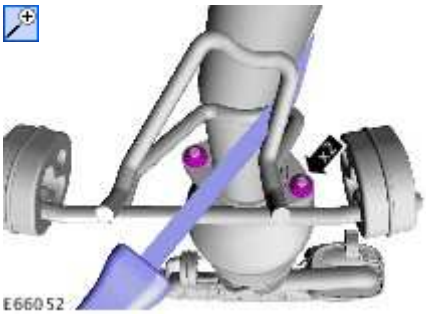
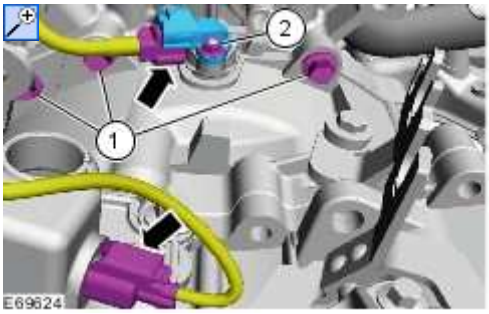
Removal and Installation).

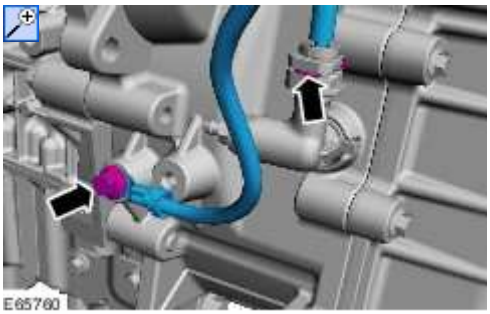


15. NOTE: Make sure that the exhaust flexible pipe is not twisted.
Coat the studs with grease.

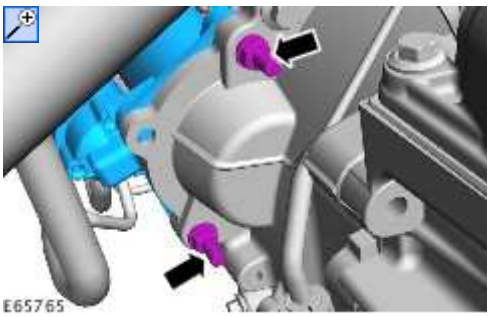
Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
Torque: 48 Nm



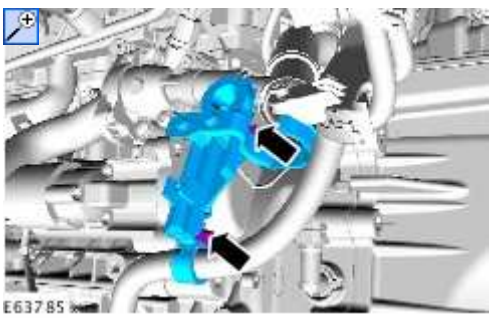
16.
1. *Torque:* 48 Nm
2. *Torque:* 9 Nm



17. *Torque:* 25 Nm



18. *Torque:* 25 Nm



19. *Torque:* 10 Nm

20.

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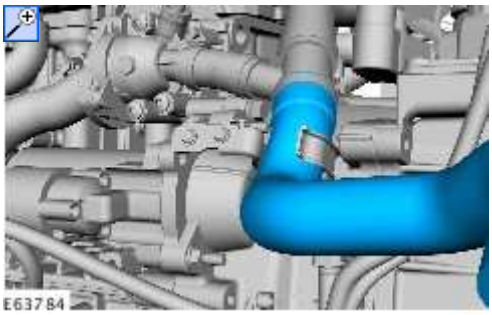
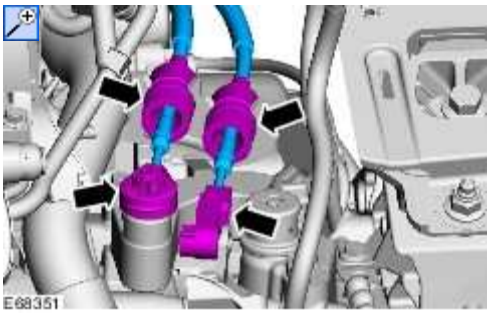
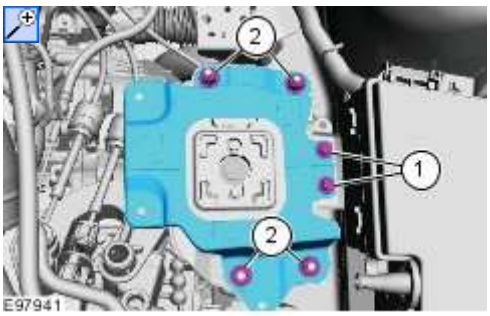




21. CAUTION: The gearshift cables must not be kinked or twisted.



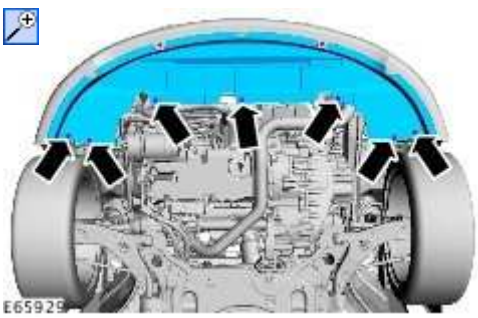
22.
    1. *Torque:* 25 Nm
    2. *Torque:* 48 Nm

23. Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (M66) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

24. Install the following items:
    1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
    2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

25. Check the transmission fluid fill level.

    Refer to: Transmission Draining and Filling - 2.5L Duratec (162kW/220PS) - VI5 (308-03C Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, General Procedures).



26.

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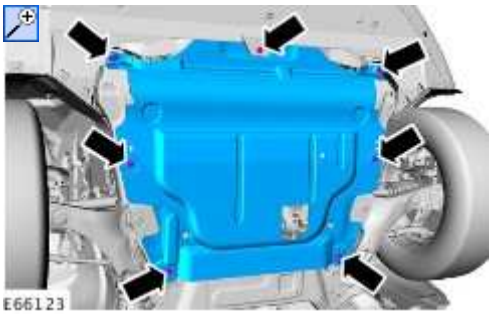

27.

28. Initialize the window regulator motors.

    Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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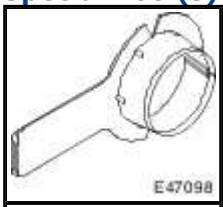
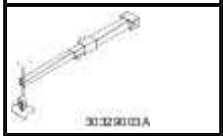
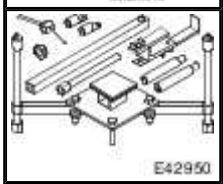
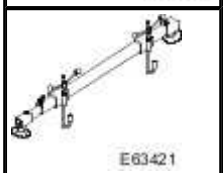
Print

Installation

Special Tool(s)

 E47098	205-775 Protector Halfshaft Seal
	303-290-03A Adapter for 303-290A
	303-290-13 Adapter for 303-290A
 E42950	303-290A-15 Adapter für 303-290A
 E63421	303-290B Support Bar, Engine
E63418	303-290B-16 Adapter for 303-290B

Materials

Name	Specification
Grease KS-LL	9U7J-M1C273-BA
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

Retaining Strap
Tire lever
Transmission jack
Wooden Block

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Coat the input shaft splines with a thin coating of grease.

   Material: Grease KS-LL (9U7J-M1C273-BA)
3. This step is only required when replacing the

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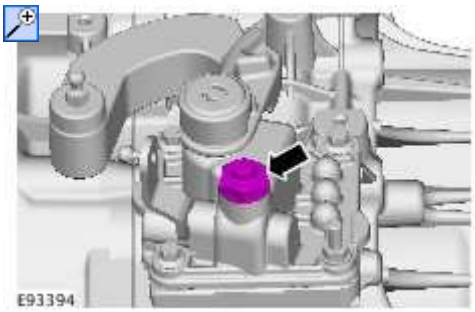
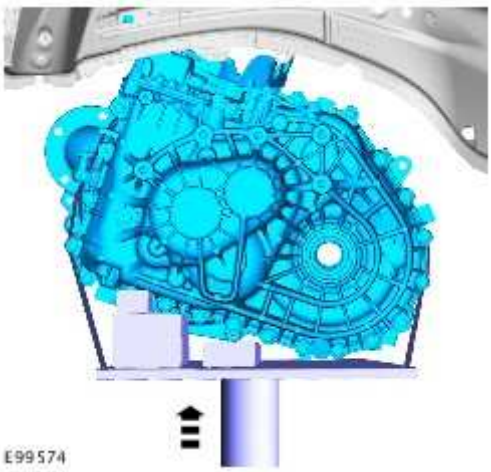
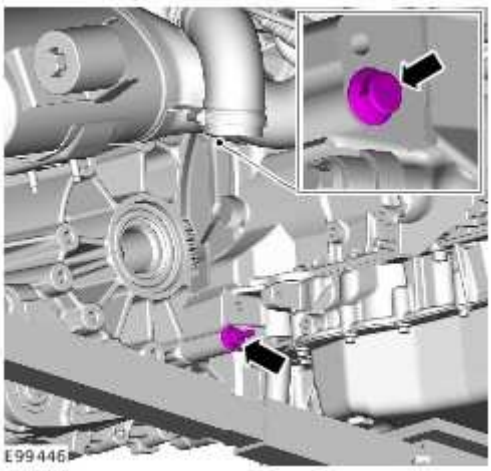


transmission.

Torque: 32 Nm

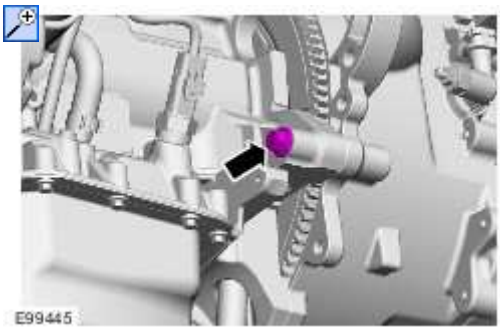


4. *General Equipment:* Transmission jack
   General Equipment: Wooden Block
   General Equipment: Retaining Strap



5. Perform this and the following operation simultaneously.

   Torque: 48 Nm



6. *Torque:* 48 Nm

7. Remove the following items:
   - *General Equipment:* Wooden Block
     General Equipment: Retaining Strap
     General Equipment: Transmission jack
8. *Torque:*
   Stage 1: 35 Nm
   Stage 2: 60°

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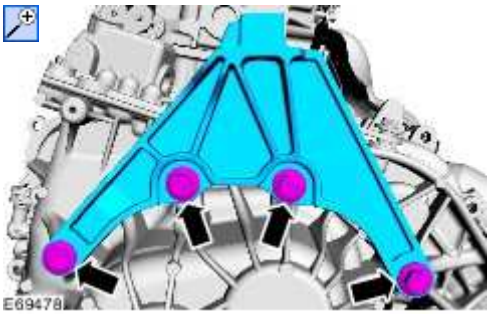
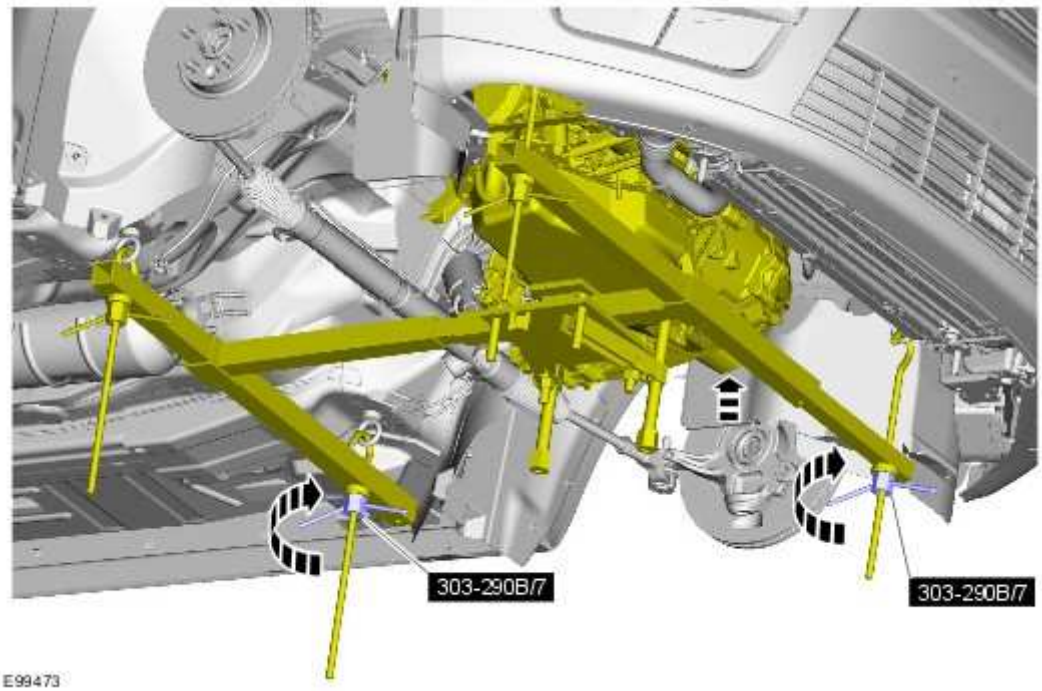
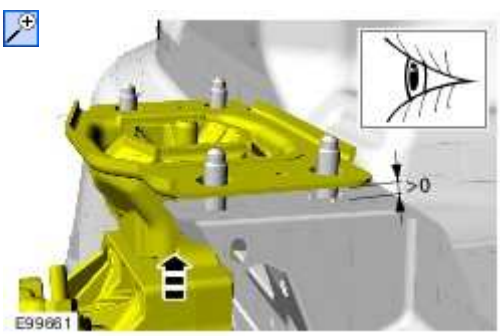


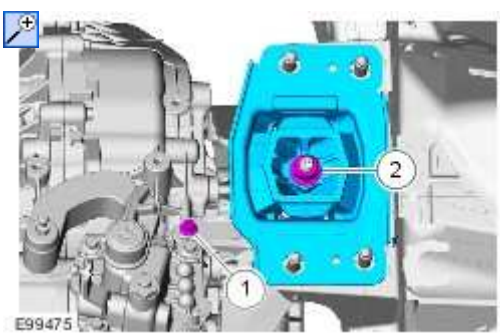


9. *Special Tool (s):* 303-290B



10.

11. Lower the vehicle.



12.
    1. *Torque:* 24 Nm
    2. CAUTION: Make sure that a new nut is installed.
       Torque: 148 Nm

13. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

14. *Remove the Special Tool(s):* 303-290B, 303-290-

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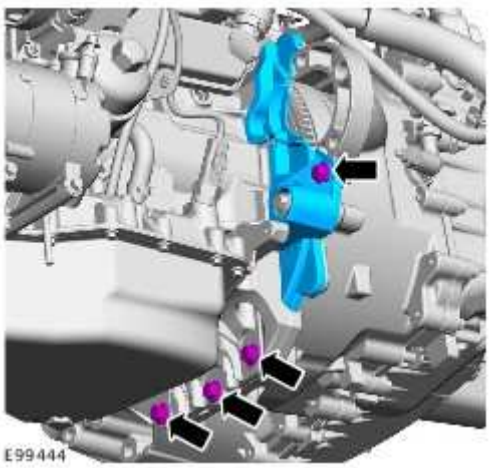
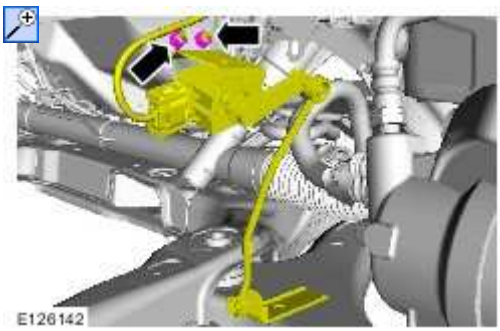
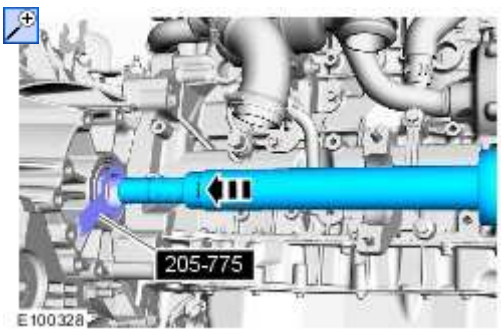


15. *Torque:* 48 Nm



16. *Torque:* 10 Nm

17.



18. Remove the special tool before completely installing the halfshaft.

Special Tool(s): 205-775

19.

1. NOTE: Make sure that a new component is installed.
2. NOTE: Make sure that new components are installed.

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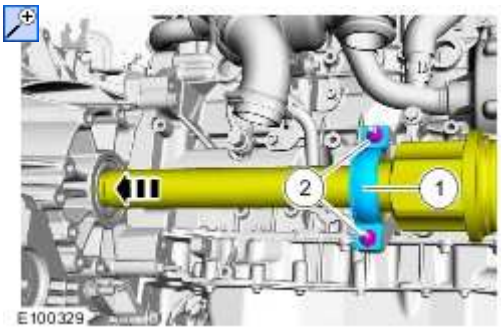
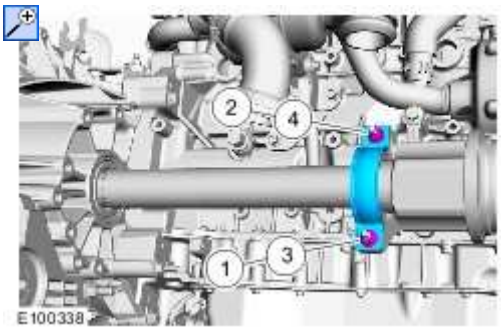
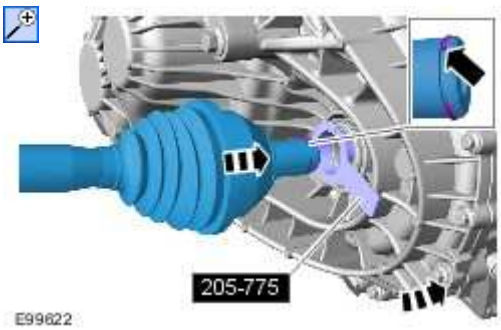




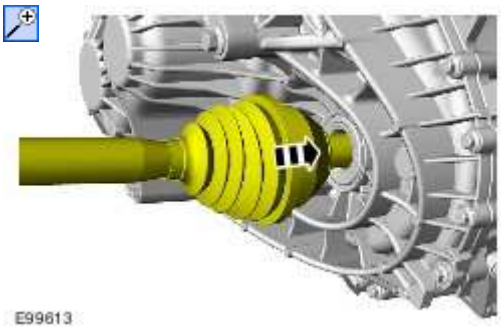
20.

1. *Torque:* 6 Nm
2. *Torque:* 6 Nm
3. *Torque:* 25 Nm
4. *Torque:* 25 Nm



21. Remove the special tool before completely installing the halfshaft.

Special Tool(s): 205-775



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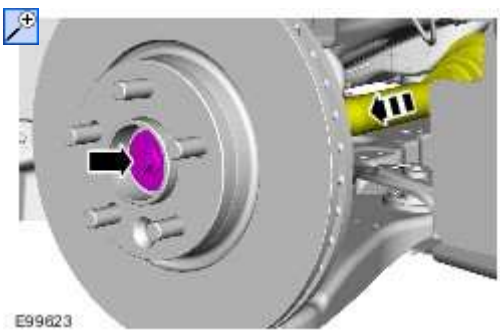

23. On both sides.

Torque: 20 Nm

24. On both sides.

Torque:
Stage 1: 45 Nm
Stage 2: 80°

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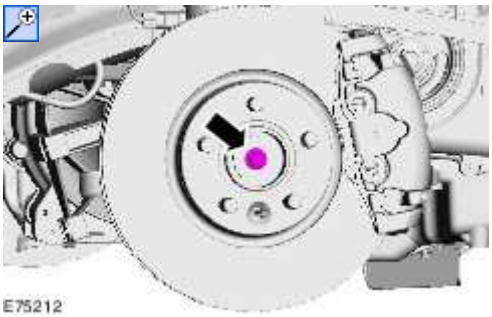
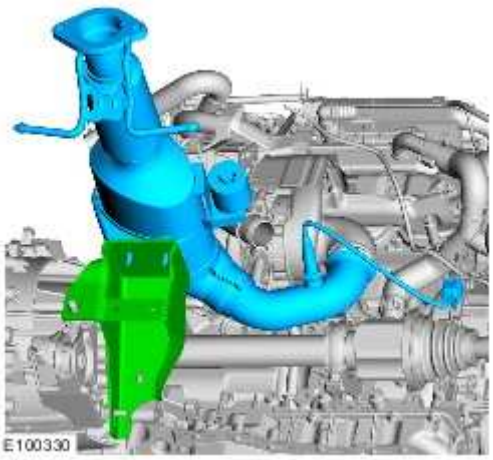
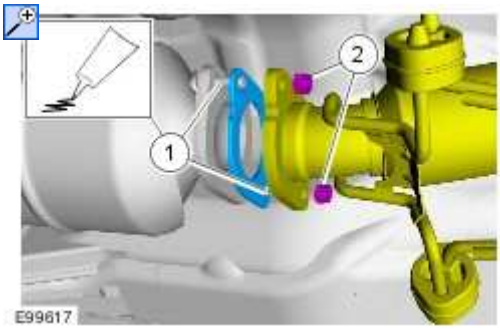


25.



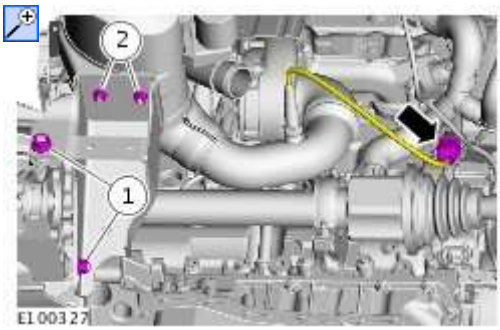
26.

1. *Material:* Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
2. NOTE: Only tighten the nuts finger tight at this stage.

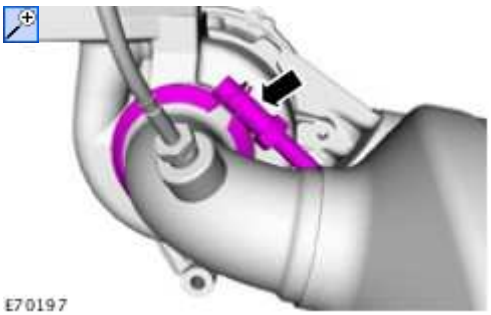


27.

1. *Torque:* 24 Nm
2. *Torque:* 24 Nm



28. NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that this component is installed to the noted removal position.
Torque: 24 Nm



29. NOTE: Make sure that the exhaust flexible pipe is not twisted.

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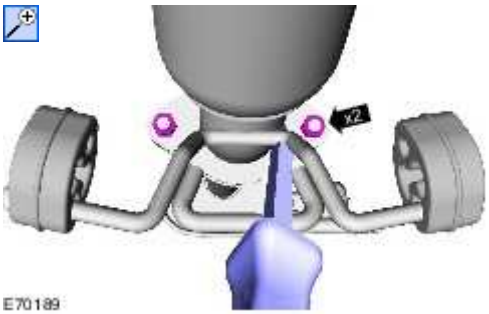
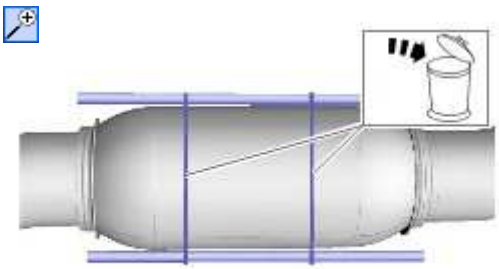
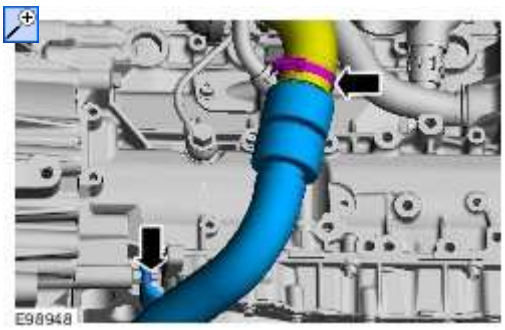


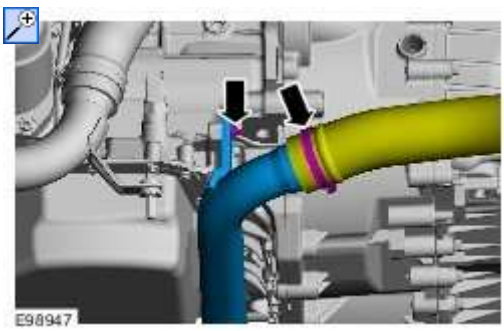
General Equipment: Tire lever
Torque: 48 Nm



30.



31. *Torque:* 10 Nm



32. *Torque:* 10 Nm

33. Install the following items:
    1. Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).
    2. Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

34.
    1. *Torque:* 40 Nm
    2. *Torque:* 48 Nm

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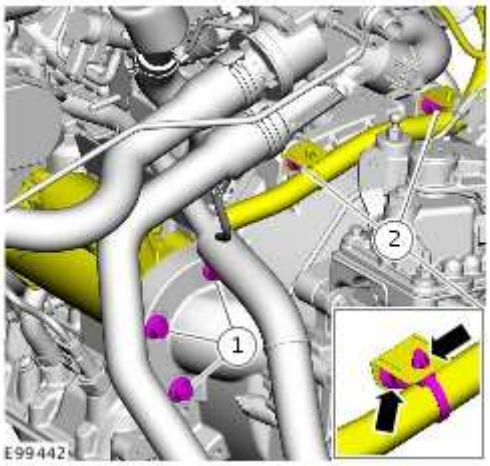
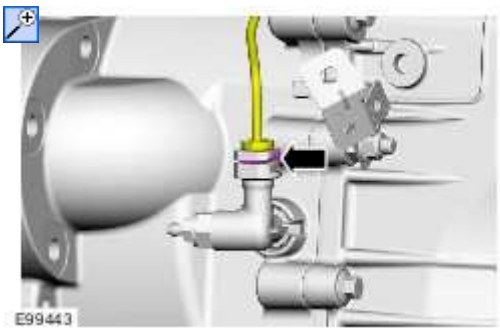
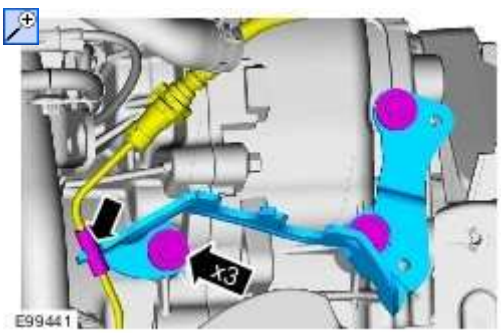


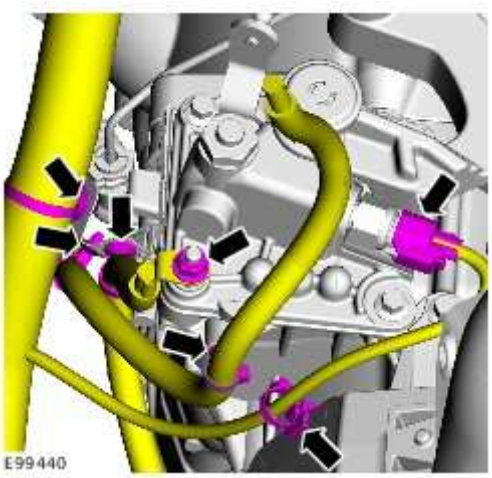


35.

36. Refer to: Clutch System Bleeding - Vehicles With: 6-Speed Manual Transaxle - M66 (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).



37. *Torque:* 25 Nm



38. *Torque:* 25 Nm

39.

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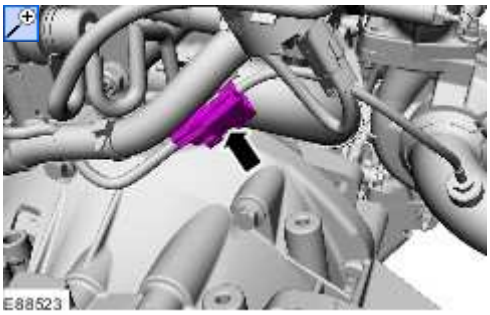
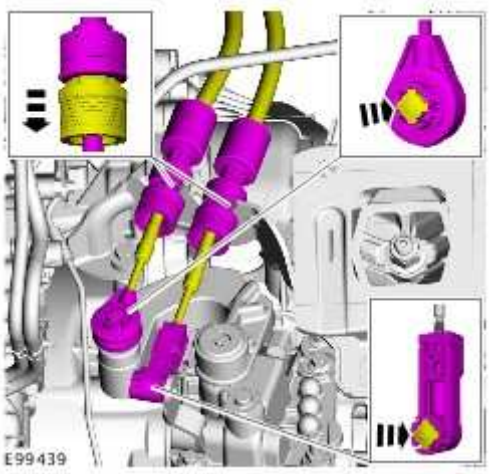
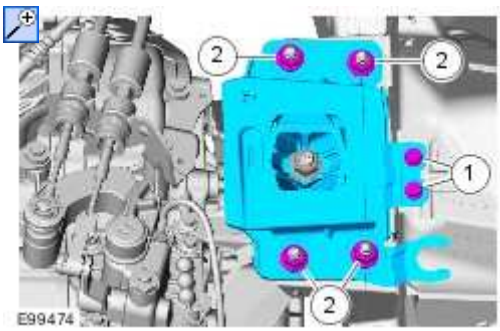




40. Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (M66) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).



41.
1. *Torque:* 25 Nm
2. *Torque:* 48 Nm

42. *Torque:* 10 Nm

43. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
Refer to: Air Cleaner (303-12F Intake Air Distribution and Filtering - 2.2L Duratorq-TDCi (129kW/175PS) - DW, Removal and Installation).

44. *Torque:* 10 Nm

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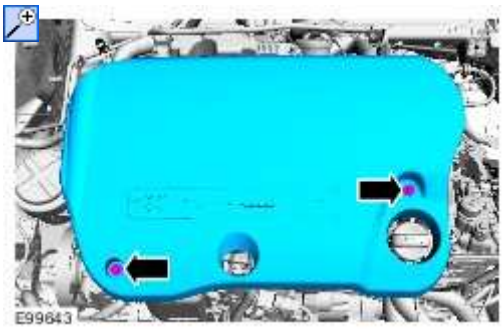
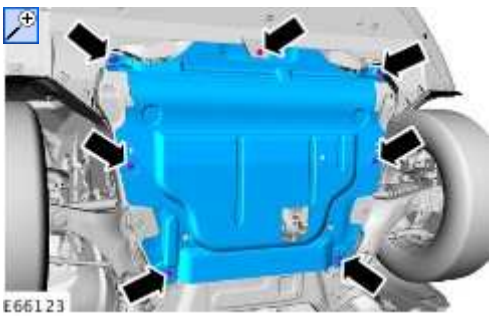


45. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
Refer to: Transmission Fluid Level Check (308-03 Manual Transmission/Transaxle - Vehicles With: 6-Speed Manual Transaxle - M66, General Procedures).



46.

47. Lower the vehicle.

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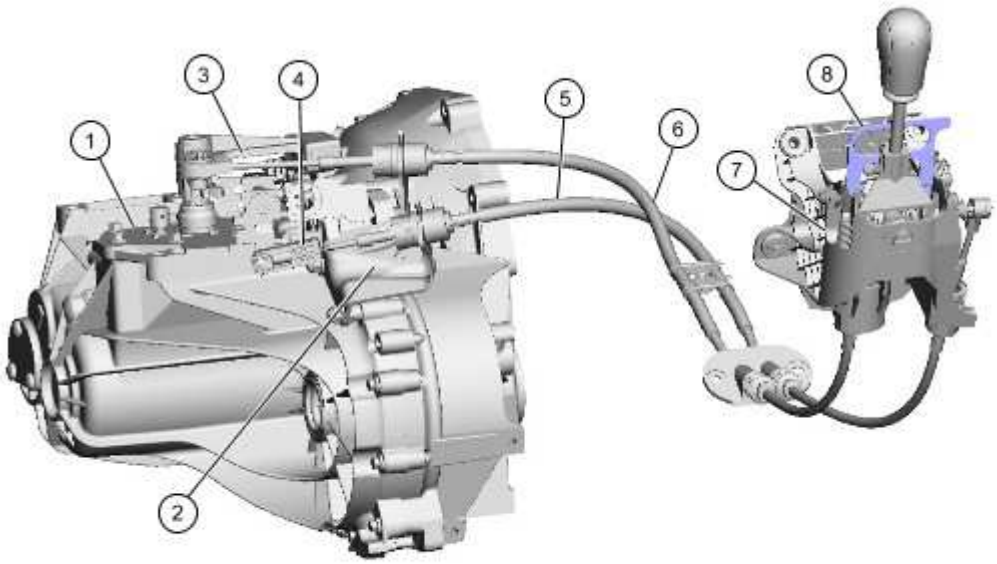
Print

Description and Operation

Gear selector unit and gearshift cable



E71146

Item	Part Number	Description
1	-	Shift unit
2	-	Gearshift cables retaining brackets
3	-	Shift arm with damping weight
4	-	Selector cable adjusting mechanism
5	-	Selector cable
6	-	Shift cable
7	-	Shift lever
8	-	Adjustment tool, gearshift lever

The length of the selector cable can be adjusted.

The spring in the gearshift lever pulls the selector cable into the neutral position of the gate for 3rd/4th gear.

The gearshift lever is locked in this position using an adjustment tool.

The adjustment mechanism is located at the end nearest the transmission.

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Removal and Installation

General Equipment

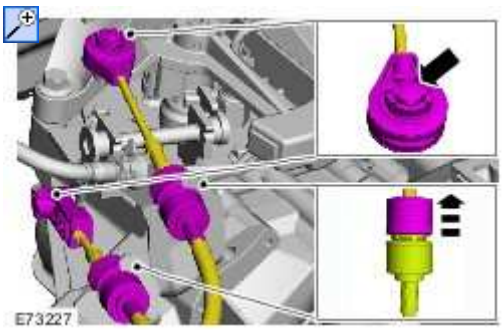
Knife

Removal

CAUTION: Gearshift cables must not be kinked or bent.

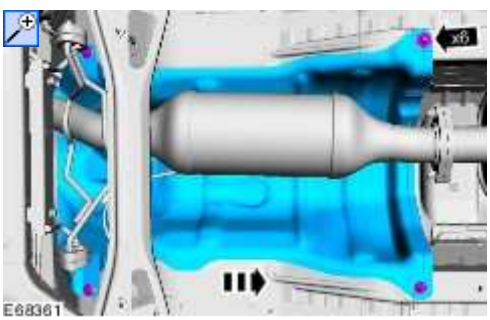
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

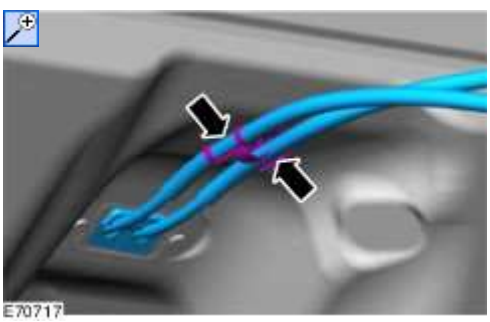


2.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5.

6. Lower Vehicle

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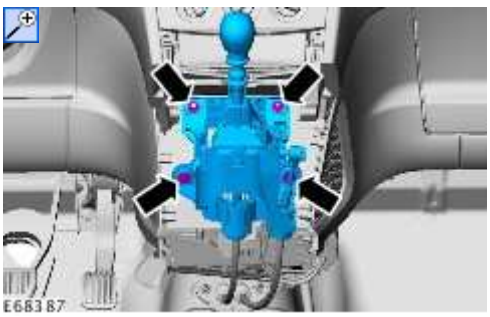
Vehicles with electronic parking brake (EPB)

7. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

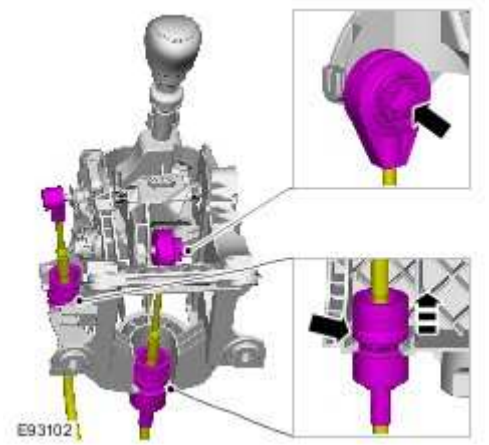
Vehicles with manual parking brake

8. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



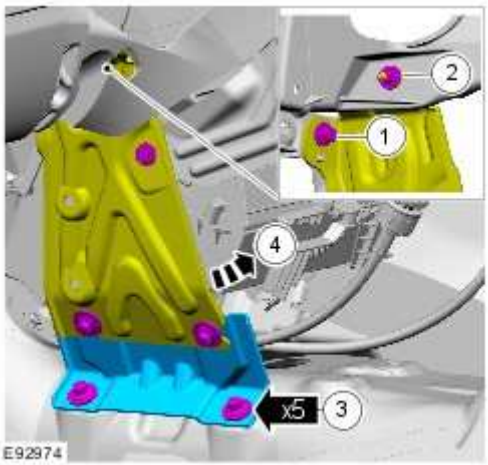
9. *Torque:* 9 Nm

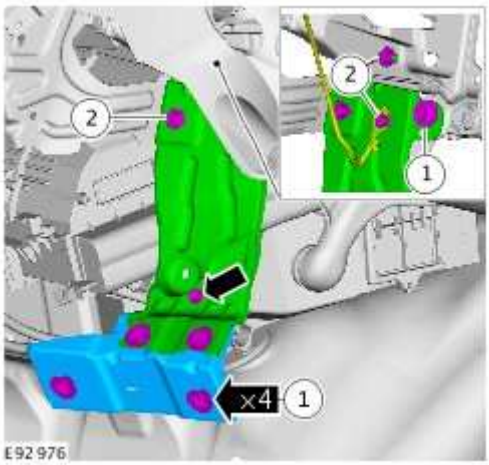


10.

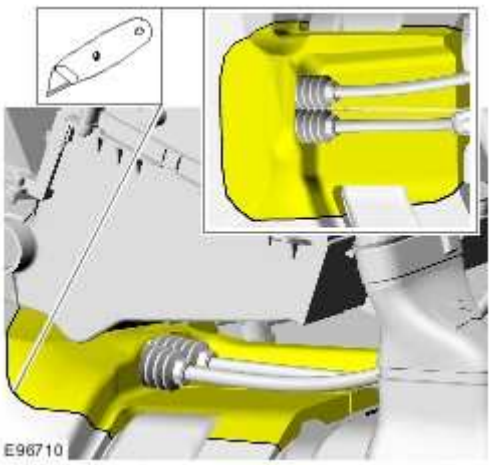
11.
    2. *Loosen:* 4 turn(s)

http://vnx.su

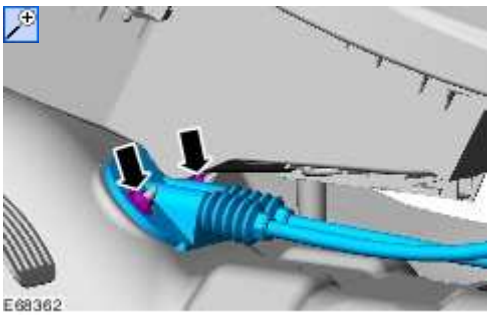




12.
1. *Torque:* 25 Nm
2. *Torque:* 9 Nm



13. *General Equipment:* Knife



14. *Torque:* 9 Nm

Installation

1. To install, reverse removal procedure

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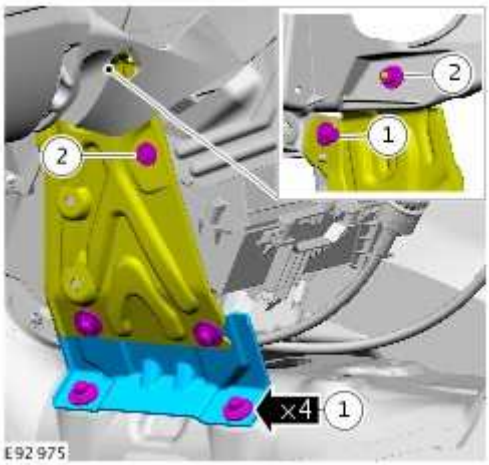

2.
   1. *Torque:* 25 Nm
   2. *Torque:* 9 Nm

3. Refer to: Gearshift Cable Adjustment - Vehicles With: 5-Speed Manual Transaxle (MTX-75) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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Removal and Installation

Removal

CAUTION: The gearshift cables must not be kinked or twisted.
NOTE: Removal steps in this procedure may contain installation details.

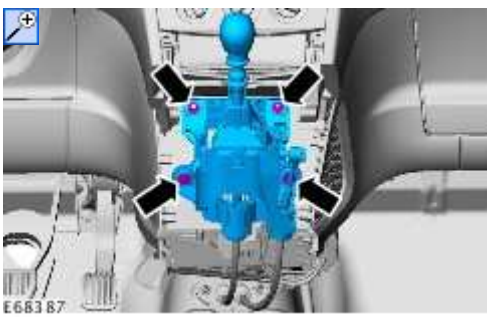
Vehicles with electronic parking brake (EPB)

1. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

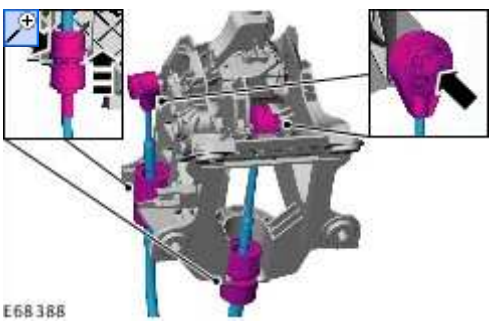
Vehicles with manual parking brake

2. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



3. *Torque:* 9 Nm



4.

Installation

1. To install, reverse the removal procedure.
2. Refer to: Gearshift Cable Adjustment - Vehicles With: 5-Speed Manual Transaxle (MTX-75) (308-00 Manual Transmission/Transaxle and Clutch -

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General Information, General Procedures).

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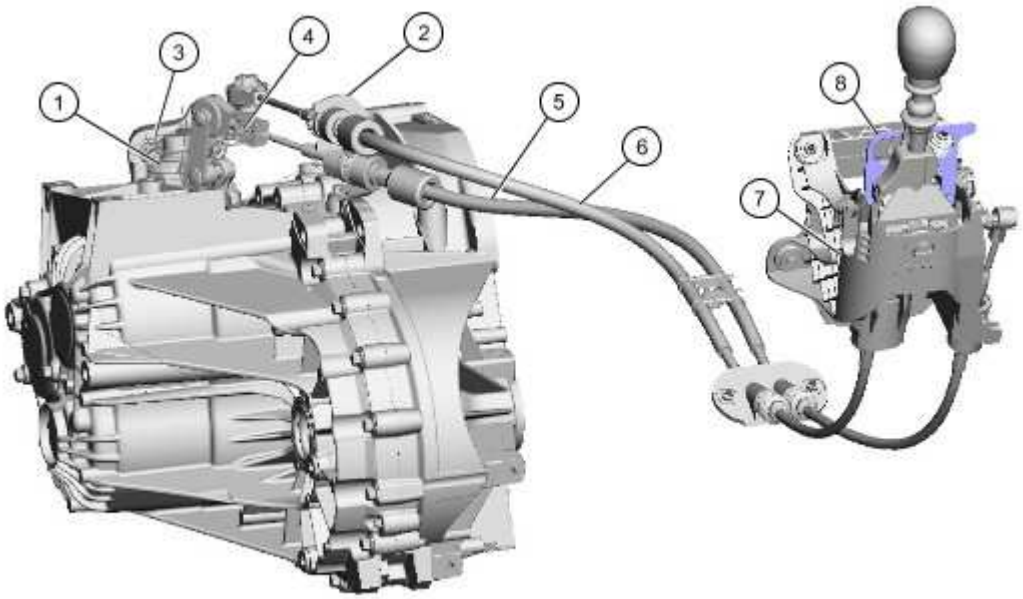
Description and Operation

Gear selector unit and gearshift cable



E71147

Item	Part Number	Description
1	-	Shift unit
2	-	Gearshift cable retaining brackets
3	-	Shift arm with damping weight
4	-	Selector cable adjusting mechanism
5	-	Selector cable
6	-	Shift cable
7	-	Shift lever
8	-	Adjustment tool, gearshift lever

The length of the selector cable can be adjusted.

The spring in the gearshift lever pulls the selector cable into the neutral position of the gate for 3rd/4th gear.

The gearshift lever is locked in this position using an adjustment tool.

The adjustment mechanism is located at the end nearest the transmission.

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Removal and Installation

General Equipment

Knife

Removal

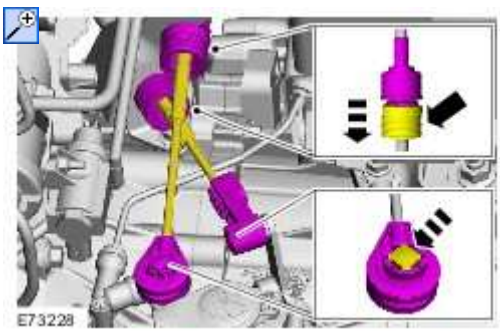
All vehicles

CAUTION: The gearshift cables must not be kinked or twisted.

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

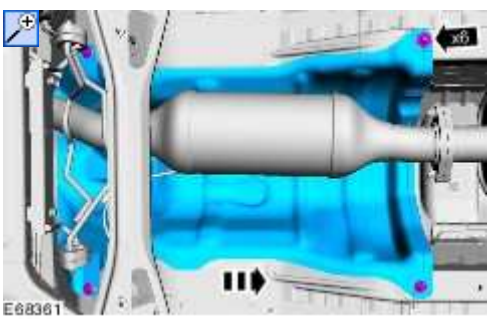
1. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation). Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

Vehicles built up to 10/2007



2.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.

Vehicles built from 10/2007

5.

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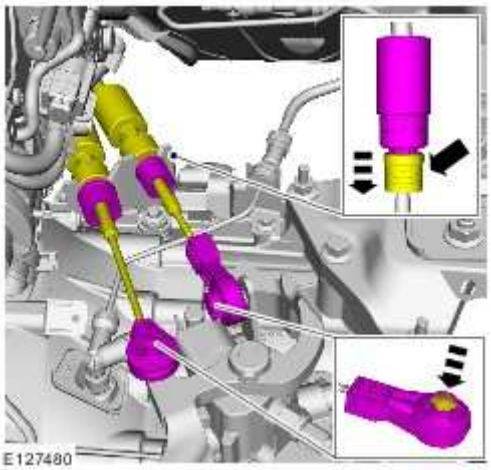
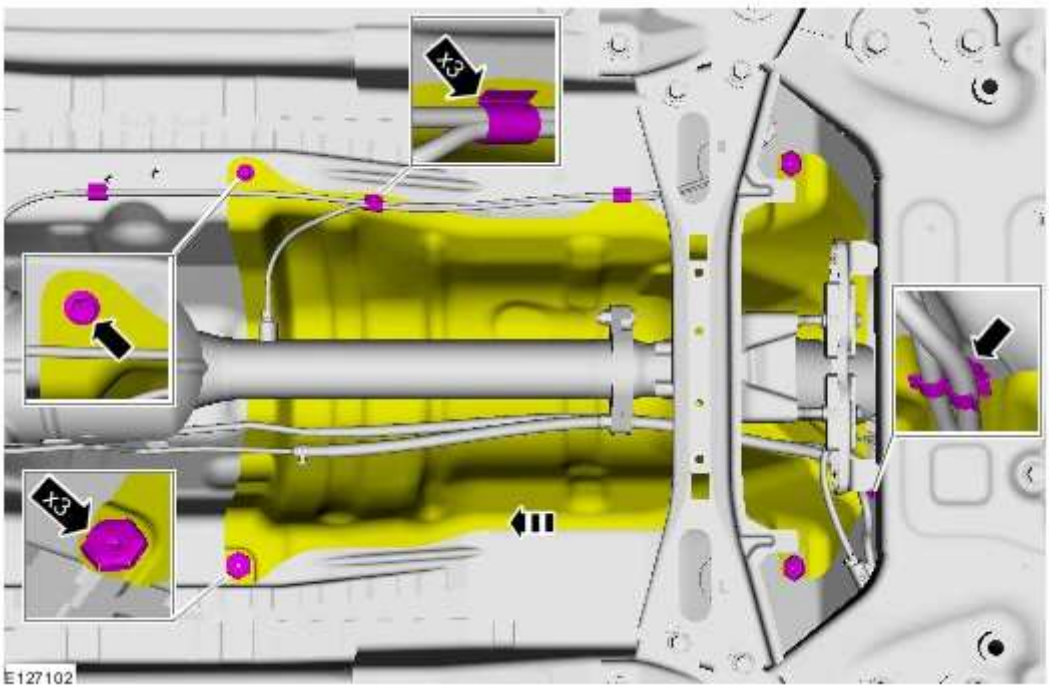


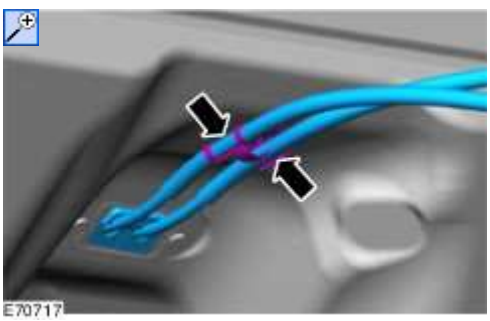
6. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

7.



All vehicles

8.



9. Lower Vehicle

Vehicles with electronic parking brake (EPB)

10. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).

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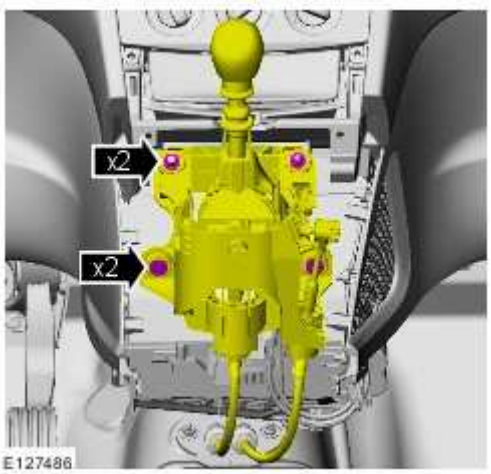
Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

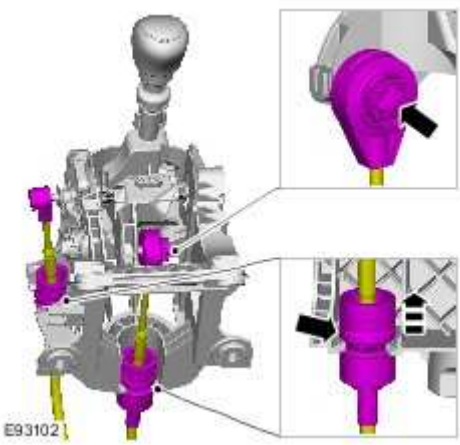
Vehicles with manual parking brake

11. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



12. *Torque:* 9 Nm



13.

14.
2. *Loosen:* 4 turn(s)

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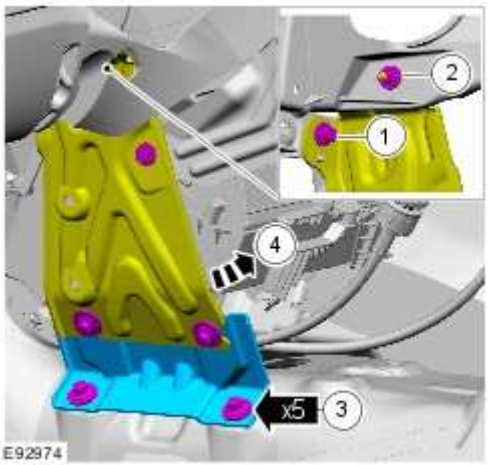
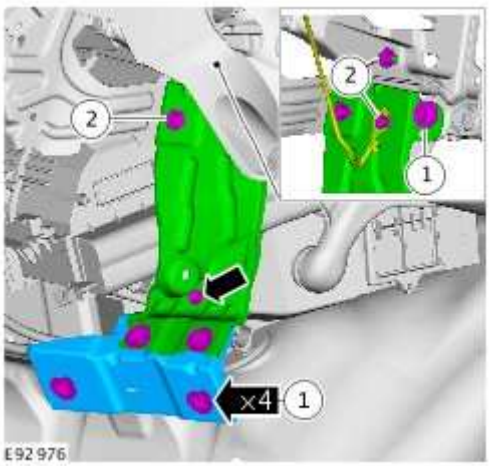
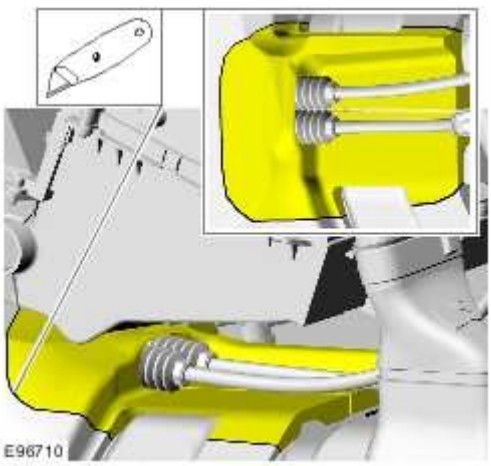
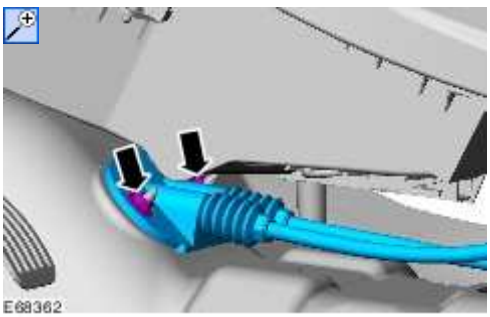


15.
1. *Torque:* 25 Nm
2. *Torque:* 9 Nm



16. *General Equipment:* Knife





17. *Torque:* 9 Nm

Installation

1. To install, reverse the removal procedure.

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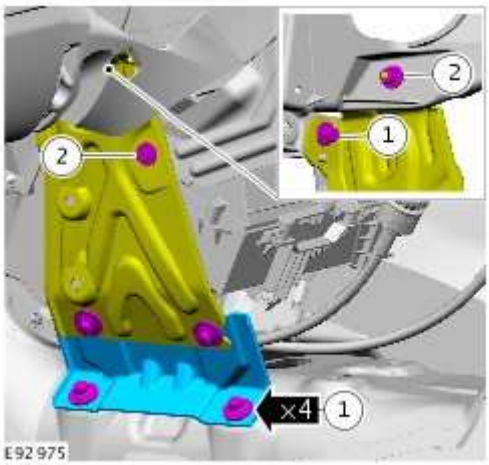

2.
   1. *Torque:* 25 Nm
   2. *Torque:* 9 Nm

3. Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (MMT6) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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Removal and Installation

Removal

CAUTION: Gearshift cables must not be kinked or bent.
NOTE: Removal steps in this procedure may contain installation details.

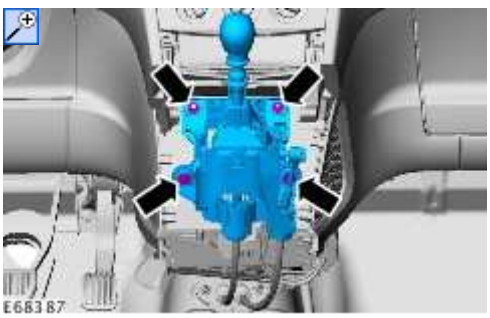
Vehicles with electronic parking brake (EPB)

1. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

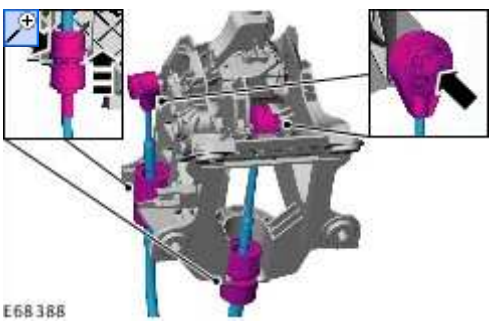
Vehicles with manual parking brake

2. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



3. *Torque:* 9 Nm



4.

Installation

1. To install, reverse removal procedure
2. Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (MMT6) (308-00 Manual Transmission/Transaxle and Clutch -

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General Information, General Procedures).
Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (M66) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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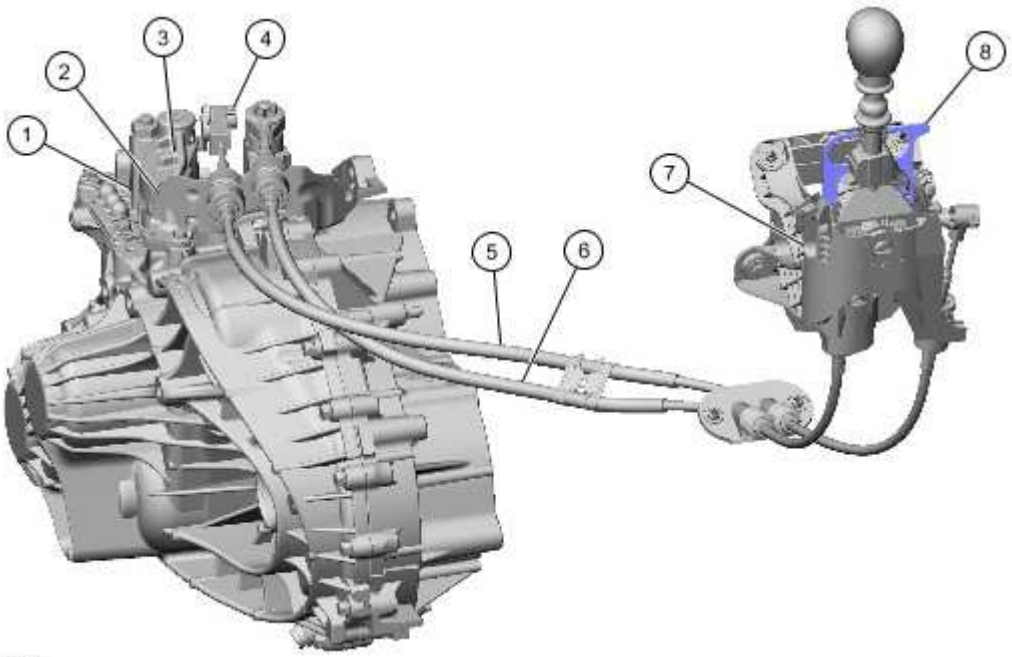
Description and Operation

Gear selector unit and gearshift cables



E68456

Item	Part Number	Description
1	-	Shift unit
2	-	Gearshift cables retaining brackets
3	-	Shift arm with damping weight
4	-	Selector cable adjusting mechanism
5	-	Selector cable
6	-	Shift cable
7	-	Gearshift lever
8	-	Adjustment tool, gearshift lever

The length of the selector cable can be adjusted.

The spring in the gearshift lever pulls the selector cable into the neutral position of the gate for 3rd/4th gear.

The gearshift lever is locked in this position using an adjustment tool.

The adjustment mechanism is located at the end nearest the transmission.

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Removal and Installation

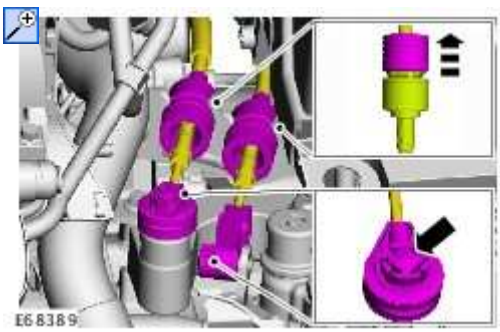
General Equipment

Knife

Removal

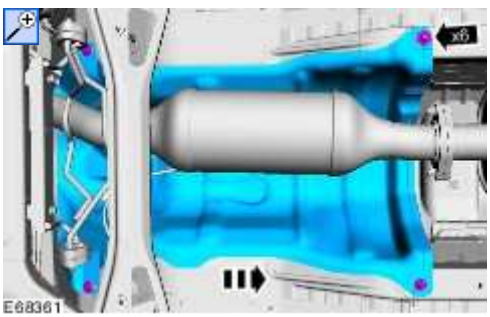
CAUTION: The gearshift cables must not be kinked or twisted.
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Luftfilter (303-12 Ansaugsystem - 2.5L Duratec (VI5), Removal and Installation).

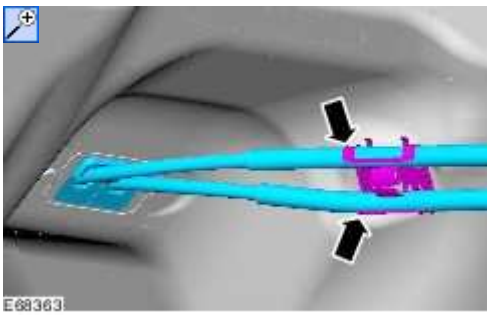


2.

3. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5.

6. Lower Vehicle

Vehicles with electronic parking brake (EPB)

7. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and

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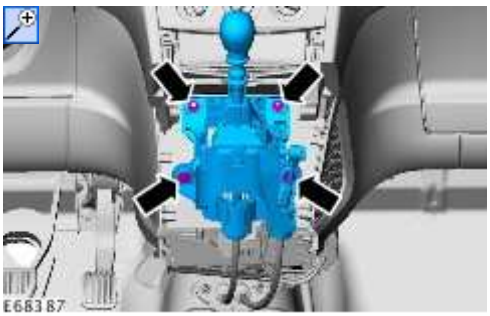
Console, Removal and Installation).

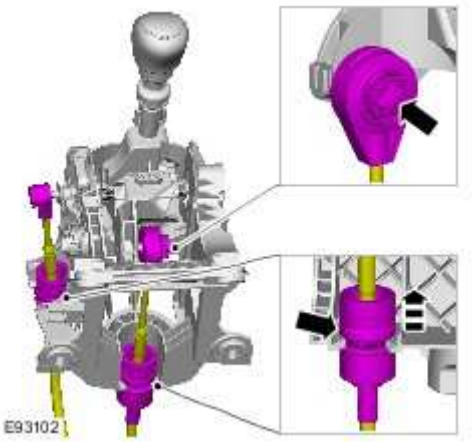
Vehicles with manual parking brake

8. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

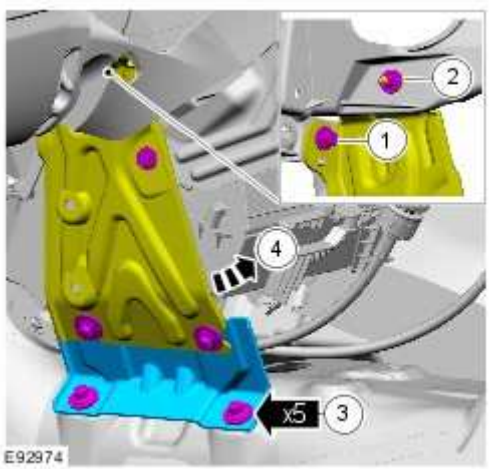
All vehicles



9. *Torque:* 9 Nm



10.



11.
   2. *Loosen:* 4 turn(s)

12.
   1. *Torque:* 25 Nm
   2. *Torque:* 9 Nm

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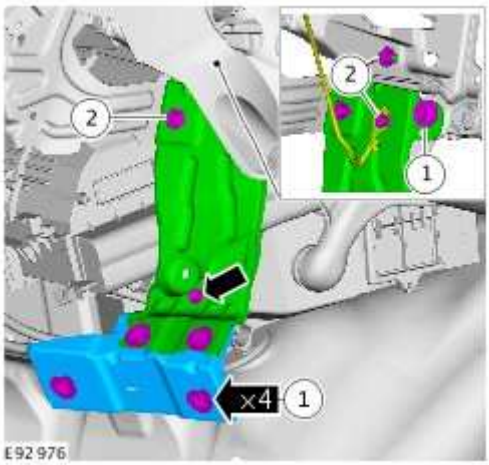
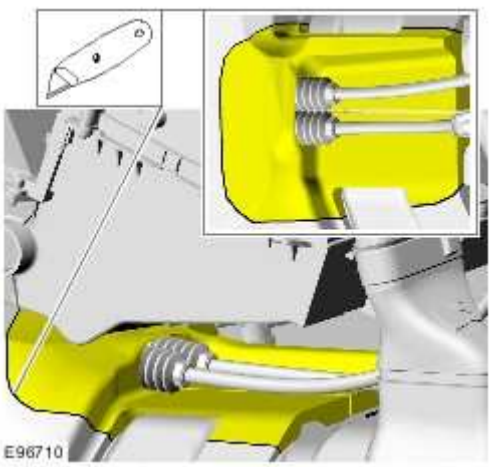
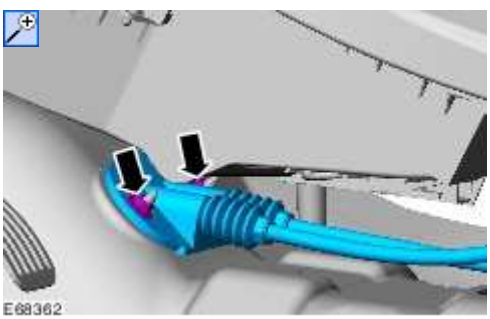


13. *General Equipment:* Knife

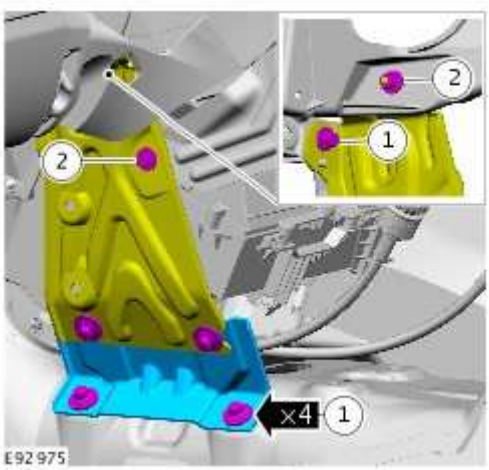




14. *Torque:* 9 Nm

Installation

1. To install, reverse the removal procedure.
2.
    1. *Torque:* 25 Nm
    2. *Torque:* 9 Nm



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3. Refer to: Schaltseilzug einstellen - Fahrzeuge ausgestattet mit 6-Gang Schaltgetriebe (M66) (308-00 Schaltgetriebe und Kupplung - Allgemeine Informationen, General Procedures).

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Removal and Installation

Removal

CAUTION: Gearshift cables must not be kinked or bent.
NOTE: Removal steps in this procedure may contain installation details.

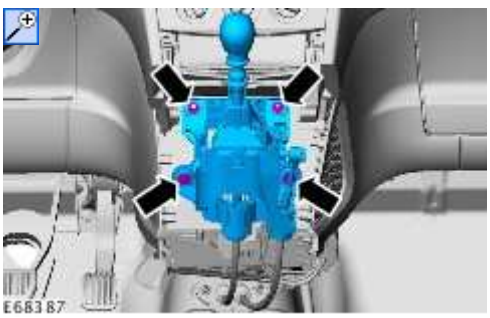
Vehicles with electronic parking brake (EPB)

1. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

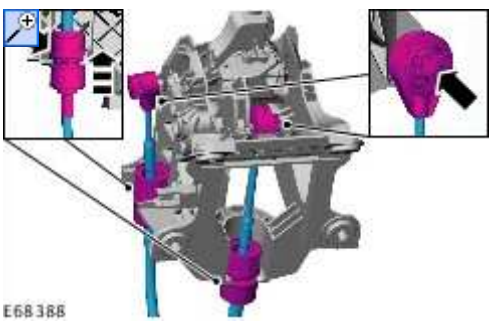
Vehicles with manual parking brake

2. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

All vehicles



3. *Torque:* 9 Nm



4.

Installation

1. To install, reverse removal procedure
2. Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (MMT6) (308-00 Manual Transmission/Transaxle and Clutch -

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General Information, General Procedures).
Refer to: Gearshift Cable Adjustment - Vehicles With: 6-Speed Manual Transaxle (M66) (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

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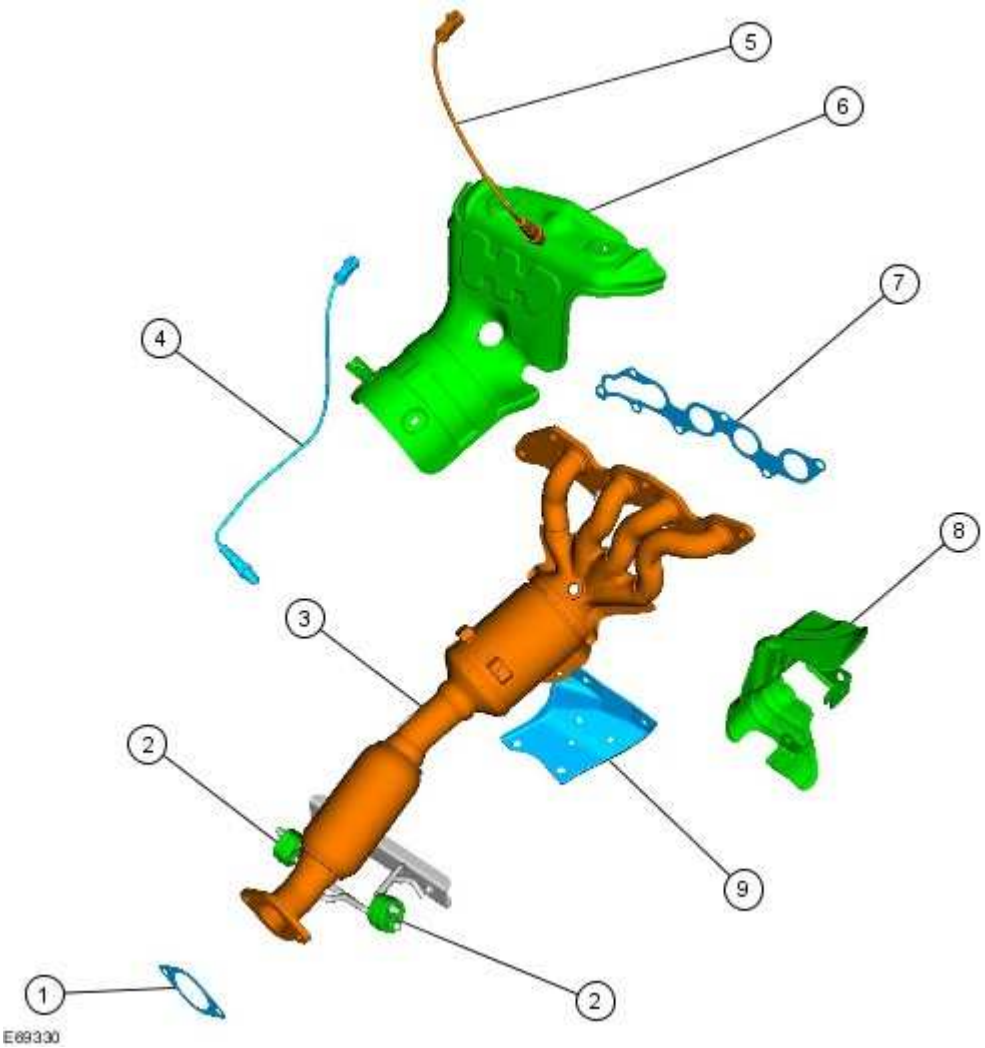
Description and Operation



Item	Part Number	Description
1	-	Exhaust flexible pipe gasket
2	-	Exhaust hanger insulators
3	-	Exhaust manifold, catalytic converter and exhaust flexible pipe assembly
4	-	Catalyst monitor sensor
5	-	Heated oxygen sensor (HO2S)
6	-	Exhaust manifold and catalytic converter heat shield
7	-	Exhaust manifold gasket
8	-	Generator heat shield
9	-	Catalytic converter support bracket

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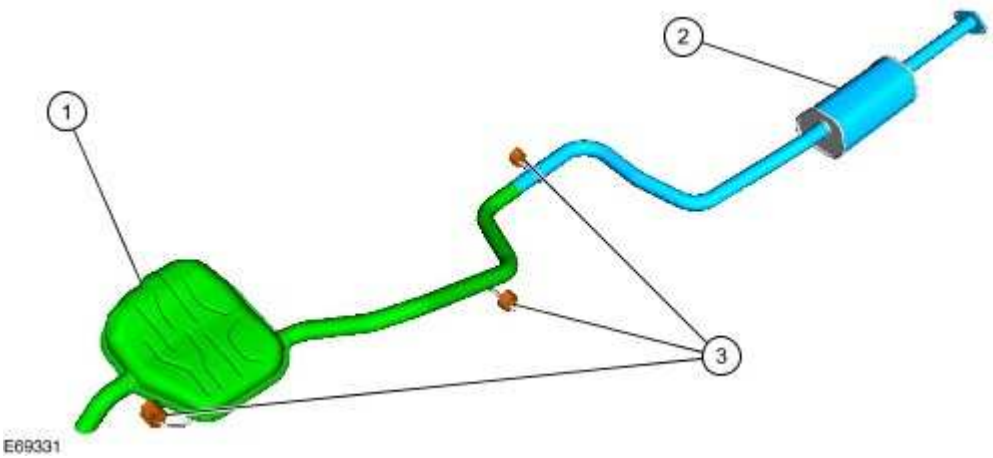

Item	Part Number	Description
1	-	Rear muffler
2	-	Front muffler
3	-	Exhaust hanger insulators

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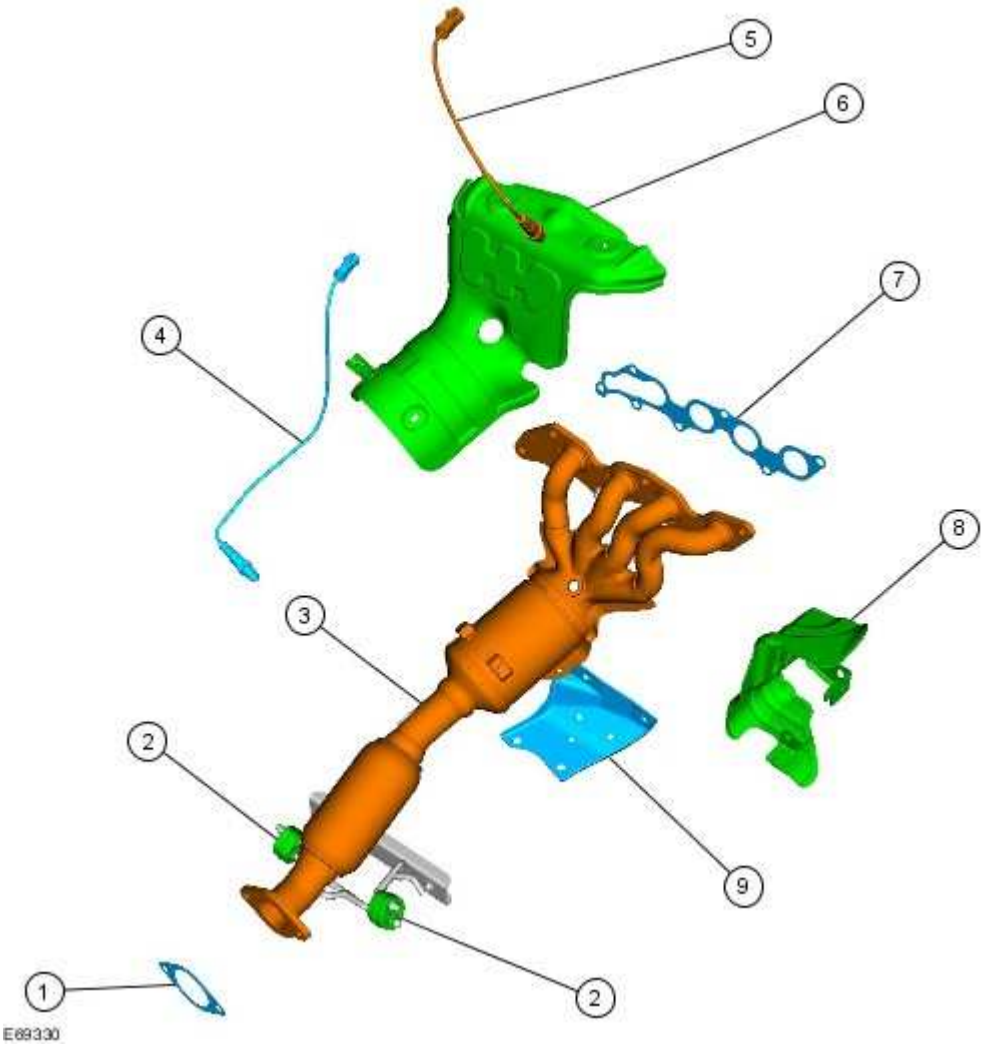
Description and Operation



Item	Part Number	Description
1	-	Exhaust flexible pipe gasket
2	-	Exhaust hanger insulators
3	-	Exhaust manifold, catalytic converter and exhaust flexible pipe assembly
4	-	Catalyst monitor sensor
5	-	Heated oxygen sensor (HO2S)
6	-	Exhaust manifold and catalytic converter heat shield
7	-	Exhaust manifold gasket
8	-	Generator heat shield
9	-	Catalytic converter support bracket

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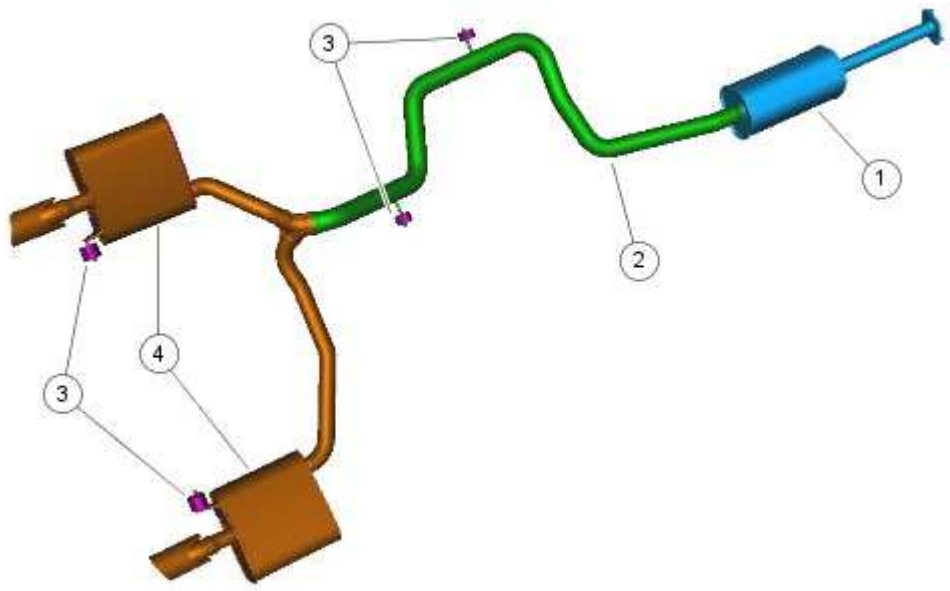

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Item	Part Number	Description
1	-	Front muffler
2	-	Intermediate pipe
3	-	Exhaust hanger insulators
4	-	Rear mufflers

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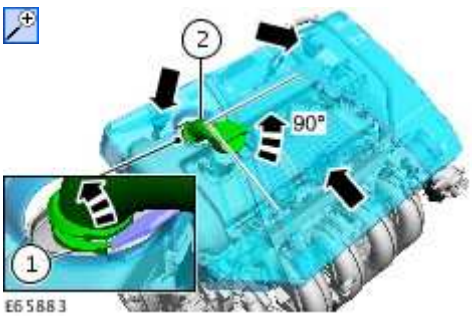
Removal and Installation

Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal



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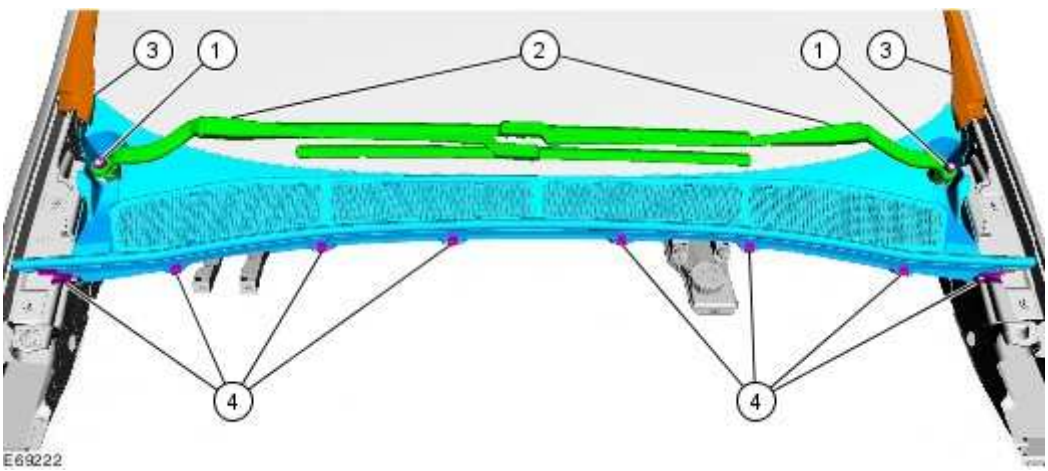

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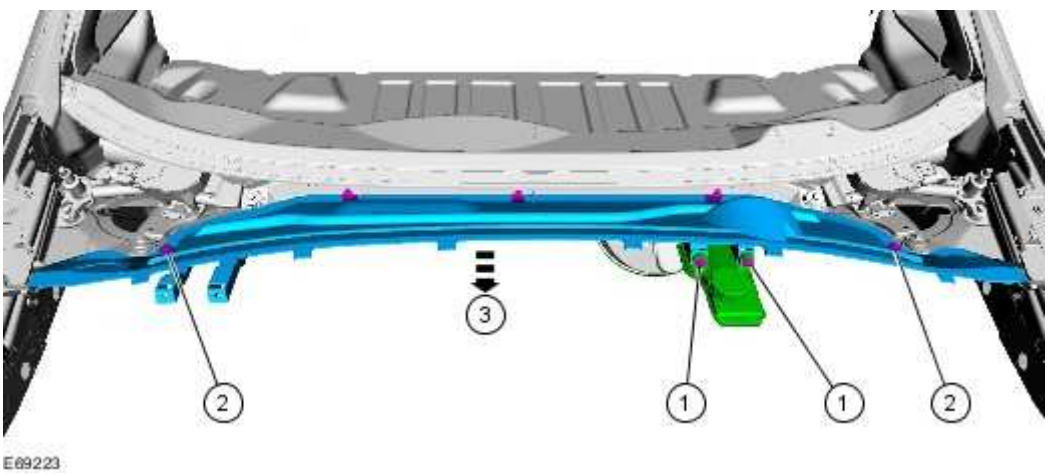

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4.

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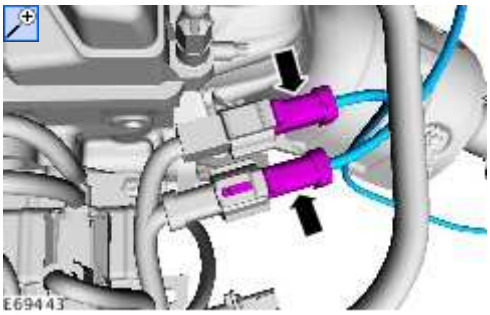

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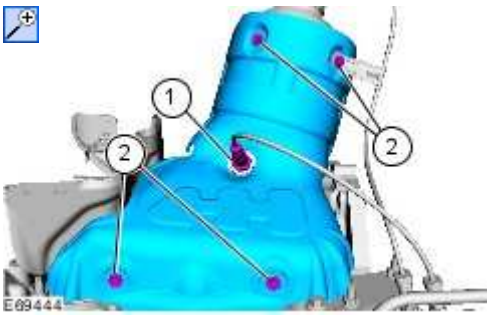

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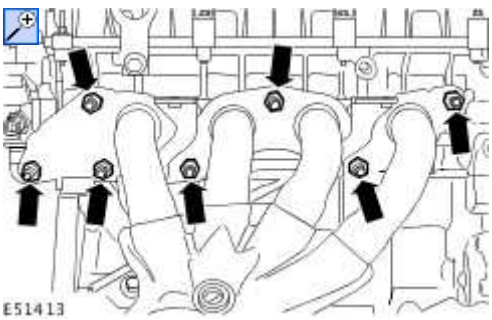
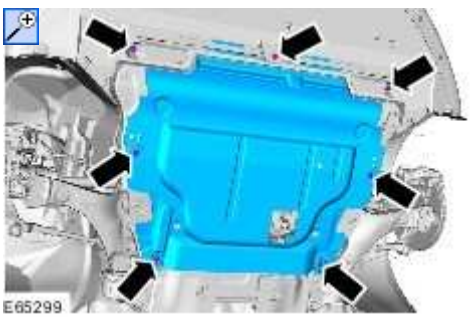


7. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

8.



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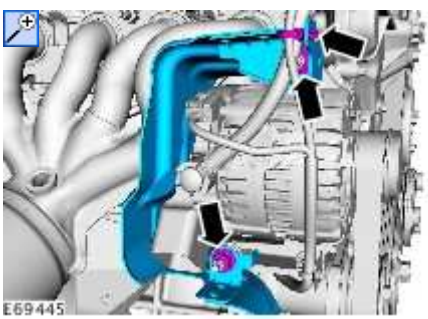

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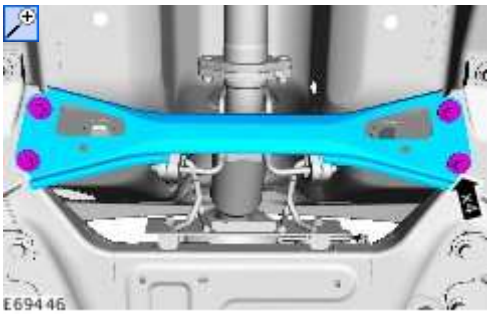

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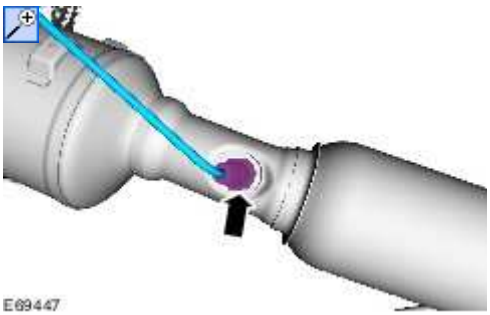

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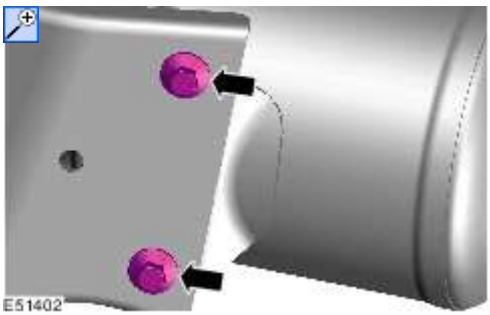
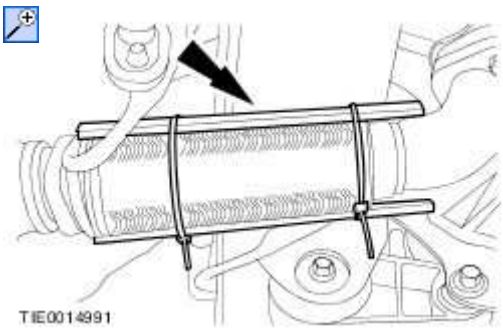
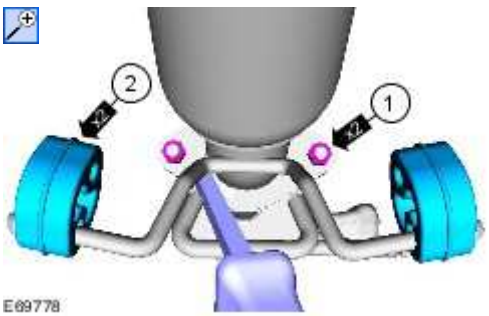




13. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



14. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation

1. CAUTION: Jointing compound must not be use forward of the catalytic converter.
NOTE: Only tighten the nuts finger tight at this stage.

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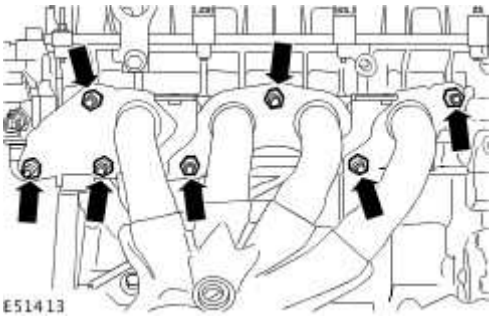
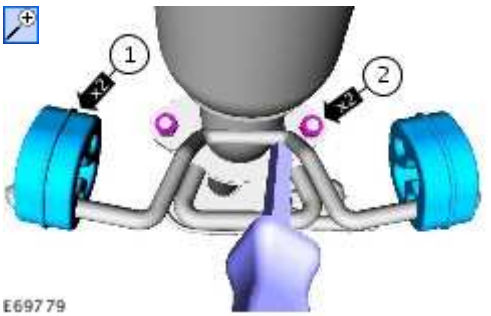
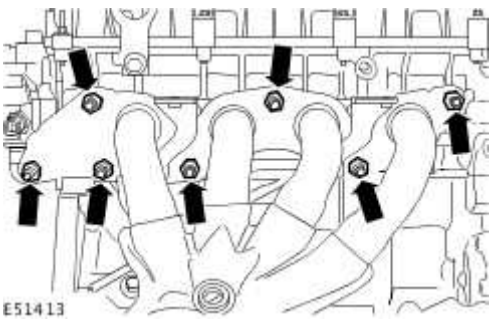




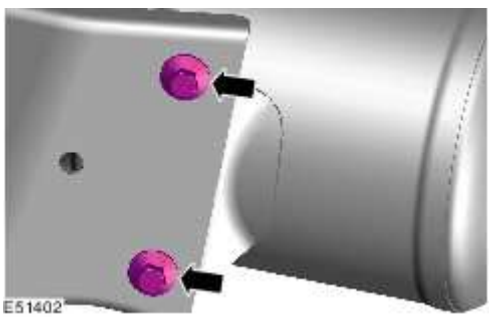
2. NOTE: Only tighten the nuts finger tight at this stage.
   Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)



3. *Torque:* 55 Nm

4. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   Torque: 48 Nm



5. *Torque:* 24 Nm

6. *Torque:* 47 Nm

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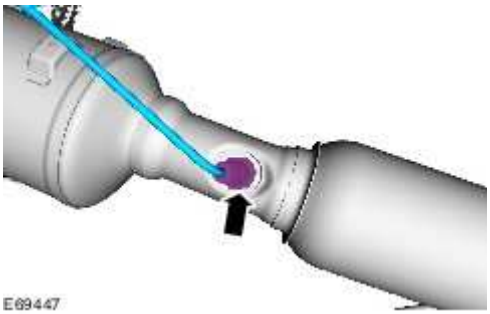
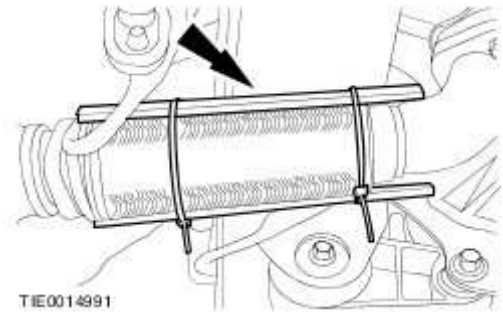
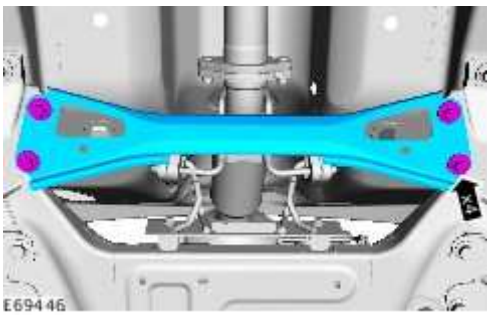
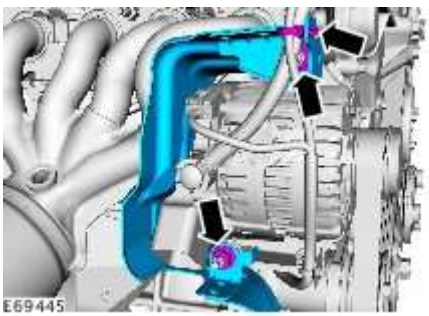




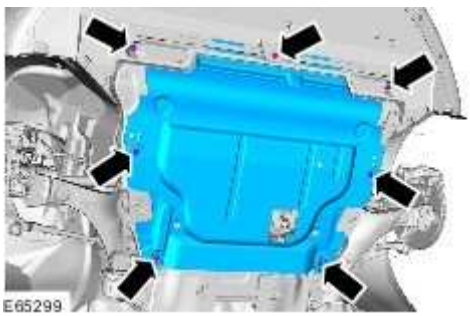
7. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



8. *Torque:* 60 Nm



9. *Torque:* 20 Nm



10.

11. Lower the vehicle.
12.
    1. *Torque:* 48 Nm
    2. *Torque:* 10 Nm

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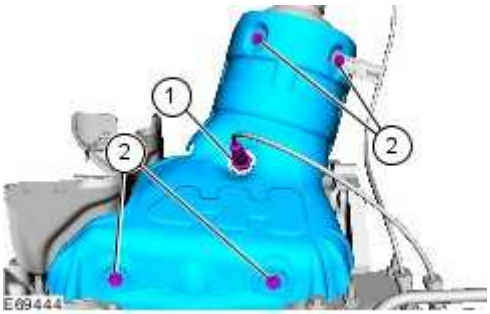

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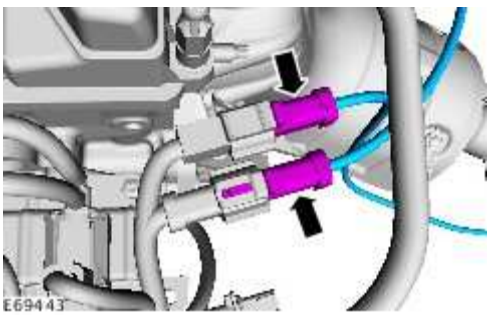

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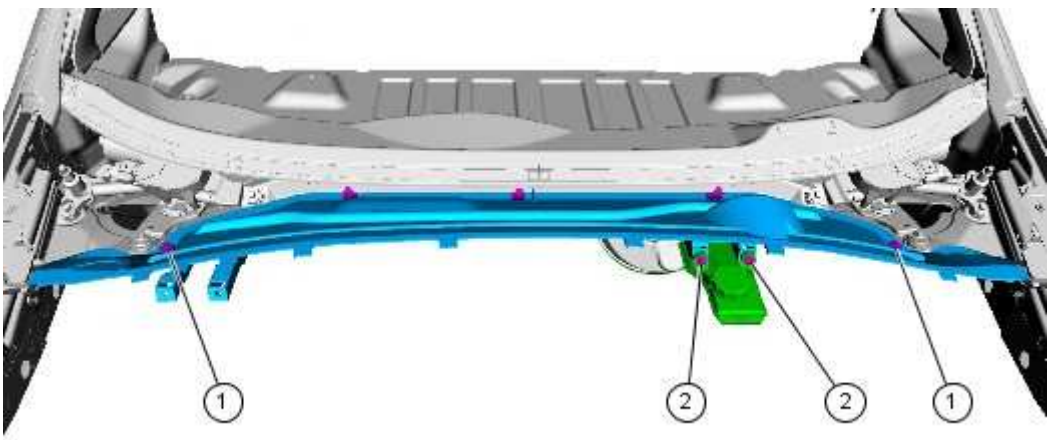

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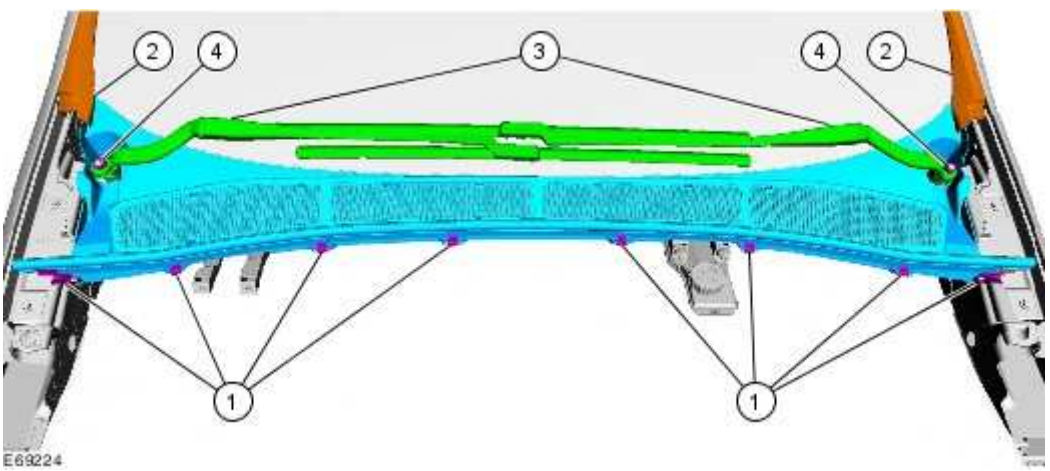

4. *Torq*
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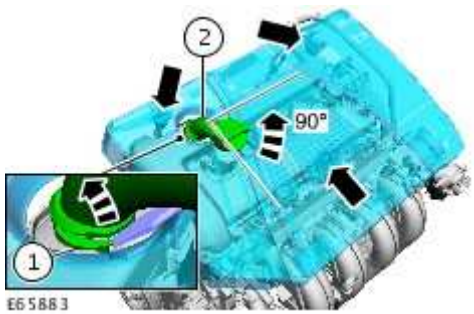

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Removal and Installation

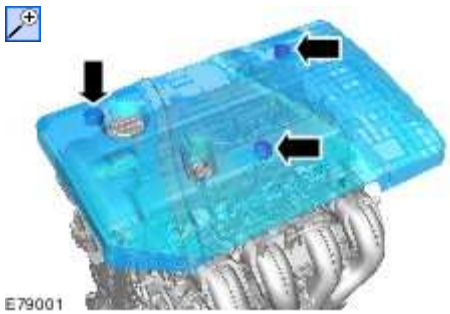
Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal

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

1.



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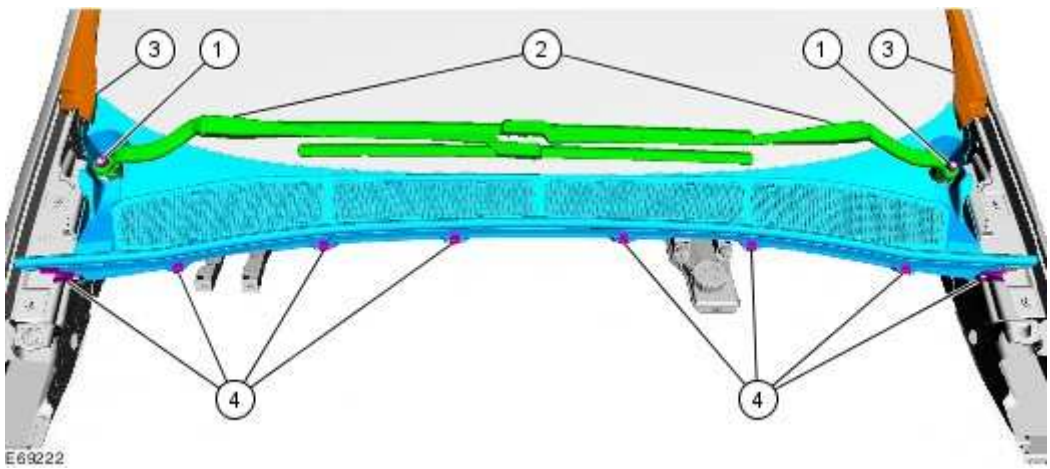

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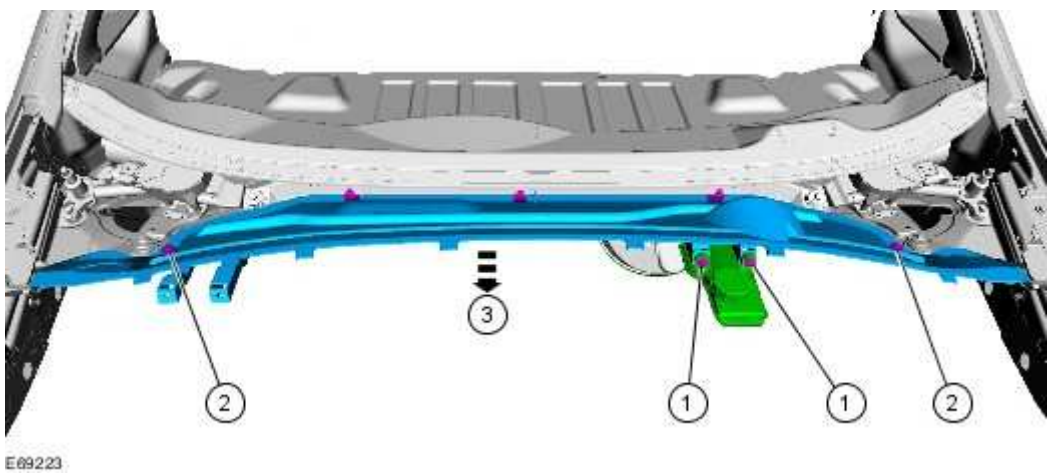

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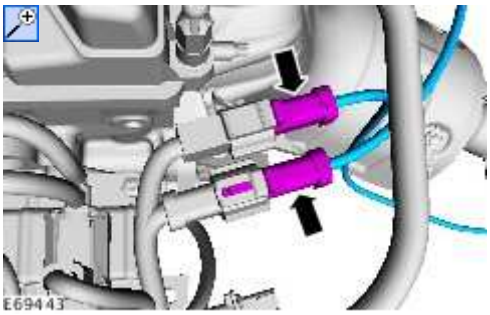

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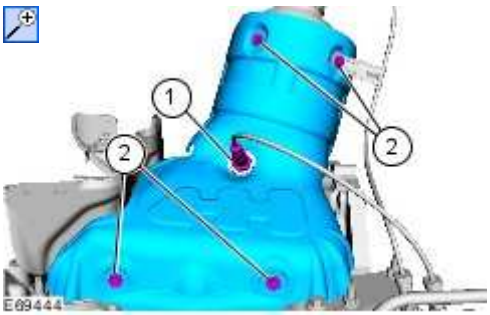

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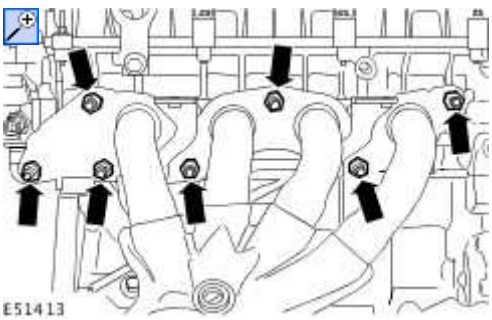
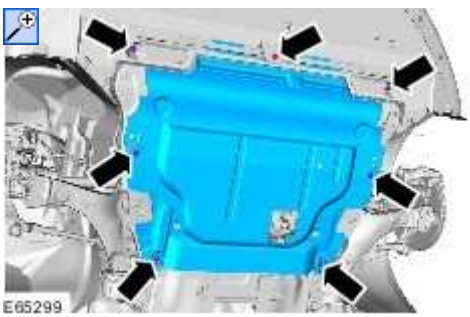


7. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

8.



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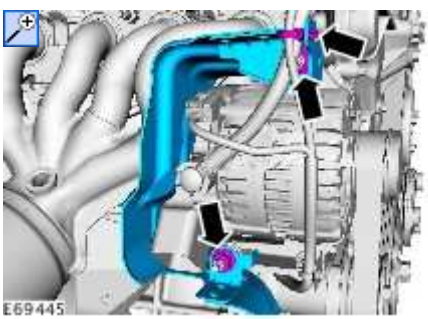

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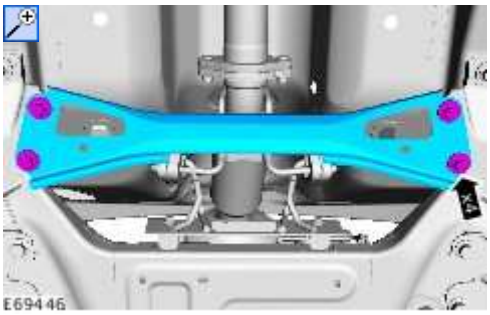

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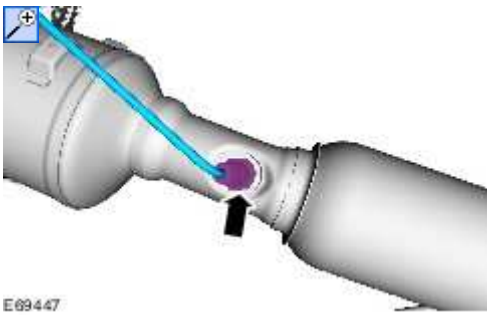

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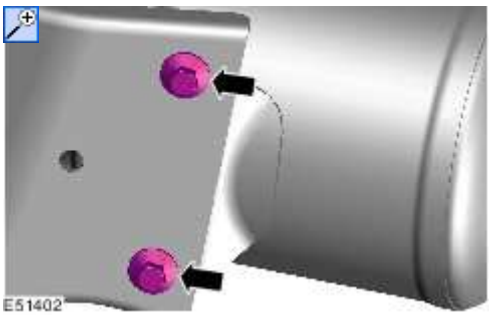
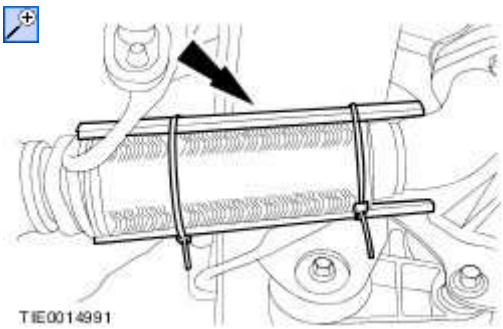
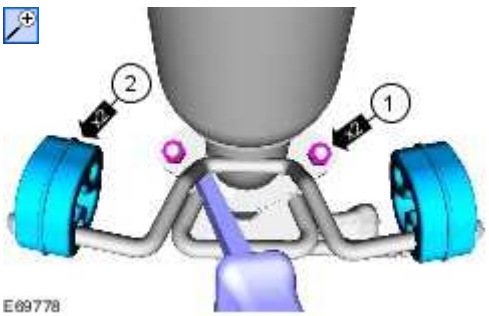




13. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



14. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation

1. CAUTION: Jointing compound must not be used forward of the catalytic converter.
NOTE: Only tighten the nuts finger tight at this stage.

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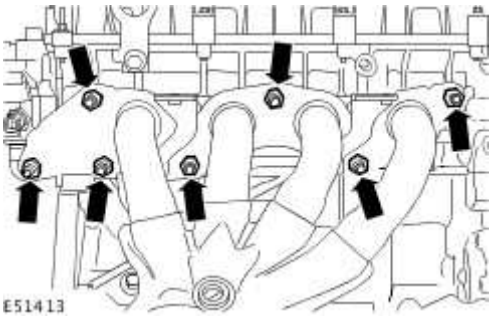
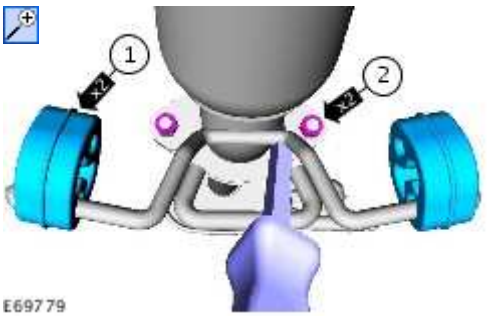
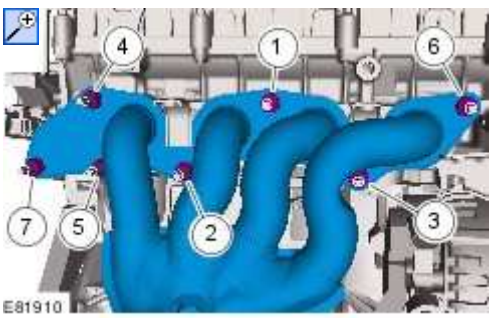




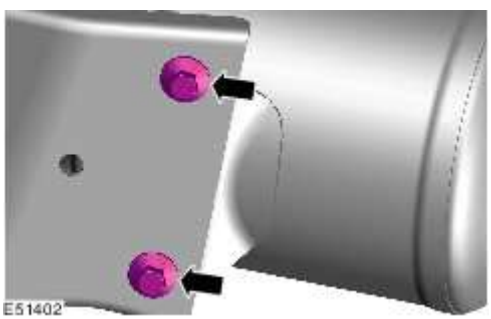
2. NOTE: Only tighten the nuts finger tight at this stage.
   Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)



3. *Torque:* 55 Nm

4. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   Torque: 48 Nm



5. *Torque:* 24 Nm

6. *Torque:* 47 Nm

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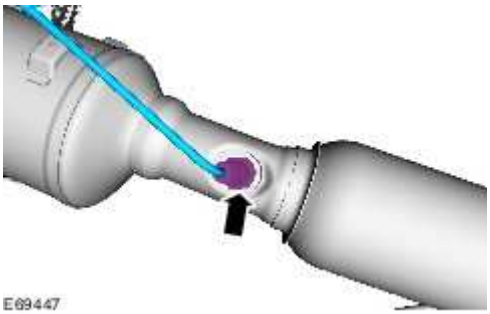
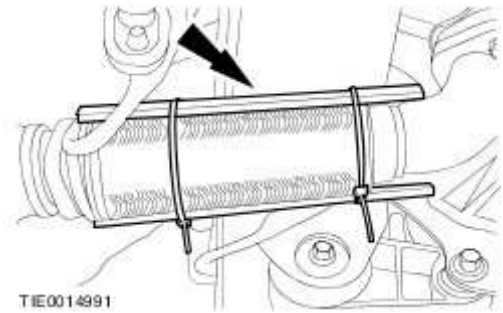
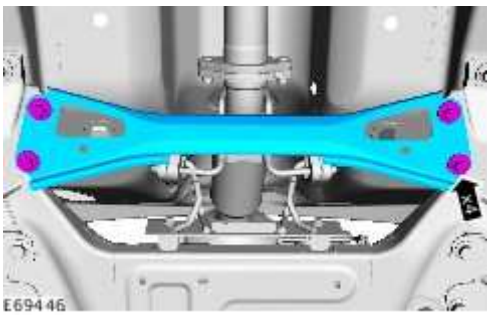
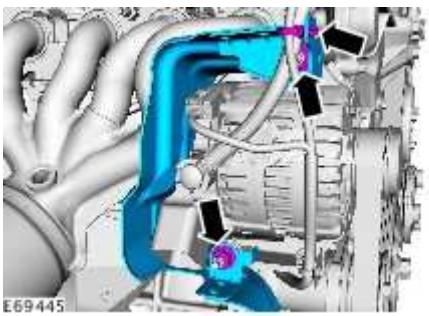




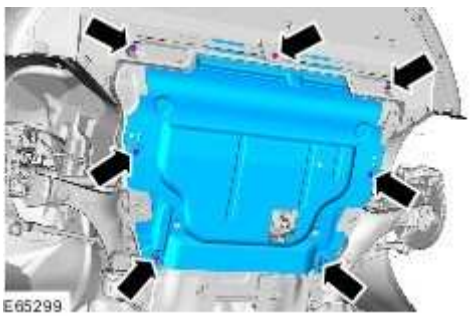
7. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



8. *Torque:* 60 Nm



9. *Torque:* 20 Nm



10.

11. Lower the vehicle.
12.
    1. *Torque:* 48 Nm
    2. *Torque:* 10 Nm

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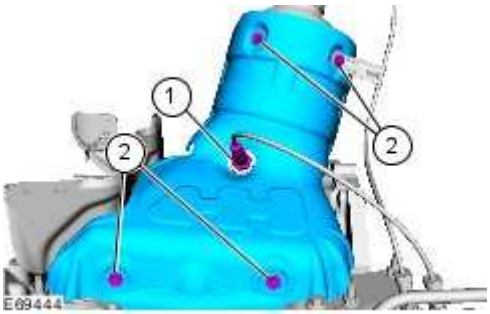

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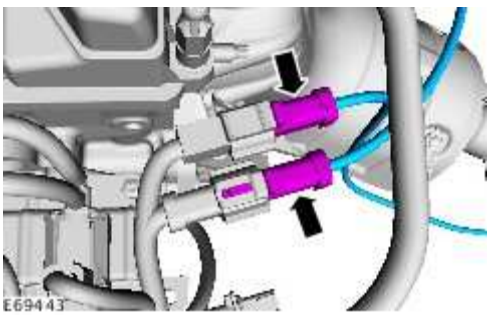

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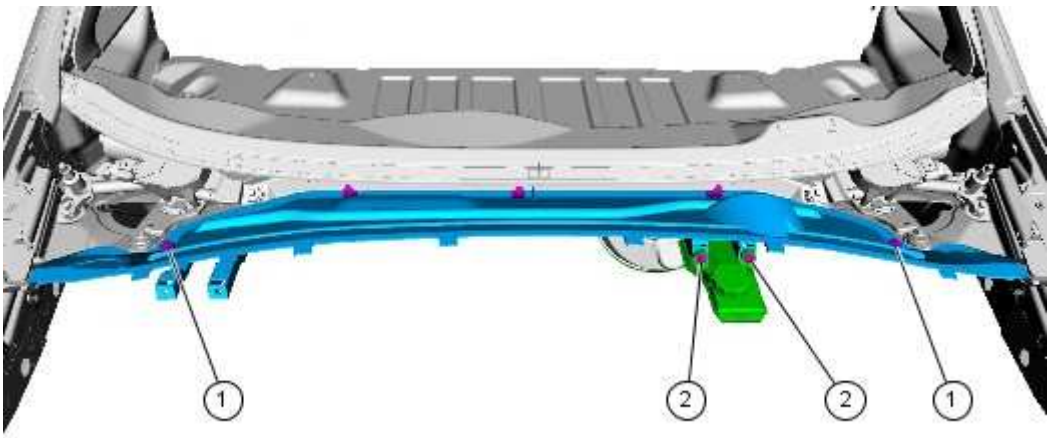

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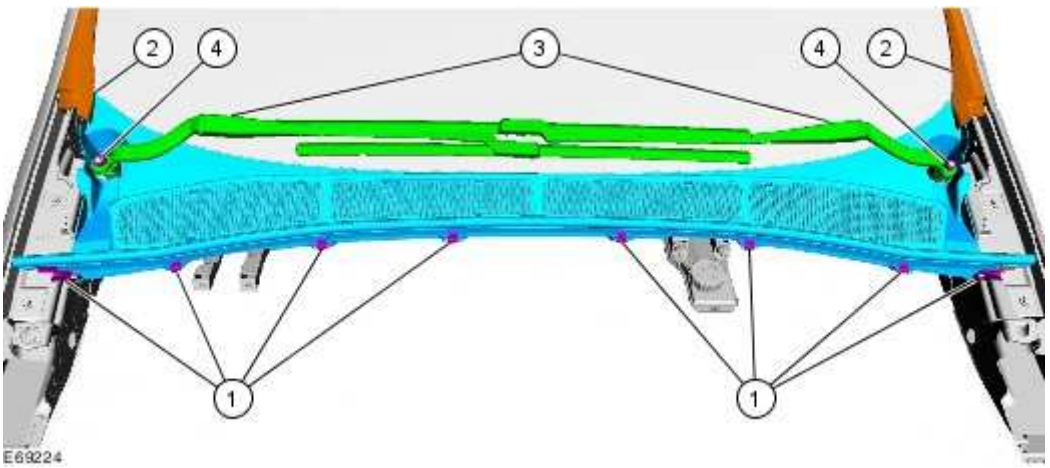

4. *Torq*
22 N

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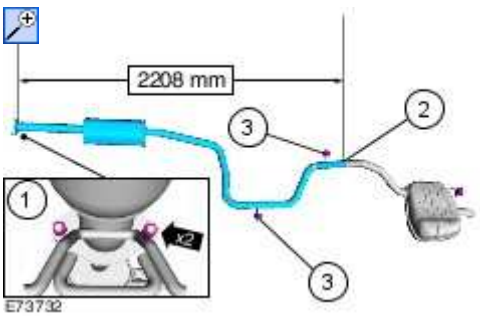
Removal and Installation

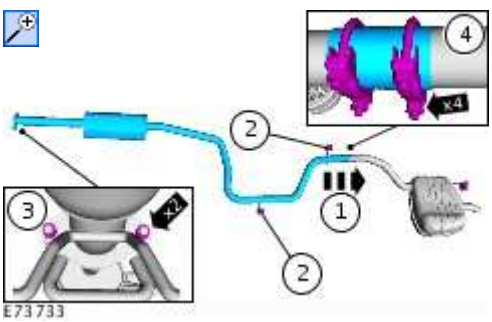
Removal



1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation



1. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   3. *Torque:* 48 Nm
   4. *Torque:* 45 Nm

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Removal and Installation

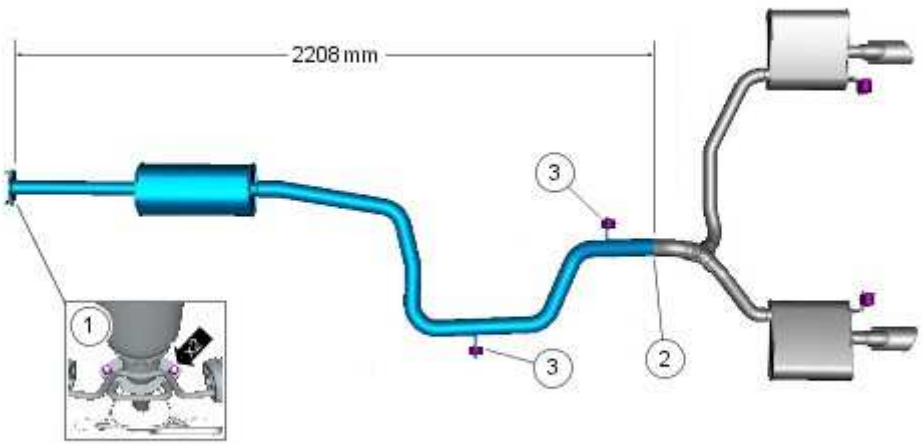
Removal

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

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

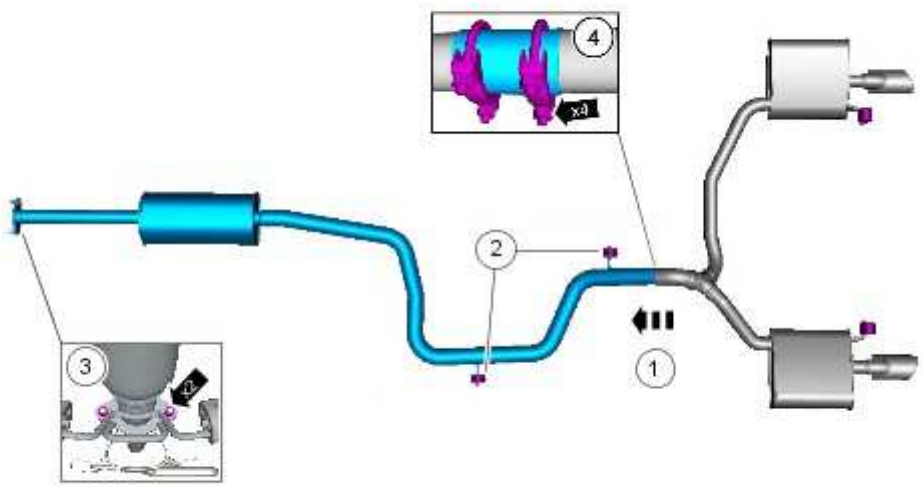
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.



E76686

Installation

1. NOTE: Make sure that the exhaust flexible pip is not twisted.
3. *Torq* 48 N
4. *Torq* 45 N



E76690

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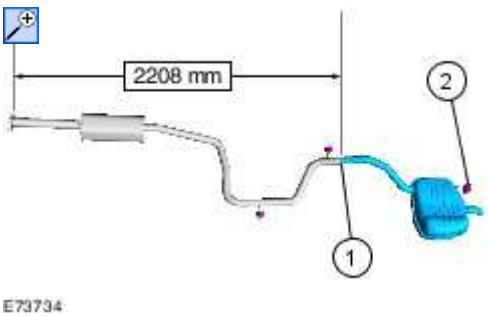
Removal and Installation

Removal

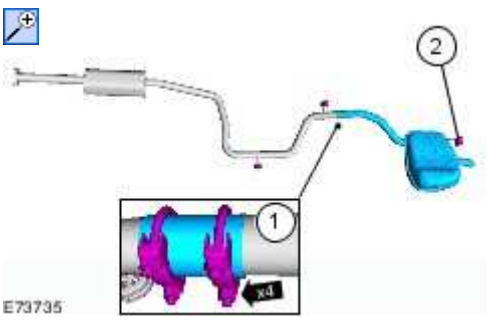


1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2.

Installation



1. *Torque:* 45 Nm

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Removal and Installation

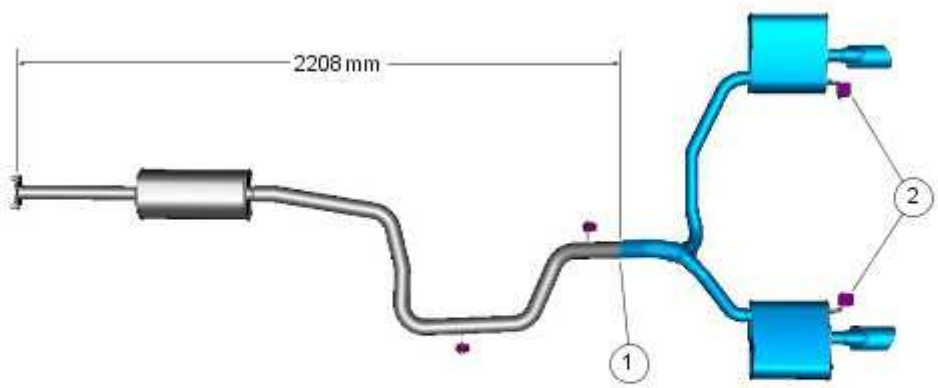
Removal

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

1. Raise and support the vehicle.

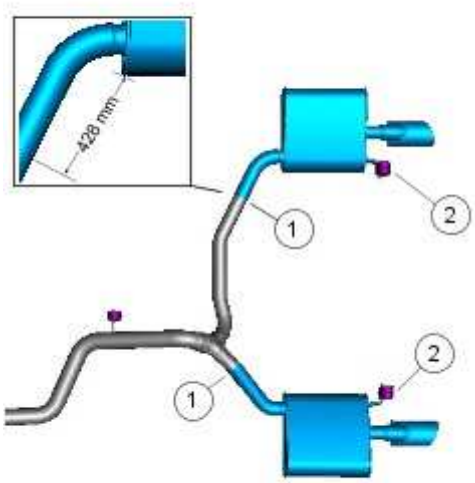
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2. Step required when replacing both rear mufflers.



E76688

3. Step required when replacing a single rear muffler.



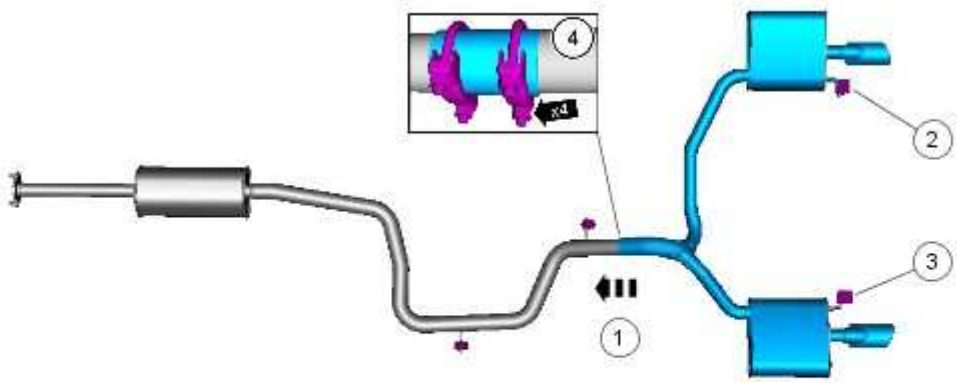
E76689

Installation

http://vnx.su

1. Step required when replacing both rear mufflers.

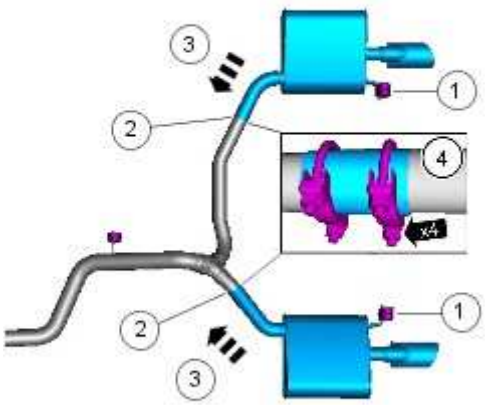
   Torque: 45 Nm



E79314

2. Step required when replacing a single rear muffler.

   Torque: 45 Nm



E79315

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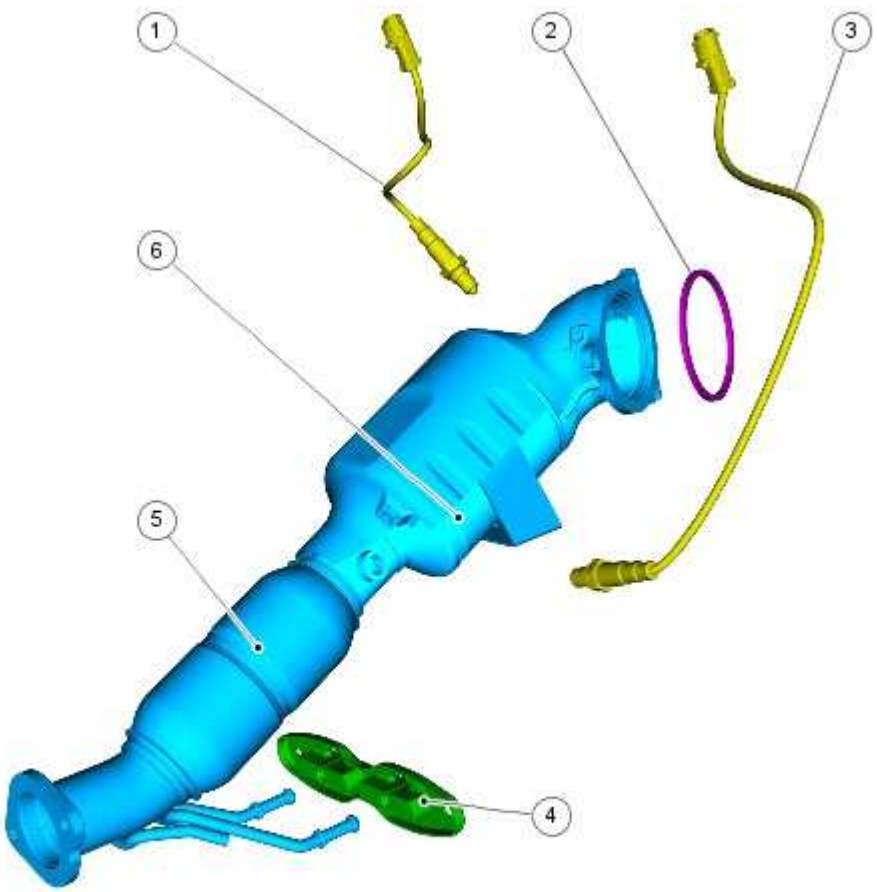
Description and Operation



E128027

Item	Description
1	Heated lambda probeHO2S (heated oxygen sensor)
2	Gasket, catalytic converter - turbocharger
3	Catalytic converter monitoring sensor
4	Exhaust bracket
5	Exhaust flexible pipe
6	catalytic converter

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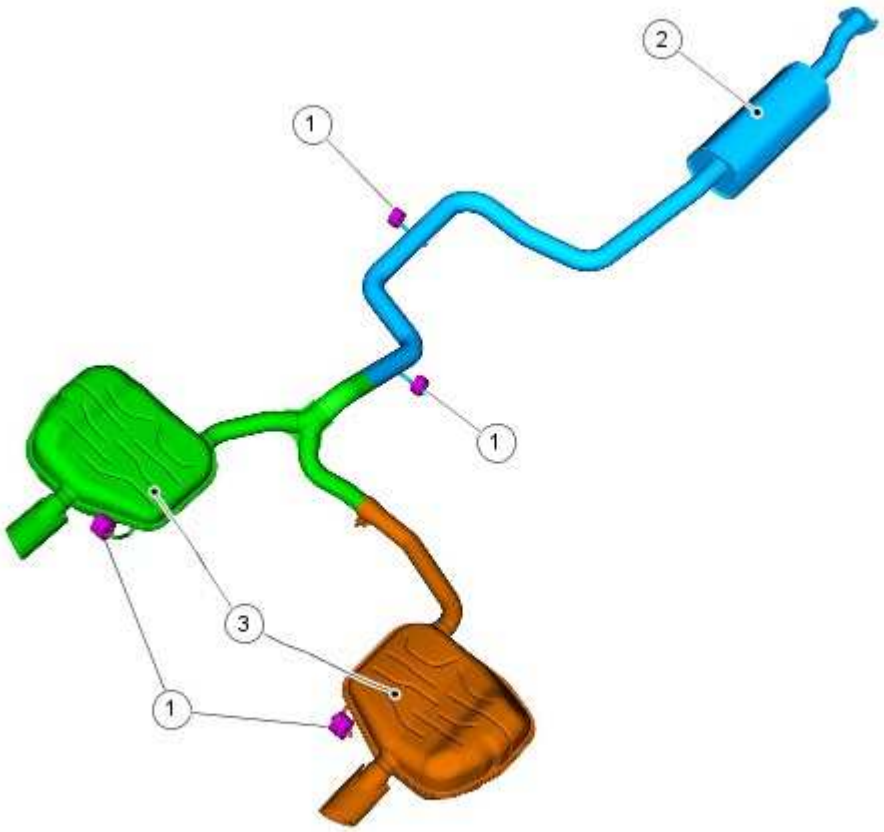

E128028

Item	Description
1	Exhaust bracket
2	Front silencer
3	Rear silencer

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Removal and Installation

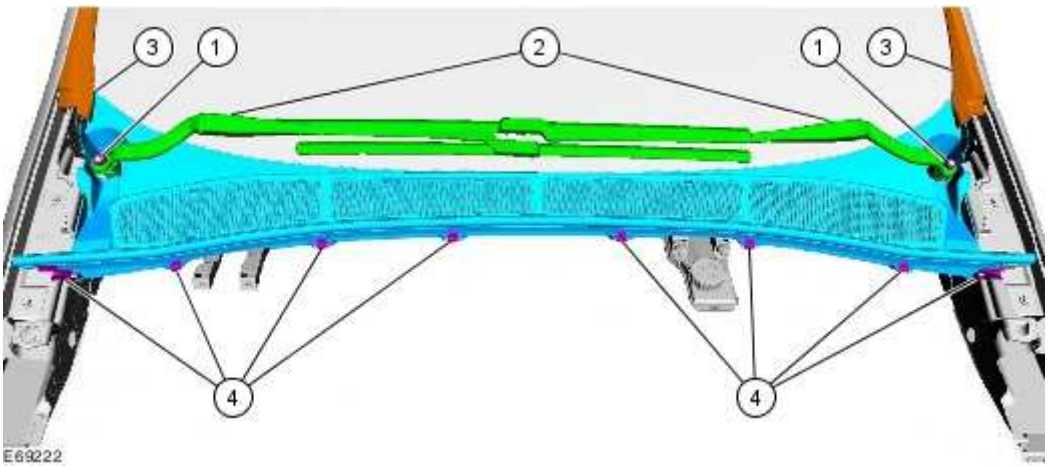
General Equipment

Cable ties

Removal

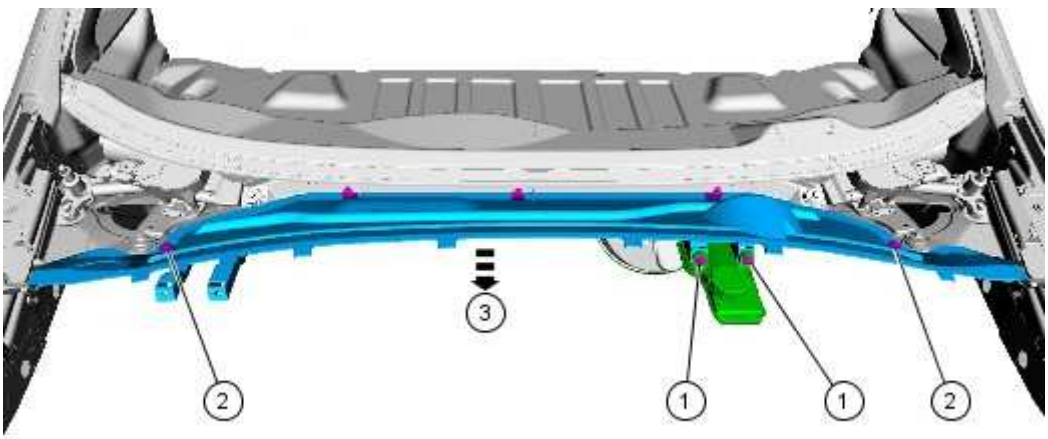
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
3. Detach the A-pillar exterior trim panel lower retaining clips.



E69222

4.



E69223

5. *Torque:* 24 Nm

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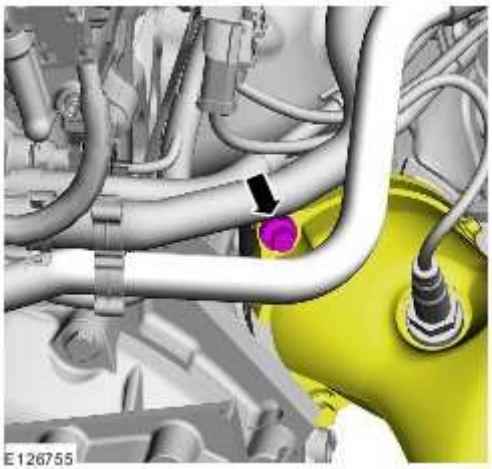

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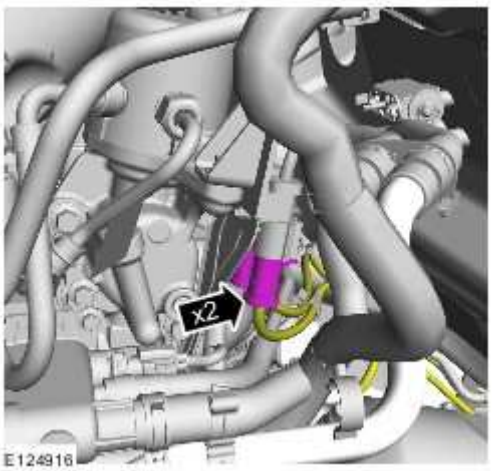
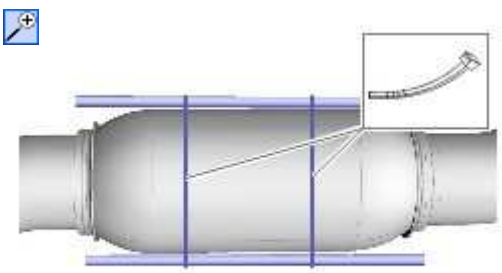
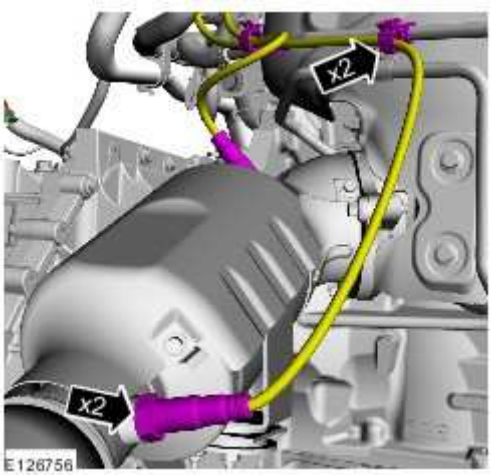


7. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
8. *General Equipment:* Cable ties





9. *Torque:* 48 Nm

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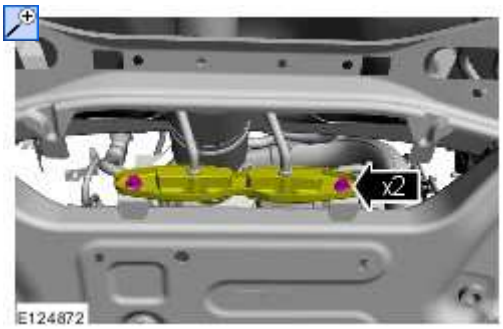
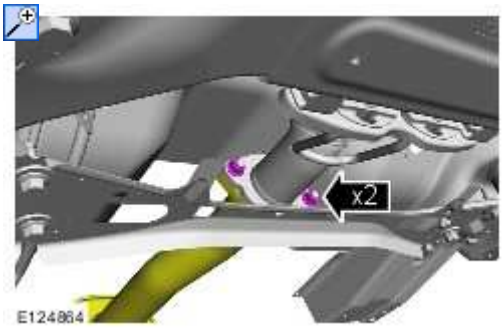
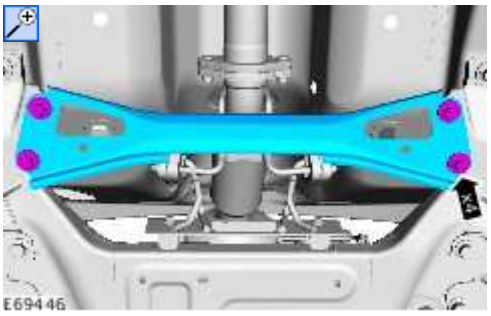
10. *Torque:* 48 Nm



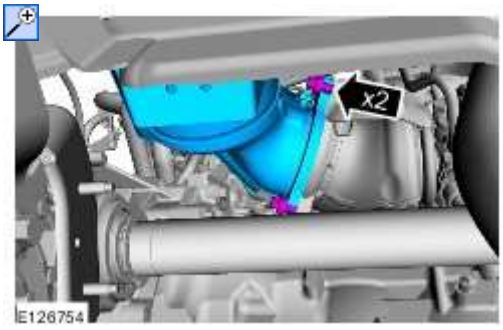
11. *Torque:* 24 Nm



12. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.
Torque: 48 Nm



13. *Torque:* 60 Nm



14. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent or twisted.
Torque: 24 Nm

Installation

1. To install, reverse the removal procedure.
2.

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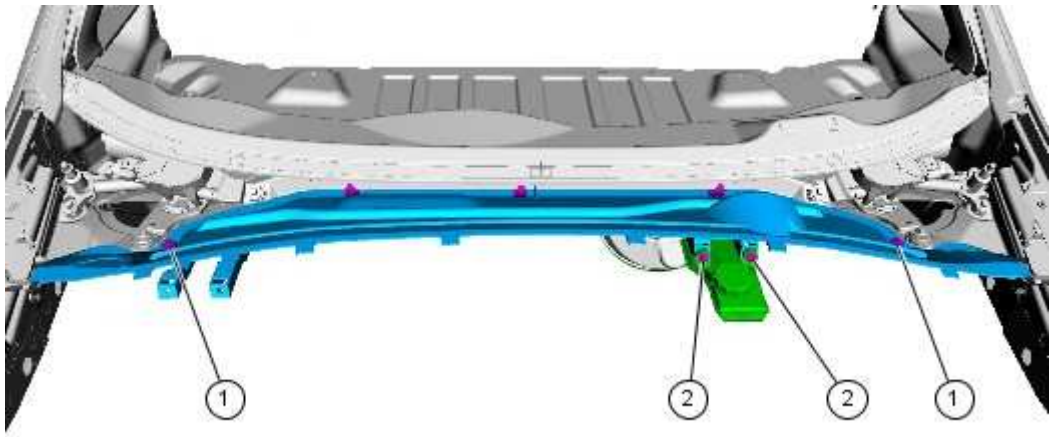
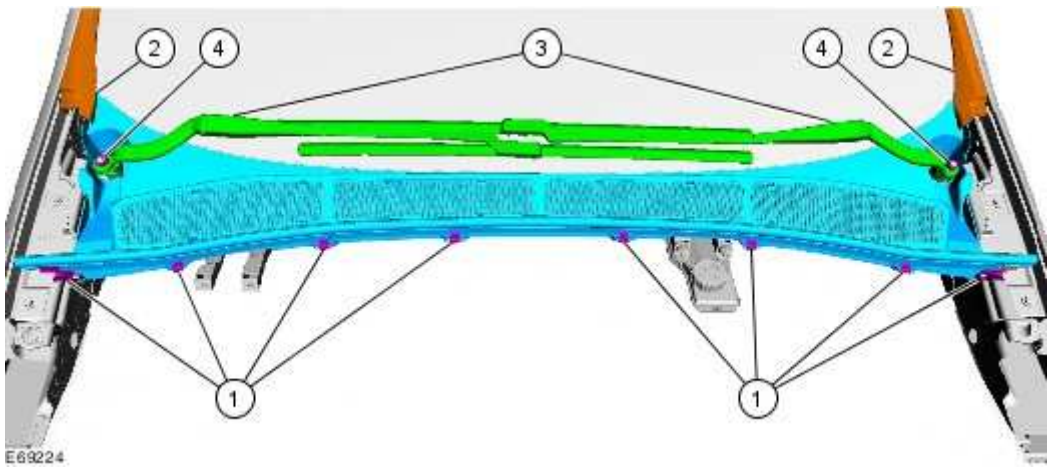


E69225



E69224

3. *Torque:* 22 Nm

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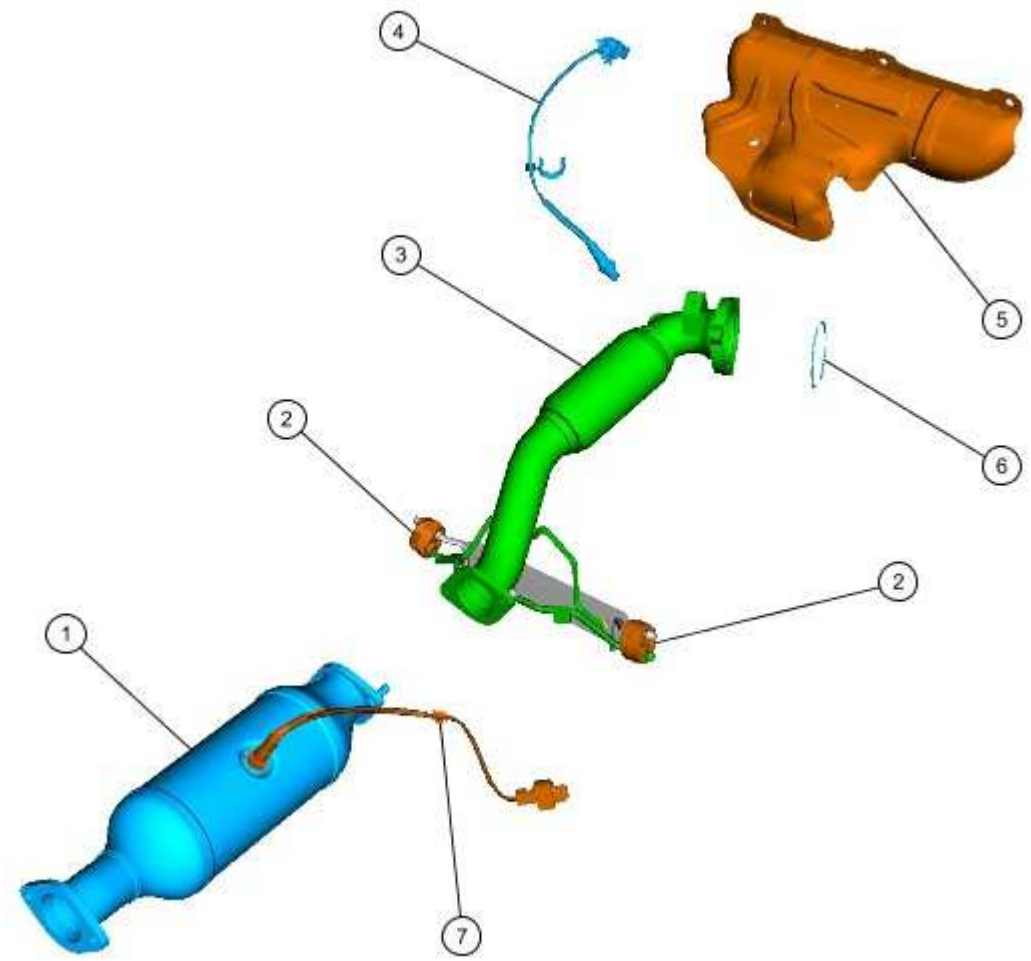
Description and Operation



E69326

Item	Part Number	Description
1	-	Catalytic converter
2	-	Exhaust hanger insulators
3	-	Exhaust flexible pipe
4	-	Heated oxygen sensor (HO2S)
5	-	Heat shield
6	-	Exhaust flexible pipe to turbo charger gasket
7	-	Catalyst monitor sensor

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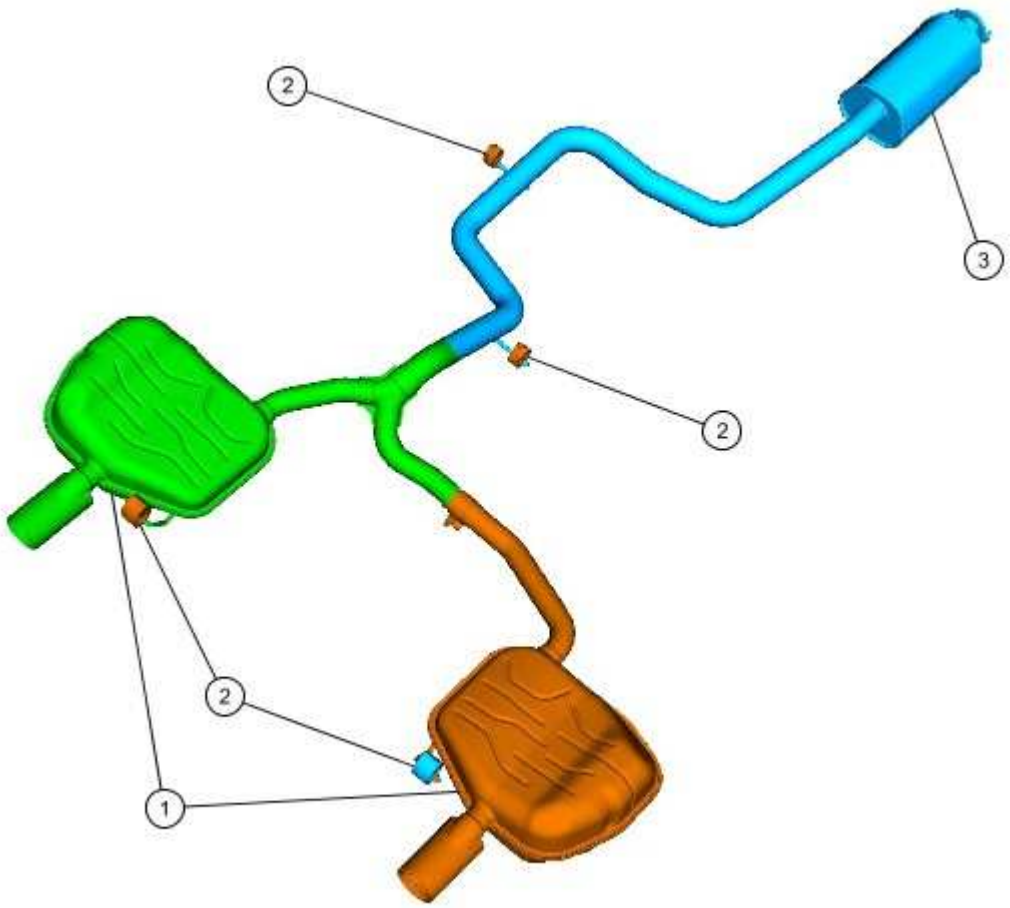

E69327

Item	Part Number	Description
1	-	Rear mufflers
2	-	Exhaust hanger insulators
3	-	Front muffler

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Removal and Installation

Materials

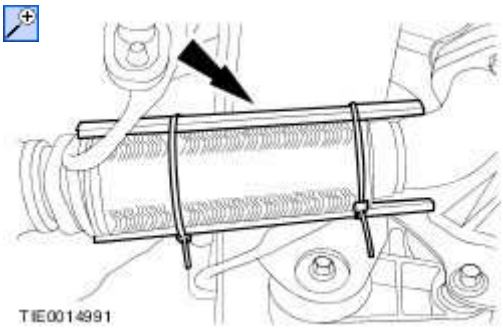
Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal

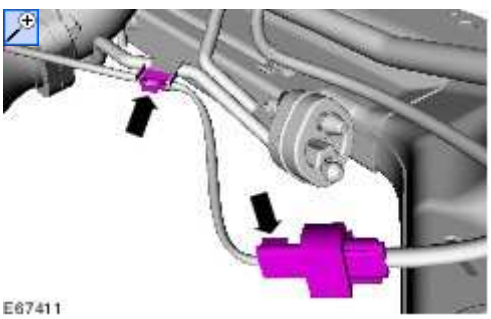
NOTE: Removal steps in this procedure may contain installation details.

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



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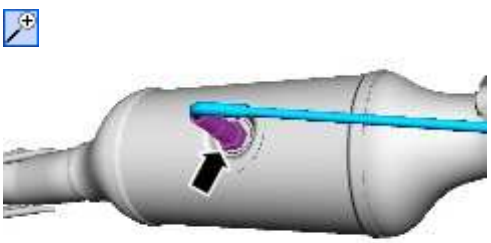
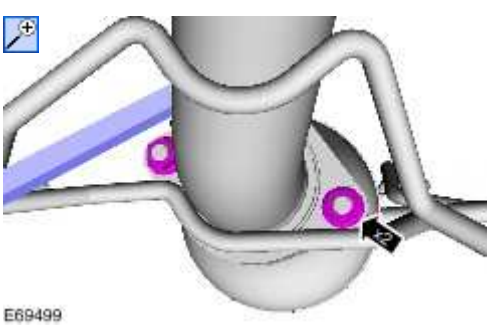


4. *Torque:* 47 Nm



5. CAUTION: Jointing compound must not be used forward of the catalytic converter.
   NOTE: Make sure that the exhaust flexible pipe is not twisted.
   Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
   Torque: 48 Nm

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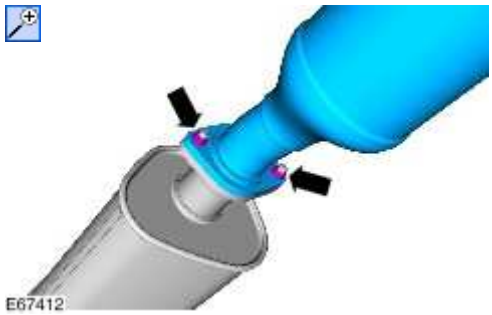

6. Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
   Torque: 48 Nm

Installation

1. To install, reverse the removal procedure.

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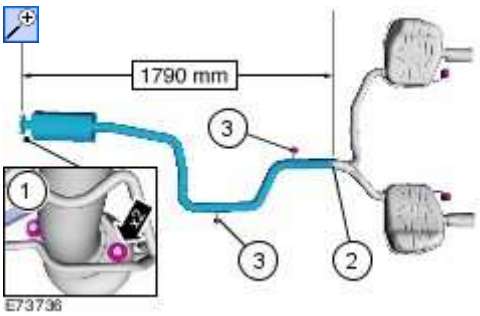
Removal and Installation

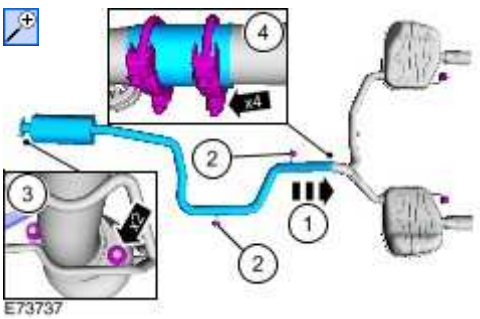
Removal



1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation



1. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   3. *Torque:* 48 Nm
   4. *Torque:* 45 Nm

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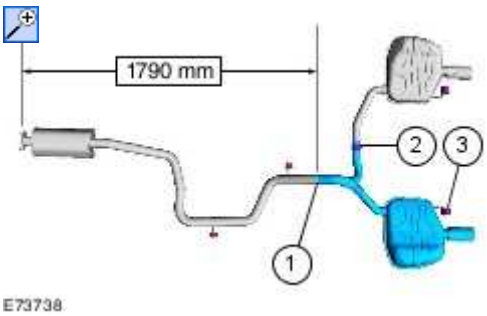
Removal and Installation

Removal

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



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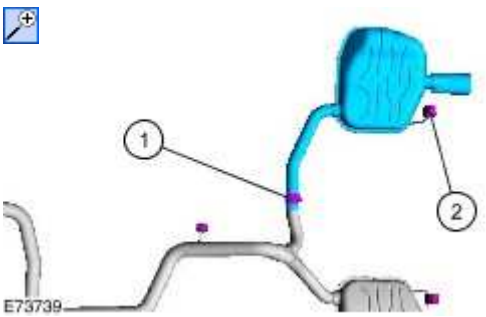
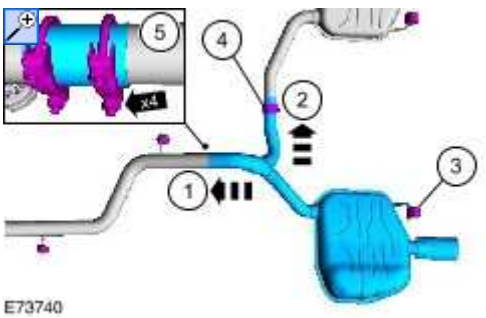


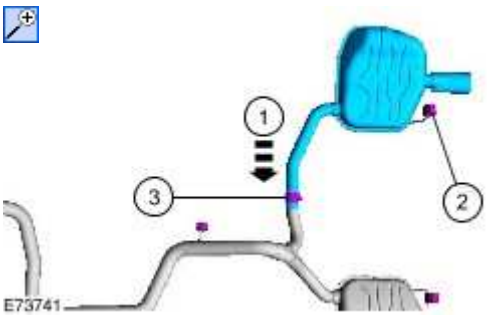
3.

Installation



1.

4. *Torque:* 54 Nm
5. *Torque:* 45 Nm



2.

3. *Torque:* 54 Nm

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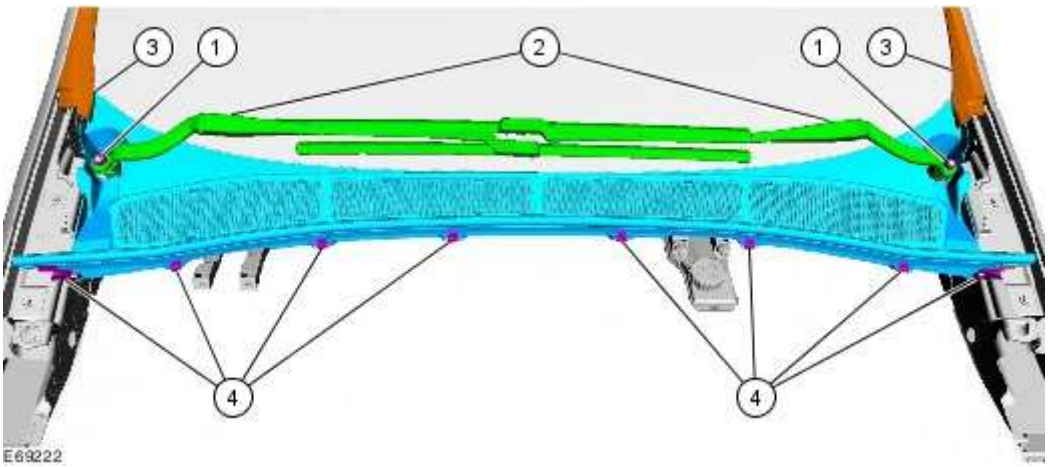
Removal and Installation

Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal



E69222

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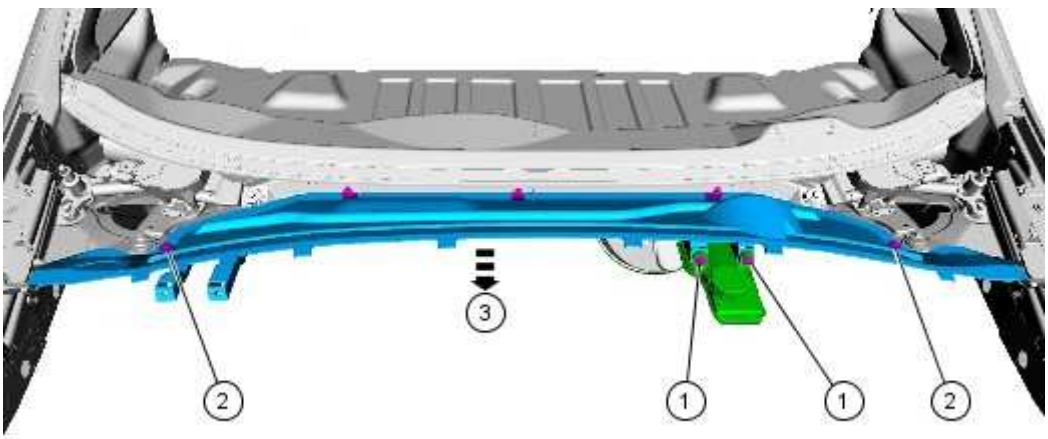

E69223

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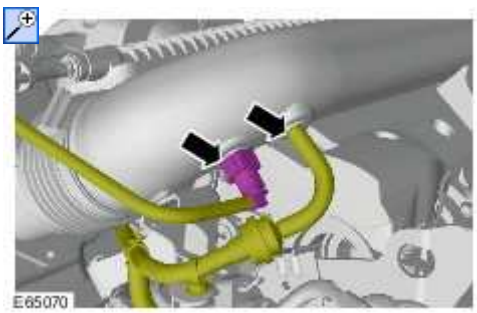
E65070

3.

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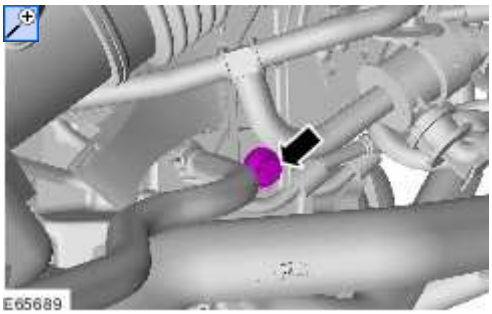
http://vnx.su



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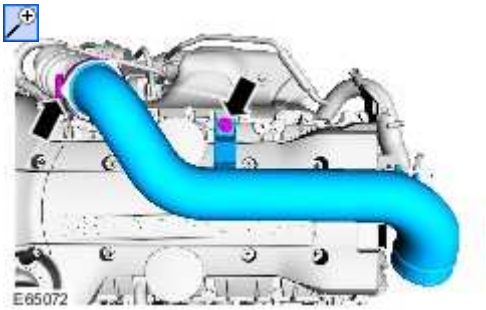

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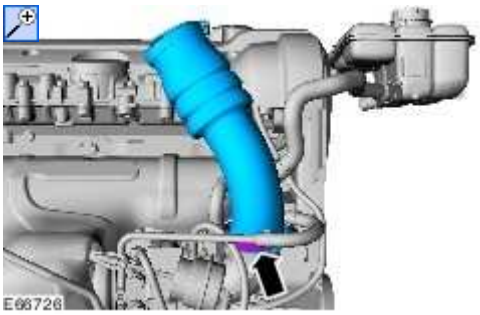

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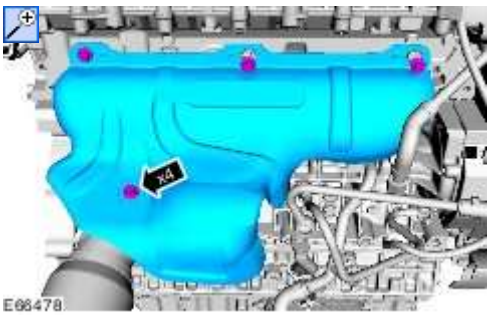

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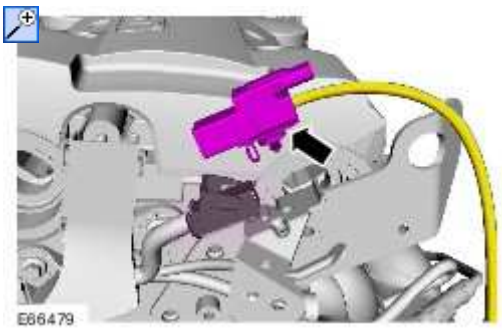
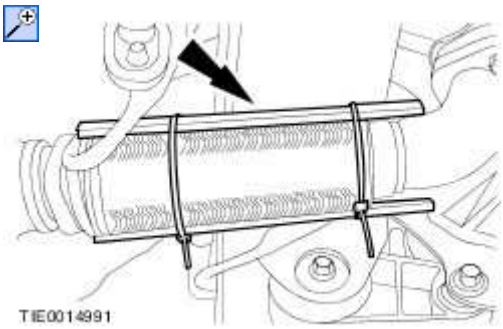


9. Raise and support the vehicle.

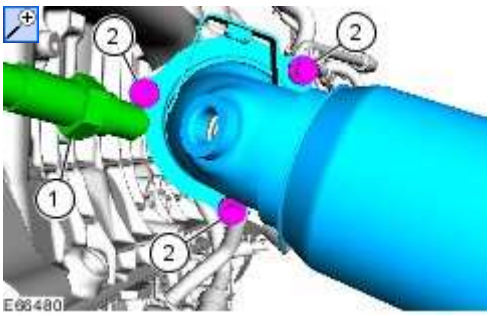
   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

10. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

http://vnx.su



11. CAUTION: Make sure that the exhaust flexible pipe is not twisted.



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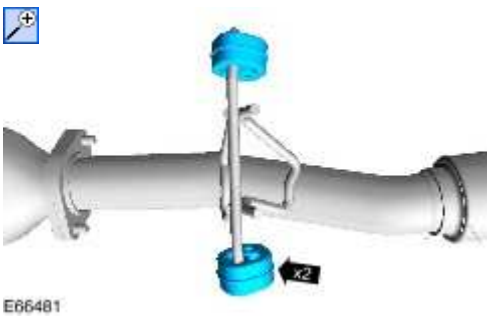
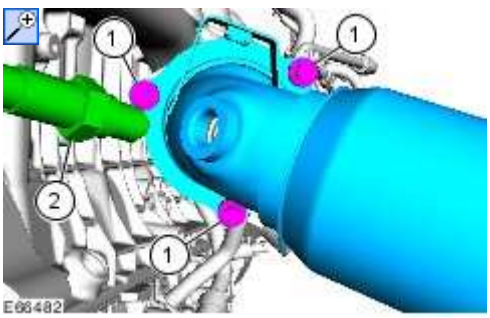


13.

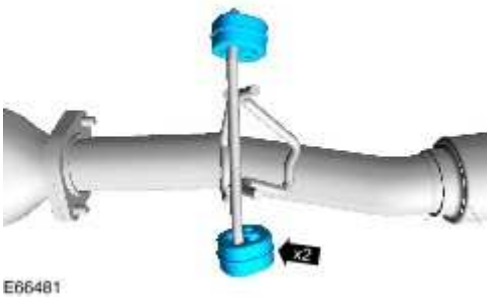
Installation

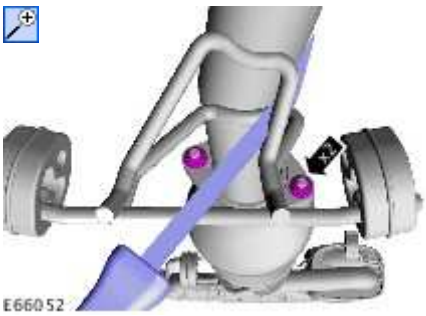


1. CAUTION: Jointing compound must not be use forward of the catalytic converter.
   1. *Torque:* 28 Nm
   2. *Torque:* 47 Nm

2.

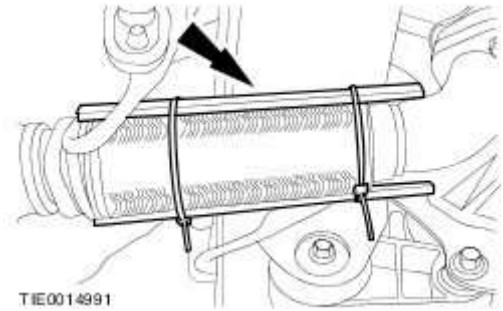
http://vnx.su





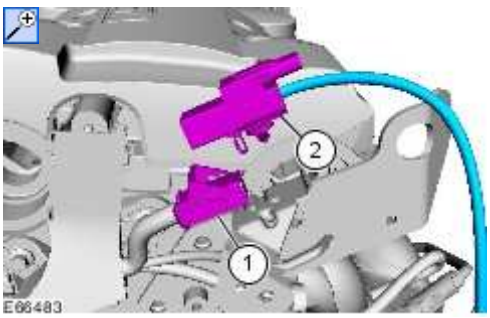
3. CAUTION: Make sure that the exhaust flexible pipe is not twisted.
   - Coat the studs with grease.

     Material: Grease KS-PS (SA-M1C9107-A / YS5 M1C9107-AA)
     Torque: 48 Nm

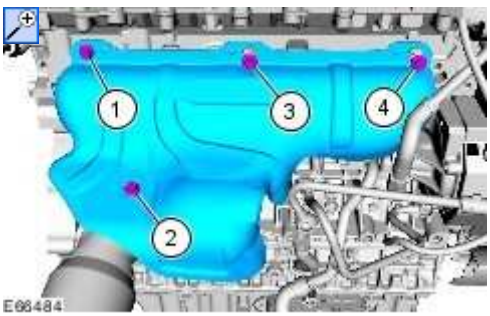


4. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

5. Lower the vehicle.



6.



7. *Torque:* 20 Nm

8.

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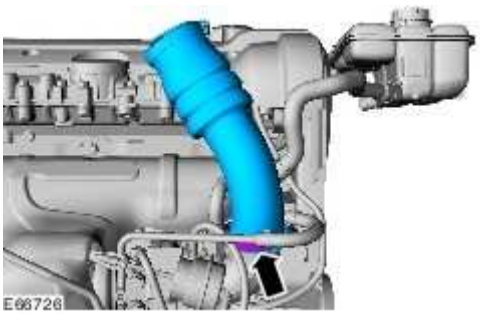
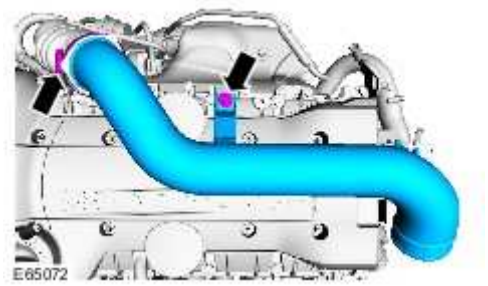
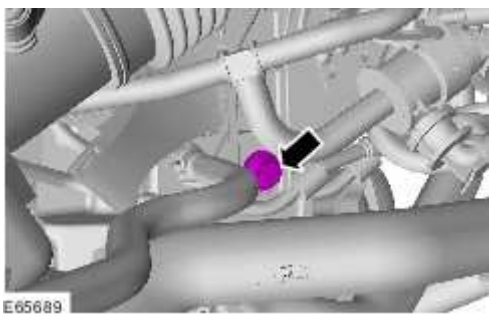


9. *Torque:* 10 Nm



10. *Torque:* 10 Nm



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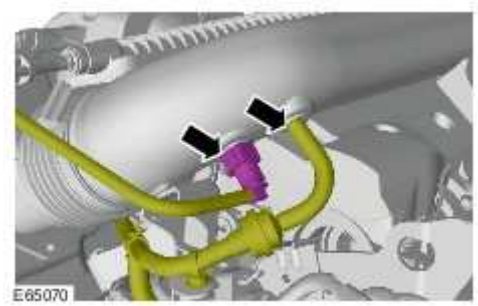

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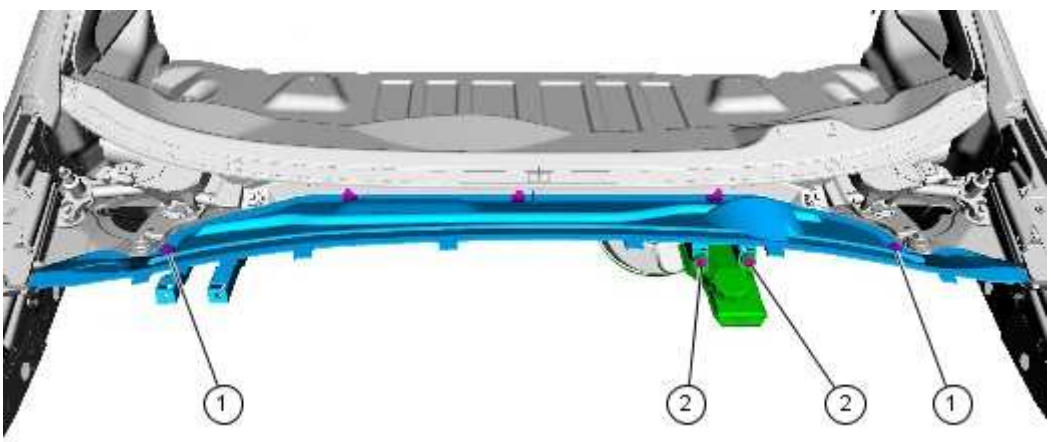

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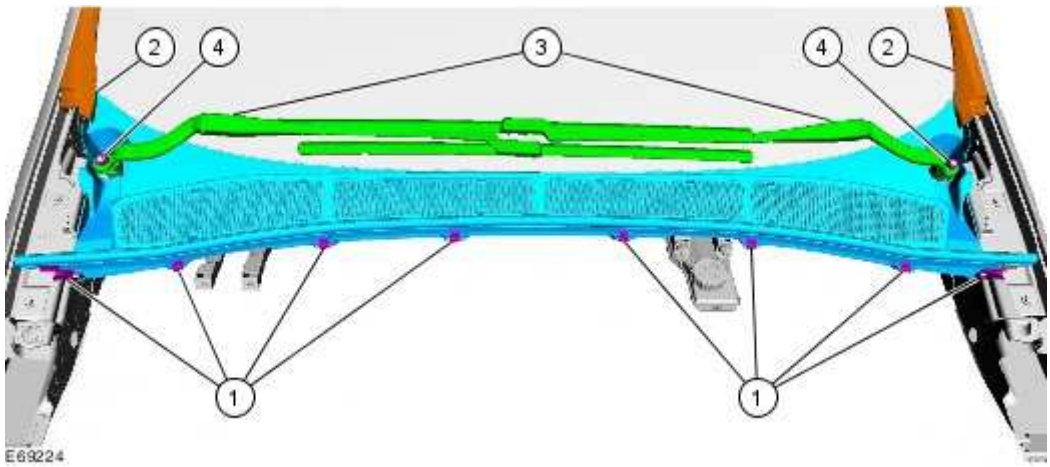
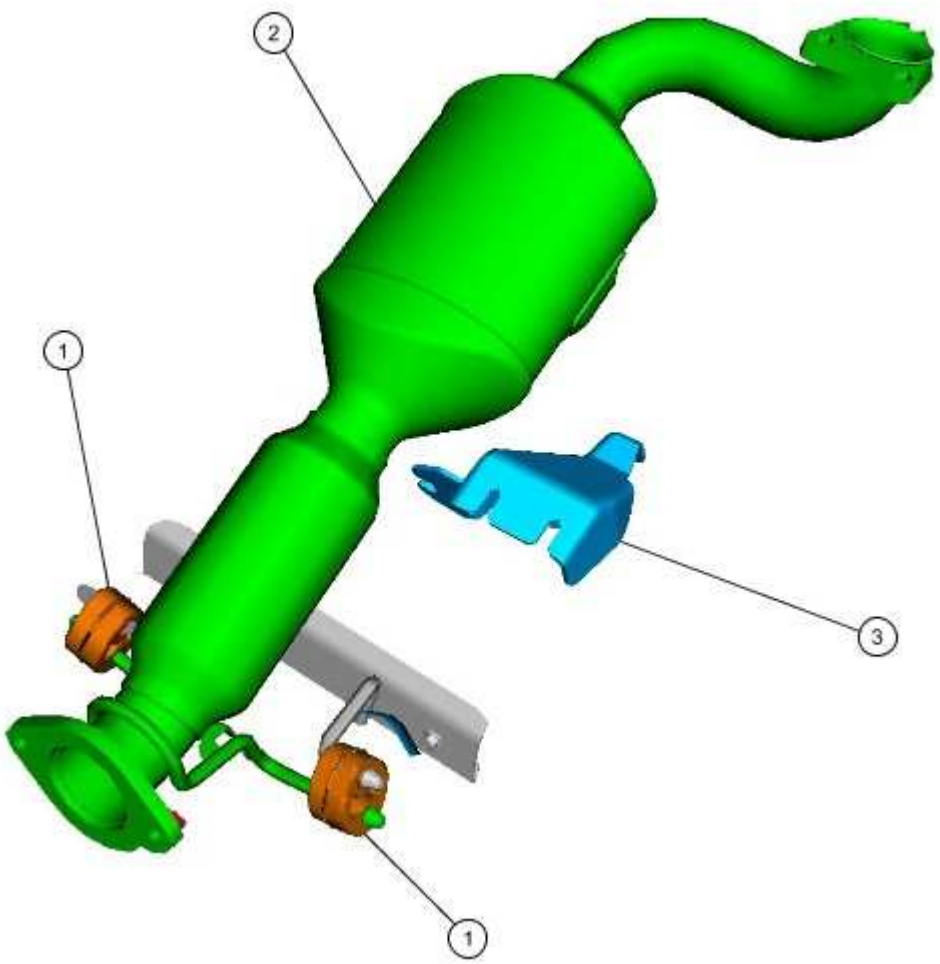


http://vnx.su

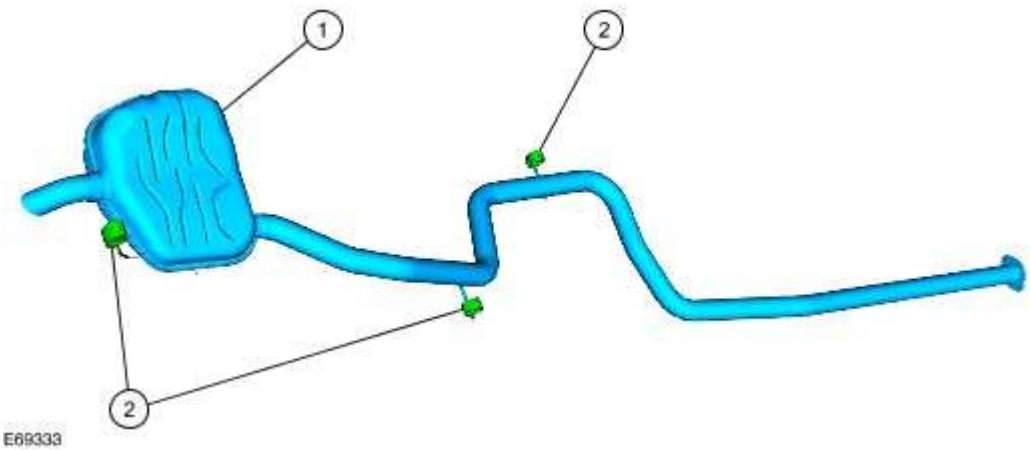
Description and Operation



E69332

Item	Part Number	Description
1	-	Exhaust hanger insulators
2	-	Catalytic converter and exhaust flexible pipe assembly
3	-	Catalytic converter support bracket

http://vnx.su



Item	Part Number	Description
1	-	Rear muffler
2	-	Exhaust hanger insulators

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Print

Removal and Installation

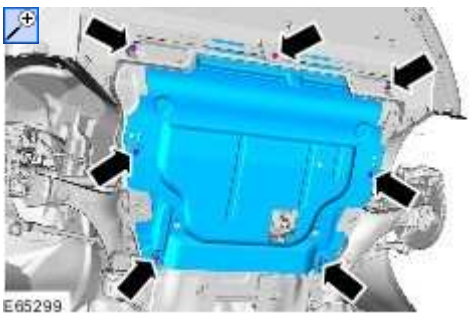
Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



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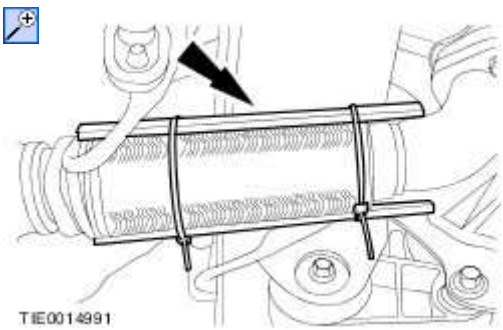
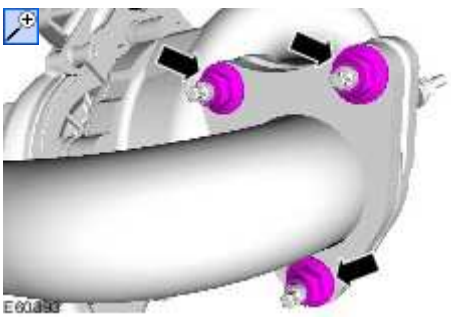


3. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



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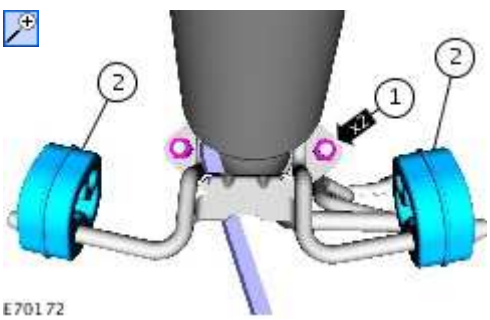

5. CAUTION: Make sure that the exhaust flexible pipe is not twisted.

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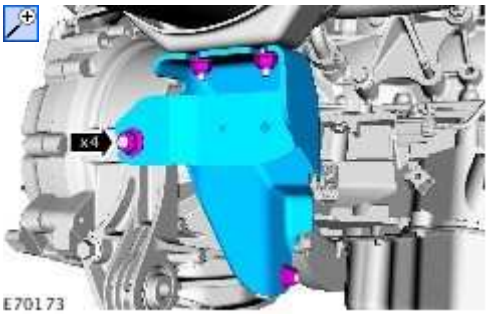
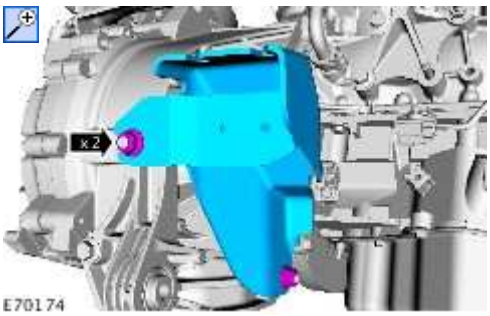
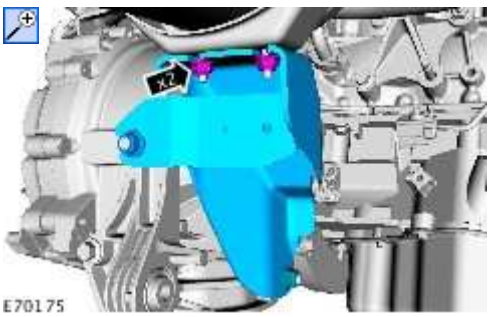


6.

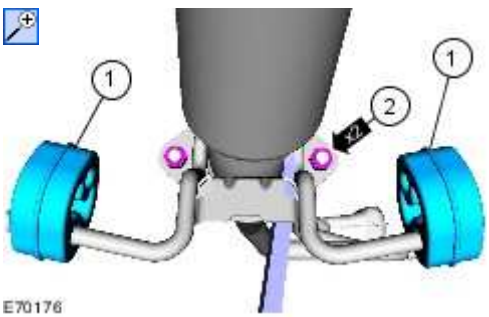
Installation



1. *Torque:* 24 Nm

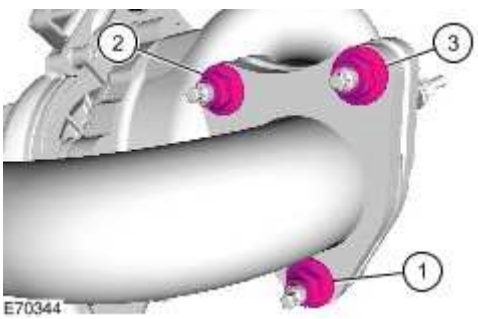


2. NOTE: Only tighten the nuts finger tight at this stage.



3. NOTE: Only tighten the nuts finger tight at this stage.
Coat the studs with grease.

Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)

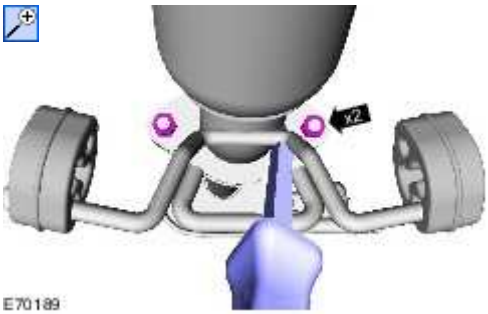


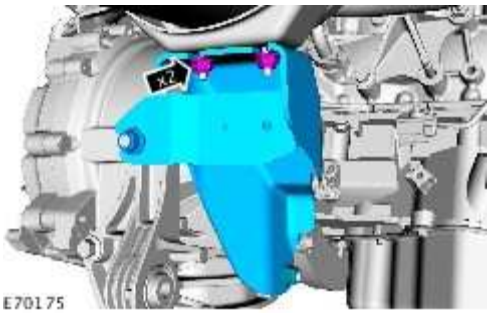
4. CAUTION: Jointing compound must not be used forward of the catalytic converter.
Tighten the catalytic converter to turbocharger nuts in the sequence shown.

Torque: 24 Nm

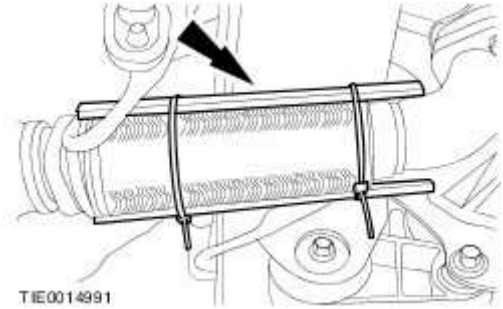
5. CAUTION: Make sure that the exhaust flexible pipe is not twisted.
Torque: 48 Nm

http://vnx.su

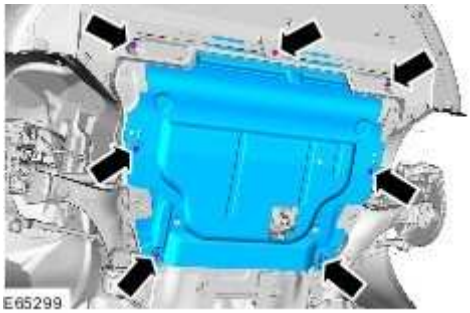




6. *Torque:* 24 Nm



7. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



8.

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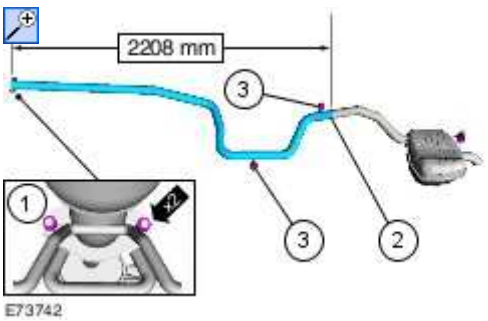
Removal and Installation

Removal

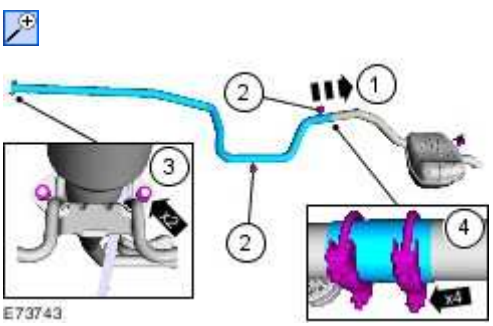


E73742

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation



E73743

1. NOTE: Make sure that the exhaust flexible pipe is not twisted.
3. *Torque:* 48 Nm
4. *Torque:* 45 Nm

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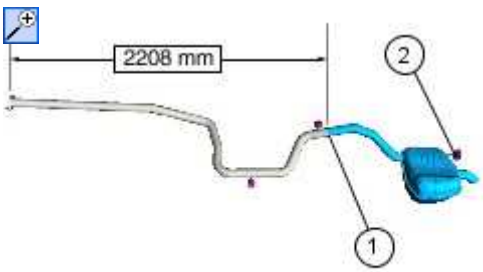
Print

Removal and Installation

Removal



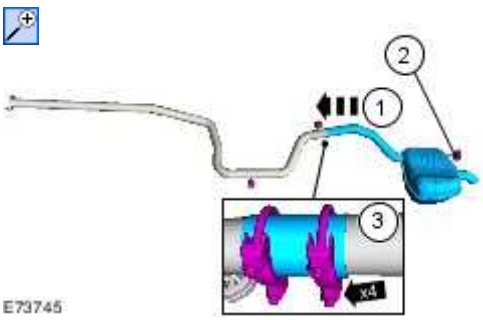
E73744

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2.

Installation



E73745

1. *Torque:* 45 Nm

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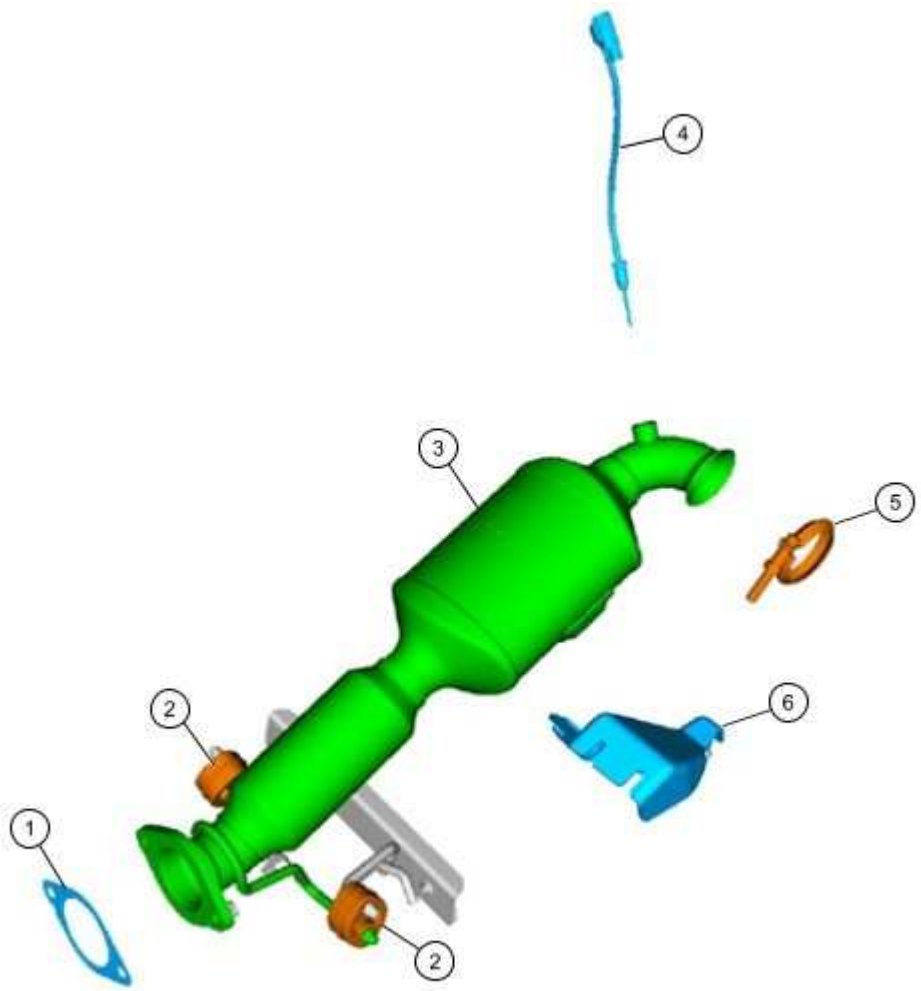
Description and Operation

Catalytic converter



E70550

Item	Part Number	Description
1	-	Exhaust flexible pipe gasket
2	-	Exhaust hanger insulators
3	-	Catalytic converter and exhaust flexible pipe assembly
4	-	Exhaust temperature sensor
5	-	Catalytic converter to turbocharger clamp
6	-	Catalytic converter support bracket

Diesel Particulate Filter (DPF)

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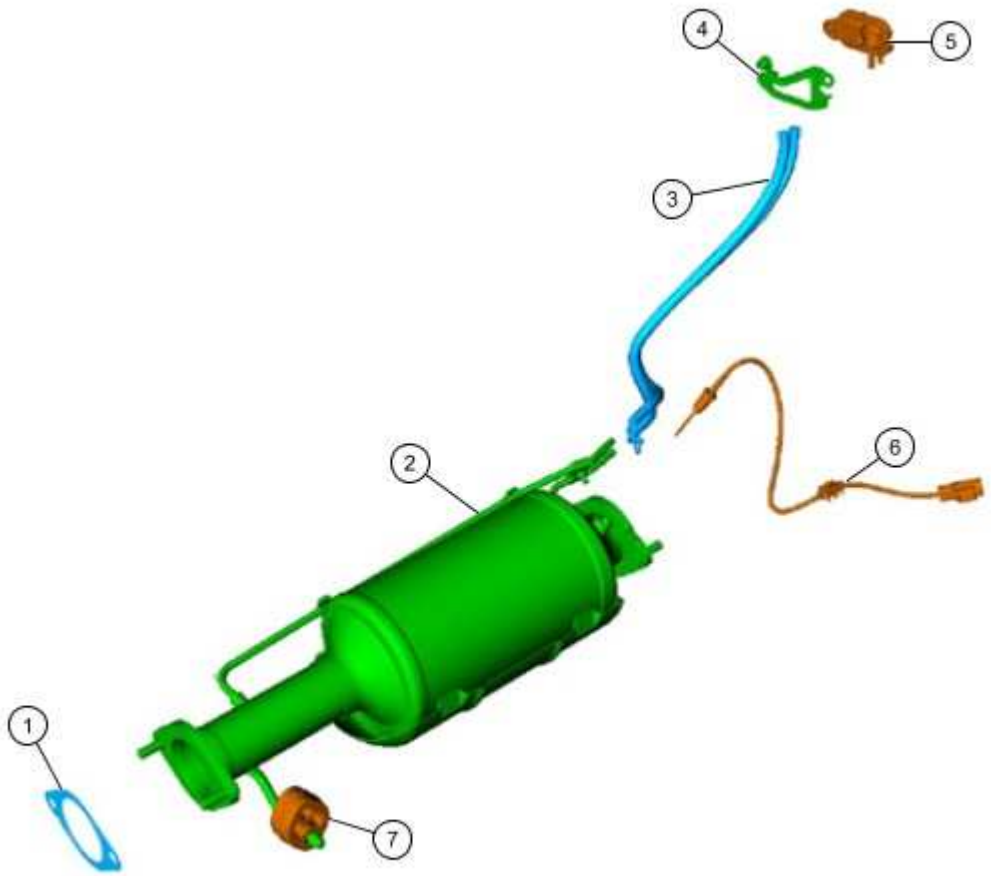


E70551

Item	Part Number	Description
1	-	DPF gasket
2	-	DPF
3	-	Pressure differential sensor lines
4	-	Pressure differential sensor bracket
5	-	Pressure differential sensor
6	-	DPF temperature sensor
7	-	Exhaust hanger insulators

DPF filter system consists of the following components:

- Diesel particulate filter (DPF)
- Pressure differential sensor
- Temperature sensor

DPF

The DPF reduces the pollution generated by diesel vehicles by filtering soot particles out of the exhaust gases.

Pressure Differential Sensor

The pressure differential sensor monitors the pressure drop within the DPF.

Temperature Sensors

http://vnx.su

The exhaust temperature sensor monitors the catalyst temperature. The DPF temperature sensor monitors the pre-DPF temperature. These signals are sent to the powertrain control module (PCM).

Regeneration of the DPF

Soot particles can accumulate in the post DPF exhaust tailpipe. The accumulation of the soot particles should not be considered a concern, as the DPF is not 100% efficient at filtering the soot particles.

During the regeneration process, it is possible that white smoke may be emitted from the exhaust tailpipe. This is an inherent by-product of the regeneration process and should not be considered a concern.

The pressure differential sensor is connected to the DPF by the pressure differential sensor lines to monitor the pre-pressure and post-pressure of the DPF. The pressure differential sensor converts these measurements to a signal voltage, which is then sent to the PCM to be used as part of the decision of whether to apply the regeneration process or not.

The PCM will choose the optimum time for the regeneration of the DPF. Under normal operating conditions the regeneration process occurs when the PCM has calculated that the DPF requires regeneration and that predetermined vehicle conditions are met (for example coolant temperature, vehicle speed and engine load).

Manual regeneration of the DPF

If the DPF becomes blocked the pressure differential sensor will register a high pressure diagnostic trouble code (DTC) with the PCM, the malfunction indicator lamp (MIL) will be illuminated and the limp home mode activated.

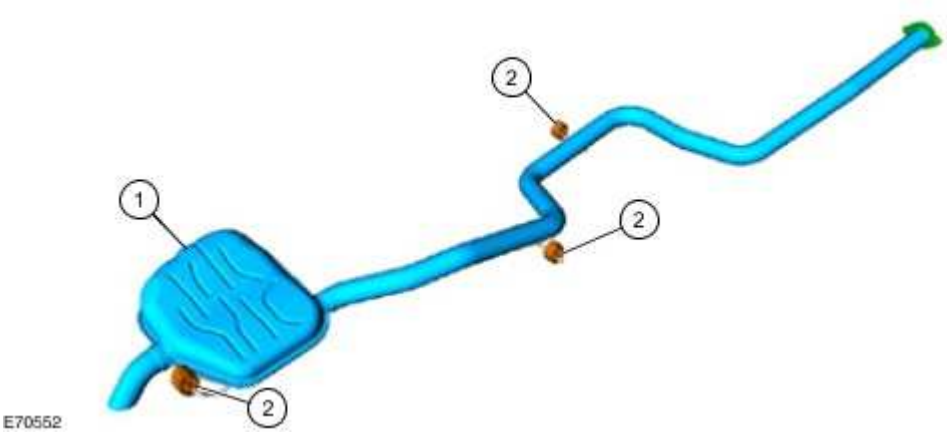
A blocked DPF can be a result of:

- Excessive soot particles production
- Multiple failed regeneration events

- Mechanical or electrical failure of a related system or sub-system (for example EGR valve stuck open, charge air system leak, fuel injectors)

The manual regeneration of the DPF can be used to clear the soot particles from the DPF. For additional information, refer to WDS.

Muffler



Item	Part Number	Description
1	-	Muffler
2	-	Exhaust hanger insulators

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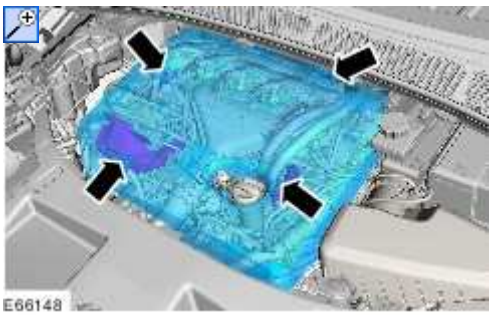
Removal and Installation

Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

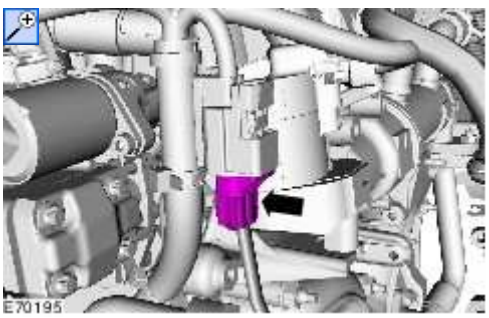
Removal

Vehicles with diesel particulate filter


E66148

1.

2. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

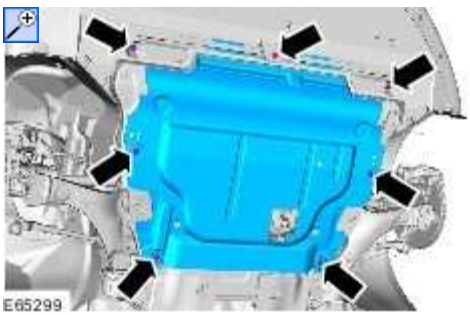

E70195

3.

All vehicles

4. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).


E65299

5.

6. CAUTION: Make sure that the exhaust

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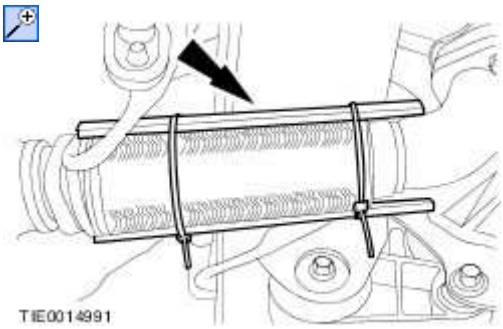
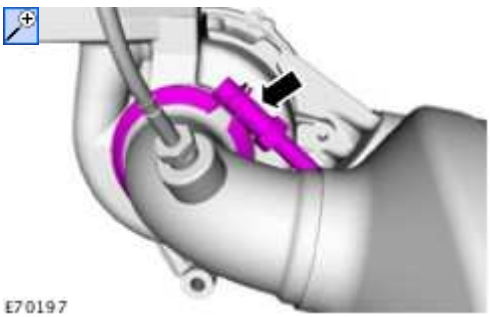
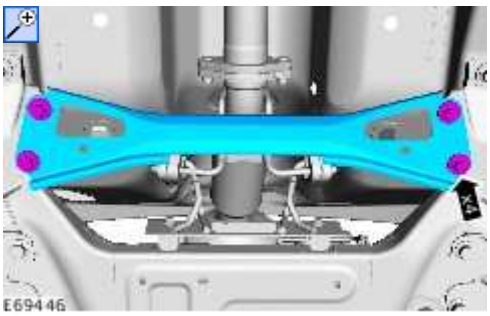


flexible pipe is not forcibly bent.



7. NOTE: Note the orientation of the clamp to aid installation.



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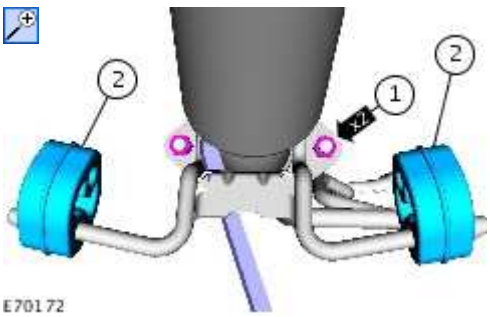
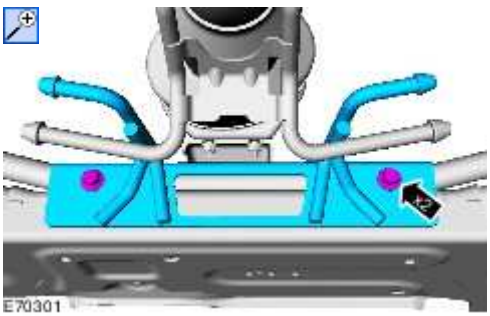


9. NOTE: Make sure that the exhaust flexible pipe is not twisted.



10.

11.

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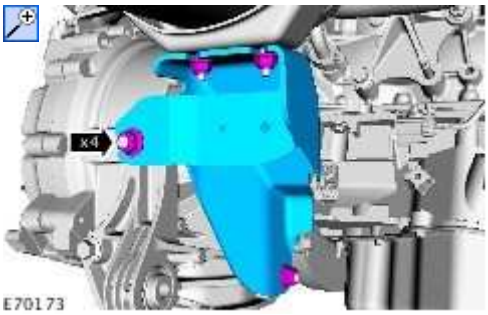
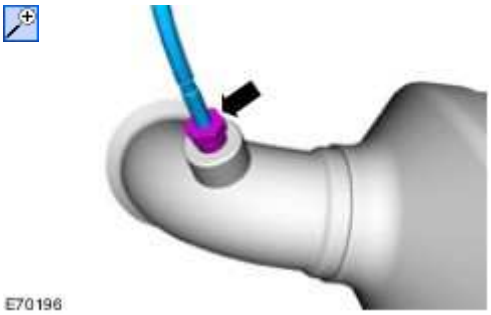


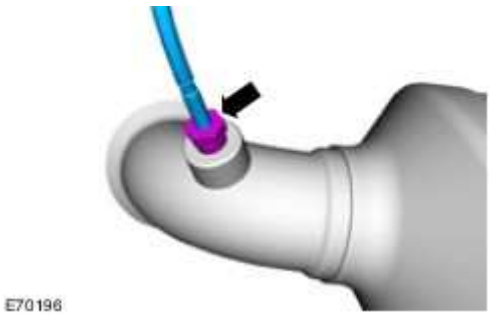
Vehicles with diesel particulate filter



12.

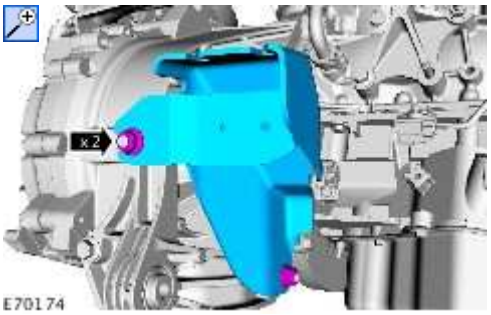
Installation

Vehicles with diesel particulate filter

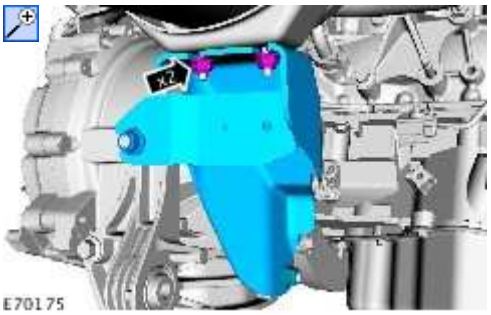


1. *Torque:* 30 Nm

All vehicles



2. *Torque:* 24 Nm



3. NOTE: Only tighten the nuts finger tight at this stage.

4. *Torque:* 24 Nm

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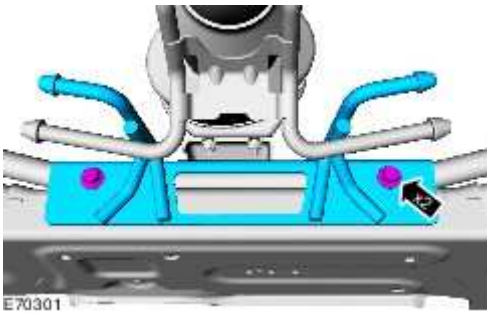
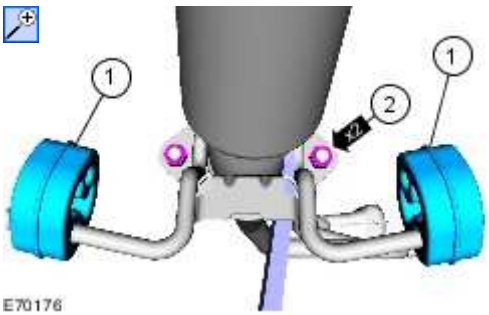
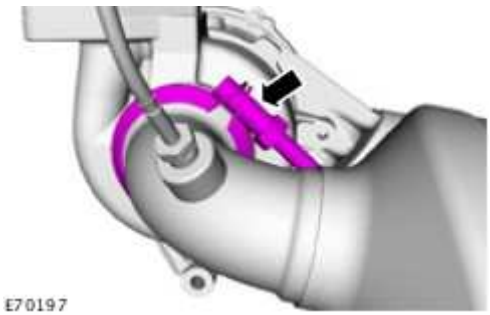




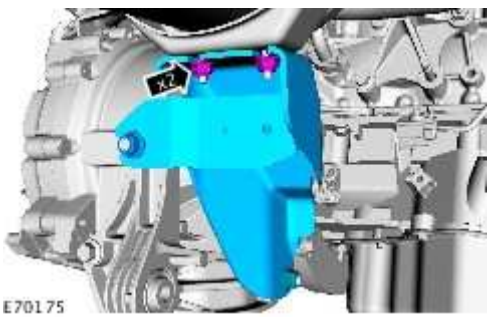
5. NOTE: Only tighten the nuts finger tight at this stage.
   Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)



6. NOTE: Make sure that a new clamp is installed.
   NOTE: Make sure that the clamp is installed to the same orientation as when removed.
   Torque: 24 Nm

7. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   Torque: 48 Nm



8. *Torque:* 24 Nm

9. *Torque:* 60 Nm

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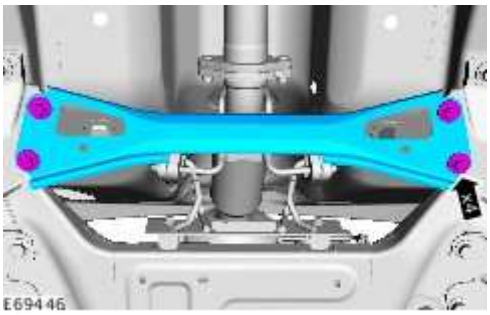
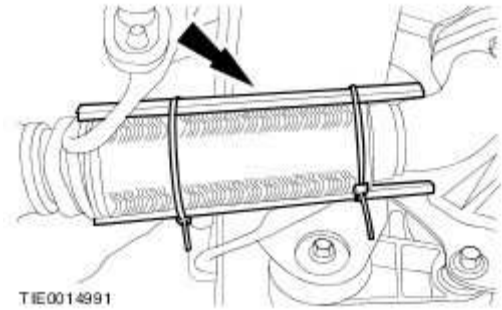
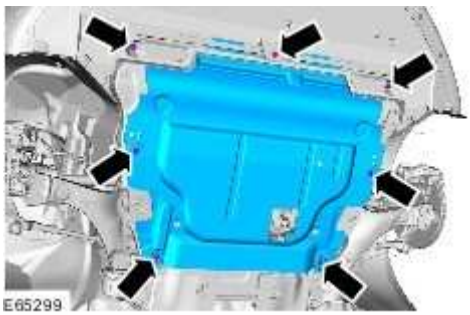




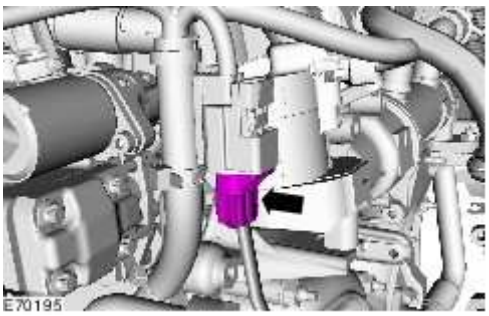
10. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



11.

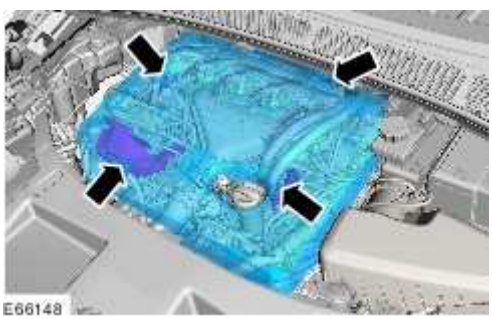
12. Lower the vehicle.

Vehicles with diesel particulate filter



13.

14. Refer to: Air Cleaner (303-12D Intake Air Distribution and Filtering - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



15.

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Removal and Installation

Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

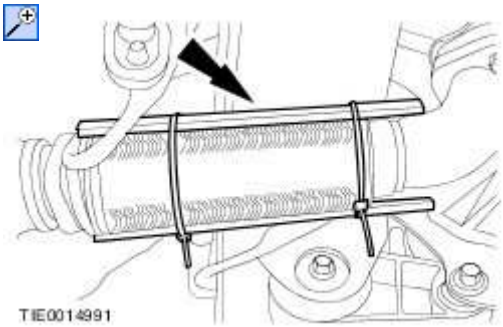
Ford diagnostic equipment

Removal

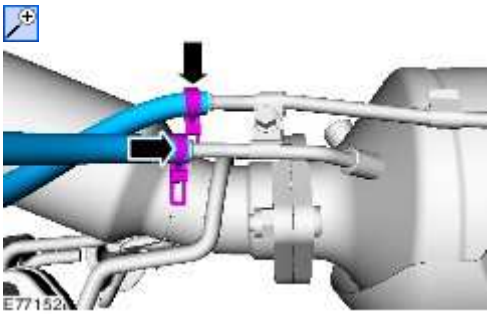
NOTE: Removal steps in this procedure may contain installation details.

1. Raise and support the vehicle.

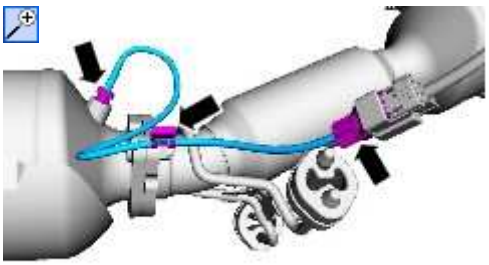
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



3.



4.

5. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.
   Coat the studs with grease.

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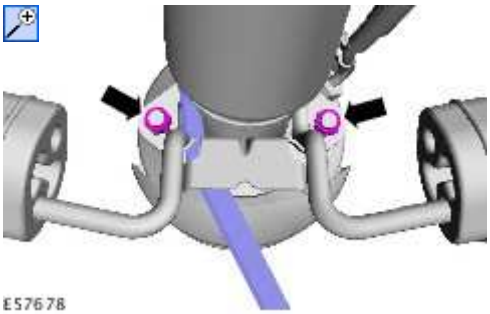
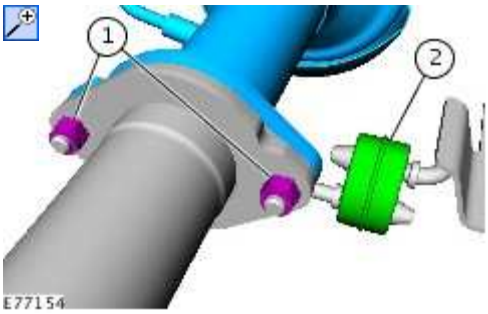


Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
Torque: 48 Nm



6. Coat the studs with grease.

Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
Torque: 48 Nm

Installation

1. To install, reverse the removal procedure.

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

2. Carry out the powertrain control module (PCM) Reset the Diesel Particulate Filter Learned Values service function.

General Equipment: Ford diagnostic equipment

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Removal and Installation

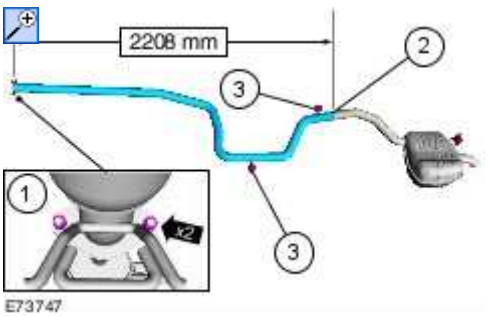
Removal

All vehicles

1. Raise and support the vehicle.

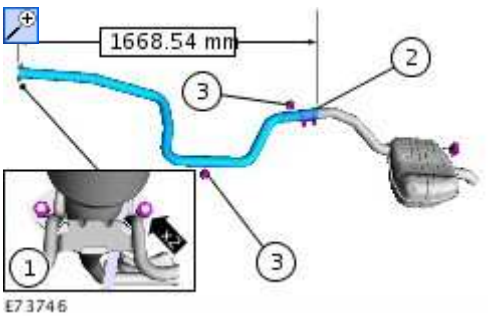
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

Vehicles without diesel particulate filter



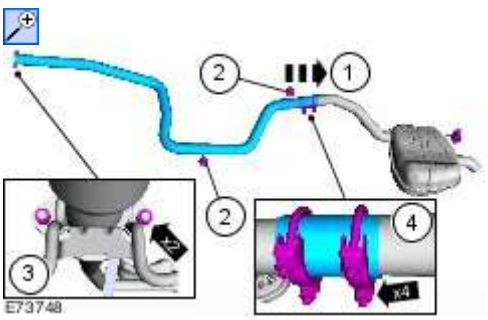
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Vehicles with diesel particulate filter



3. NOTE: Make sure that the exhaust flexible pipe is not twisted.

Installation



1. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   3. *Torque:* 48 Nm
   4. *Torque:* 45 Nm

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Removal and Installation

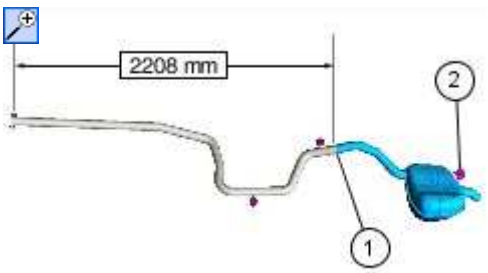
Removal

All vehicles

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

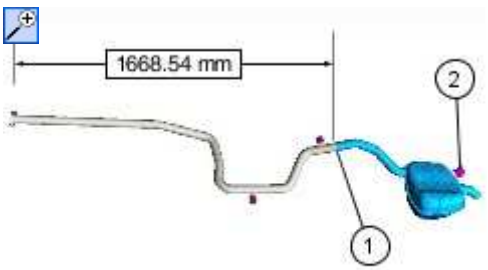
Vehicles without diesel particulate filter



E73750

2.

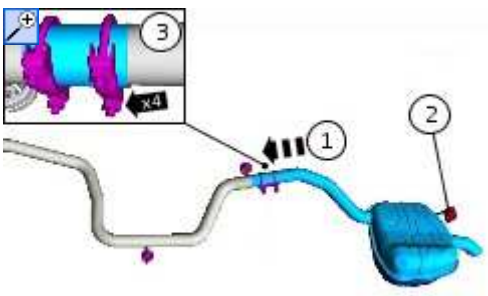
Vehicles with diesel particulate filter



E73749

3.

Installation



E73751

1.

3. *Torque:* 45 Nm

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Removal and Installation

General Equipment

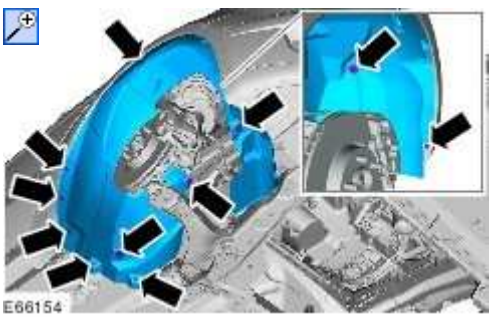
Ford diagnostic equipment

Removal

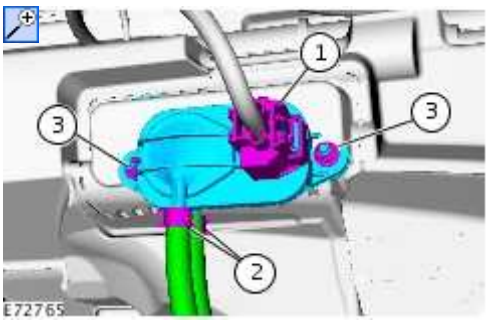
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front left-hand wheel and tire.

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

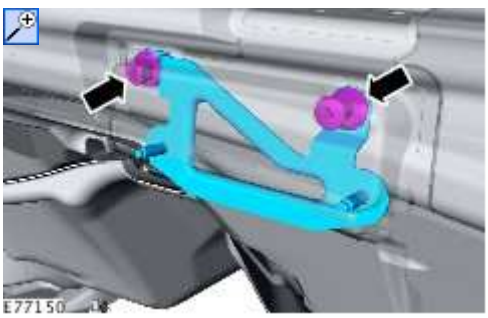


2.



3.

3. *Torque:* 5 Nm



4. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.
2. Carry out the powertrain control module (PCM) Reset the Diesel Particulate Filter Differential Pressure Sensor Learned Values service function.

   General Equipment: Ford diagnostic equipment

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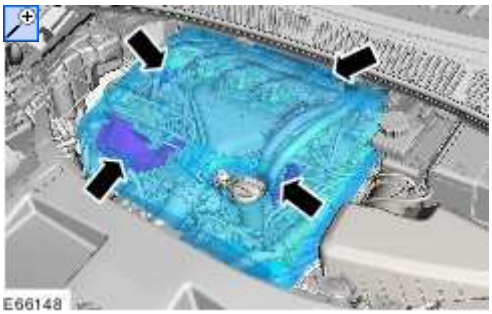
Print

Removal and Installation

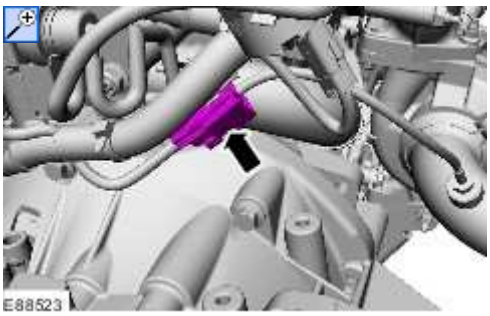
Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

Removal



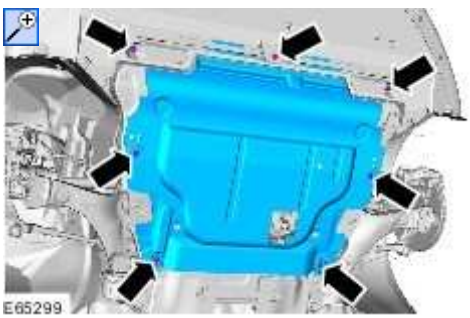
1.



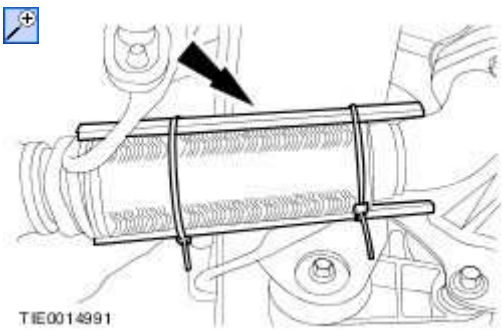
2.

3. Raise and support the vehicle.

   Refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



4.



5. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

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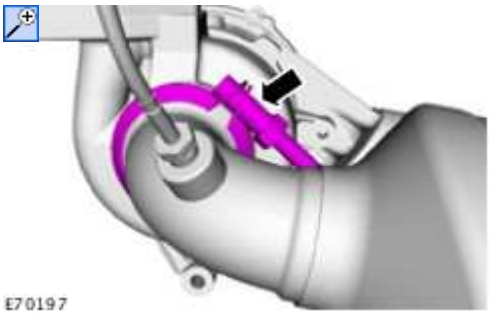
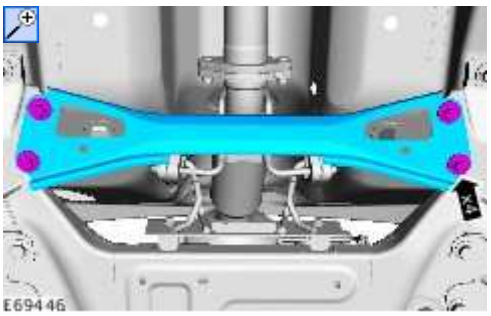
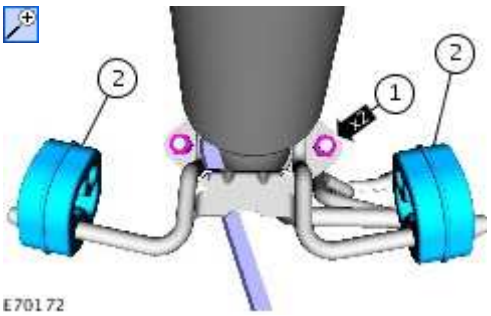


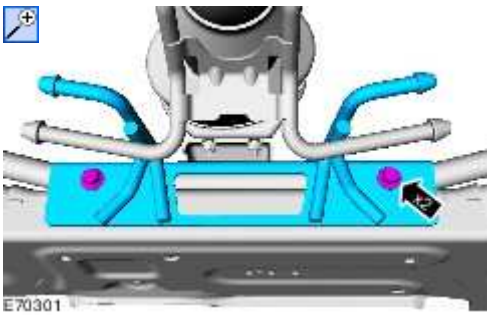
6. NOTE: Note the orientation of the clamp to aid installation.



7.

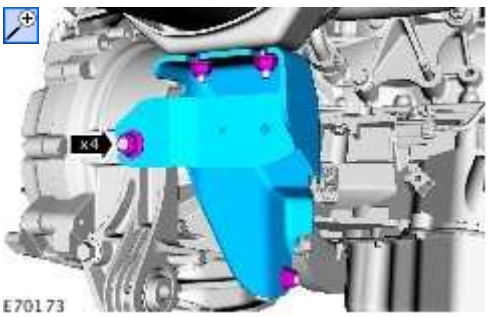


8. NOTE: Make sure that the exhaust flexible pipe is not twisted.



9.

Vehicles with manual transaxle



10.

Vehicles with automatic transaxle

11.

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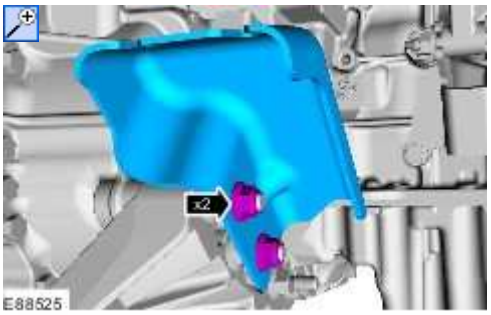
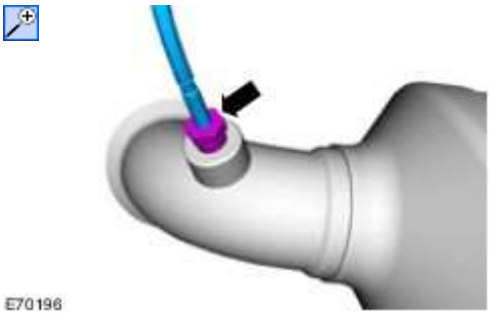
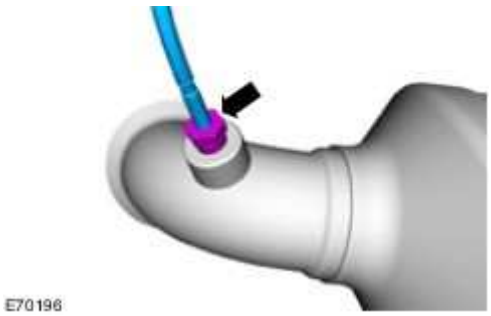


All vehicles

12.

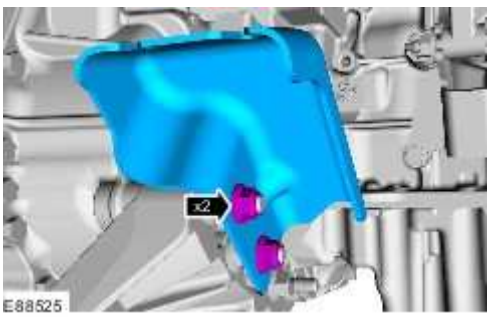


Installation

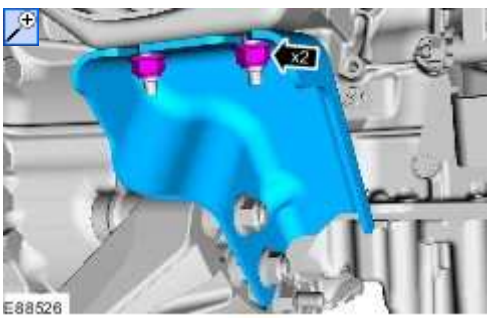


1. *Torque:* 30 Nm

Vehicles with automatic transaxle



2. *Torque:* 24 Nm



3. NOTE: Only tighten the nuts finger tight at this stage.

Vehicles with manual transaxle

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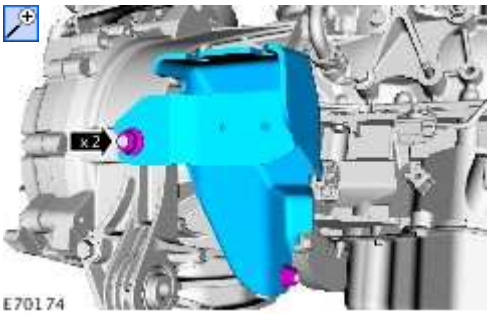
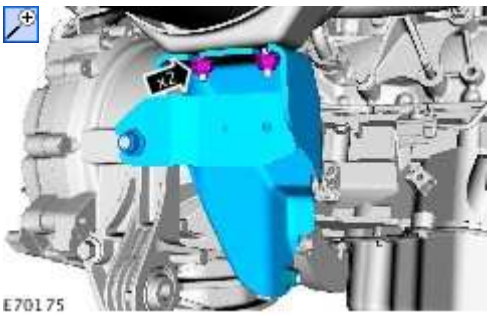
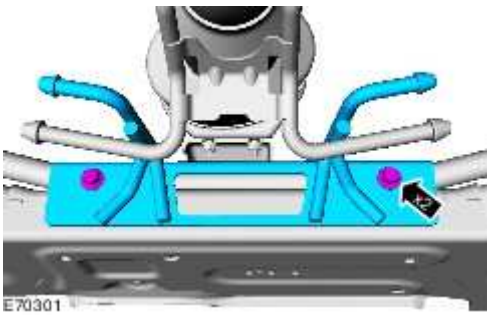


4. *Torque:* 24 Nm

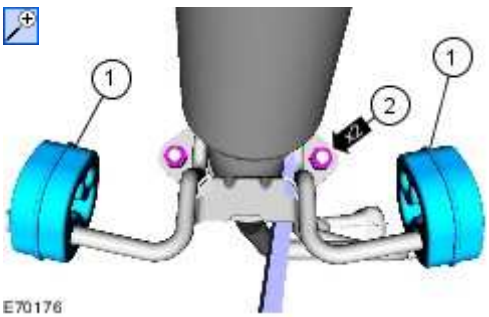


5. NOTE: Only tighten the nuts finger tight at this stage.

All vehicles

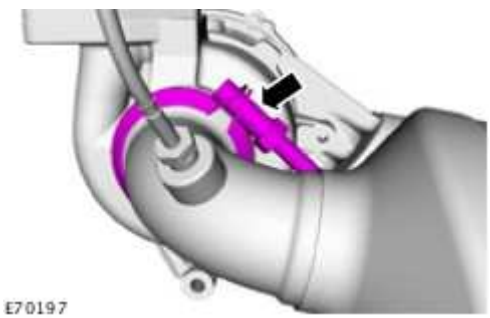


6. *Torque:* 24 Nm



7. NOTE: Only tighten the nuts finger tight at this stage.
Coat the studs with grease.

Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)



8. NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that the clamp is installed to the same orientation as when removed.
Torque: 24 Nm

9. NOTE: Make sure that the exhaust flexible pipe is not twisted.
Torque: 48 Nm

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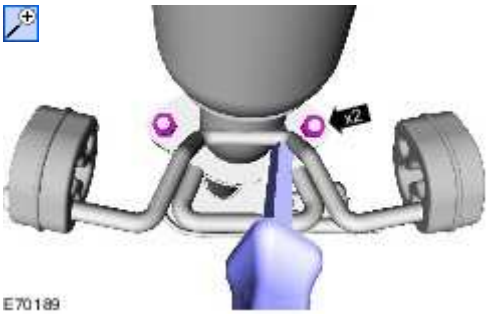
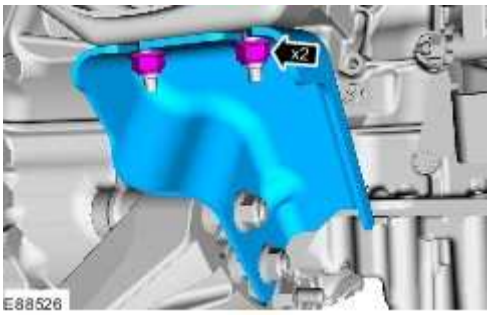
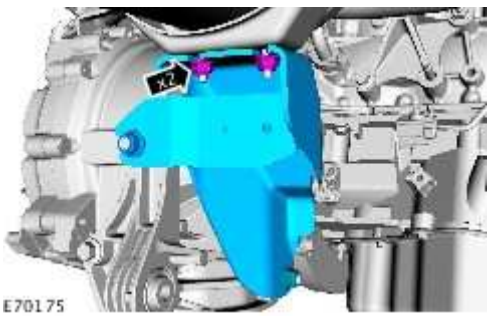


Vehicles with automatic transaxle



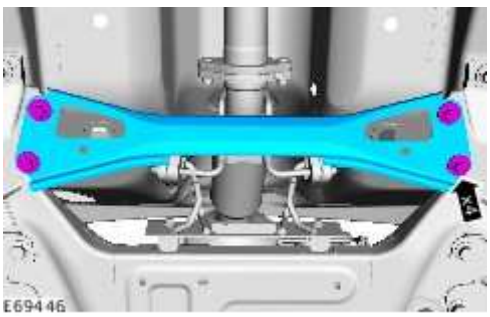
10. *Torque:* 24 Nm

Vehicles with manual transaxle

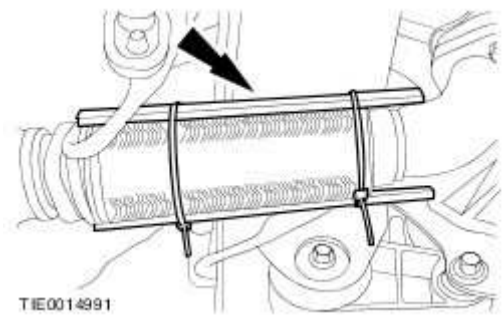


11. *Torque:* 24 Nm

All vehicles



12. *Torque:* 60 Nm



13. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

14.

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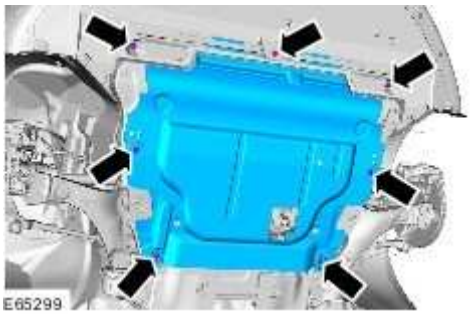
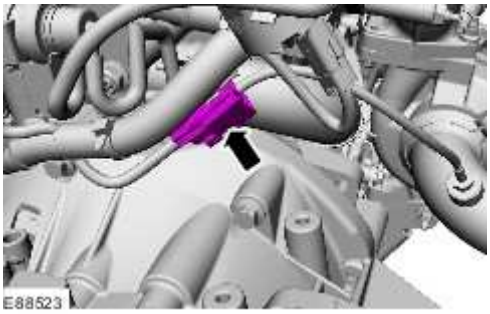
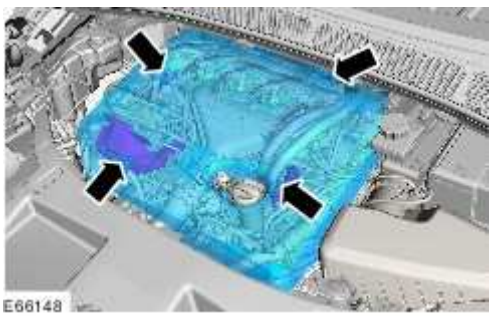

E65299

15. Lower the vehicle.
16.


E88523


E66148

17.

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Removal and Installation

Materials

Name	Specification
Grease KS-PS	SA-M1C9107-A / YS5J-M1C9107-AA

General Equipment

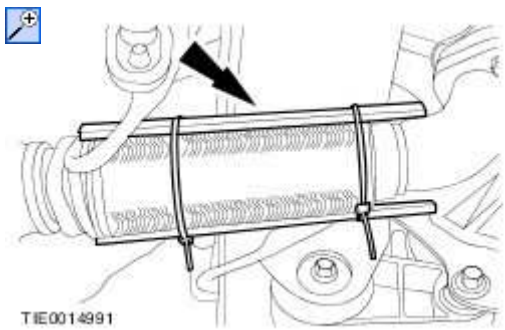
Ford diagnostic equipment

Removal

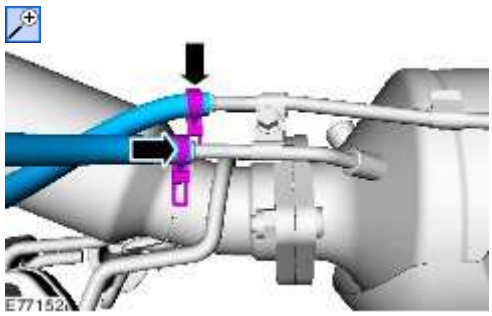
NOTE: Removal steps in this procedure may contain installation details.

1. Raise and support the vehicle.

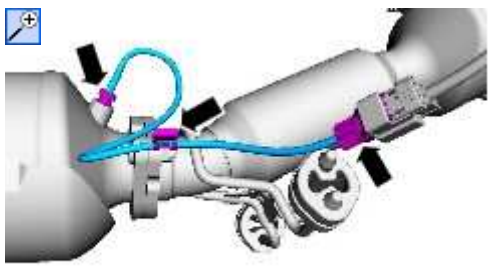
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



3.



4.

5. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.
   Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
   Torque: 48 Nm

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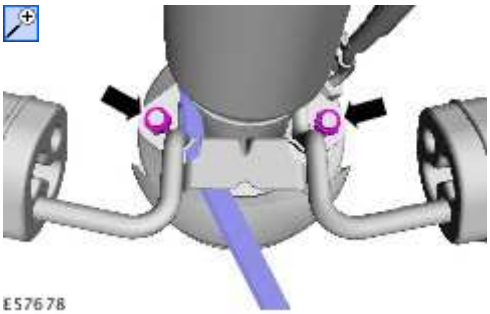

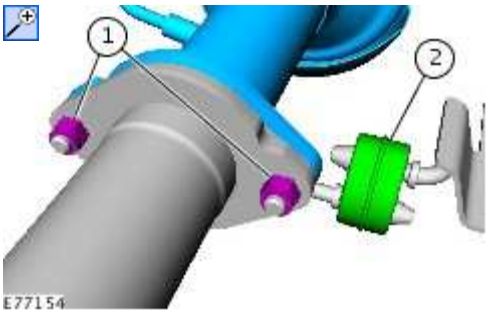

6. Coat the studs with grease.

   Material: Grease KS-PS (SA-M1C9107-A / YS5J-M1C9107-AA)
   Torque: 48 Nm

Installation

1. To install, reverse the removal procedure.
2. Carry out the powertrain control module (PCM) Reset the Diesel Particulate Filter Learned Values service function.

   General Equipment: Ford diagnostic equipment

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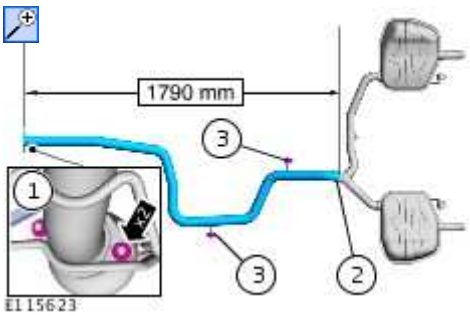
Removal and Installation

General Equipment

Air Body Saw

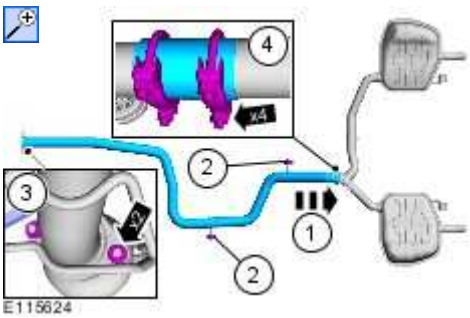
Removal



1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   General Equipment: Air Body Saw

Installation



1. NOTE: Make sure that the exhaust flexible pipe is not twisted.
   Torque:
   3: 48 Nm
   4: 45 Nm

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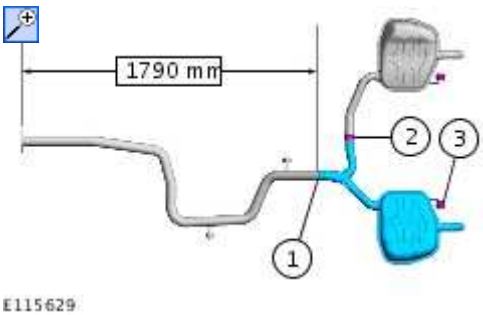
Removal and Installation

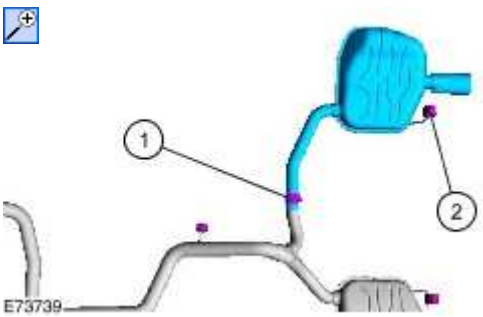
General Equipment

Air Body Saw

Removal

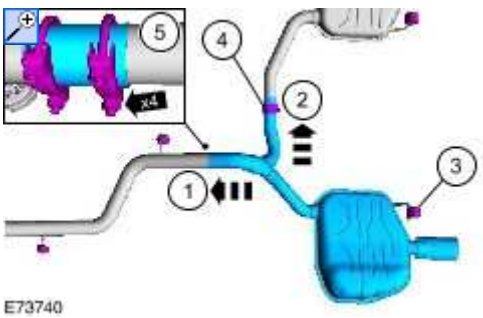


1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2.
   1. *General Equipment:* Air Body Saw

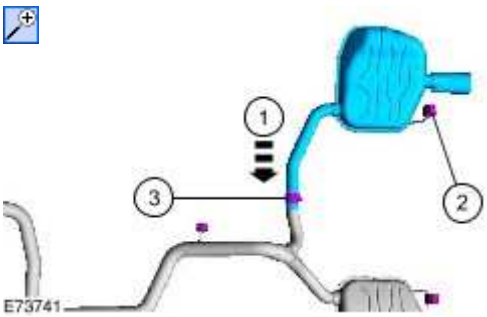


3.

Installation



1. *Torque:*
   4: 54 Nm
   5: 45 Nm



2.
   3. *Torque:* 54 Nm

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Removal and Installation

General Equipment

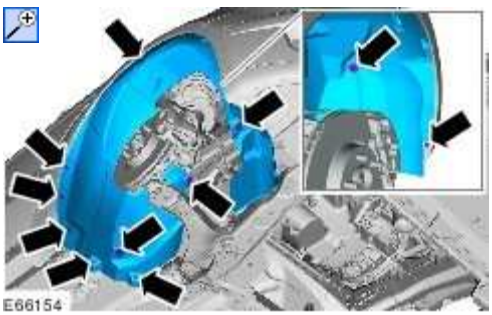
Ford diagnostic equipment

Removal

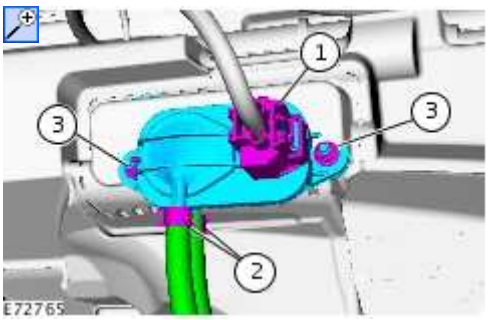
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front left-hand wheel and tire.

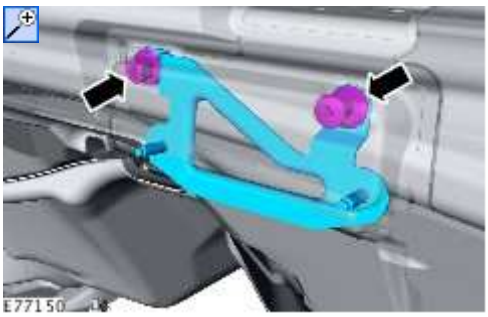
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



2.



3.
   3. *Torque:* 5 Nm



4. *Torque:* 5 Nm

Installation

1. To install, reverse the removal procedure.
2. Carry out the powertrain control module (PCM) Reset the Diesel Particulate Filter Differential Pressure Sensor Learned Values service function.

   General Equipment: Ford diagnostic equipment

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Fuel level • Fuel pump and sender unit • Fuel leak(s) • Fuel line(s) • Fuel filter • Fuel tank • Fuel tank filler pipe • Fuel tank filler cap	• Electrical connector(s) • Wiring harness • Fuel pump module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Ford approved diagnostic tool.

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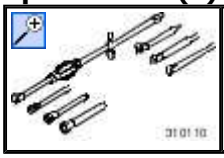
Diagnosis and Testing

Special Tool(s)

	Hand Pressure Pump with Adapter Kit 310-110

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Fuel level • Fuel leak(s) • Fuel line(s) • Fuel filler cap • Fuel filter • Fuel tank • Fuel tank ventilation hose • Fuel tank filler hose	• Wiring harness • Electrical connector(s) • Fuel level sensor

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Engine cranks but does not start	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint

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		Test B.
	* Contaminated fuel.	* DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Poor starting	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
	* Contaminated fuel.	* DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Engine starts but immediately stops	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
Poor idling	* Fuel charging and	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel

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	controls.	engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
	* Contaminated fuel.	* DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Engine lacks power	* Fuel tank to fuel filter fuel supply line blocked.	* CHECK the fuel supply lines for damage. INSTALL a new fuel filter fuel supply line. * Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test C. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test D.
	* Fuel filter blocked.	* INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L

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		Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
	* Contaminated fuel.	* DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
Engine misfire	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
Excessive fuel consumption	* Fuel charging and controls.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing). Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).
	* Air ingress into the fuel lines.	* Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine. GO to Pinpoint Test A. Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine. GO to Pinpoint Test B.
	* Contaminated fuel.	* DRAIN and REFILL the fuel system with fresh fuel. INSTALL a new fuel filter. REFER to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation) / Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

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Fuel filler nozzle shuts off prematurely	* Fuel tank ventilation hose or pipe blocked. * Fuel tank ventilation hose or pipe collapsed.	* CHECK the fuel tank ventilation hose for obstruction or damage. INSTALL a new fuel tank ventilation pipe.
	* Fuel tank filler pipe or hose blocked. * Fuel tank filler pipe or hose collapsed.	* CHECK the fuel tank filler pipe or hose for obstruction or damage. INSTALL a new fuel tank filler pipe.
	* Fuel gauge indication.	* CHECK the fuel level in the fuel tank. CHECK the fuel indication system. For additional information, REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).
	* Fuel filler nozzle at fuel filling station not functioning correctly.	* VERIFY condition by using a known good fuel filler nozzle.
Fuel loss after nozzle shutoff or during refilling	* Fuel tank filler pipe or hose leaking.	* CHECK the fuel tank filler pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank filler pipe or hose.
	* Fuel tank leaking.	* CHECK the fuel tank for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank.
	* Fuel tank ventilation pipe or hose leaking.	* CHECK the fuel tank ventilation pipe and hose for evidence of a fuel leak. If a fuel leak is evident, INSTALL a new fuel tank ventilation pipe or hose.

Pinpoint Tests

PINPOINT TEST A : AIR INGRESS INTO THE FUEL LINES - VEHICLES WITH 1.8L DURATORQ-TDCI (KENT) DIESEL ENGINE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR AIR INGRESS INTO THE FUEL SYSTEM	
WARNINGS: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.	
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.	
CAUTIONS: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.	
Always carry out the cleaning process before carrying out any repairs to the fuel system components to prevent foreign material ingress to the components.	

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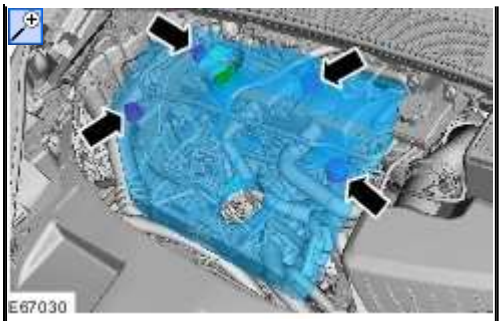
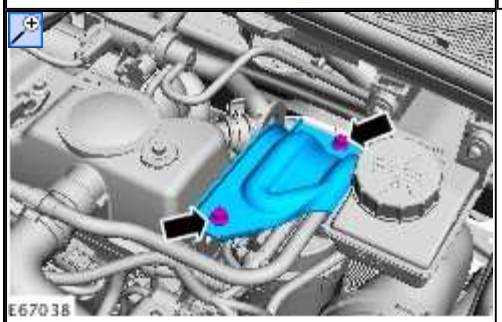
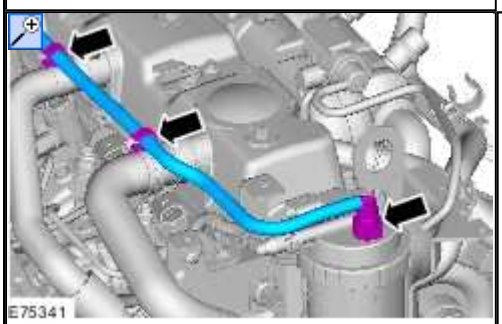
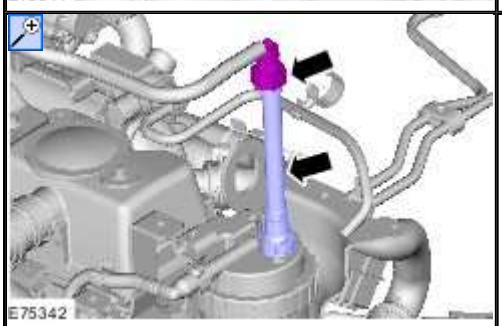
 E67030	
 E67038	
 E75341	1 REFER to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
 E75342	2 Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter fuel supply line and fuel filter.
	3 Start the engine, wait a few minutes and then observe the clear plastic fuel pipe between the fuel filter fuel supply line and fuel filter for signs of air ingress.
	Are any signs of air present in the clear plastic pipe? **Yes** GO to A2. **No** For additional diagnostics, REFER to: Fuel Charging and Controls (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Diagnosis and Testing).
A2: CHECK WHERE AIR IS ENTERING THE SYSTEM	
	1 Using suitable clean engine oil, apply the oil to each of the fuel supply line and fuel return line connections, unions and joints in turn and observe the clear plastic pipe for visible signs of air after each oil application.

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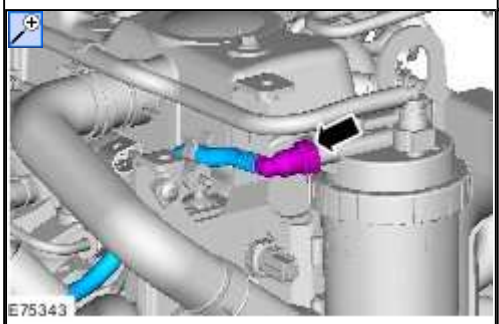
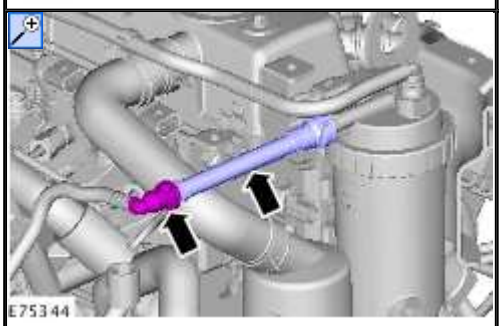
	Did the amount of air in the clear plastic fuel pipe decrease when any of the connectors, unions or joints were oiled? **Yes** INSTALL a new fuel pipe(s) as necessary. Test the system for normal operation. **No** GO to A3.
A3: CHECK THE FUEL LEVEL SENSOR FOR AIR INGRESS	
	1 Drain the fuel tank. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).
	2 Fill the fuel tank with 10 liters of diesel.
	3 REFER to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
	4 Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter to fuel pump fuel supply line.
	NOTE: Make sure that the engine is at normal operating temperature. 5 Start the engine, wait a few minutes and observe the clear plastic pipe for signs of air ingress.
	Are any signs of air present in the clear plastic pipe? **Yes** INSTALL a new fuel level sensor or fuel tank to fuel filter supply pipe as necessary. **No** INSTALL a new fuel filter. REFER to: Fuel Filter Element (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

PINPOINT TEST B : AIR INGRESS INTO THE FUEL LINES - VEHICLES WITH 2.0L DURATORQ-TDCI (DW) DIESEL ENGINE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FOR AIR INGRESS INTO THE FUEL SYSTEM	
WARNINGS: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.	

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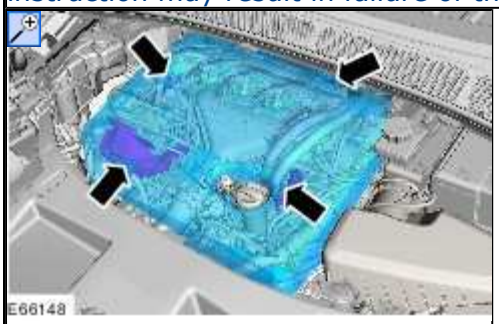
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.

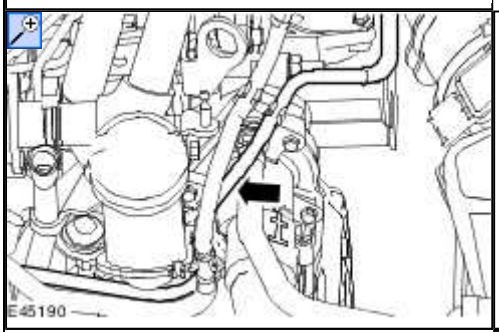
CAUTIONS:

Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

Always carry out the cleaning process before carrying out any repairs to the fuel injection system components to prevent foreign matter ingress to the components.

The generator must be protected from contamination. Failure to follow this instruction may result in failure of the generator.





1 Start the engine, wait a few minutes and then observe the clear plastic fuel pipe in the fuel pump fuel return line for signs of air ingress.

Are any signs of air present in the clear plastic fuel pipe?

Yes

GO to B2.

No

For additional diagnostics for Fuel Charging and Controls,
REFER to: Fuel Charging and Controls (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Diagnosis and Testing).

B2: CHECK WHERE AIR IS ENTERING THE SYSTEM

1 Using suitable clean engine oil, apply the oil to each of the fuel supply line and fuel return line connections, unions and joints in turn and observe the clear plastic pipe for visible signs of air after each oil application.

Did the amount of air in the clear plastic pipe decrease when any of the connectors, unions or joints were oiled?

Yes

INSTALL a new fuel pipe(s) as necessary. Test the system for normal operation.

No

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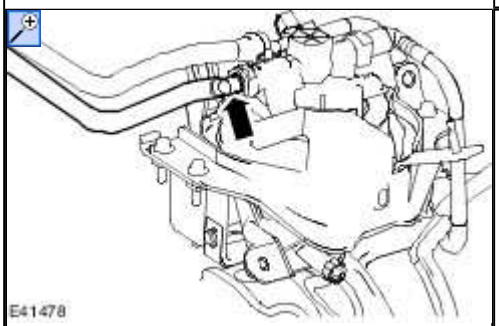
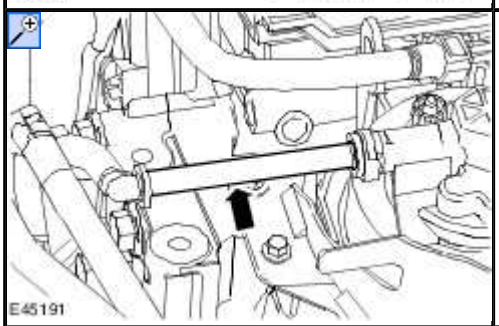
	GO to B3.
B3: CHECK THE FUEL LEVEL SENSOR FOR AIR INGRESS	
	1 Drain the fuel tank. REFER to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).
	2 Fill the fuel tank with 10 liters of diesel.
	3 Protect the generator with lint-free material to prevent contamination.
 E41478	4 Disconnect the fuel filter fuel supply line quick release coupling. REFER to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).
 E45191	5 Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel filter and the fuel tank to fuel filter supply line.
	6 Remove the lint-free material.
	NOTE: Make sure that the engine is at normal operating temperature. 7 Start the engine, wait a few minutes and then observe the clear plastic pipe for signs of air ingress.
	Are any signs of air present in the clear plastic pipe? **Yes** INSTALL a new fuel level sensor or fuel tank to fuel filter supply pipe as necessary. **No** INSTALL a new fuel filter. REFER to: Fuel Filter Element (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

PINPOINT TEST C : FUEL FILTER FUEL SUPPLY LINE BLOCKAGE - VEHICLES WITH 1.8L DURATORQ-TDCI (KENT) DIESEL ENGINE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE FUEL FILTER FUEL SUPPLY LINE FOR BLOCKAGE	
WARNINGS: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.	
This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.	

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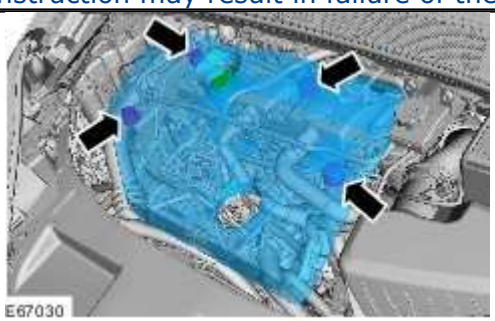
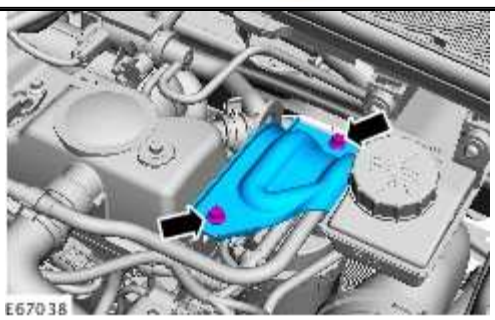
CAUTIONS:

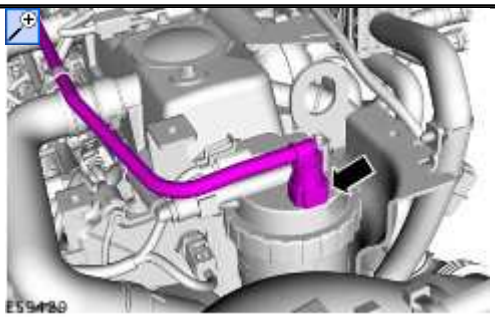
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.

Always carry out the cleaning process before carrying out any repairs to the fuel injection system components to prevent foreign material ingress to the components.

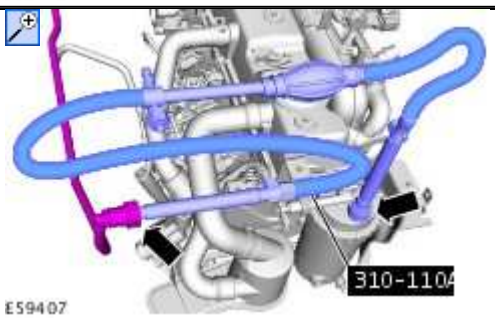
The generator must be protected from contamination. Failure to follow this instruction may result in failure of the generator.







1 Disconnect the fuel filter fuel supply line quick release coupling.
REFER to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



NOTE: Make sure that the hand pressure pump arrow indicating the direction of fuel flow is pointing towards the fuel filter.

2 Install the special tool between the fuel filter fuel supply line quick release coupling and the fuel filter union.

3 Operate the hand pressure pump at least 30 times.

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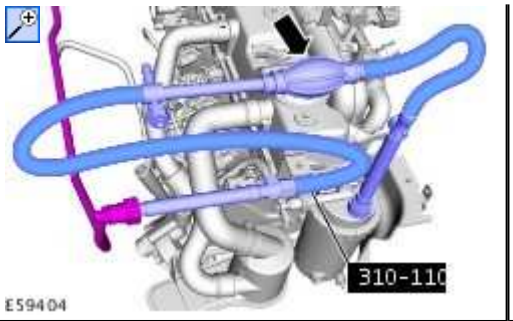
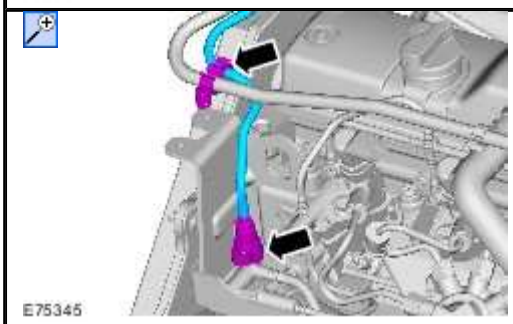
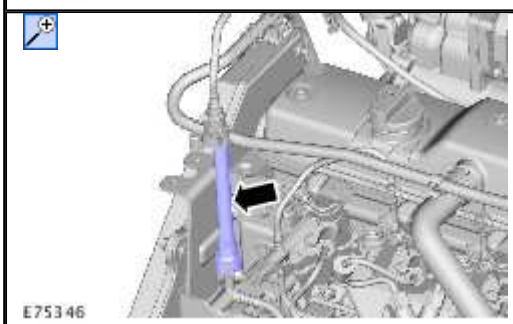
	
	4 REFER to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
	5 Using a suitable piece of clear plastic pipe, manufacture and install a pipe between the fuel pump fuel return line and fuel return line union.
	6 Observe the flow of fuel in the clear plastic pipe.
	Does the fuel from the fuel tank flow freely with no restrictions? **Yes** GO to Pinpoint Test A. **No** REPAIR or INSTALL a new fuel filter fuel supply line.

PINPOINT TEST D : FUEL FILTER FUEL SUPPLY LINE BLOCKAGE - VEHICLES WITH 2.0L DURATORQ-TDCI (DW) DIESEL ENGINE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE FUEL FILTER FUEL SUPPLY LINE FOR BLOCKAGE	
WARNINGS: Do not smoke or carry lighted tobacco of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury. This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury. CAUTIONS: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines.	

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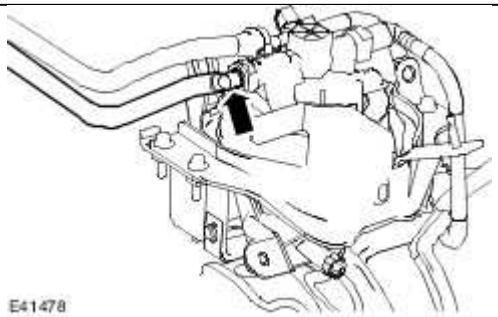
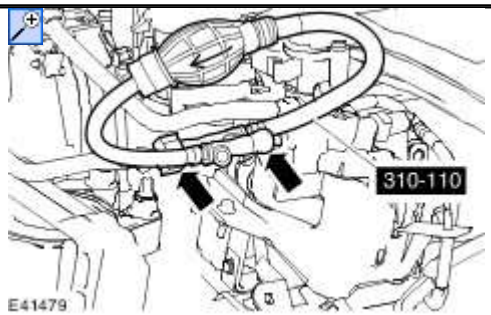
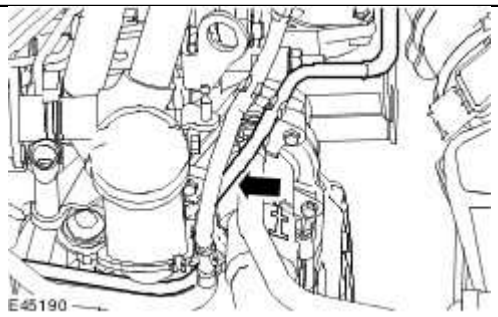
Always carry out the cleaning process before carrying out any repairs to the fuel injection system components to prevent foreign matter ingress to the components.

The generator must be protected from contamination. Failure to follow this instruction may result in failure of the generator.

	1 Protect the generator with lint-free material to prevent contamination.
	**2** Disconnect the fuel filter fuel supply line quick release coupling. REFER to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
	**3** Install the special tool between the fuel filter fuel supply line quick release coupling and the fuel filter union.
	4 Operate the hand pressure pump.
	**5** Observe the flow of fuel in the clear plastic fuel pipe in the fuel pump fuel return line.
	Does the fuel from the fuel tank flow freely with no restrictions? **Yes** GO to Pinpoint Test B. **No** REPAIR or INSTALL a new fuel filter fuel supply line.

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General Procedures

General Equipment

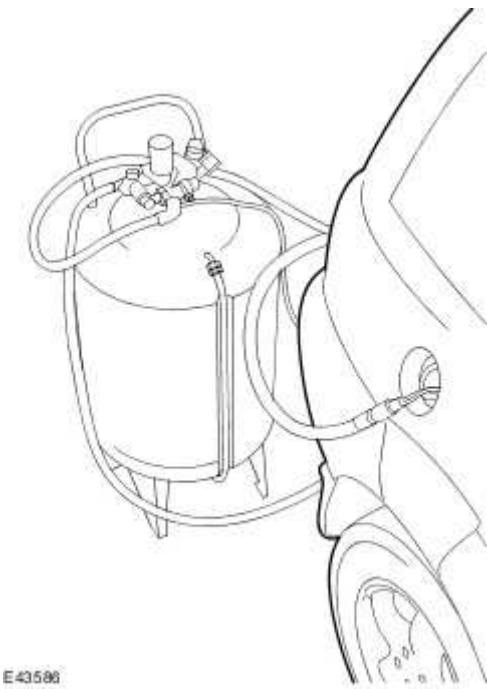
Fuel tank draining equipment

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.

4. Connect the fuel tank drain equipment ground cable to the vehicle.

   General Equipment: Fuel tank draining equipment



5. Drain the fuel tank.
6. WARNING: Fuel may still be present in the fuel tank after draining.
   Remove the fuel tank drain equipment.
7.

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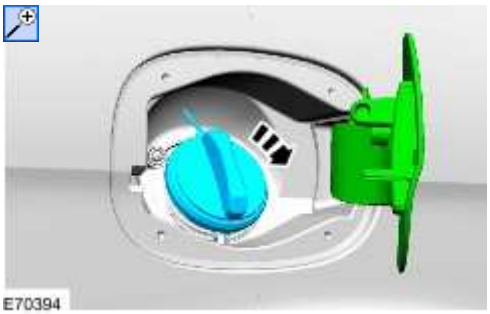

8. Connect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

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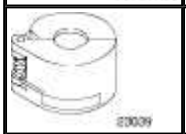
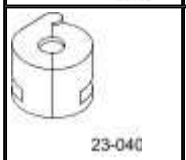
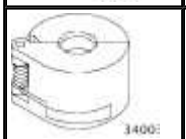
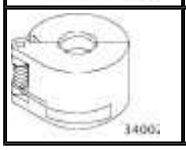
General Procedures

Special Tool(s)

	310-040 Disconnect Tool, Fuel Line (5/16")
	310-137 Disconnect Tool, Fuel Line
	310-D004 Disconnect Tool, Spring Lock Coupling (3/8" yellow)
	310-D005 Disconnect Tool, Spring Lock Coupling (1/2" green)
	412-038 Disconnect Tool, Spring Lock Coupling (5/8" black)
	412-069 Disconnect Tool, Spring Lock Coupling (3/4" white)

Materials

Name	Specification
Engine Oil - 5W-30	WSS-M2C153-G

Disconnect

WARNINGS:

Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

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

NOTE: Fuel supply line connectors are color coded white. Fuel return line connectors are color coded red.

1. Release the fuel system pressure

   Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
2. *Special Tool(s):* 310-137

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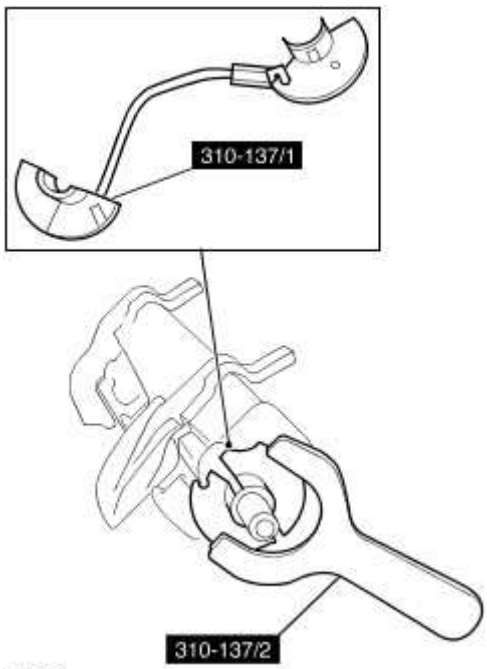
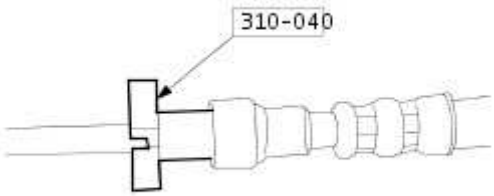


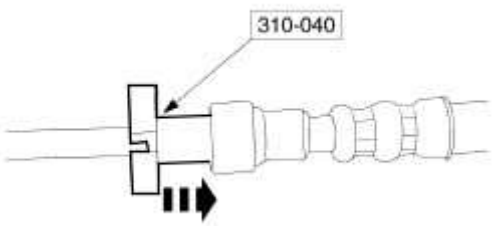
E77752

3. *Special Tool(s):* 310-040



VUE0028631

4. *Special Tool(s):* 310-040



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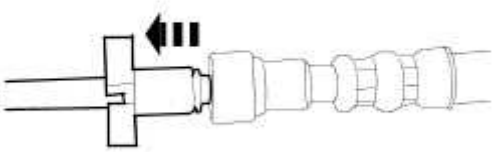
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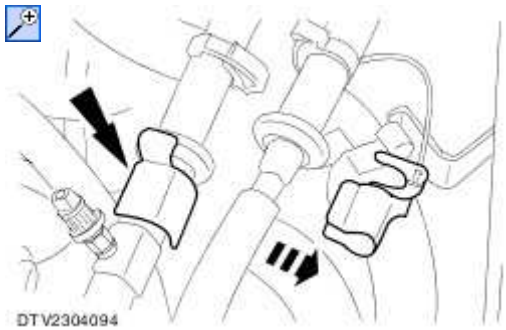
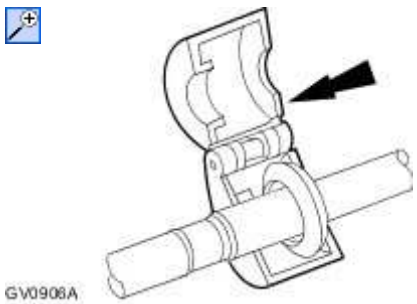
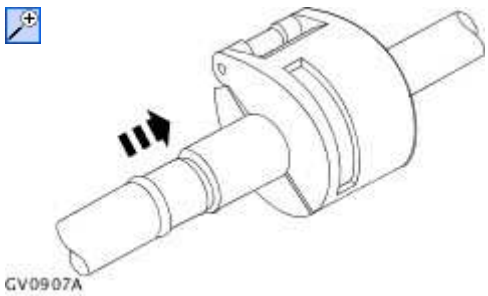
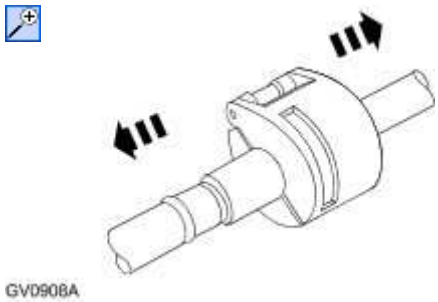




7. *Special Tool(s):* 310-D004, 310-D005, 412-038, 412-069



8. *Special Tool(s):* 310-D004, 310-D005, 412-038, 412-069



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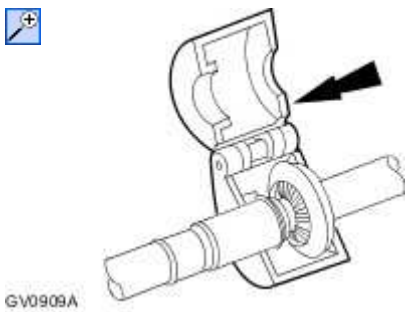

10. *Special Tool(s):* 310-D004, 310-D005, 412-038, 412-069

Connect

1. CAUTION: Only use the specified material to lubricate the seals.
   To connect, reverse the disconnect procedure.

   Material: Engine Oil - 5W-30 (WSS-M2C153-G)

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General Procedures

General Equipment

Flat-bladed screwdriver

Disconnect

WARNINGS:

Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

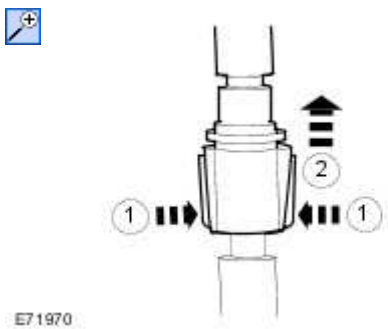
Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Fuel supply line connectors are color coded white. Fuel return line connectors are color coded red.

1. Release the fuel system pressure

   Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

2.



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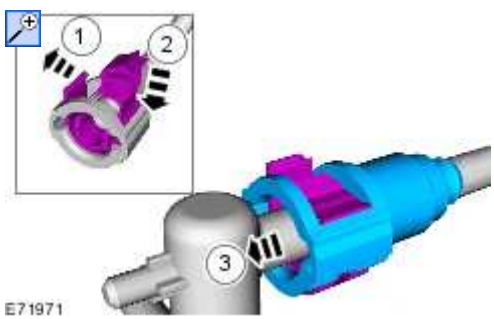

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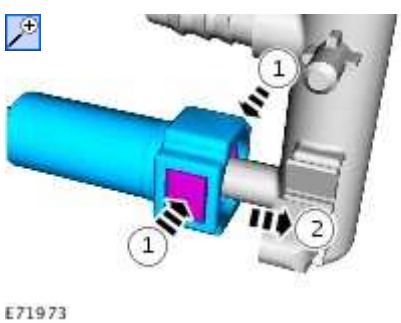

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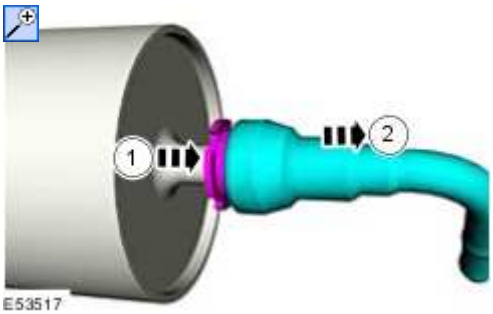

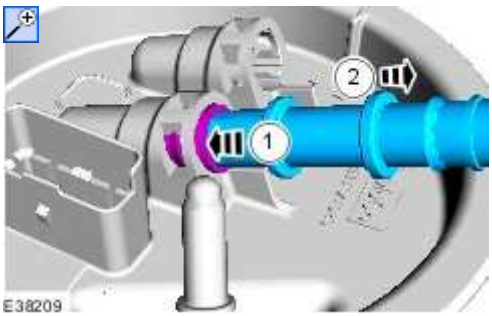

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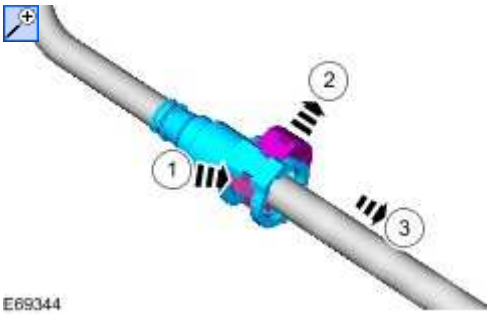

7. *General Equipment:* Flat-bladed screwdriver

Connect

1. To connect, reverse the disconnect procedure.

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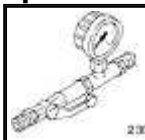
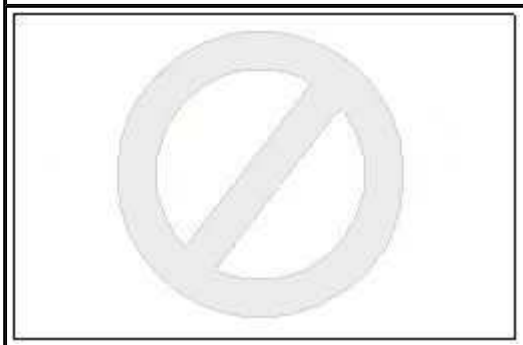
General Procedures

Special Tool(s)

	310-025 Fuel Pressure Gauge
	310-025-18 Test Hose for 310-025
	310-025-19A Test Hose for 310-025
	310-137 Disconnect Tool, Fuel Line

General Equipment

Flat-bladed screwdriver

WARNING: Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.0L engine

2. *General Equipment:* Flat-bladed screwdriver

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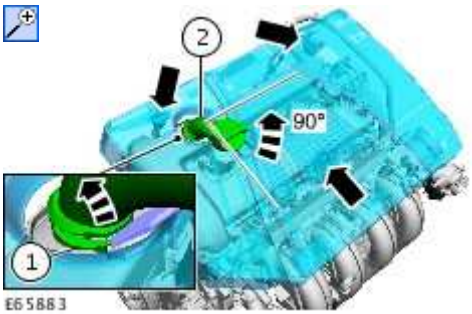
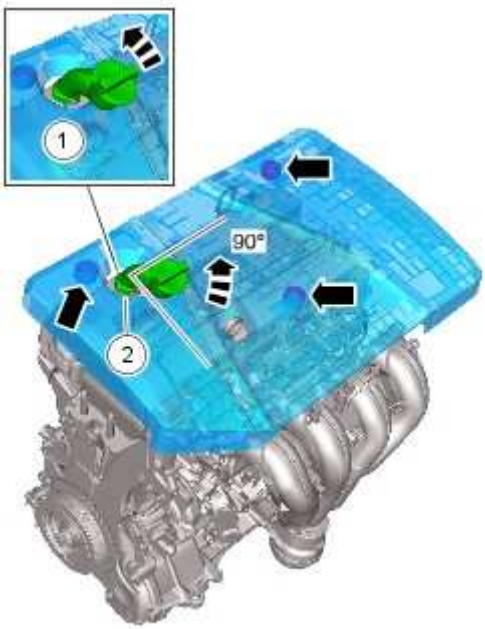
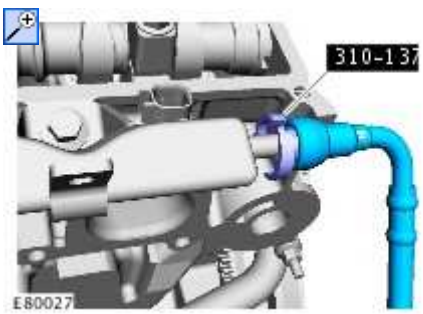


Vehicles with 2.3L engine

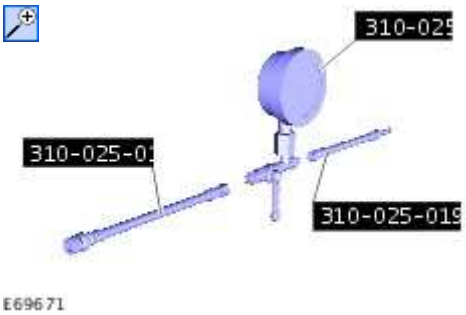
3. *General Equipment:* Flat-bladed screwdriver



All vehicles



4. *Special Tool(s):* 310-137



5. *Install the Special Tool(s):* 310-025, 310-025-18, 310-025-19A

6. *Install the Special Tool(s):* 310-025-18

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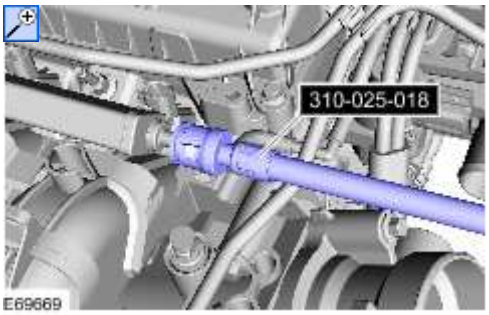
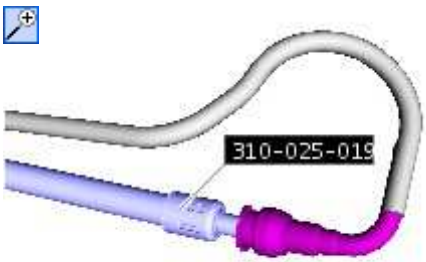




7. *Install the Special Tool(s):* 310-025-19A

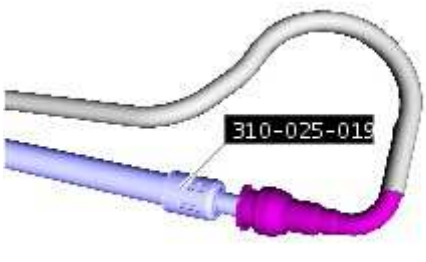
8. Start the engine and allow it to idle.

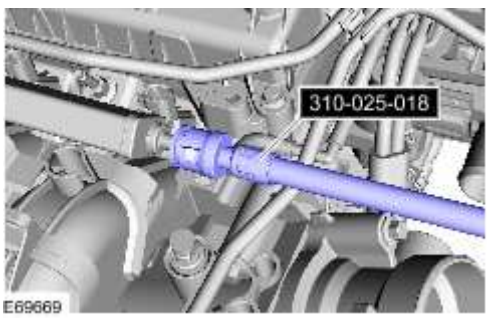
9. Record the fuel system pressure at idle (3.8 +/- 0.2 bar maximum).

10. Stop the engine.

11. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).

12. *Remove the Special Tool(s):* 310-025-19A





13. *Remove the Special Tool(s):* 310-025-18

14.

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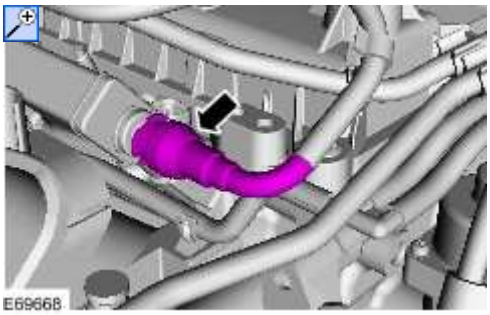
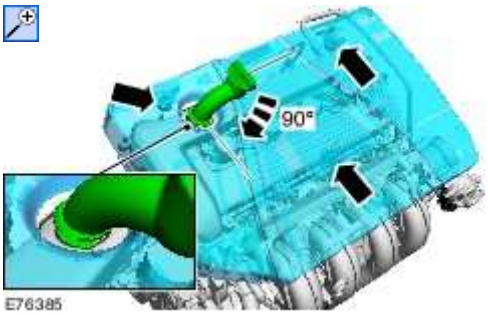


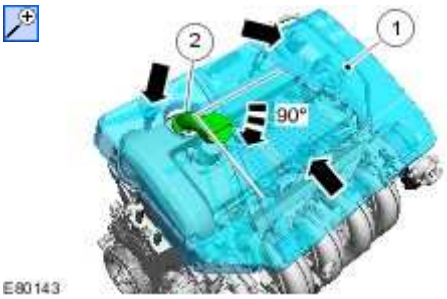
Vehicles with 2.0L engine

15.



Vehicles with 2.3L engine

16.



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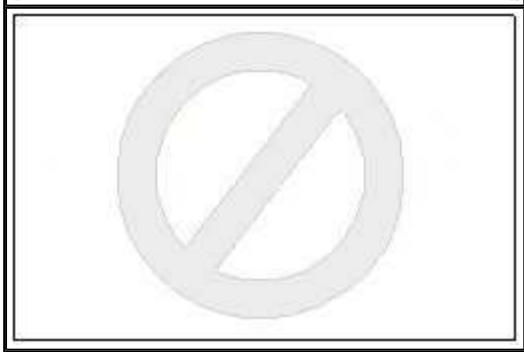
General Procedures

Special Tool(s)

	310-025-18 Test Hose for 310-025
	310-025-19A Test Hose for 310-025
E51251	310-137 Disconnect Tool, Fuel Line

General Equipment

Adapter pressure vacuum transducer (C219)
Ford diagnostic equipment
GV2323 Connector
Pressure vacuum transducer (C407)

Activation

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
3.

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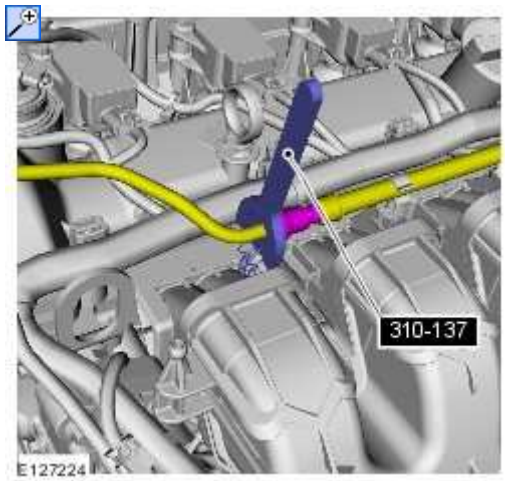
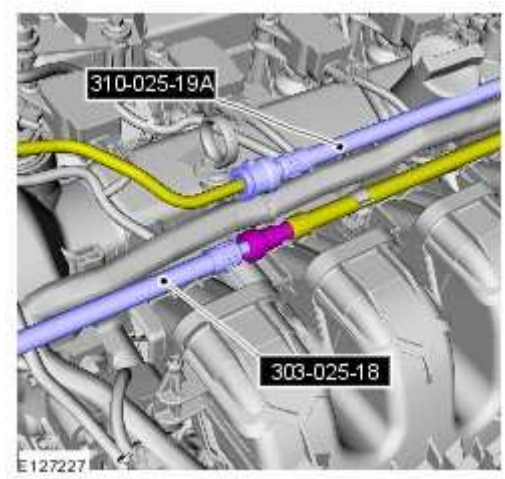
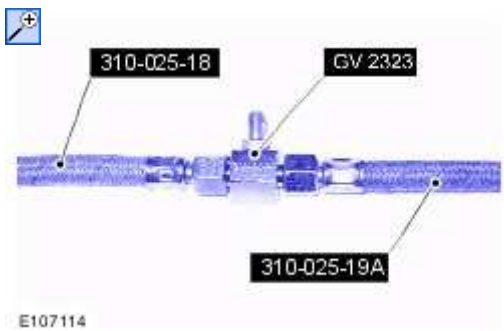


4. *Special Tool(s):* 310-137



5. *Install the Special Tool(s):* 310-025-18, 310-025-19A



6. *Install the Special Tool(s):* 310-025-18, 310-025-19A
   General Equipment: GV2323 Connector

7. Connect the following items:
   - *General Equipment:* GV2323 Connector
   - *General Equipment:* Adapter pressure vacuum transducer (C219)

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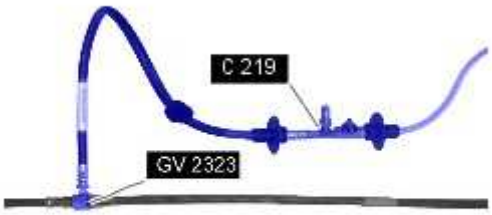
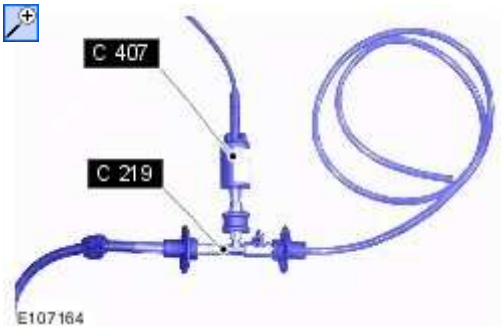


E107161



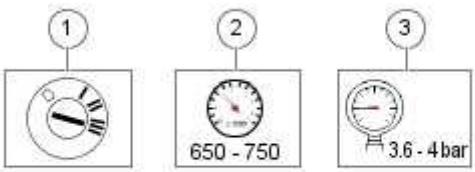
E107164

8. Connect the following items:
   - *General Equipment:* Pressure vacuum transducer (C407)
   - *General Equipment:* Adapter pressure vacuum transducer (C219)

9. Using the digital multi-meter function, measure the fuel system pressure.

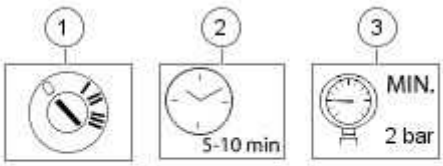
   General Equipment: Ford diagnostic equipment

10. *General Equipment:* Ford diagnostic equipment



E107190

11. *General Equipment:* Ford diagnostic equipment



E107203

12. Refer to: Fuel System Pressure Release - 2.0L EcoBoost SCTi (149kW/203PS) - MI4 (310-00 Fuel System - General Information, General Procedures).
13. Disconnect the following items:
    - *General Equipment:* Pressure vacuum transducer (C407)
    - *General Equipment:* Adapter pressure vacuum transducer (C219)

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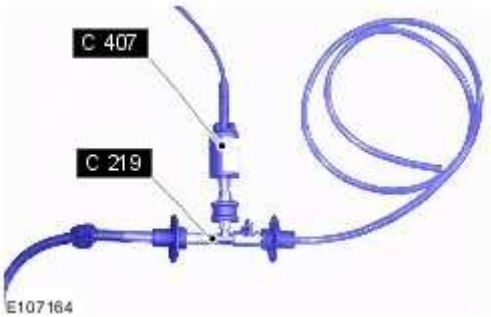
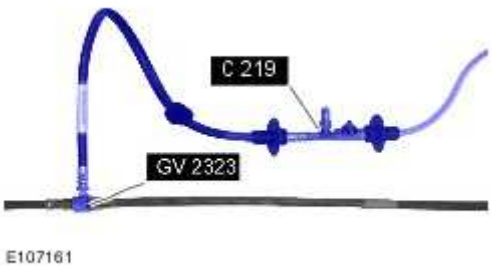
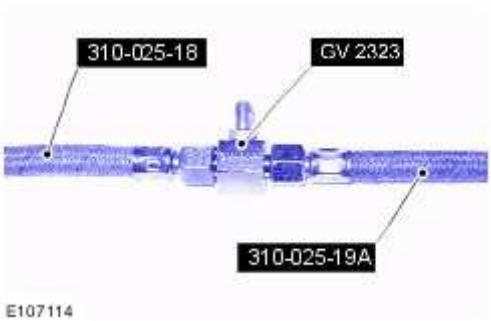
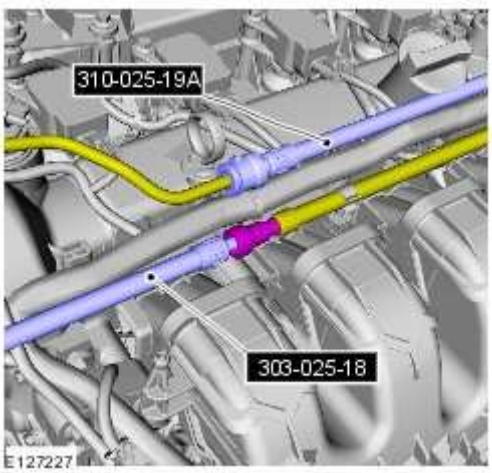


14. Disconnect the following items:
    - *General Equipment:* GV2323 Connector
    - *General Equipment:* Adapter pressure vacuum transducer (C219)





15. *Remove the Special Tool(s):* 310-025-19A, 310-025-18
    General Equipment: GV2323 Connector



16. *Remove the Special Tool(s):* 310-025-19A, 310-025-18

17.

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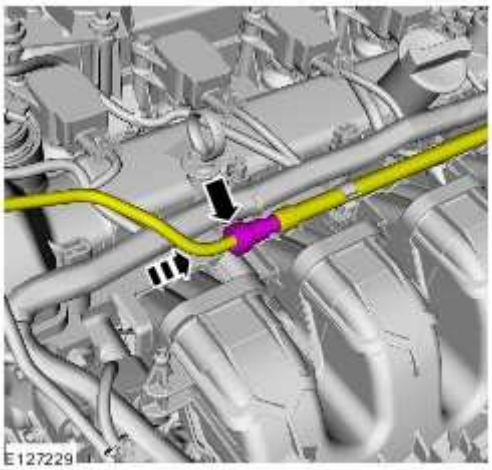

18.

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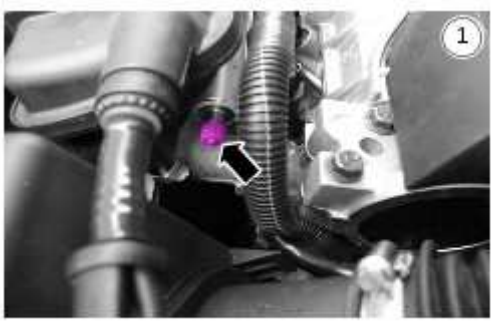
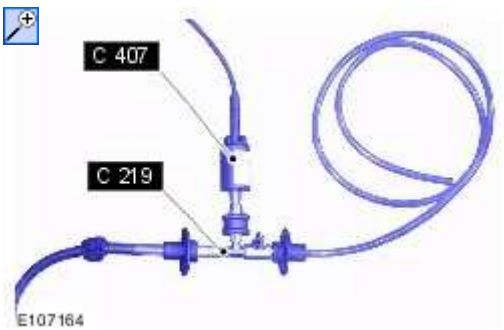
General Procedures

General Equipment

Adapter pressure vacuum transducer (C219)
Ford diagnostic equipment
Pressure vacuum transducer (C407)

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).
3.
   - *General Equipment:* Adapter pressure vacuum transducer (C219)





4. Connect the following items:
   - *General Equipment:* Adapter pressure vacuum transducer (C219)
   - *General Equipment:* Pressure vacuum transducer (C407)
5. Using the digital multi-meter function, measure the fuel system pressure.

   General Equipment: Ford diagnostic equipment
6. *General Equipment:* Ford diagnostic equipment

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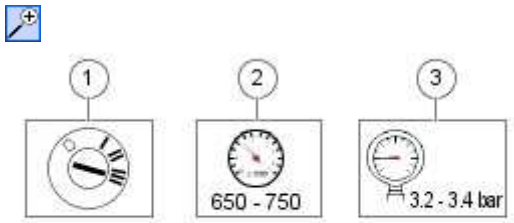
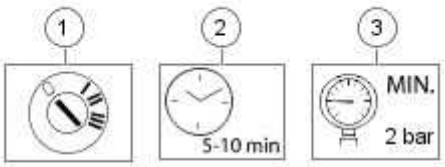


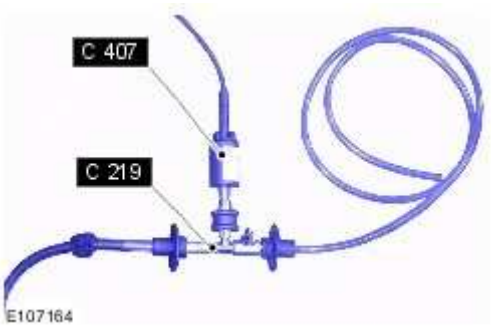
E118167



E107203

7. *General Equipment:* Ford diagnostic equipment

8. Refer to: Fuel System Pressure Release (310-00 Fuel System - General Information, General Procedures).



E107164

9. Disconnect the following items:
   - *General Equipment:* Adapter pressure vacuum transducer (C219)
   - *General Equipment:* Pressure vacuum transducer (C407)

10.
   - *General Equipment:* Adapter pressure vacuum transducer (C219)

E118168

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General Procedures

Release

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the fuel pump and sender unit fuse.
3. Start the engine and allow it to idle until the engine stalls.
4. Crank the engine for approximately five seconds to make sure that the fuel rail pressure is released.
5. Install the fuel pump and sender unit fuse.

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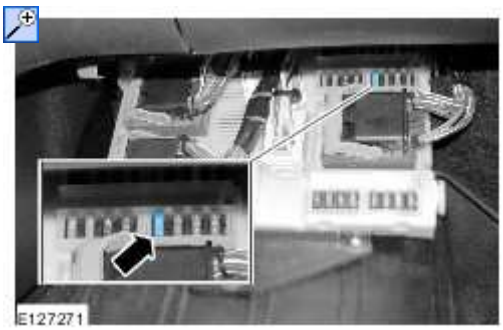
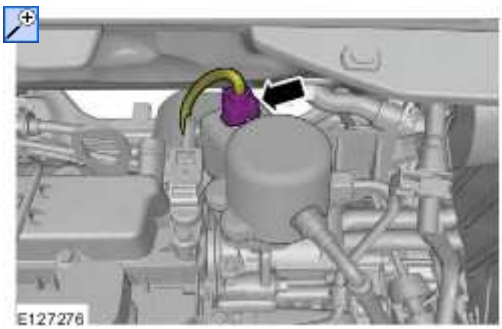
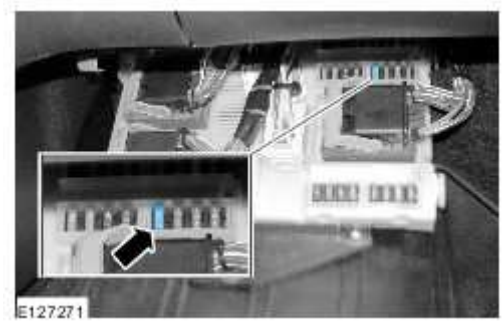
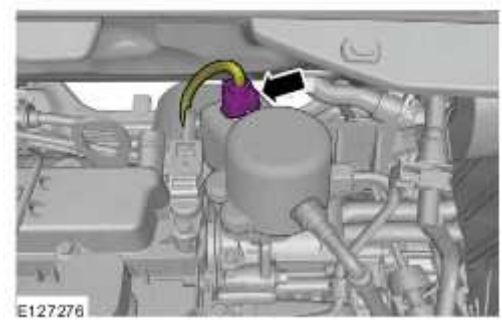
General Procedures

Pressure release

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. 

4. Start and run the engine at idle speed until the engine stops.
5. Crank the engine for approximately 5 seconds to release the fuel pressure.
6. 

7. 

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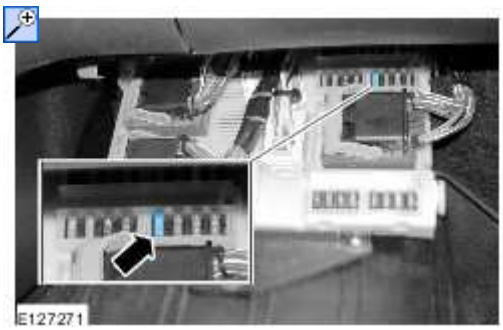
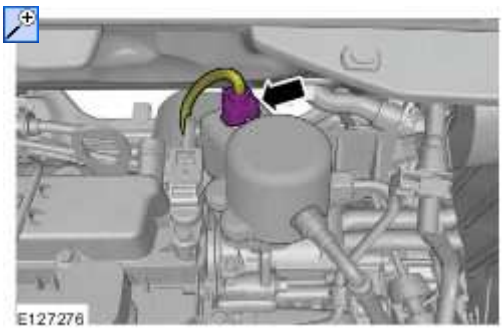
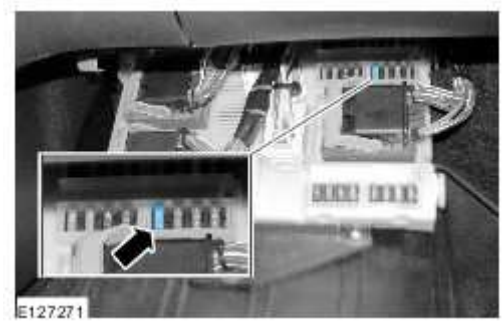
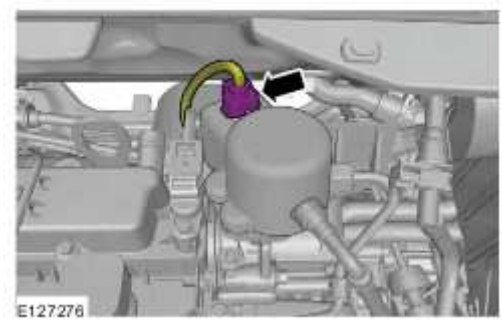
General Procedures

Pressure release

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
2. 

3. 

4. Start and run the engine at idle speed until the engine stops.
5. Crank the engine for approximately 5 seconds to release the fuel pressure.
6. 

7. 

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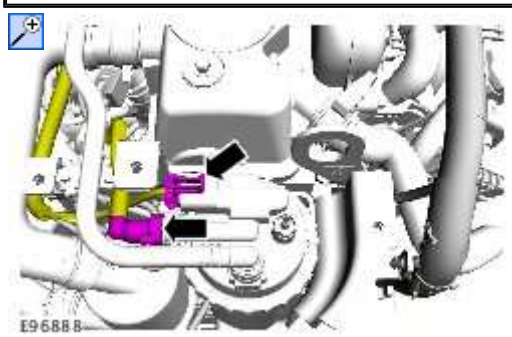
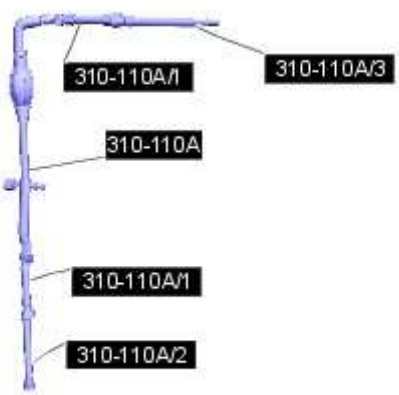
General Procedures

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit
	310-110A-01 Adapter for 310-110A



1. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



2. *Install the Special Tool(s):* 310-110A, 310-110A-01

3. Operate the hand pressure pump special tool adapter until the fuel filter is full and the special tool becomes firm.

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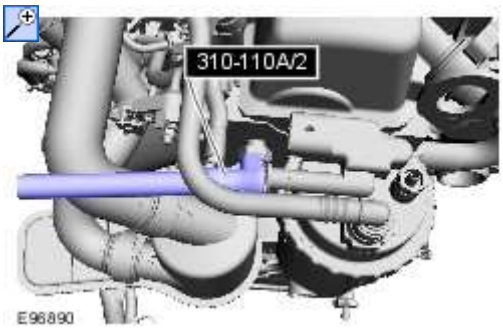

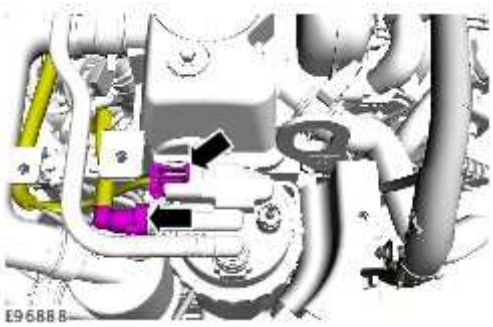

4. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

5. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
   Start the engine and allow it to idle until it reaches normal operating temperature.
6. Switch off the engine.
7. *Remove the Special Tool(s):* 310-110A, 310-110A-01

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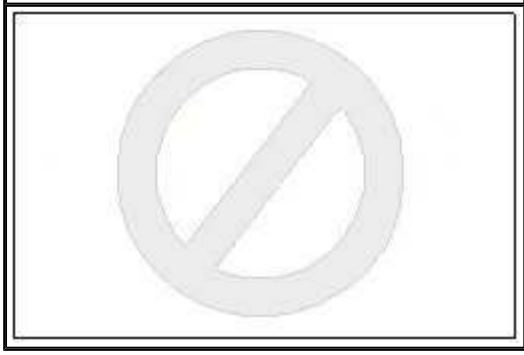
General Procedures

Special Tool(s)

	310-025-19A Test Hose for 310-025
	310-042 Connector for 310-025
	310-110A Hand Pressure Pump with Adapter Kit

1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00, Description and Operation).
2.

3. *Special Tool(s):* 310-025-19A, 310-110A, 310-042

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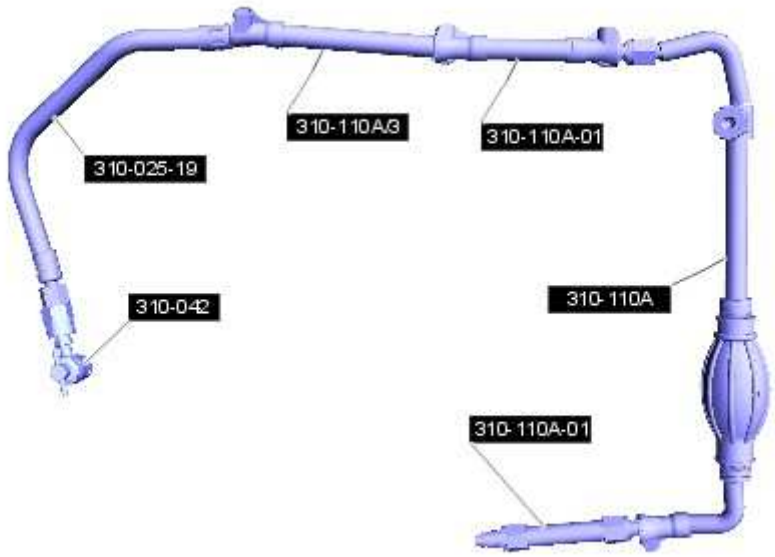
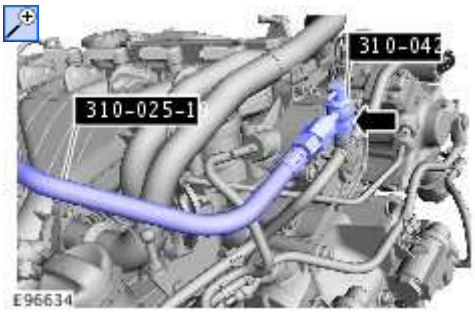


E96633

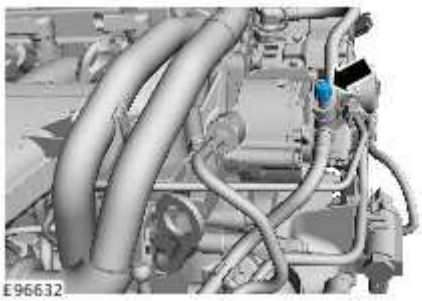


E96634

4. Operate the hand pressure pump special tool adapter until fuel is visible in the clear plastic tube.

   Special Tool(s): 310-025-19A, 310-110A, 310-042

5. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
   Start the engine and allow it to idle until it reaches normal operating temperature.
6. Switch off the engine.
7. *Remove the Special Tool(s):* 310-025-19A, 310-025-19A, 310-110A
8.



E96632

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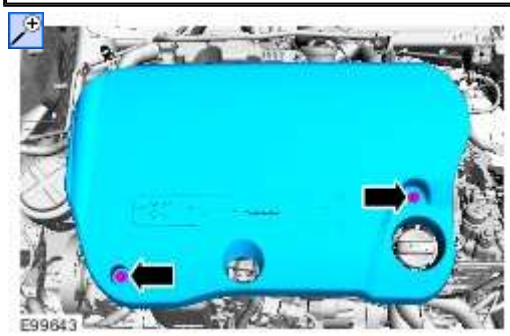
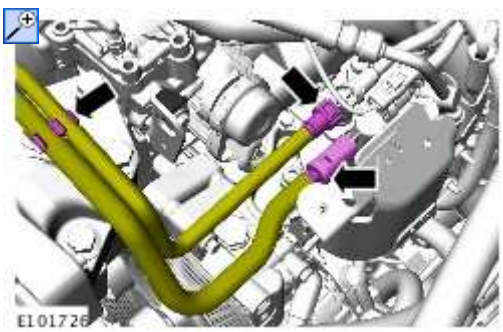
General Procedures

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit

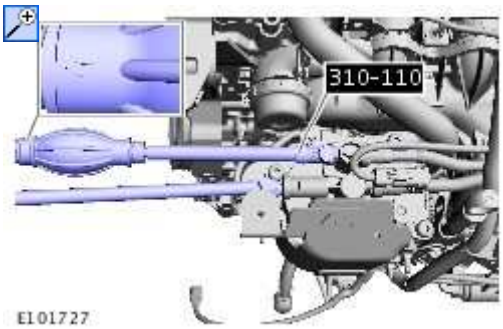


1.



2. WARNING: Be prepared to collect escaping fuel.

CAUTION: Extreme cleanliness must be exercised when handling these components.



3. WARNING: Be prepared to collect escaping fuel.
Operate the hand pressure pump special tool adapter until the fuel filter is full and the special tool becomes firm.

Special Tool(s): 310-110A

4.

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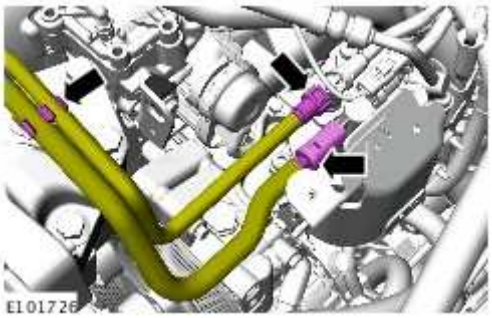

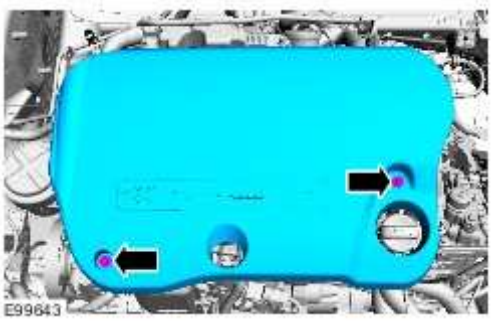

5. *Torque:* 10 Nm

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Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5 - Fuel Tank and Lines—2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4	S-MAX/Galaxy 2006.5 (02/2006-)

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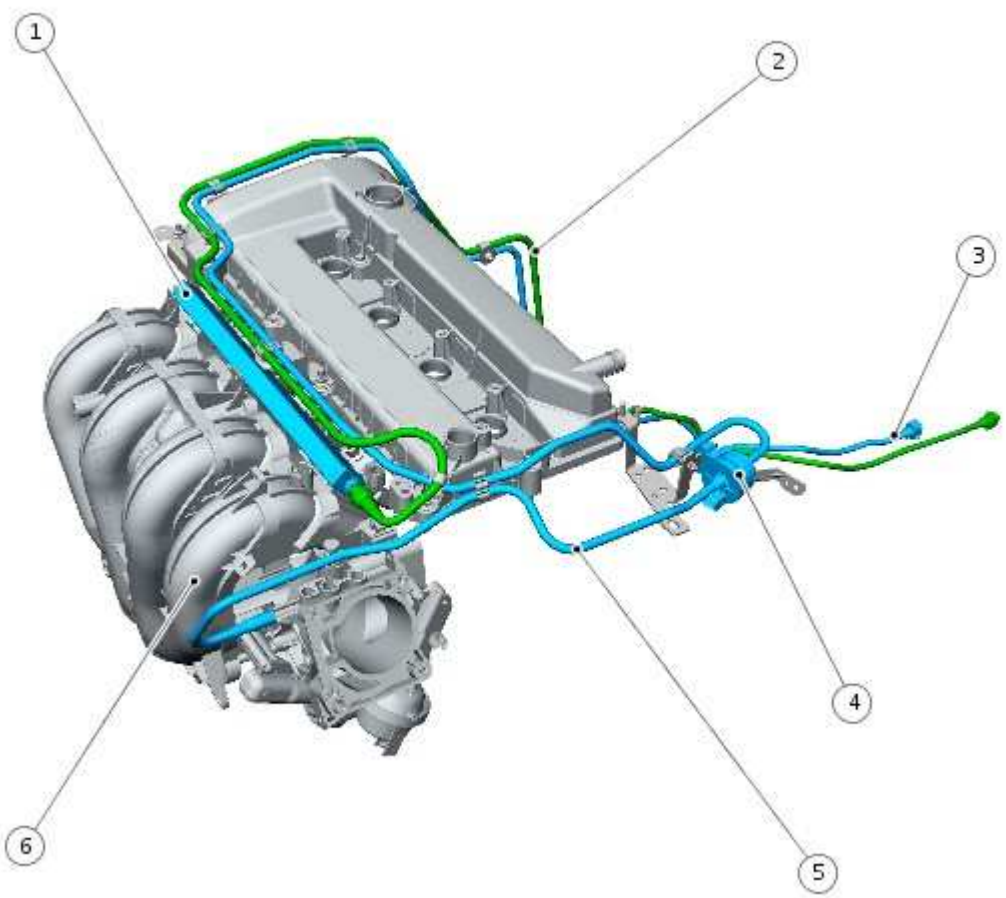
Description and Operation

General overview



E64950

Item	Part Number	Description
1	-	Fuel rail
2	-	Fuel supply line
3	-	Evaporative emission canister to evaporative emission canister purge valve line
4	-	Evaporative emission canister purge valve
5	-	Evaporative emission canister purge to intake manifold vacuum line
6	-	Intake manifold

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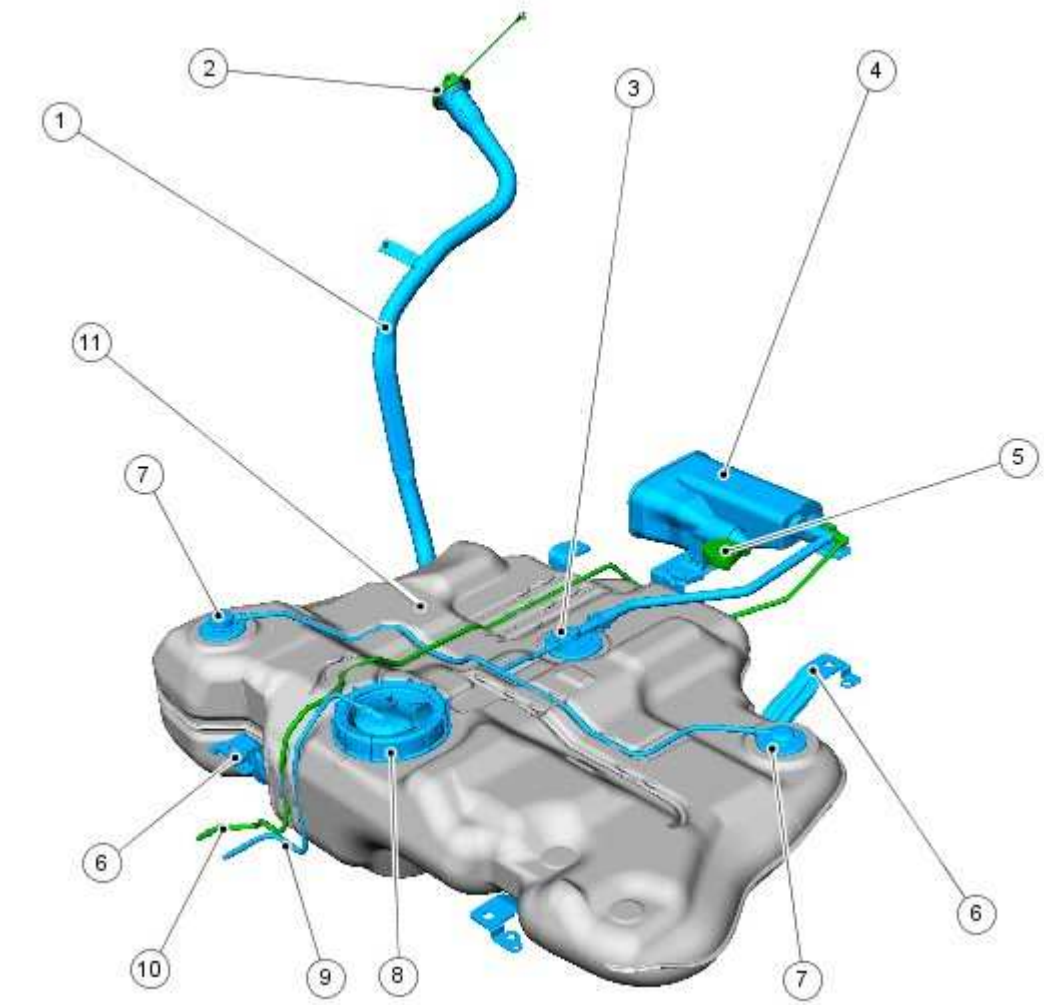

E64951

Item	Part Number	Description
1	-	Fuel tank filler pipe
2	-	Fuel tank filler pipe cap
3	-	Fill limit vent valve
4	-	Evaporative emission canister
5	-	Evaporative emission canister dust filter
6	-	Fuel tank support straps
7	-	Fuel tank vent valve(s)
8	-	Fuel pump and sender unit (including fuel filter)
9	-	Fuel supply line
10	-	Evaporative emission canister to evaporative emission canister purge valve line
11	-	Fuel tank

The fuel tank holds approximately 70 liters of usable fuel and is of a plastic construction. It is retained to the vehicle by means of two steel support straps, the fuel tank supports straps are secured by four retaining bolts onto the underside of the vehicle chassis.

Fuel tank ventilation is achieved by two fuel tank vent valves venting through a fuel limit vent valve and into an evaporative emission canister which absorbs the fuel vapor. The fuel tank vent valve will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Fuel lines

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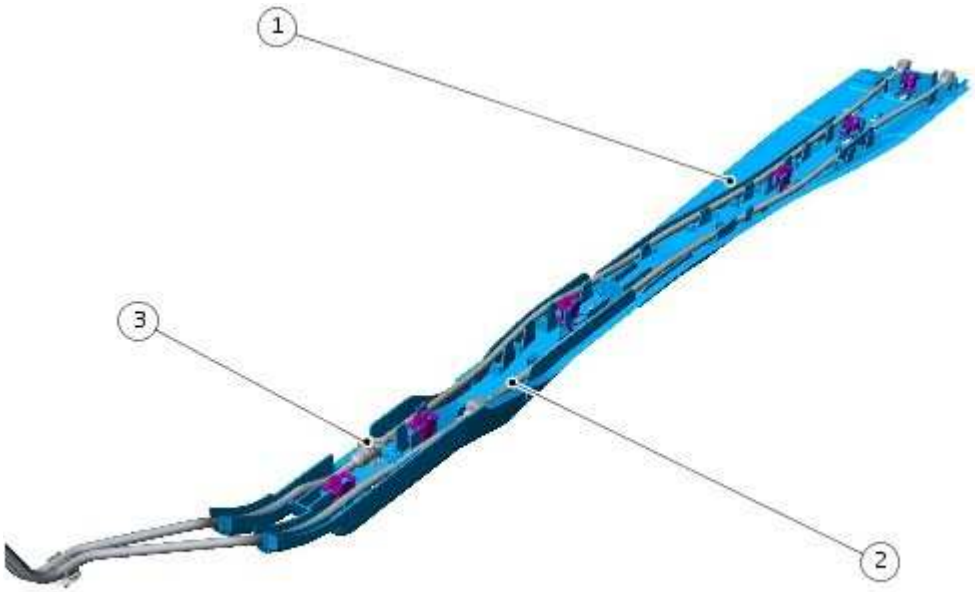

E66226

Item	Part Number	Description
1	-	Fuel line cover
2	-	Fuel supply line
3	-	Evaporative emission canister to evaporative emission canister purge valve line

The fuel supply and return lines are constructed from PA nylon tubes and are retained by clips which are made of plastic. The fuel lines are protected under the vehicle by a plastic cover, which is clipped to welded studs.

Within the engine compartment, some fuel lines are produced from steel for improved robustness.

The fuel supply and return lines are separated into three sections. The fuel line connections have quick release couplings at each end to secure them to the fuel tank lines and front end fuel lines.
For additional information, refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Fuel pump and sender unit

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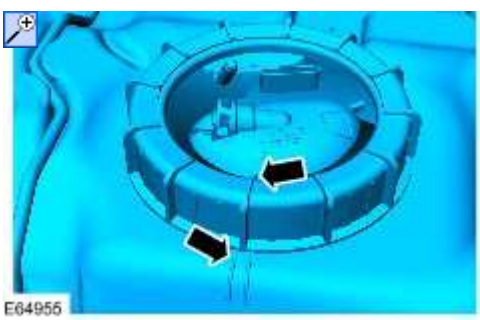
E64954

Item	Part Number	Description
1	-	Fuel tank locking ring
2	-	Fuel pump and sender unit
3	-	Fuel filter
4	-	Fuel pump and sender unit seal
5	-	Fuel tank level sensor float and arm

The fuel pump and sender unit is located in the top of the fuel tank and retained by a re-usable fuel tank locking ring. The fuel pump and sender unit seal must not be re-used once removed from the fuel tank.

The fuel pump and sender unit consists of a fuel sender, a fuel filter and a high pressure fuel pump with pressure regulator. The fuel tank module filter has been designed as a non-serviceable item and will last the lifetime of the vehicle. If the fuel tank module fuel filter becomes blocked a new fuel pump and sender unit must be installed.
For additional information, refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
The fuel pump is a turbine type pump which is an integral part of the fuel pump and sender unit. The fuel tank module fuel sender communicates directly with the instrument cluster which drives the fuel gauge informing the driver the amount of fuel that is currently in the fuel tank.


E64955

CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

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NOTE: Make sure that the installation marks are aligned.
The fuel tank must be completely removed from the vehicle before the fuel pump and sender unit unit can be removed.
For additional information, refer to: Fuel Tank (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Installation of a new fuel level sensor may not solve fuel indication issues which may occur during the vehicles life time.

Fuel tank vent valve

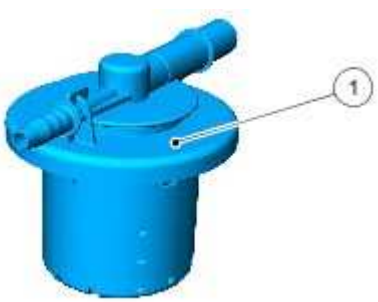
E64953

Item	Part Number	Description
1	-	Fuel tank vent valve

Fuel tank ventilation is achieved by two fuel tank vent valves and the fill limit vent valve, which are installed into the top of the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

The fuel tank vent valve also acts as a fuel tank breather with a dust filter located at the atmospheric port of the evaporative emission canister. If this dust filter becomes blocked or restricted during the vehicle's lifetime, problems will be experienced with draining the fuel tank. Also there could be a possibility of fuel tank deformation if the fuel filter is blocked.

Fill limit vent valve



E64952

Item	Part Number	Description
1	-	Fill limit vent valve

The fill limit vent valve is an intermediate ventilation valve between the fuel tank vent valves and the evaporative emission canister.

The fill limit vent valve allows the fuel tank to be filled to its maximum, by expelling the air within the fuel tank to the evaporative emission canister.

Evaporative emission system

The evaporative emission system consists of an evaporative emission canister, evaporative emission canister purge valve and vacuum lines.
For additional information, refer to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).

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Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5 - Fuel Tank and Lines—2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Vehicles With: Ethanol Capability - Overview	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Description and Operation

The fuel tank and fuel lines are the same as those in vehicles for petrol operation.

Properties of ethanol E85

CAUTION: Fuels containing ethanol have a corrosive effect on other materials such as plastic, paint and metal.

Ethanol E85:

- is described by the standard ASTM D5798 (Ed75-Ed85)
- contains approximately 85% ethanol and 15% petrol with 95 octane rating in "summer quality"
- contains approximately 75% ethanol and 25% petrol with 95 octane rating in "winter quality"
- has an antiknock resistance of approx. 104 RON (research octane number)
- supplies around 66% of the energy content of petrol
- causes around 70-80% less carbon dioxide emissions
- the ethanol share is free from sulphur and odors and contains no carcinogenic compounds such as benzene

Fuel Tank and Lines

CAUTION: If another fuel type is used after emptying the fuel tank, at least 10 liters more must be added in order to start fuel type determination and adaptation.
The fuel tank and rust-free fuel lines are the same for petrol vehicles as for vehicles operated with ethanol. To achieve this, the components optimized for ethanol operation have been applied to the entire product range.

Fuel pump driver module

The fuel pump driver module must not be dismantled and must be replaced as a whole.

The fuel pump driver module is different for petrol vehicles and for vehicles operated with ethanol, and must not be interchanged.

Item	Description
1	Fuel pump driver module - petrol vehicle

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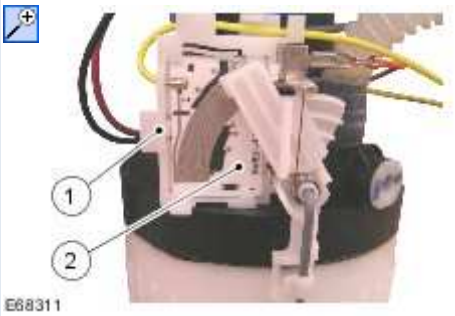
2	Fuel pump driver module - ethanol vehicle
3	Encapsulated connector

The fuel pump module for ethanol operation looks very similar to the fuel pump module for petrol vehicles. The difference is in the fuel pump connector. This is encapsulated due to the higher conductivity of the ethanol share.



Item	Description
1	Fuel level sensor
2	Resistor board

The resistor board of the fuel level sensor is supplied with alternating voltage instead of direct voltage. This prevents electrolysis and the deposit of particles. The alternating voltage is generated by a DC (direct current)-AC (alternating current) converter. The DC-AC converter is integrated in the wiring harness or the GEM (generic electronic module) depending on the construction period. It converts the direct voltage into an alternating voltage with a frequency of 170 Hz. The course of the alternating voltage corresponds to a rectangular impulse.

Both fuel pump driver units have different resistance tracks for the fuel level sensor.

Another difference is that the fuel pump driver unit for ethanol operation is manufactured from ethanol-resistant materials.

The fuel level sensor is used during fuel type determination.
Refer to: Electronic Engine Controls - Vehicles With: Ethanol Capability (303-14A Electronic Engine Controls - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4, Description and Operation).

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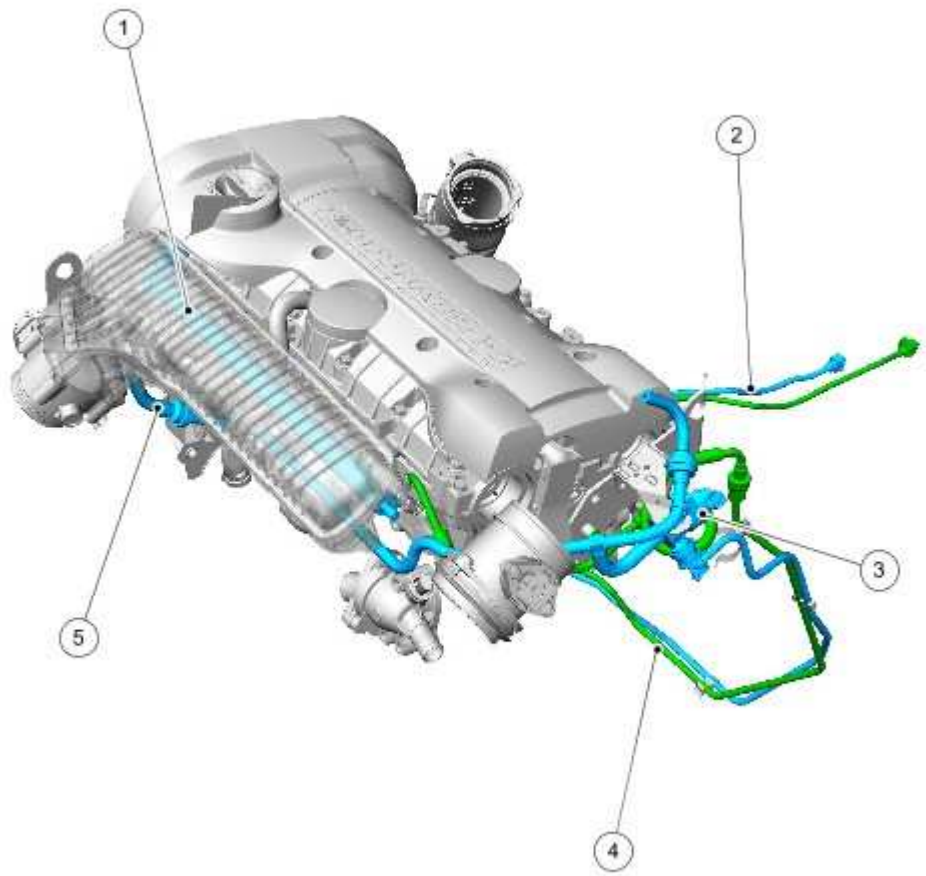
Description and Operation

General overview



E69923

Item	Part Number	Description
1	-	Fuel rail
2	-	Evaporative emission canister to evaporative emission canister purge valve line
3	-	Evaporative emission canister purge valve
4	-	Fuel supply line
5	-	Evaporative emission canister purge to intake manifold vacuum line

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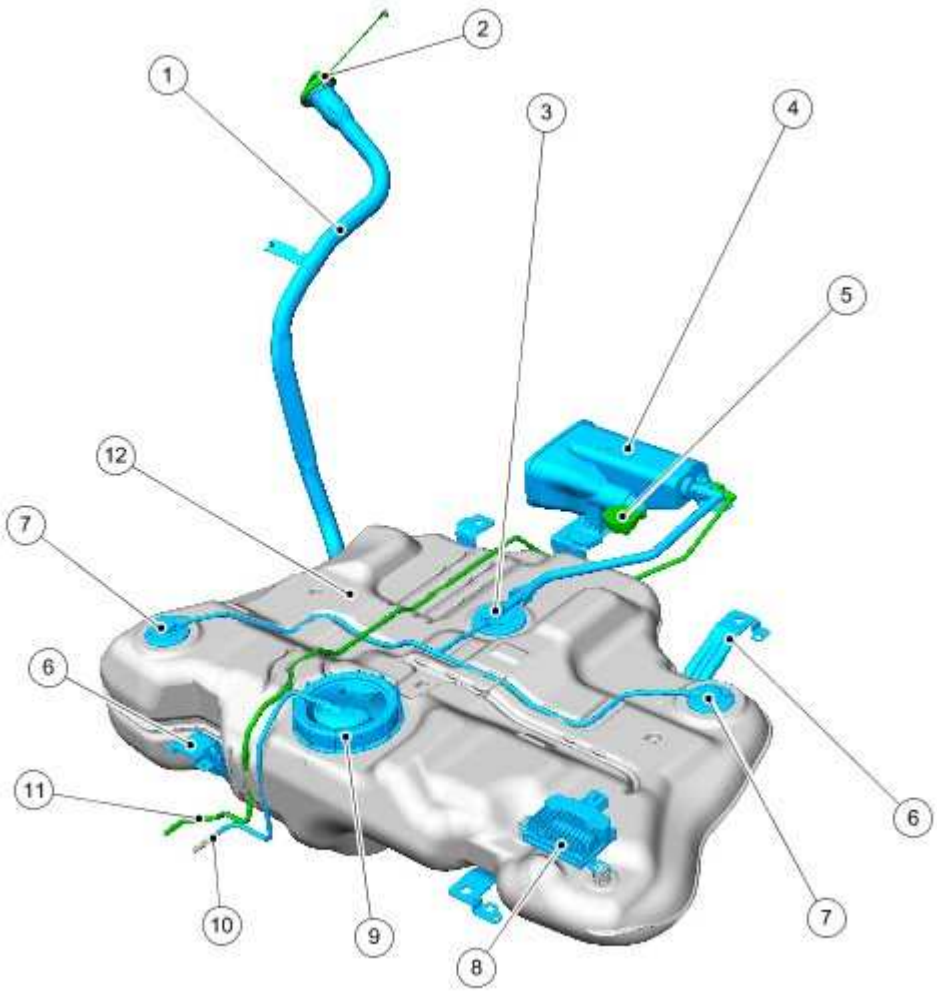

E69921

Item	Part Number	Description
1	-	Fuel tank filler pipe
2	-	Fuel tank filler pipe cap
3	-	Fill limit vent valve
4	-	Evaporative emission canister
5	-	Evaporative emission canister dust filter
6	-	Fuel tank support strap(s)
7	-	Fuel tank vent valve(s)
8	-	Fuel pump driver module (FPDM)
9	-	Fuel pump and sender unit (including fuel filter)
10	-	Fuel supply line
11	-	Evaporative emission canister to evaporative emission canister purge valve line
12	-	Fuel tank

The fuel tank holds approximately 70 liters of usable fuel and is of a plastic construction. It is retained to the vehicle by means of two steel support straps, the fuel tank supports straps are secured by four retaining bolts onto the underside of the vehicle chassis.

Fuel tank ventilation is achieved by two fuel tank vent valves venting through a fuel limit vent valve and into an evaporative emission canister which absorbs the fuel vapor. The fuel tank vent valve will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

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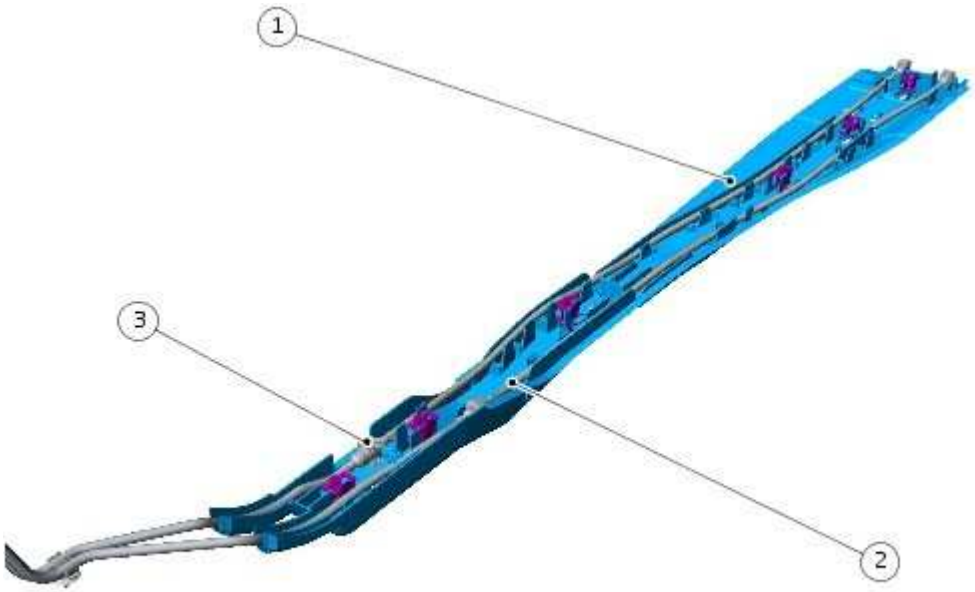
Fuel lines



E66226

Item	Part Number	Description
1	-	Fuel line cover
2	-	Fuel supply line
3	-	Evaporative emission canister to evaporative emission canister purge valve line

The fuel supply and return lines are constructed from PA nylon tubes and are retained by clips which are made of plastic. The fuel lines are protected under the vehicle by a plastic cover, which is clipped to welded studs.

Within the engine compartment, some fuel lines are produced from steel for improved robustness.

The fuel supply and return lines are separated into three sections. The fuel line connections have quick release couplings at each end to secure them to the fuel tank lines and front end fuel lines.
For additional information, refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Fuel pump and sender unit

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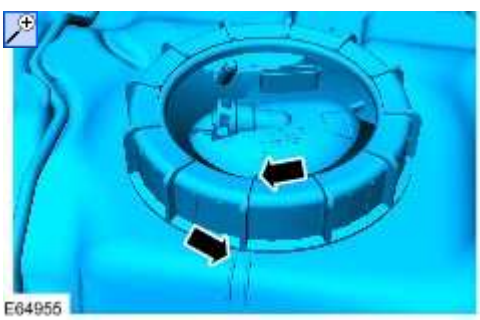
E64954

Item	Part Number	Description
1	-	Fuel tank locking ring
2	-	Fuel pump and sender unit
3	-	Fuel filter
4	-	Fuel pump and sender unit seal
5	-	Fuel tank level sensor float and arm

The fuel pump and sender unit is located in the top of the fuel tank and retained by a re-usable fuel tank locking ring. The fuel pump and sender unit seal must not be re-used once removed from the fuel tank.

The fuel pump and sender unit consists of a fuel sender, a fuel filter and a high pressure fuel pump with pressure regulator. The fuel tank module filter has been designed as a non-serviceable item and will last the lifetime of the vehicle. If the fuel tank module fuel filter becomes blocked a new fuel pump and sender unit must be installed.
For additional information, refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
The fuel pump is a turbine type pump which is an integral part of the fuel pump and sender unit. The fuel tank module fuel sender communicates directly with the instrument cluster which drives the fuel gauge informing the driver the amount of fuel that is currently in the fuel tank.


E64955

CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

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NOTE: Make sure that the installation marks are aligned.
The fuel tank must be completely removed from the vehicle before the fuel pump and sender unit unit can be removed.
For additional information, refer to: Fuel Tank (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Installation of a new fuel level sensor may not solve fuel indication issues which may occur during the vehicles life time.

Fuel pump driver module (FPDM)

E69922

Item	Part Number	Description
1	-	FPDM

The FPDM receives data from the PCM regarding engine operating states, which is the transferred to the fuel pump and sender unit to deliver the required quantity of fuel to the fuel rail in relation to the engine speed and operating conditions.

Fuel tank vent valve

E64953

Item	Part Number	Description
1	-	Fuel tank vent valve

Fuel tank ventilation is achieved by two fuel tank vent valves and the fill limit vent valve, which are installed into the top of the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

The fuel tank vent valve also acts as a fuel tank breather with a dust filter located at the atmospheric port of the evaporative emission canister. If this dust filter becomes blocked or restricted during the vehicle's lifetime, problems will be experienced with draining the fuel tank. Also there could be a possibility of fuel tank deformation if the fuel filter is blocked.

Fill limit vent valve

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E64952

Item	Part Number	Description
1	-	Fill limit vent valve

The fill limit vent valve is an intermediate ventilation valve between the fuel tank vent valves and the evaporative emission canister.

The fill limit vent valve allows the fuel tank to be filled to its maximum, by expelling the air within the fuel tank to the evaporative emission canister.

Evaporative emission system

The evaporative emission system consists of an evaporative emission canister, evaporative emission canister purge valve and vacuum lines.
For additional information, refer to: Evaporative Emissions (303-13 Evaporative Emissions, Description and Operation).

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

General Equipment

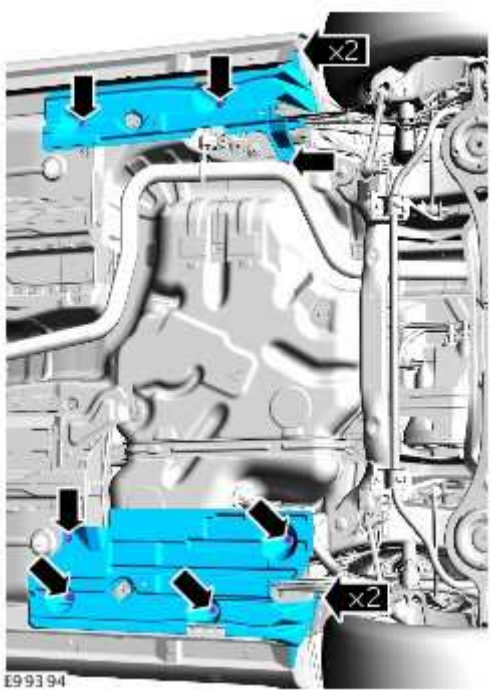
Fuel tank draining equipment
Hose clamp(s)
Hose clamp remover/installer
Retaining Strap
Transmission jack
Wooden Block

Removal

All vehicles

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. *Torque:* 10 Nm



Vehicles with 2.5L engine

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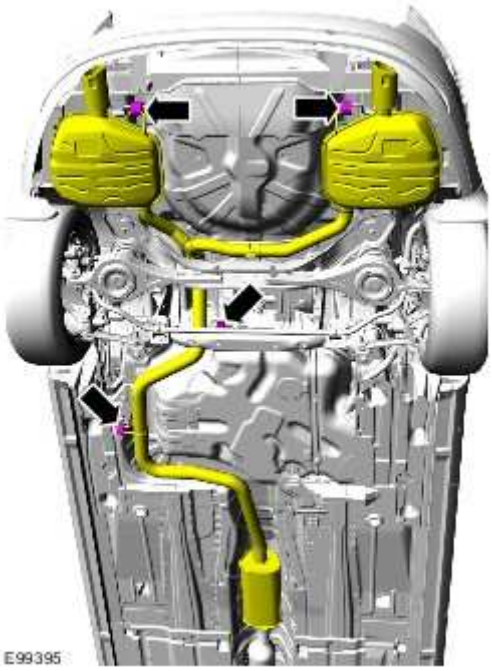
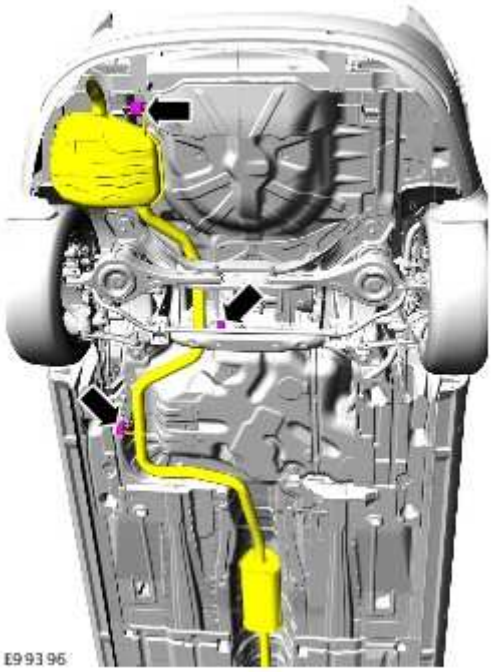
4.



All vehicles

5.



6.

CAUTION: Take extra care when handling the components.
Torque: 5 Nm

7. NOTE: Make sure that a new clamp is installed.

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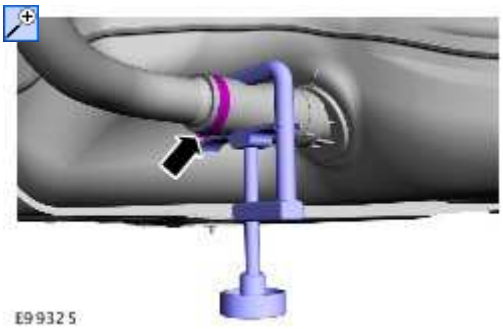
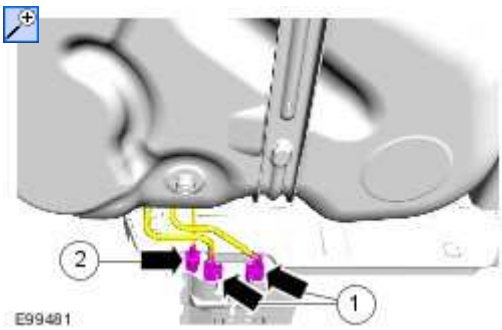


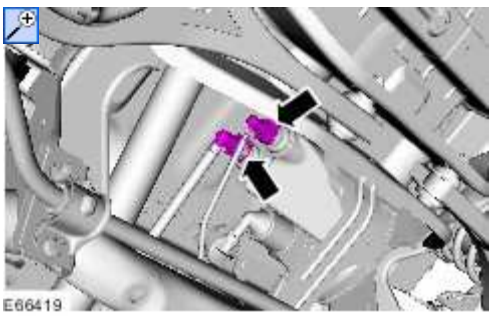
NOTE: Make sure that the clamp is installed to the same orientation as when removed.
General Equipment: Hose clamp(s)

8. WARNING: Be prepared to collect escaping fluid.
NOTE: Make sure that a new component is installed.
General Equipment: Hose clamp remover/installer



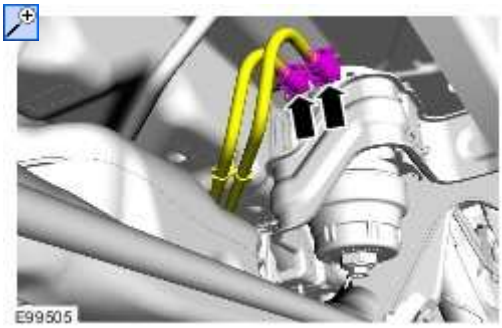
9. WARNING: Be prepared to collect escaping fluid.
    1. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
    2. If equipped.

All except vehicles with diesel engine



10. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.0L diesel engine



11. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine

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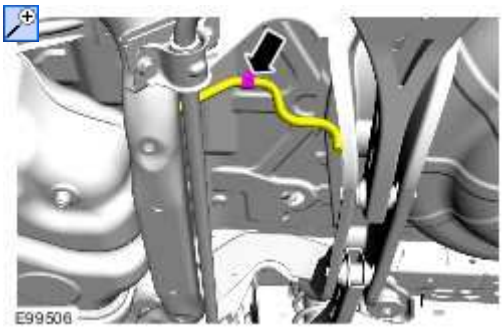
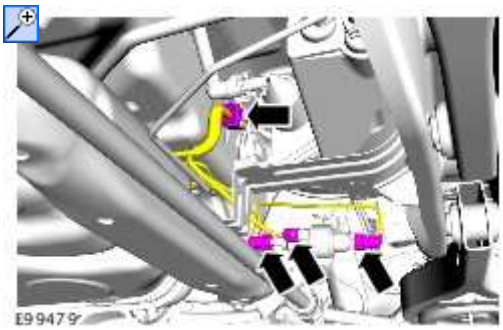


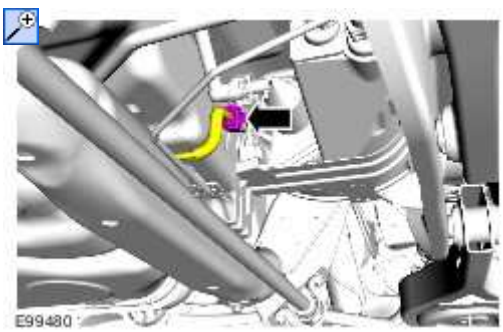
12.

Vehicles with fuel fired booster heater



13. WARNING: Be prepared to collect escaping fluid.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles



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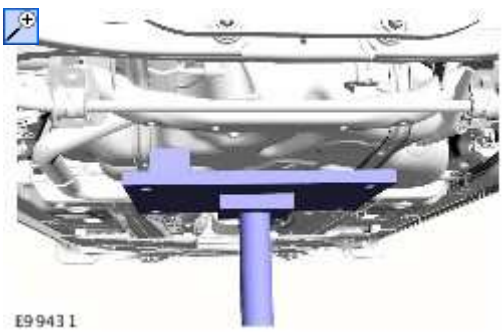
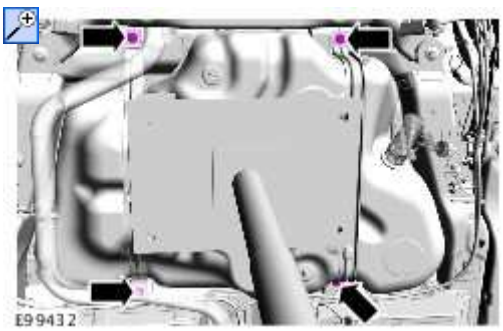


15. CAUTIONS:

Use suitable packing material to prevent damage to the component.

Make sure that no strain is placed on the fuel lines and wiring harnesses.
General Equipment: Transmission jack
General Equipment: Wooden Block



16. *Torque:* 24 Nm

17. *General Equipment:* Retaining Strap

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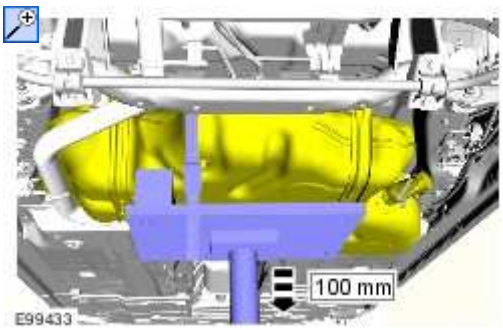
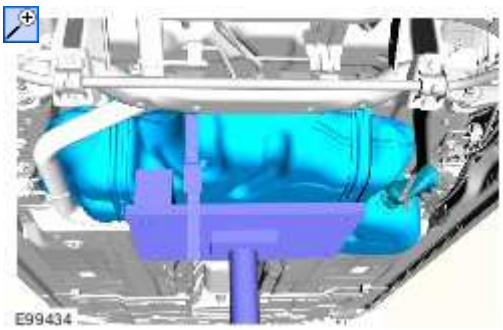
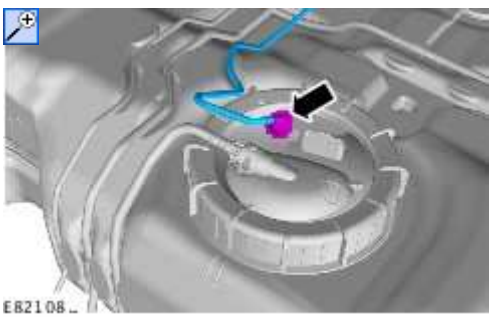


General Equipment: Wooden Block



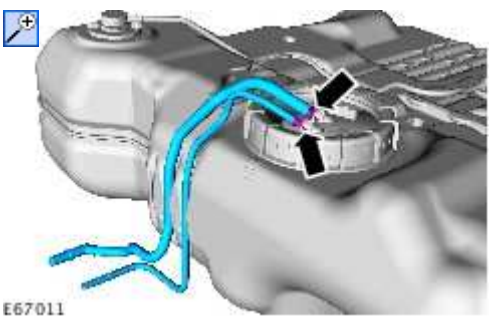
18.

Vehicles with fuel fired booster heater



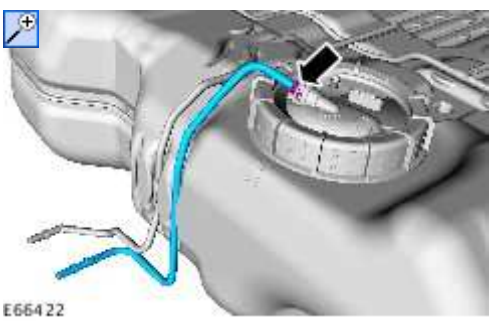
19. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine



20. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All except vehicles with diesel engine



21. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles

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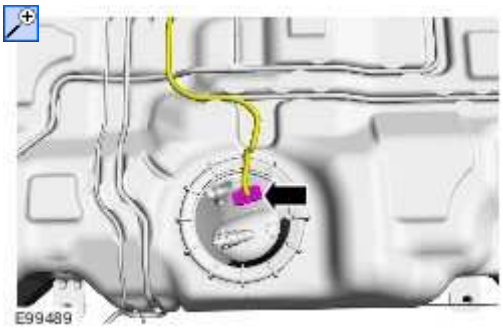
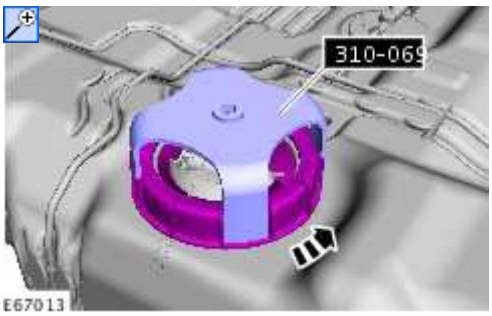
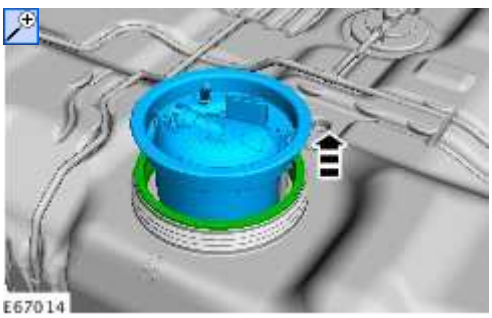


22.



23. *Special Tool(s):* 310-069
Torque: 85 Nm

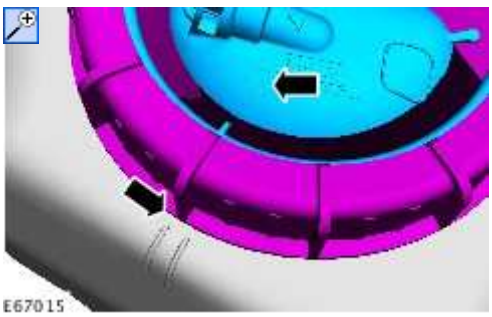


24. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

25. Drain the fuel tank.

General Equipment: Fuel tank draining equipment

Installation



1. To install, reverse the removal procedure.

2. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
NOTE: Make sure that the seal is correctly located.
NOTE: Make sure that the installation marks are aligned.

Vehicles with diesel engine

3. Refer to: Fuel System Bleeding - 1.8L Duratorq-TDCi (Lynx) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.2L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General

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Information, General Procedures).

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Removal and Installation

Removal

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

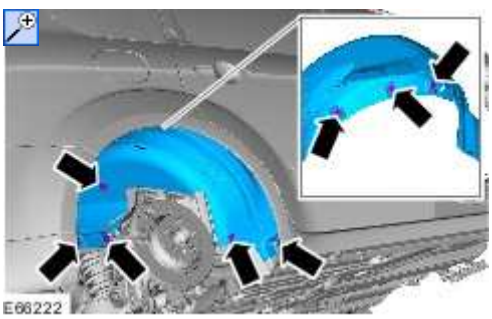
NOTE: Removal steps in this procedure may contain installation details.

2. Drain the fuel tank.

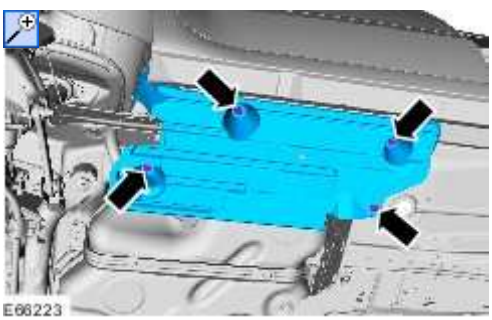
   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the right-hand rear wheel and tire.

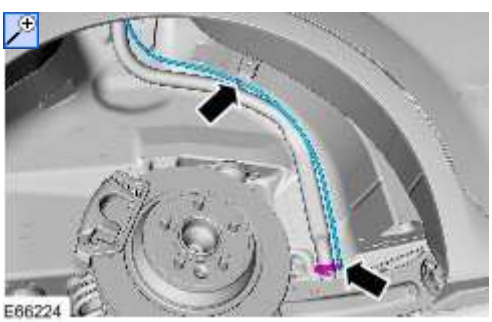
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4.



5. *Torque:* 10 Nm



6.

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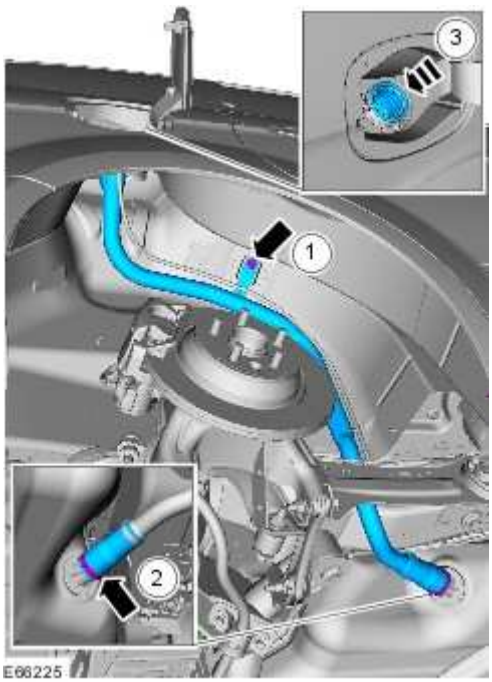

7. NOTE: Note the orientation of the clamp to aid installation.
    1. *Torque:* 10 Nm
    2. Discard the fuel tank filler pipe clamp.

Installation

NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that the clamp is installed to the same orientation as when removed.

1. To install, reverse the removal procedure.

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Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5 - Fuel Filter	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

1. NOTE: The fuel filter is an integral part of the fuel pump and sender unit.
   Remove the fuel pump and sender unit.

   Refer to: Fuel Pump and Sender Unit (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

Removal

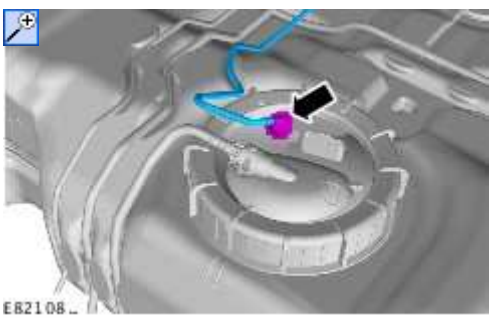
WARNING: Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Remove the fuel tank.

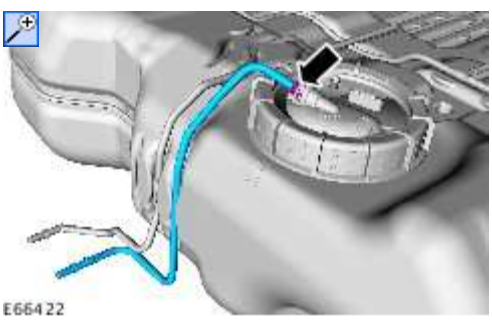
   Refer to: Fuel Tank (310-01A Fuel Tank and Lines - 2.0L EcoBoost SCTi (149kW/203PS) - MI4/2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4/2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).

Vehicles with fuel fired booster heater



2. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles



3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

4. *Special Tool(s):* 310-069
   Torque: 85 Nm

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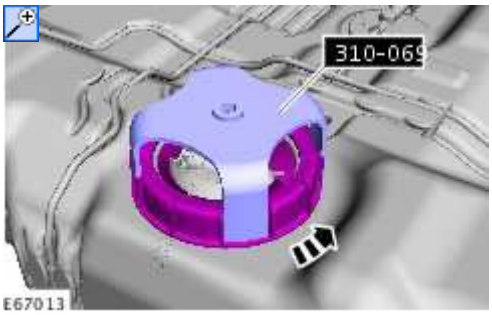
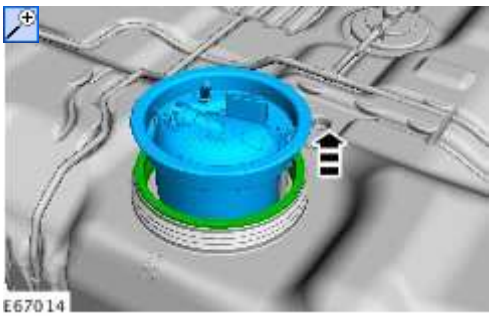
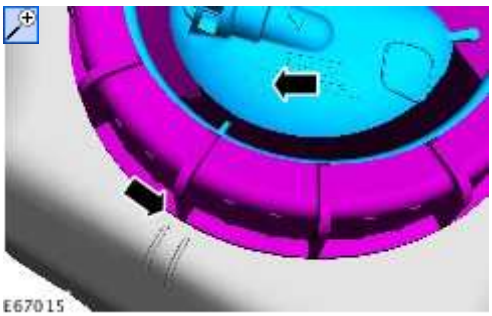




5. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

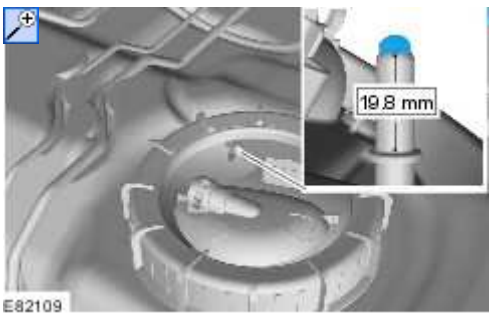
Installation

All vehicles

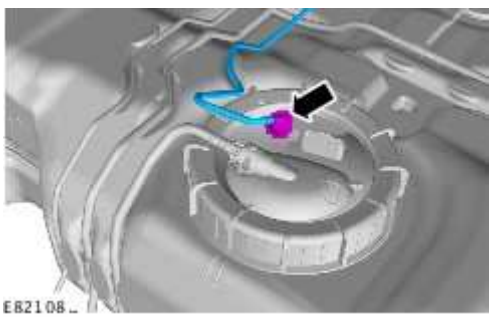


1. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
   NOTE: Make sure that the seal is correctly located.
   NOTE: Make sure that the installation marks are aligned.

Vehicles with fuel fired booster heater



2. Using a suitable tool remove the fuel fired heater fuel supply line cone spigot.



3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles

4. To install, reverse the removal procedure.

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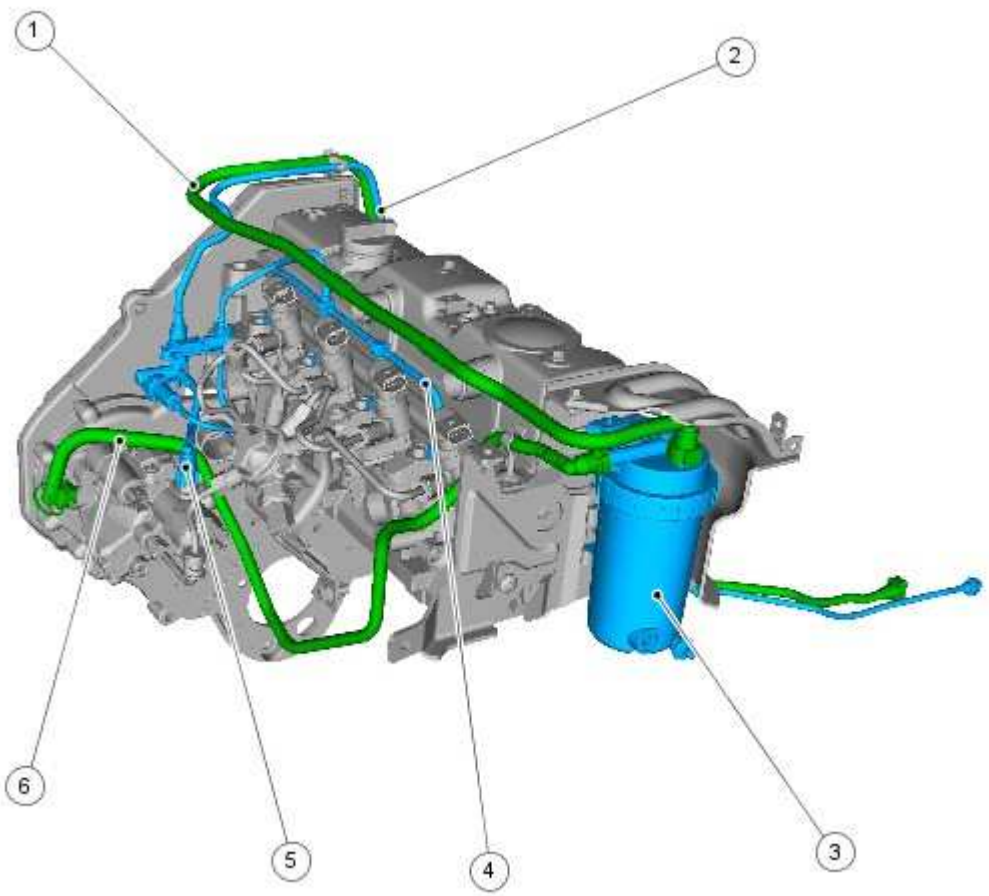
Description and Operation

General overview

Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine



E65337

Item	Part Number	Description
1	-	Fuel filter fuel supply line
2	-	Fuel return line
3	-	Fuel filter
4	-	Fuel injector fuel return lines
5	-	Fuel pump fuel return line
6	-	Fuel filter to fuel pump fuel supply line

Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine

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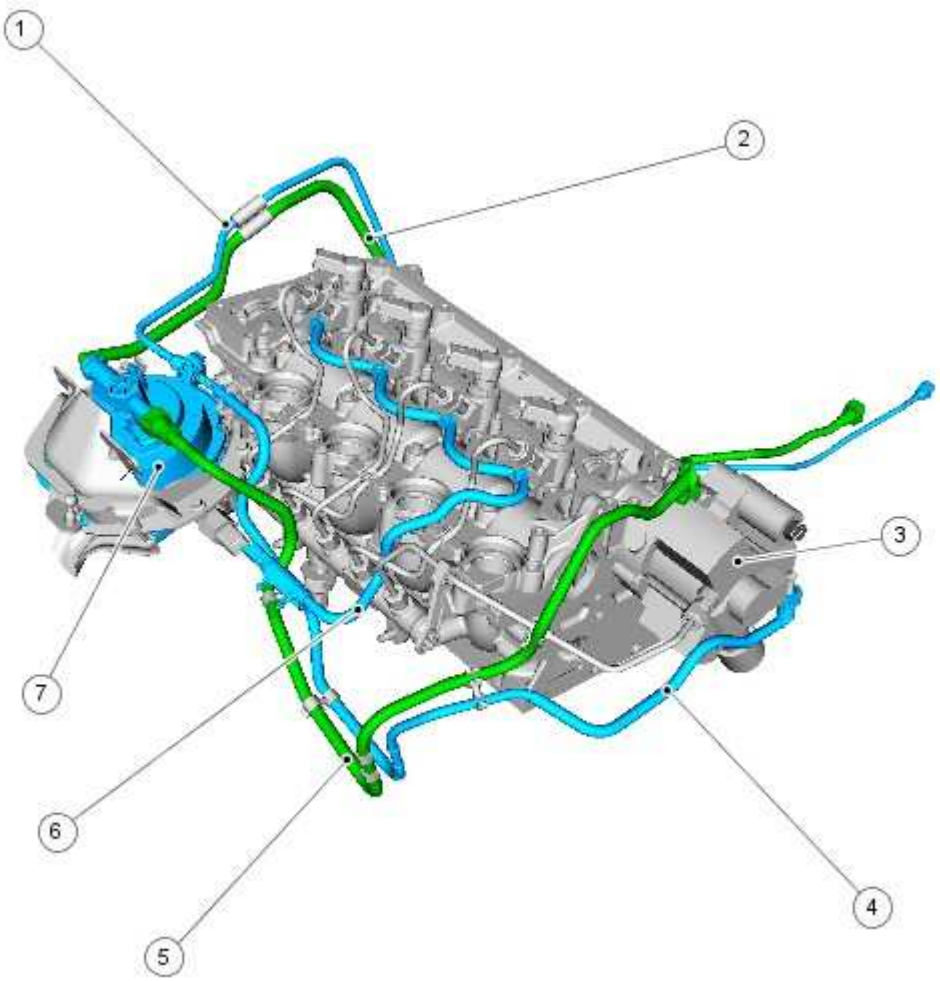

E65362

Item	Part Number	Description
1	-	Fuel return line
2	-	Fuel filter fuel supply line
3	-	Fuel pump
4	-	Fuel pump fuel return line
5	-	Fuel pump fuel supply line
6	-	Fuel injector fuel return line
7	-	Fuel filter

All vehicles

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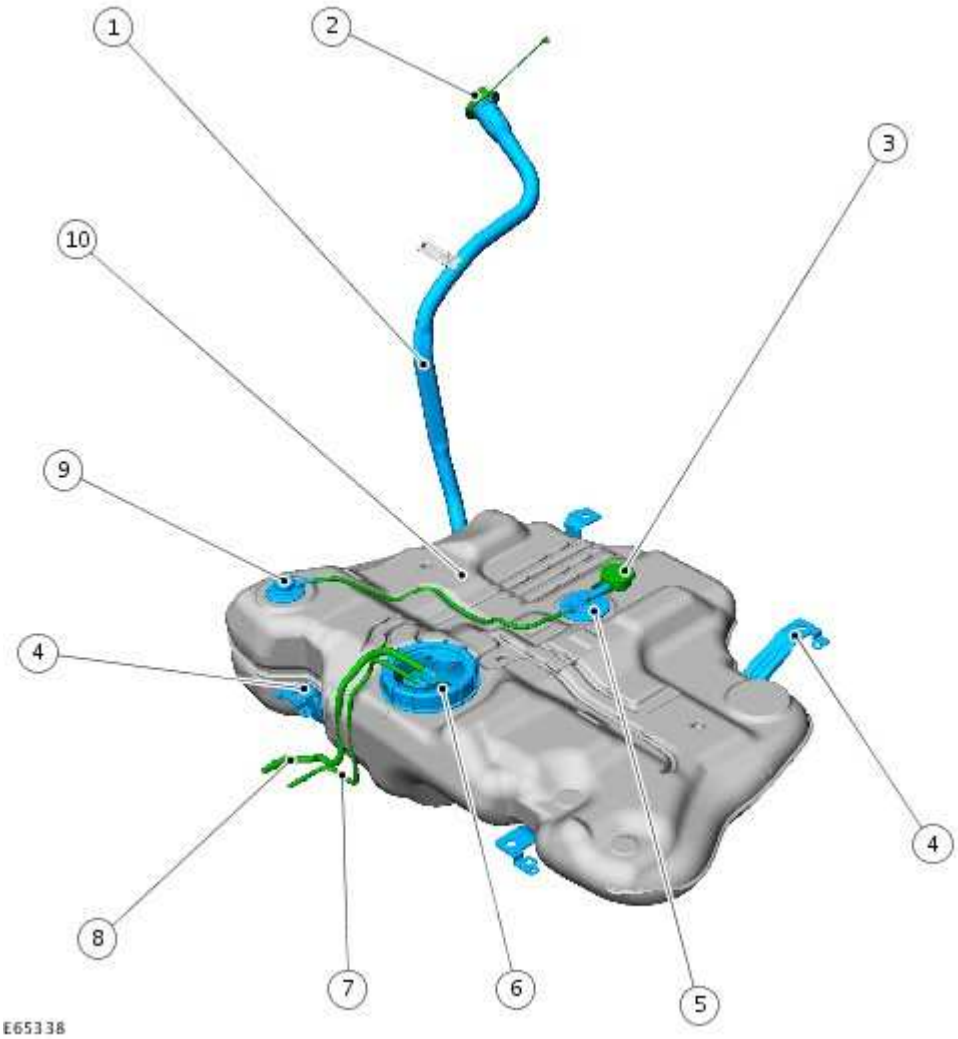

Item	Part Number	Description
1	-	Fuel tank filler pipe
2	-	Fuel tank filler pipe cap
3	-	Fill limit vent valve dust filter
4	-	Fuel tank support strap(s)
5	-	Fill limit vent valve
6	-	Fuel level sensor
7	-	Fuel return line
8	-	Fuel supply line
9	-	Fuel tank vent valve
10	-	Fuel tank

The fuel tank holds approximately 70 liters of usable fuel and is of a plastic construction. It is retained to the vehicle by means of two steel support straps, the fuel tank supports straps are secured by four retaining bolts onto the underside of the vehicle chassis.

Fuel tank ventilation is achieved by one fuel tank vent valve and a fill limit vent valve ventilating directly to atmosphere. The fuel tank vent valve will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Fuel lines

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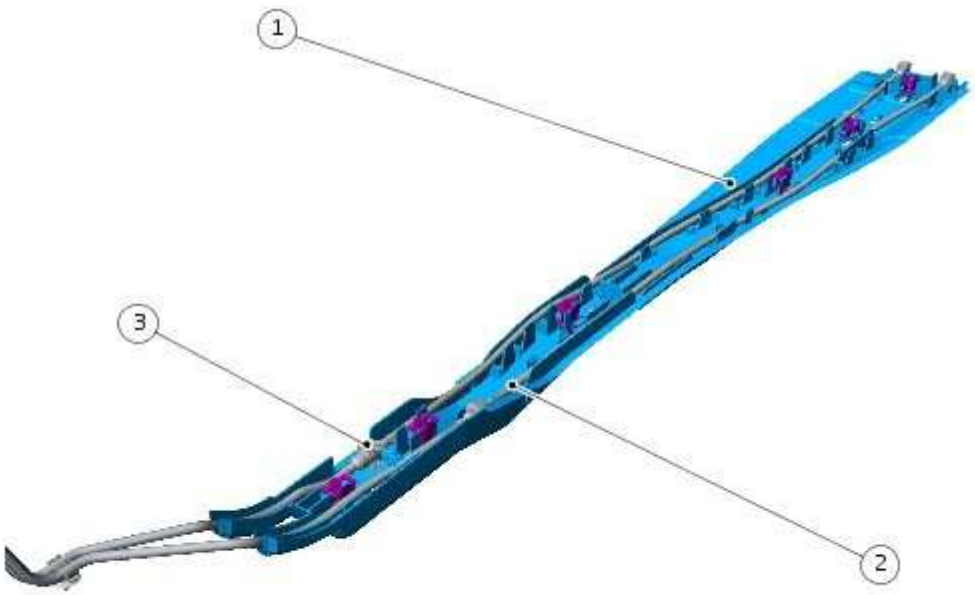


E66226

Item	Part Number	Description
1	-	Fuel line cover
2	-	Fuel return line
3	-	Fuel supply line

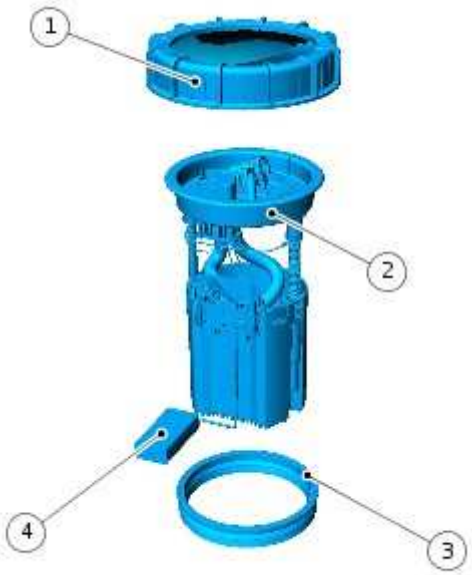
The fuel supply and return lines are constructed from PA nylon tubes and are retained by clips which are made of plastic. The fuel lines are protected under the vehicle by a plastic cover, which is clipped to welded studs.

Within the engine compartment, some fuel lines are produced from steel for improved robustness.

The fuel supply and return lines are separated into three sections. The fuel line connections have quick release couplings at each end to secure them to the fuel tank lines and front end fuel lines.
For additional information, refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Fuel level sensor

http://vnx.su

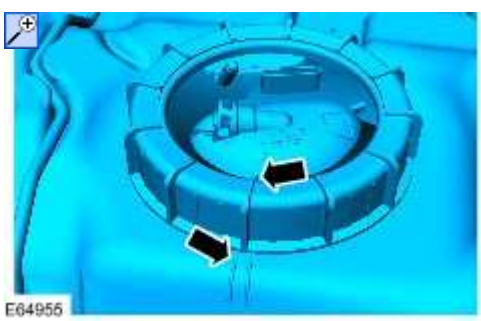


E65339

Item	Part Number	Description
1	-	Fuel tank locking ring
2	-	Fuel level sensor
3	-	Fuel level sensor seal
4	-	Fuel tank level sensor float and arm

The fuel level sensor is located in the top of the fuel tank and retained by a re-usable fuel tank locking ring. The fuel level sensor seal must not be re-used once removed from the fuel tank.

The fuel level sensor is equipped with a fuel tank sender unit. The fuel tank sender unit consists of a mechanical float and a potentiometer. The potentiometer measures the fuel level using a float and communicates directly with the fuel gauge in the instrument cluster informing the driver the amount of fuel that is currently in the fuel tank.



E64956

CAUTION: Make sure that the fuel tank level sensor float and arm are not damaged during the installation.
NOTE: Make sure that the installation marks are aligned.
The fuel tank must be completely removed from the vehicle before the fuel level sensor unit can be removed.
For additional information, refer to: Fuel Tank (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

Installation of a new fuel level sensor may not solve fuel indication issues which may occur during the vehicles life time.

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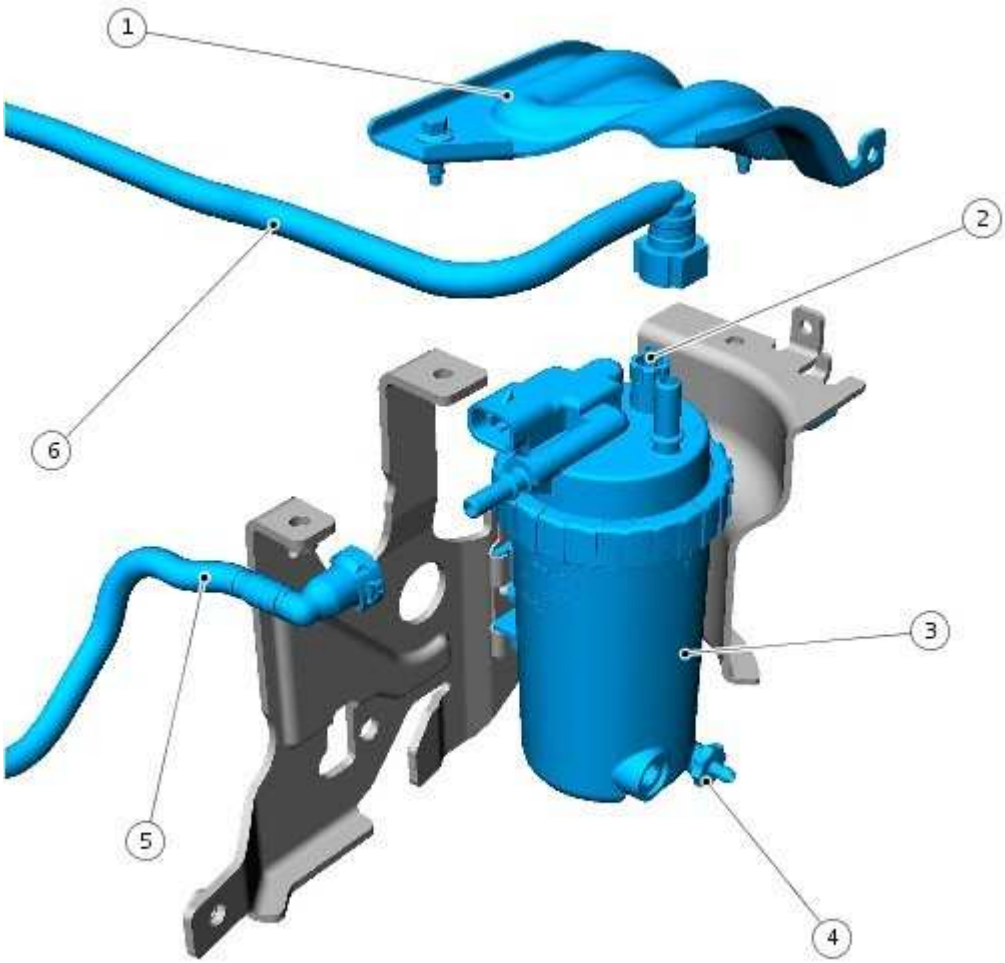
Fuel filter - vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine



E65340

Item	Part Number	Description
1	-	Fuel filter top shield
2	-	Fuel filter bleed screw
3	-	Fuel filter housing
4	-	Fuel filter drain screw
5	-	Fuel filter fuel supply line
6	-	Fuel filter to fuel pump fuel supply line

The 1.8L Duratorq-TDCi (Kent) diesel engine fuel filter is located above the transmission and is attached to the cylinder head by means of a fuel filter retaining bracket. The fuel filter has an electric fuel heater which is located next to the fuel pump fuel supply line.

When the fuel temperature is below 15ºC, a valve inside the fuel filter opens, allowing fuel which is pre-heated by the fuel pump to be recirculated back through the fuel filter to the fuel pump. This aids engine performance during warm-up.

Fuel is delivered through the fuel supply line to the fuel filter. The fuel filter cleans the fuel of water and contaminants. Unused fuel is returned to the fuel tank through the fuel pump fuel return line.

When a new fuel filter has been installed it must be bled using a hand pressure pump. Make sure that the arrows indicating the direction of fuel flow is pointing towards the fuel filter. For additional information, refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L

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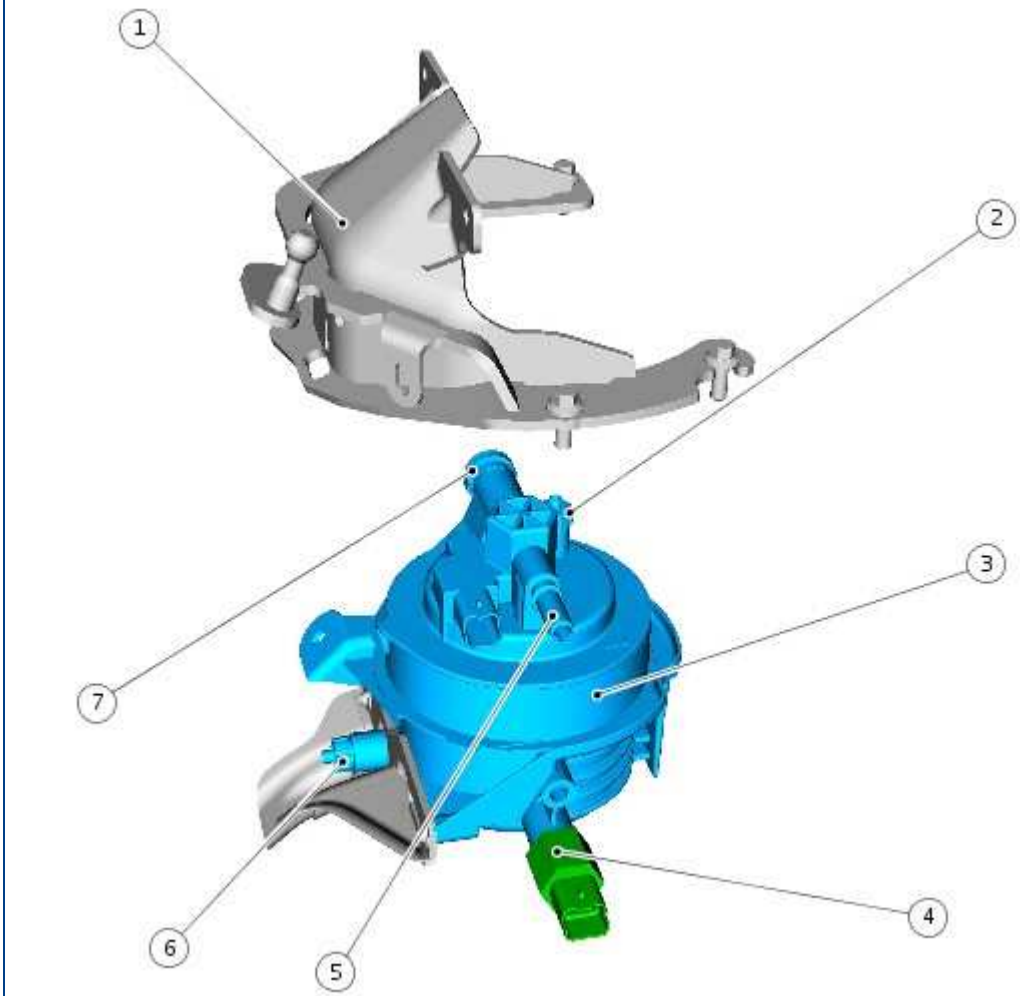
Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

Fuel filter - vehicles with 2.0L Duratorq-TDCi (DW) diesel engine



E65363

Item	Part Number	Description
1	-	Fuel filter crash protection top shield
2	-	Fuel filter bleed screw
3	-	Fuel filter housing
4	-	Water in fuel sensor
5	-	Fuel filter to fuel pump fuel supply line union
6	-	Fuel filter drain screw
7	-	Fuel filter fuel supply line union

The 2.0L Duratorq-TDCi (DW) diesel engine fuel filter is located above the generator and is attached to the cylinder head by means of a fuel filter retaining bracket, a fuel filter splash shield and a fuel filter crash protection shield are mounted to the retaining bracket. The fuel filter has an electric fuel heater which is located next to the fuel filter inlet pipe.

When the temperature is below 15ºC, a valve inside the fuel filter opens allowing fuel which is pre-heated by the fuel pump to be recirculated back through the fuel filter to the fuel pump. This aids engine performance during warm up.

Fuel is delivered through the fuel supply lines to the fuel filter. The fuel filter cleans the fuel of water and contaminants. Unused fuel is returned to the fuel tank through the fuel pump

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return line.

The fuel filter is also equipped with a water-in-fuel sensor which is located at the base of the fuel filter housing. This sensor measures the amount of water which has collected in the fuel filter element. If the quantity of water present is greater than 90 ml then a warning indicator located on the instrument cluster is illuminated and the fuel filter element should then be drained of water.

When a new fuel filter has been installed it must be bled using a hand pressure pump. Make sure that the arrows indicating the direction of fuel flow is pointing towards the fuel filter. For additional information, refer to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

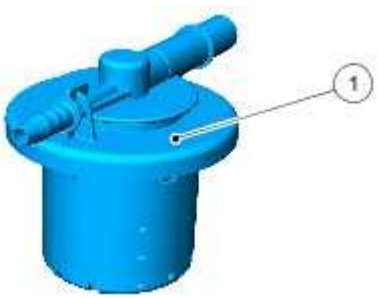
Fuel tank vent valve

E64953

Item	Part Number	Description
1	-	Fuel tank vent valve

Fuel tank ventilation is achieved by a fuel tank vent valve and the fuel limit vent valve, which is installed into the top of the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Fill limit vent valve



E64952

Item	Part Number	Description
1	-	Fill limit vent valve

The fill limit vent valve is an intermediate ventilation valve between the fuel tank vent valve and the atmosphere.

The fill limit vent valve allows the fuel tank to be filled to its maximum, by expelling the air within the fuel tank to atmosphere.

The fill limit vent valve also acts as a fuel tank breather with a dust filter. If this dust filter becomes blocked or restricted during the vehicle's lifetime, problems will be experienced with draining the fuel tank. Also there could be a possibility of fuel tank deformation if the dust filter is blocked.

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

General Equipment

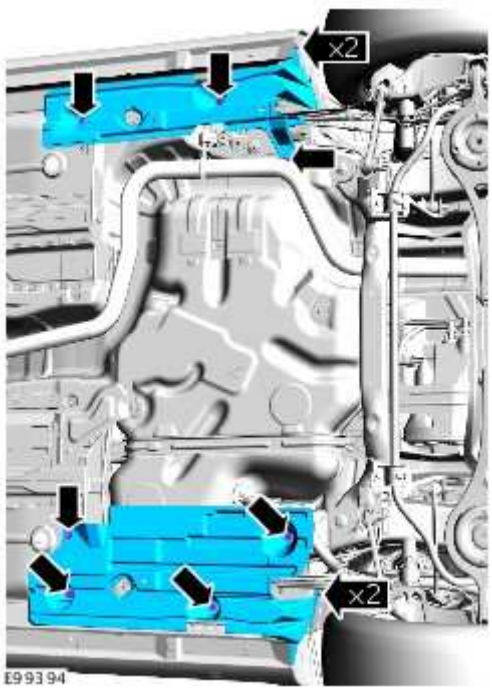
Fuel tank draining equipment
Hose clamp(s)
Hose clamp remover/installer
Retaining Strap
Transmission jack
Wooden Block

Removal

All vehicles

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. *Torque:* 10 Nm



Vehicles with 2.5L engine

4.

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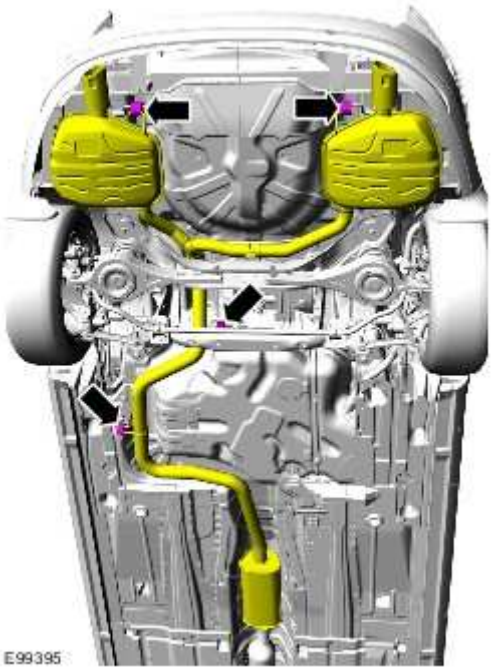
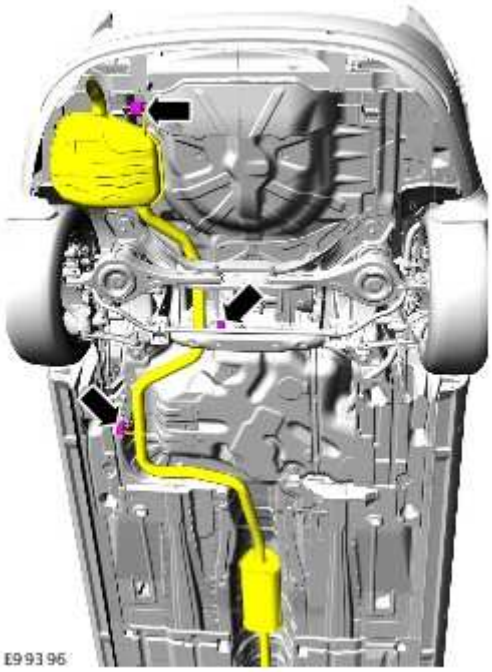


All vehicles

5.



6.

CAUTION: Take extra care when handling the components.
Torque: 5 Nm

7. NOTE: Make sure that a new clamp is installed.

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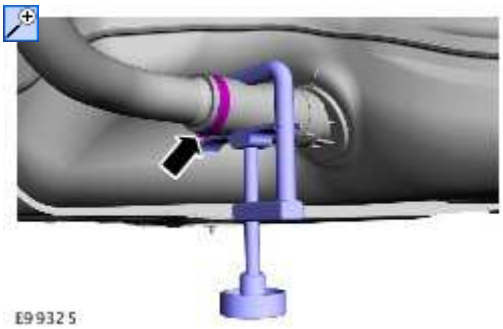
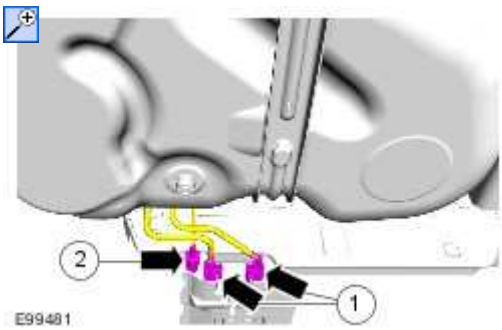


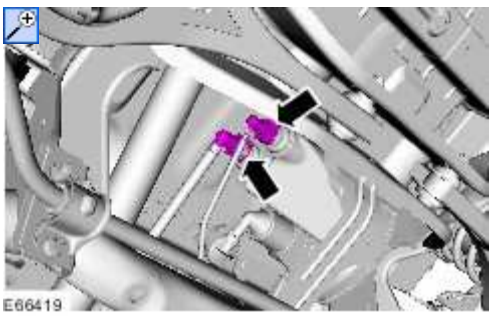
NOTE: Make sure that the clamp is installed to the same orientation as when removed.
General Equipment: Hose clamp(s)

8. WARNING: Be prepared to collect escaping fluid.
NOTE: Make sure that a new component is installed.
General Equipment: Hose clamp remover/installer



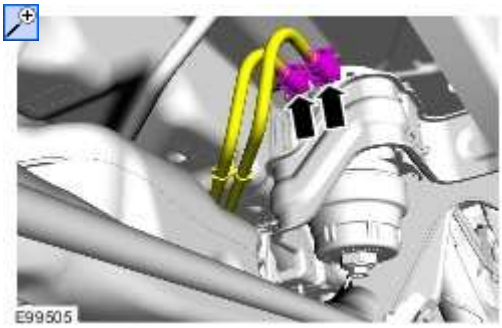
9. WARNING: Be prepared to collect escaping fluid.
    1. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
    2. If equipped.

All except vehicles with diesel engine



10. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.0L diesel engine



11. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine

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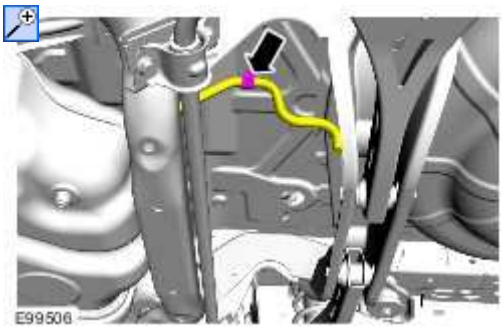
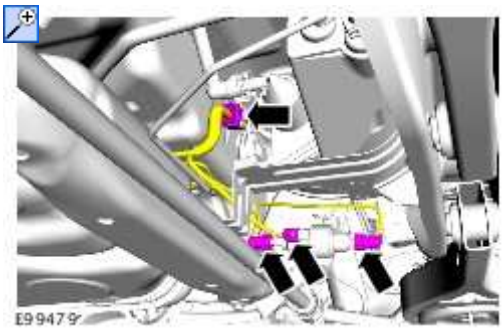


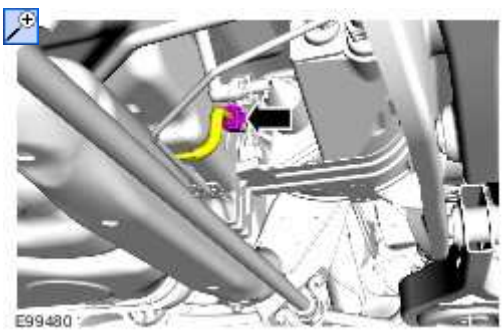
12.

Vehicles with fuel fired booster heater

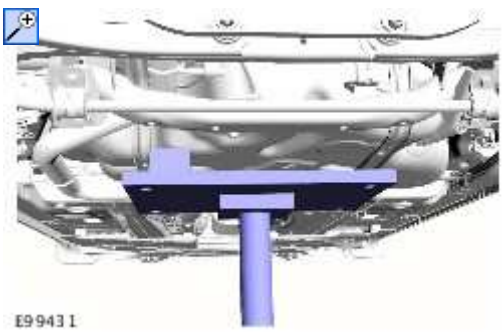


13. WARNING: Be prepared to collect escaping fluid.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles



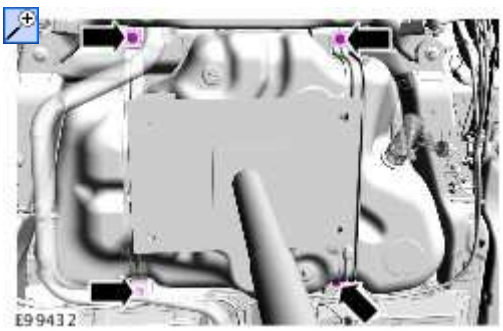
14.



15. CAUTIONS:

Use suitable packing material to prevent damage to the component.

Make sure that no strain is placed on the fuel lines and wiring harnesses.
General Equipment: Transmission jack
General Equipment: Wooden Block



16. *Torque:* 24 Nm

17. *General Equipment:* Retaining Strap

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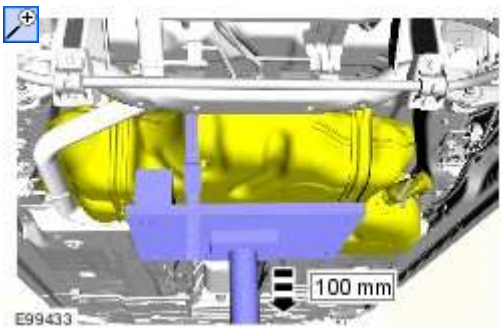
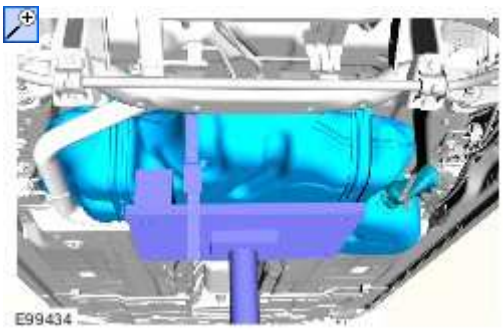
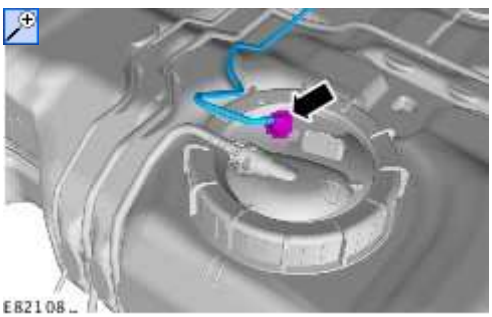


General Equipment: Wooden Block



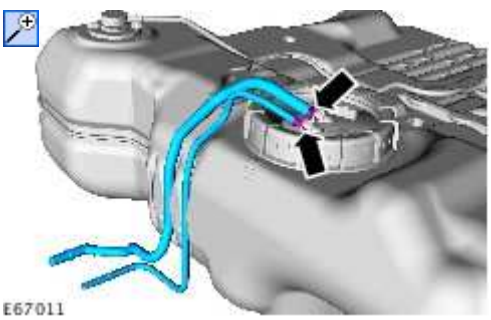
18.

Vehicles with fuel fired booster heater



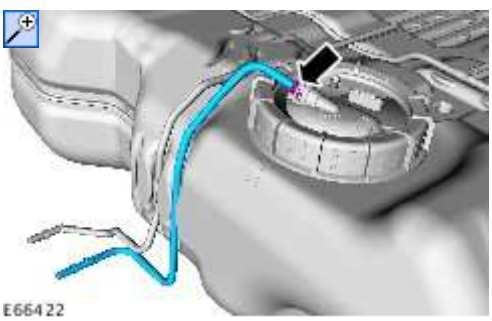
19. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine



20. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All except vehicles with diesel engine



21. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles

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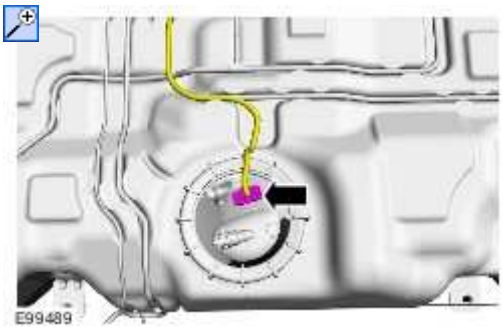

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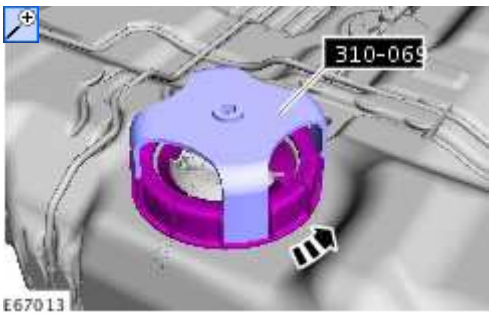
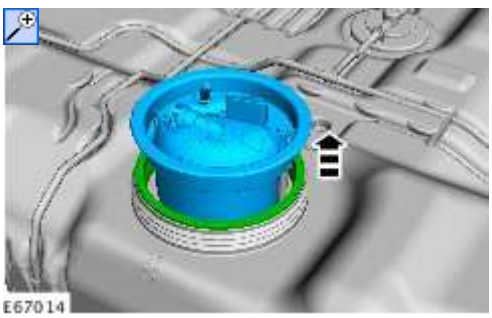


23. *Special Tool(s):* 310-069
Torque: 85 Nm

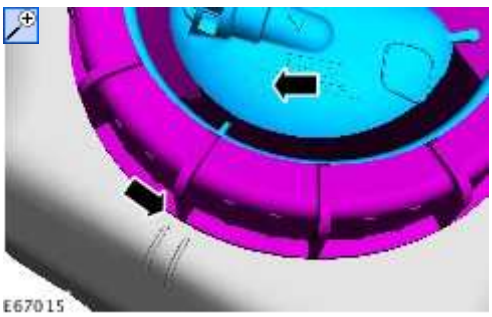


24. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

25. Drain the fuel tank.

General Equipment: Fuel tank draining equipment

Installation



1. To install, reverse the removal procedure.

2. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
NOTE: Make sure that the seal is correctly located.
NOTE: Make sure that the installation marks are aligned.

Vehicles with diesel engine

3. Refer to: Fuel System Bleeding - 1.8L Duratorq-TDCi (Lynx) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.2L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General

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Information, General Procedures).

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Removal and Installation

Removal

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

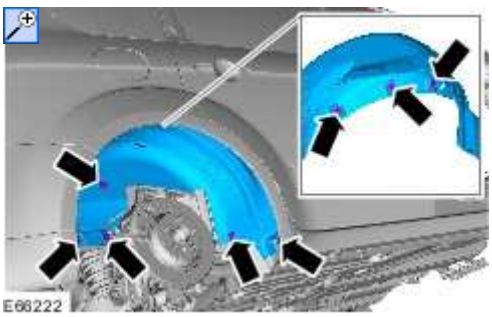
NOTE: Removal steps in this procedure may contain installation details.

2. Drain the fuel tank.

   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the right-hand rear wheel and tire.

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



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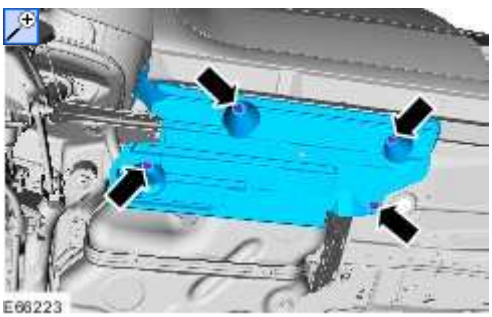
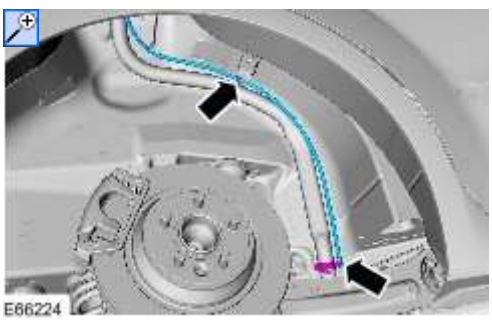


5. *Torque:* 10 Nm



6.

7. NOTE: Note the orientation of the clamp to aid installation.
   1. *Torque:* 10 Nm

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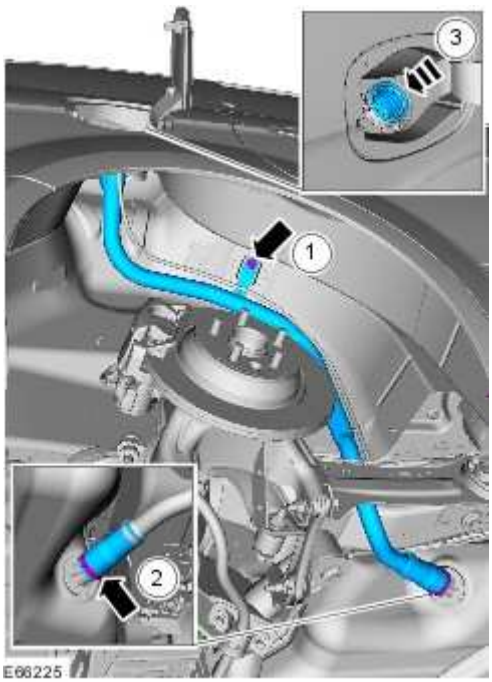

2. Discard the fuel tank filler pipe clamp.

Installation

NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that the clamp is installed to the same orientation as when removed.

1. To install, reverse the removal procedure.

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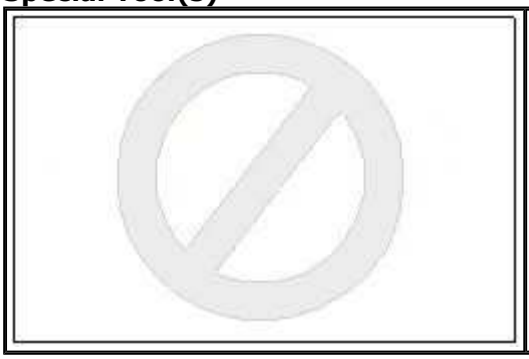
Removal and Installation

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit

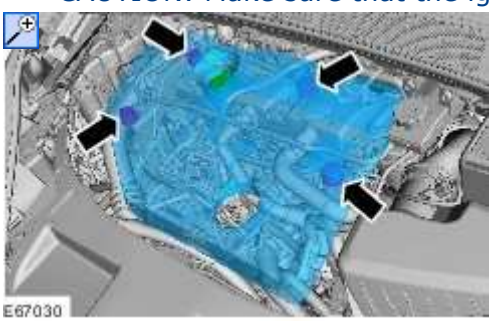
General Equipment

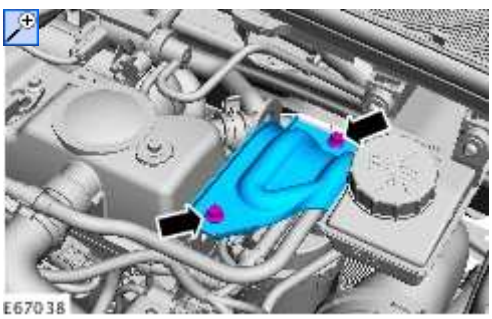
Fluid container

Removal

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

CAUTION: Make sure that the ignition key is removed.

2. 

3. 

4. Clean the fuel filter, fuel supply lines and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

5. CAUTION: Make sure that all openings

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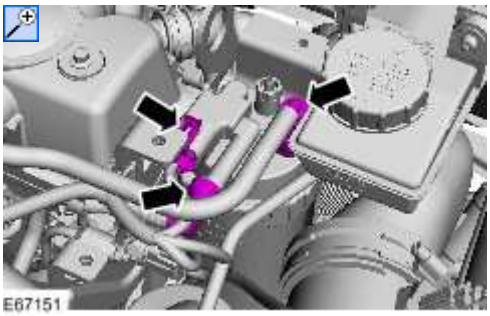
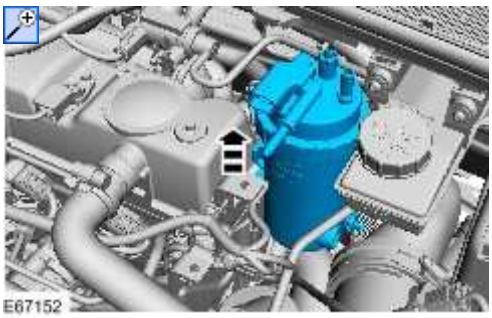
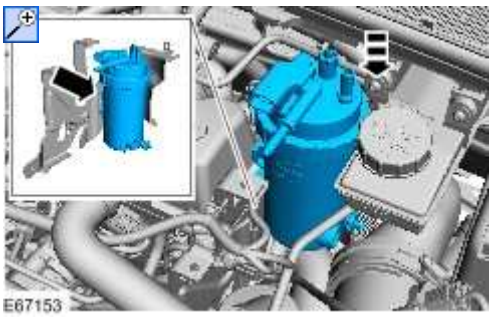


are sealed. Use new blanking caps.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

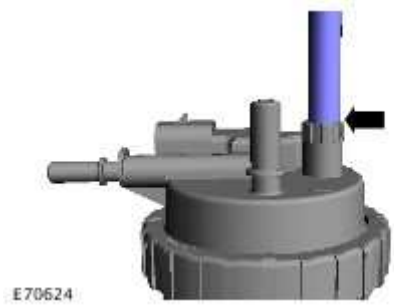


6.

Installation

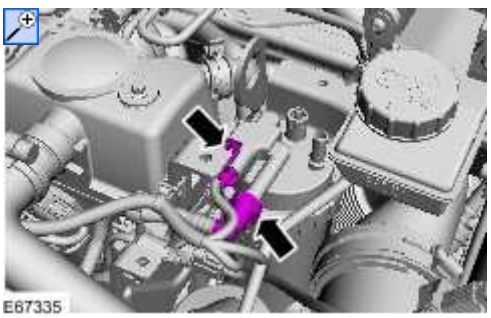


1.



2. Using a suitable length of fuel resistant tube.

   General Equipment: Fluid container



3. Discard the blanking caps.

   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

4. *Special Tool(s):* 310-110A

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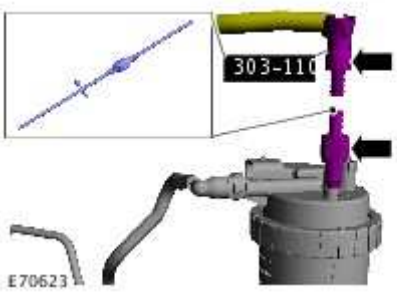
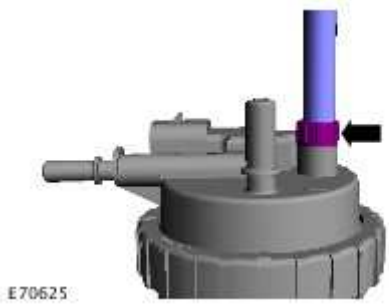
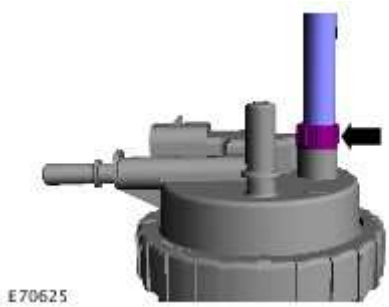


5. Loosen the fuel filter bleed screw (special tool shown removed for clarity).

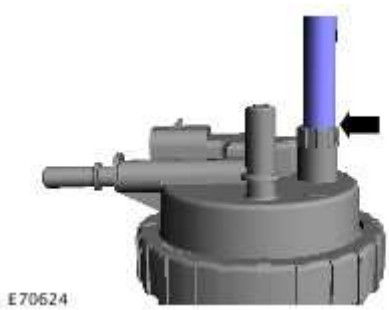


6. Operate the hand pressure pump at least 30 times.
7. Tighten the fuel filter bleed screw finger tight (special tool shown removed for clarity).



8. Remove the length of fuel resistant tube and fluid container (special tool shown removed for clarity).

   General Equipment: Fluid container



9. Operate the hand pressure pump a further 30 times to prime the fuel pump.
10. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
    Start the engine and allow it to idle until it reaches normal operating temperature.
11. Stop the engine.
12. *Special Tool(s):* 310-110A

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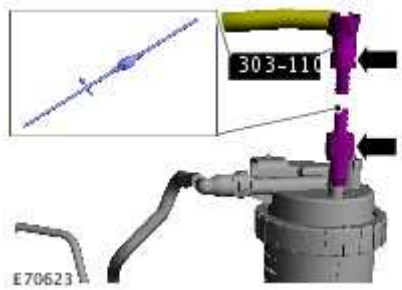
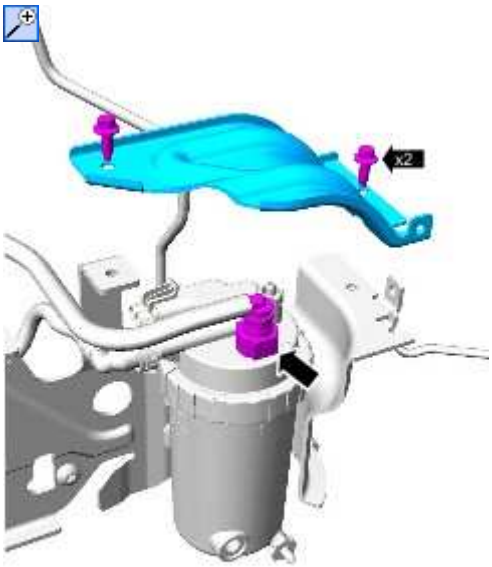
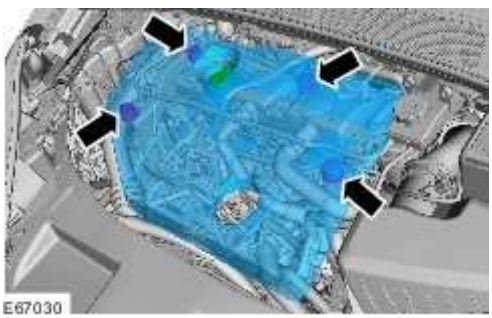




13. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
Torque: 9 Nm



14.

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Removal and Installation

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit

General Equipment

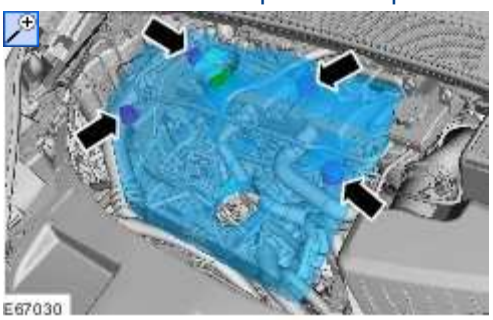
Fluid container

Removal

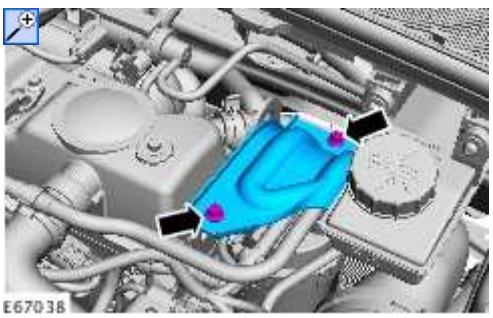
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

CAUTION: Make sure that the ignition key is removed.

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



2.



3.

4. Drain the fuel filter.

   General Equipment: Fluid container

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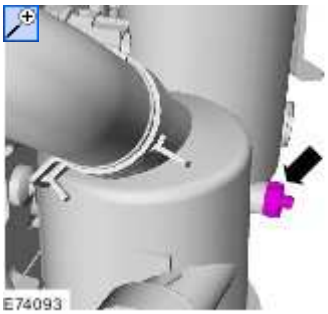
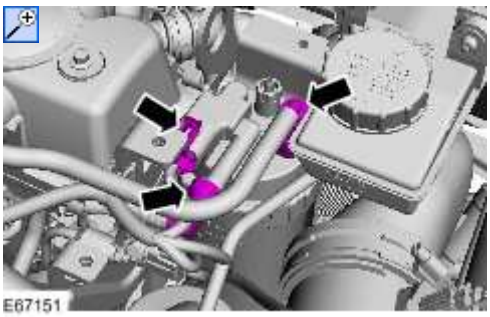
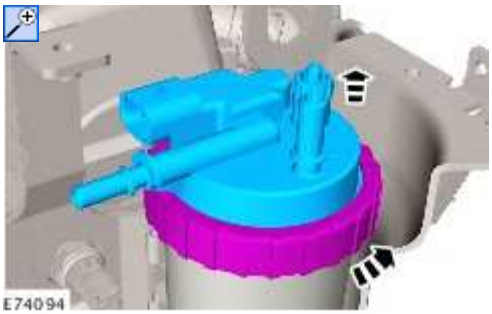


5. Clean the fuel filter, fuel supply lines and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04D Fuel Charging and Controls - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).



6. CAUTION: Make sure that all openings are sealed. Use new blanking caps.
   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



7.

8.

Installation

1.

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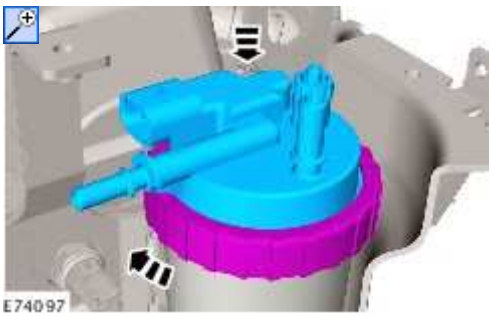
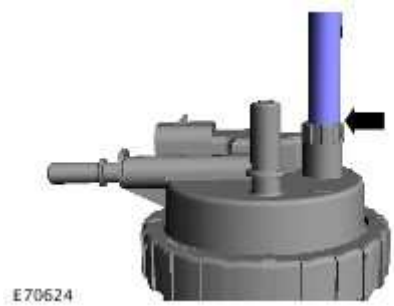


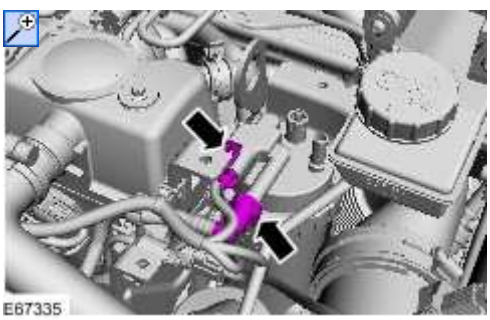
2.

3. NOTE: Make sure that the installation marks are aligned.



4. Using a suitable length of fuel resistant tube.

   General Equipment: Fluid container



5. Discard the blanking caps.

   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

6. *Special Tool(s):* 310-110A

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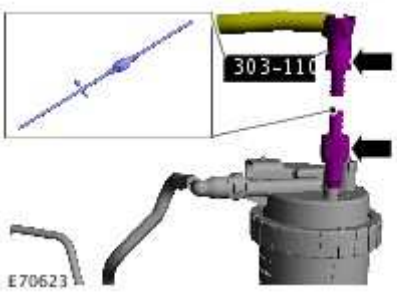
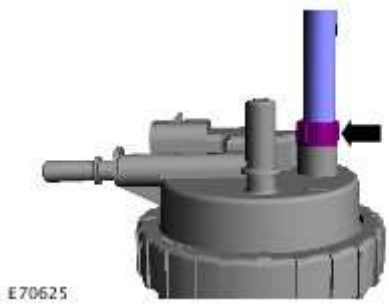
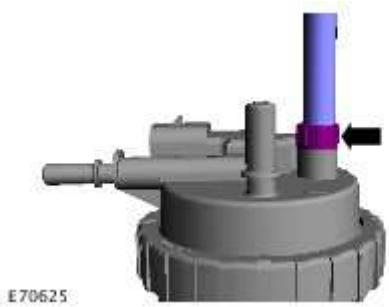




7. Loosen the fuel filter bleed screw (special tool shown removed for clarity).

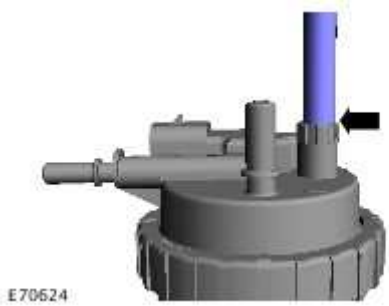
8. Operate the hand pressure pump at least 30 times.

9. Tighten the fuel filter bleed screw finger tight (special tool shown removed for clarity).



10. Remove the length of fuel resistant tube and fluid container (special tool shown removed for clarity).

    General Equipment: Fluid container



11. Operate the hand pressure pump a further 30 times to prime the fuel pump.

12. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
    Start the engine and allow it to idle until it reaches normal operating temperature.

13. Stop the engine.

14. *Special Tool(s):* 310-110A

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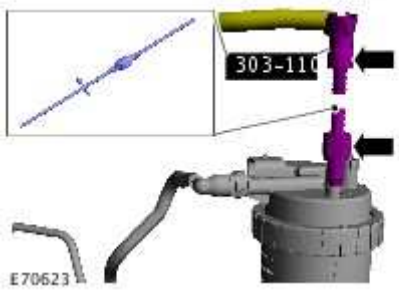
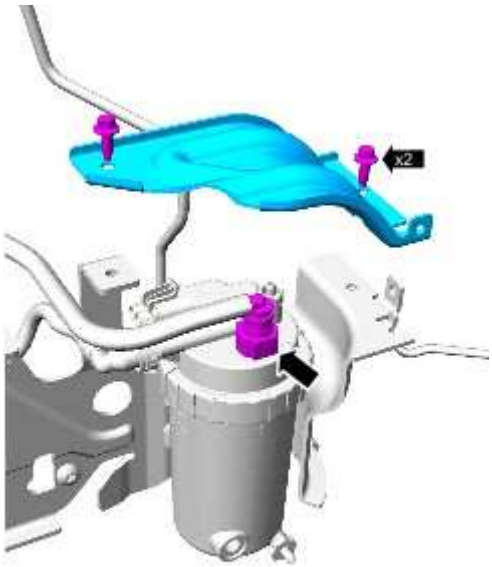


15. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
Torque: 9 Nm



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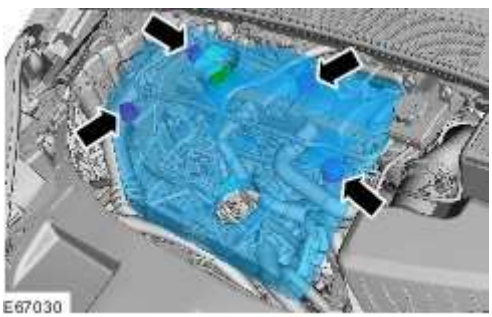

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

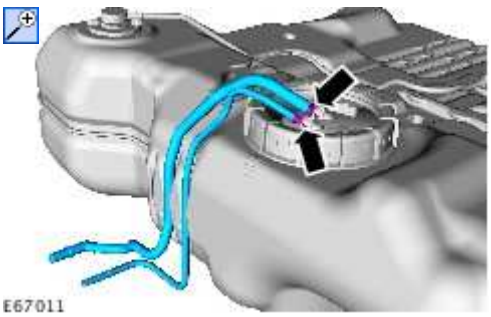
Removal

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

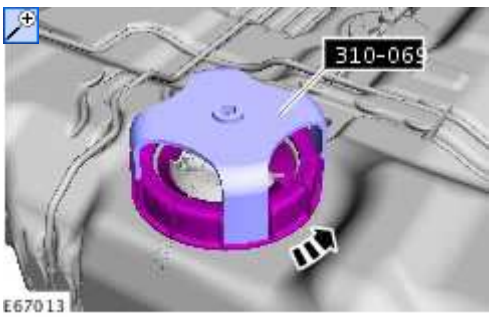
NOTE: Removal steps in this procedure may contain installation details.

2. Remove the fuel tank.

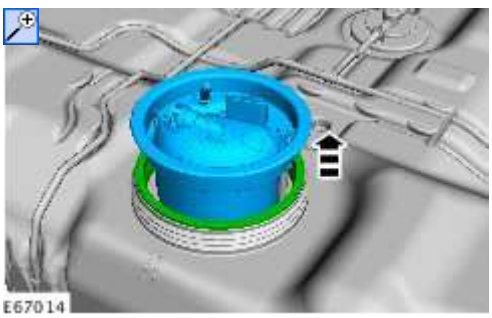
   Refer to: Fuel Tank (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



4. *Special Tool(s):* 310-069
   Torque: 85 Nm



5. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

Installation

1. CAUTION: Take extra care not to

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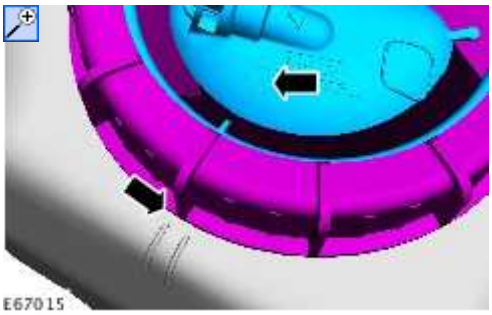

damage the fuel tank level sensor float and arm.
NOTE: Make sure that the seal is correctly located.
NOTE: Make sure that the installation marks are aligned.

2. To install, reverse the removal procedure.

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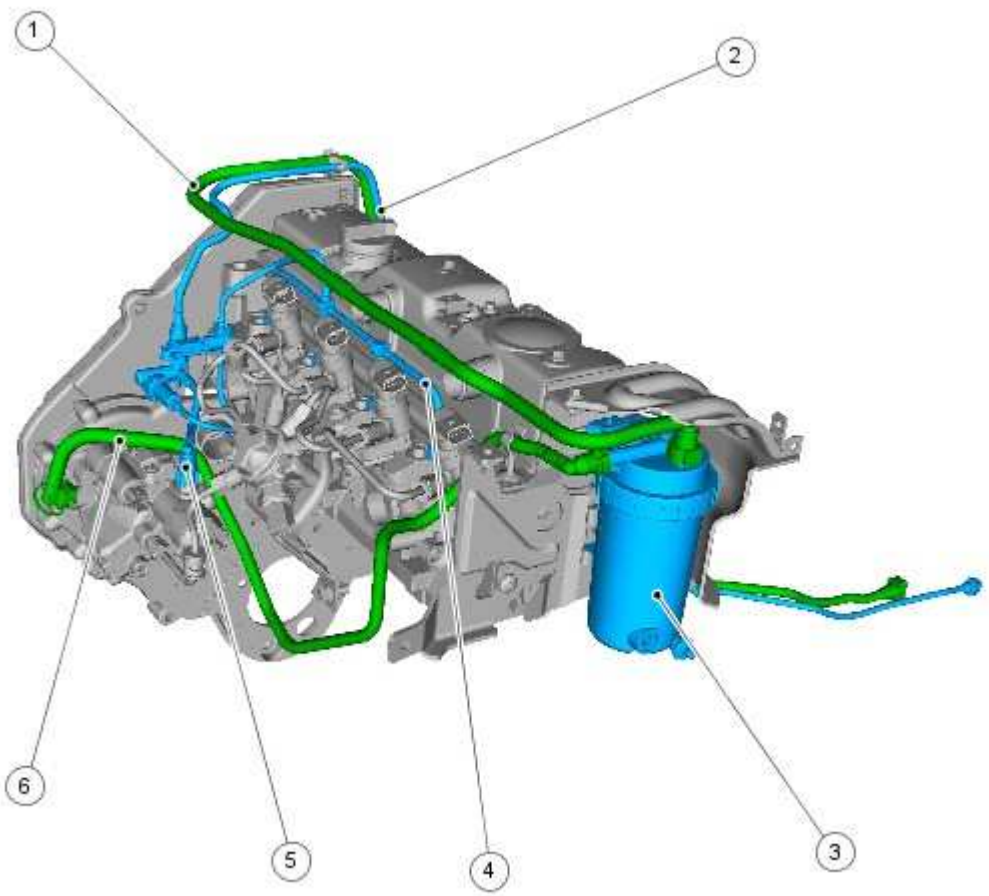
Description and Operation

General overview

Vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine



E65337

Item	Part Number	Description
1	-	Fuel filter fuel supply line
2	-	Fuel return line
3	-	Fuel filter
4	-	Fuel injector fuel return lines
5	-	Fuel pump fuel return line
6	-	Fuel filter to fuel pump fuel supply line

Vehicles with 2.0L Duratorq-TDCi (DW) diesel engine

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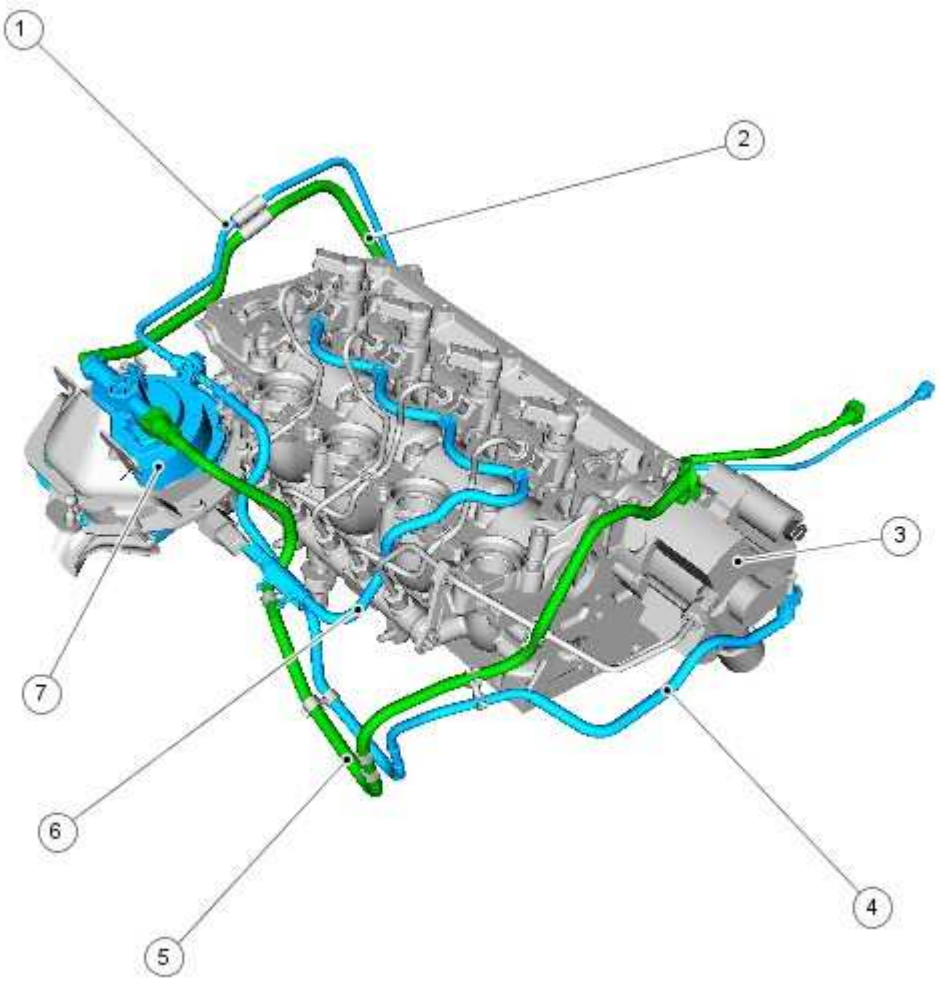

E65362

Item	Part Number	Description
1	-	Fuel return line
2	-	Fuel filter fuel supply line
3	-	Fuel pump
4	-	Fuel pump fuel return line
5	-	Fuel pump fuel supply line
6	-	Fuel injector fuel return line
7	-	Fuel filter

All vehicles

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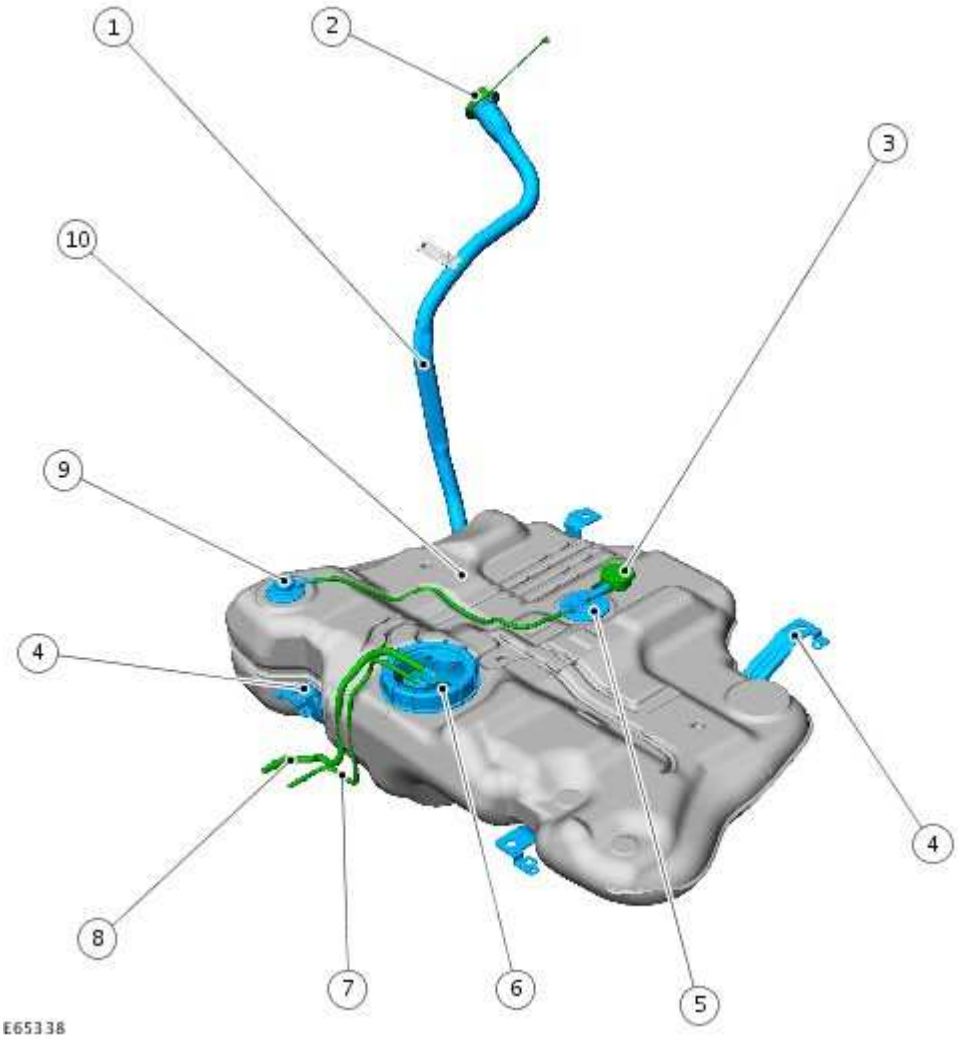

Item	Part Number	Description
1	-	Fuel tank filler pipe
2	-	Fuel tank filler pipe cap
3	-	Fill limit vent valve dust filter
4	-	Fuel tank support strap(s)
5	-	Fill limit vent valve
6	-	Fuel level sensor
7	-	Fuel return line
8	-	Fuel supply line
9	-	Fuel tank vent valve
10	-	Fuel tank

The fuel tank holds approximately 70 liters of usable fuel and is of a plastic construction. It is retained to the vehicle by means of two steel support straps, the fuel tank supports straps are secured by four retaining bolts onto the underside of the vehicle chassis.

Fuel tank ventilation is achieved by one fuel tank vent valve and a fill limit vent valve ventilating directly to atmosphere. The fuel tank vent valve will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Fuel lines

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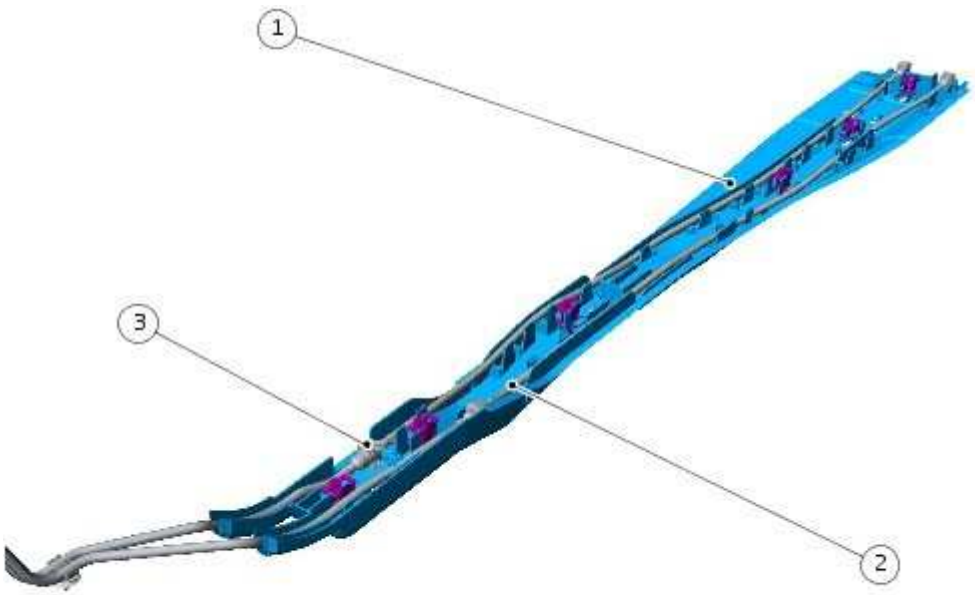

E66226

Item	Part Number	Description
1	-	Fuel line cover
2	-	Fuel return line
3	-	Fuel supply line

The fuel supply and return lines are constructed from PA nylon tubes and are retained by clips which are made of plastic. The fuel lines are protected under the vehicle by a plastic cover, which is clipped to welded studs.

Within the engine compartment, some fuel lines are produced from steel for improved robustness.

The fuel supply and return lines are separated into three sections. The fuel line connections have quick release couplings at each end to secure them to the fuel tank lines and front end fuel lines.
For additional information, refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Fuel level sensor

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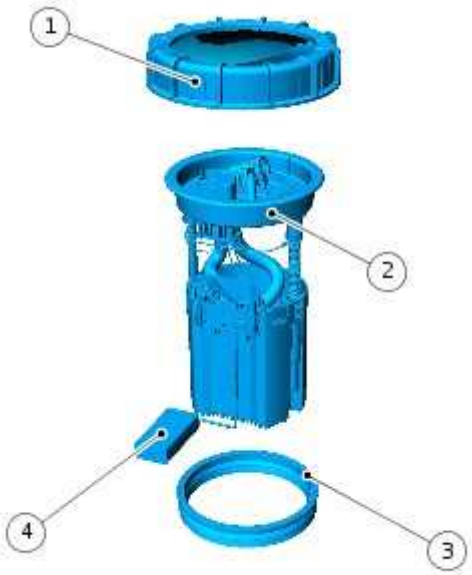
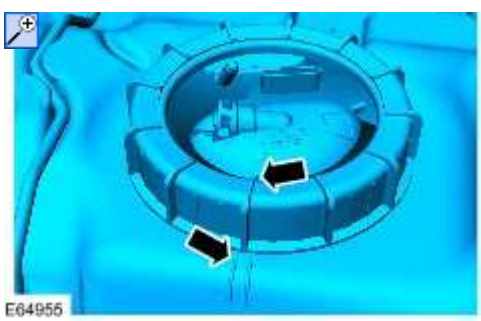


E65339

Item	Part Number	Description
1	-	Fuel tank locking ring
2	-	Fuel level sensor
3	-	Fuel level sensor seal
4	-	Fuel tank level sensor float and arm

The fuel level sensor is located in the top of the fuel tank and retained by a re-usable fuel tank locking ring. The fuel level sensor seal must not be re-used once removed from the fuel tank.

The fuel level sensor is equipped with a fuel tank sender unit. The fuel tank sender unit consists of a mechanical float and a potentiometer. The potentiometer measures the fuel level using a float and communicates directly with the fuel gauge in the instrument cluster informing the driver the amount of fuel that is currently in the fuel tank.



E64956

CAUTION: Make sure that the fuel tank level sensor float and arm are not damaged during the installation.
NOTE: Make sure that the installation marks are aligned.
The fuel tank must be completely removed from the vehicle before the fuel level sensor unit can be removed.
For additional information, refer to: Fuel Tank (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

Installation of a new fuel level sensor may not solve fuel indication issues which may occur during the vehicles life time.

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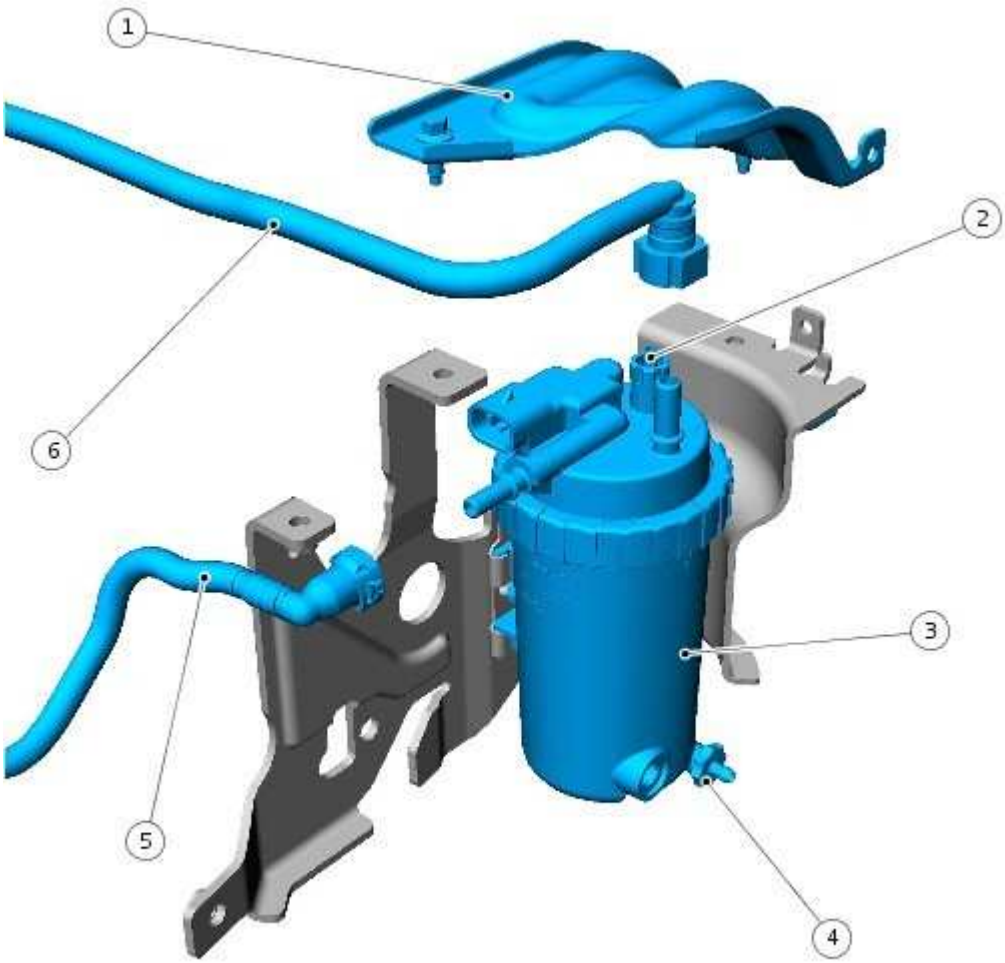
Fuel filter - vehicles with 1.8L Duratorq-TDCi (Kent) diesel engine



E65340

Item	Part Number	Description
1	-	Fuel filter top shield
2	-	Fuel filter bleed screw
3	-	Fuel filter housing
4	-	Fuel filter drain screw
5	-	Fuel filter fuel supply line
6	-	Fuel filter to fuel pump fuel supply line

The 1.8L Duratorq-TDCi (Kent) diesel engine fuel filter is located above the transmission and is attached to the cylinder head by means of a fuel filter retaining bracket. The fuel filter has an electric fuel heater which is located next to the fuel pump fuel supply line.

When the fuel temperature is below 15ºC, a valve inside the fuel filter opens, allowing fuel which is pre-heated by the fuel pump to be recirculated back through the fuel filter to the fuel pump. This aids engine performance during warm-up.

Fuel is delivered through the fuel supply line to the fuel filter. The fuel filter cleans the fuel of water and contaminants. Unused fuel is returned to the fuel tank through the fuel pump fuel return line.

When a new fuel filter has been installed it must be bled using a hand pressure pump. Make sure that the arrows indicating the direction of fuel flow is pointing towards the fuel filter. For additional information, refer to: Fuel Filter (310-01B Fuel Tank and Lines - 1.8L

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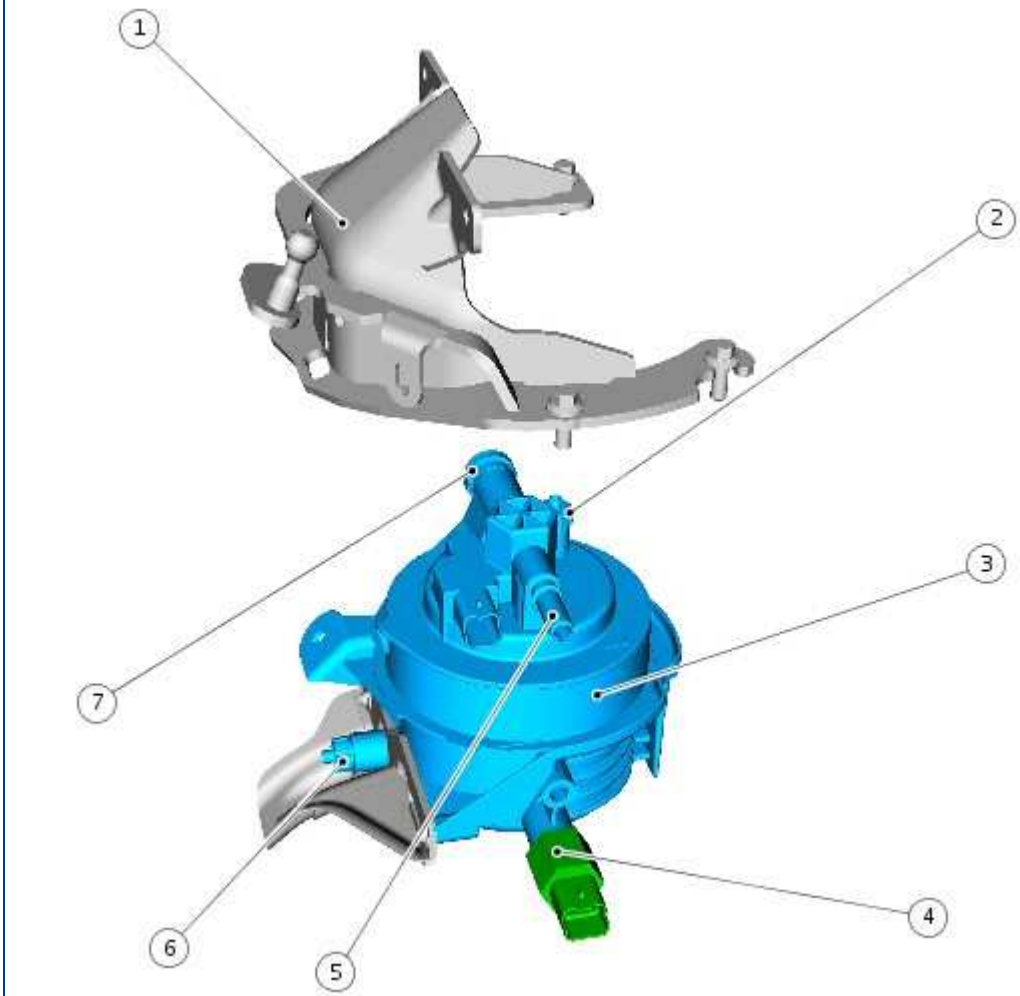
Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).

Fuel filter - vehicles with 2.0L Duratorq-TDCi (DW) diesel engine



E65363

Item	Part Number	Description
1	-	Fuel filter crash protection top shield
2	-	Fuel filter bleed screw
3	-	Fuel filter housing
4	-	Water in fuel sensor
5	-	Fuel filter to fuel pump fuel supply line union
6	-	Fuel filter drain screw
7	-	Fuel filter fuel supply line union

The 2.0L Duratorq-TDCi (DW) diesel engine fuel filter is located above the generator and is attached to the cylinder head by means of a fuel filter retaining bracket, a fuel filter splash shield and a fuel filter crash protection shield are mounted to the retaining bracket. The fuel filter has an electric fuel heater which is located next to the fuel filter inlet pipe.

When the temperature is below 15ºC, a valve inside the fuel filter opens allowing fuel which is pre-heated by the fuel pump to be recirculated back through the fuel filter to the fuel pump. This aids engine performance during warm up.

Fuel is delivered through the fuel supply lines to the fuel filter. The fuel filter cleans the fuel of water and contaminants. Unused fuel is returned to the fuel tank through the fuel pump

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return line.

The fuel filter is also equipped with a water-in-fuel sensor which is located at the base of the fuel filter housing. This sensor measures the amount of water which has collected in the fuel filter element. If the quantity of water present is greater than 90 ml then a warning indicator located on the instrument cluster is illuminated and the fuel filter element should then be drained of water.

When a new fuel filter has been installed it must be bled using a hand pressure pump. Make sure that the arrows indicating the direction of fuel flow is pointing towards the fuel filter. For additional information, refer to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).

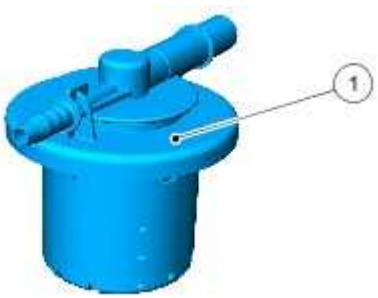
Fuel tank vent valve

E64953

Item	Part Number	Description
1	-	Fuel tank vent valve

Fuel tank ventilation is achieved by a fuel tank vent valve and the fuel limit vent valve, which is installed into the top of the fuel tank and will prevent fuel loss from the fuel tank if the vehicle becomes inverted.

Fill limit vent valve



E64952

Item	Part Number	Description
1	-	Fill limit vent valve

The fill limit vent valve is an intermediate ventilation valve between the fuel tank vent valve and the atmosphere.

The fill limit vent valve allows the fuel tank to be filled to its maximum, by expelling the air within the fuel tank to atmosphere.

The fill limit vent valve also acts as a fuel tank breather with a dust filter. If this dust filter becomes blocked or restricted during the vehicle's lifetime, problems will be experienced with draining the fuel tank. Also there could be a possibility of fuel tank deformation if the dust filter is blocked.

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Print

Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

General Equipment

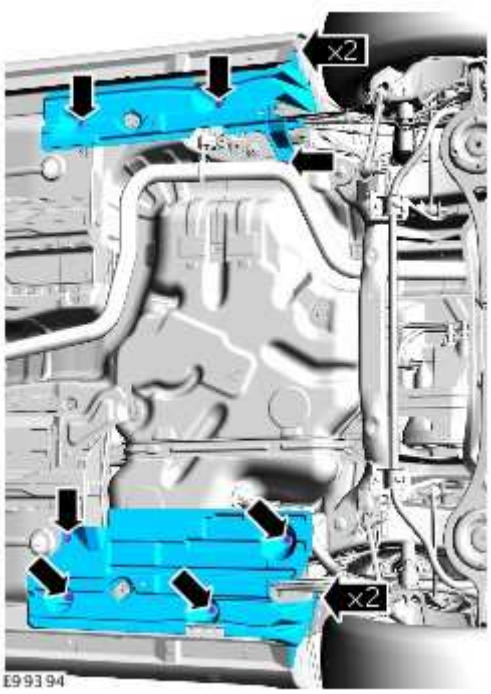
Fuel tank draining equipment
Hose clamp(s)
Hose clamp remover/installer
Retaining Strap
Transmission jack
Wooden Block

Removal

All vehicles

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. *Torque:* 10 Nm



Vehicles with 2.5L engine

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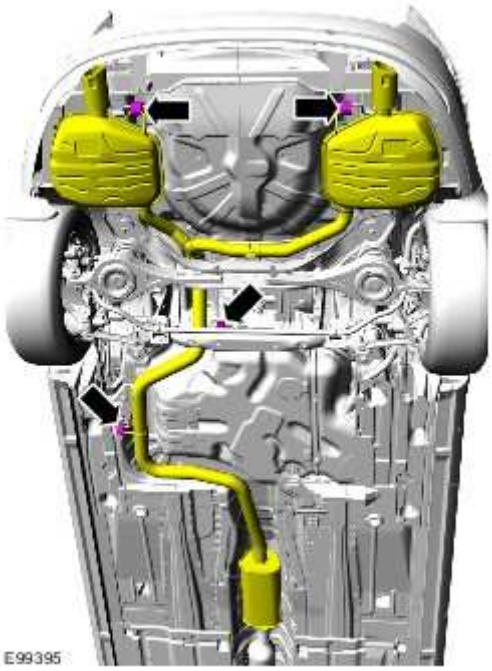
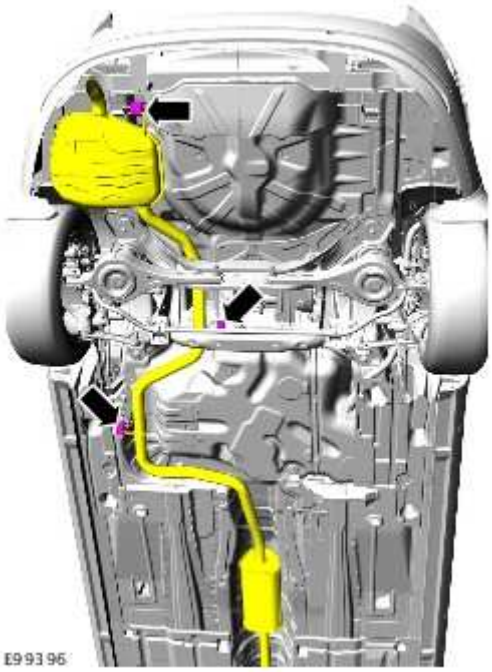
4.



All vehicles

5.



6.

CAUTION: Take extra care when handling the components.
Torque: 5 Nm

7. NOTE: Make sure that a new clamp is installed.

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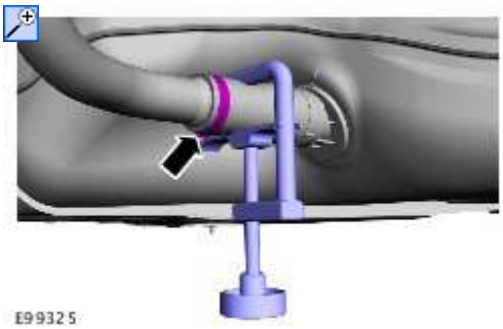
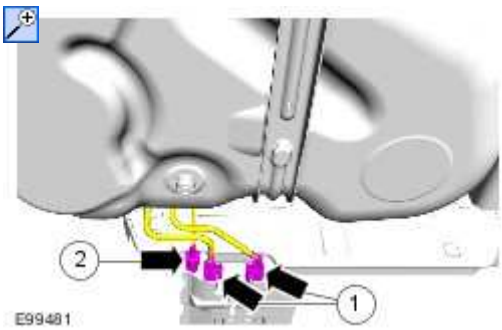


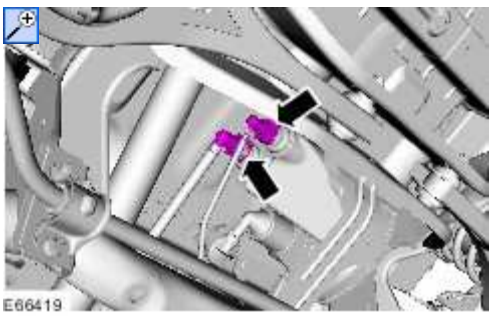
NOTE: Make sure that the clamp is installed to the same orientation as when removed.
General Equipment: Hose clamp(s)

8. WARNING: Be prepared to collect escaping fluid.
NOTE: Make sure that a new component is installed.
General Equipment: Hose clamp remover/installer



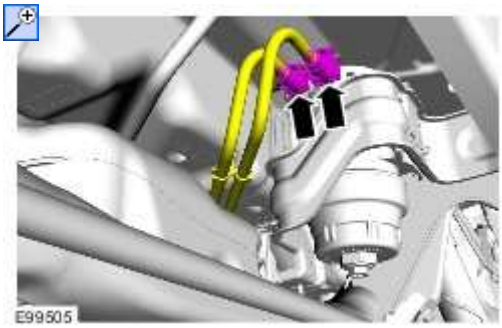
9. WARNING: Be prepared to collect escaping fluid.
    1. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
    2. If equipped.

All except vehicles with diesel engine



10. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.0L diesel engine



11. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine

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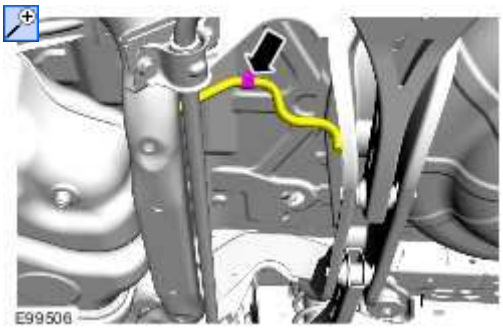
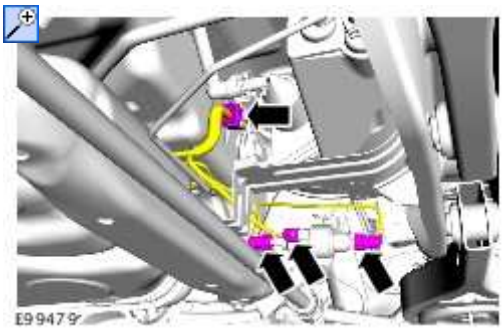


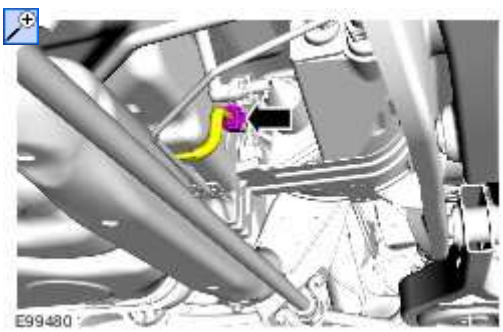
12.

Vehicles with fuel fired booster heater

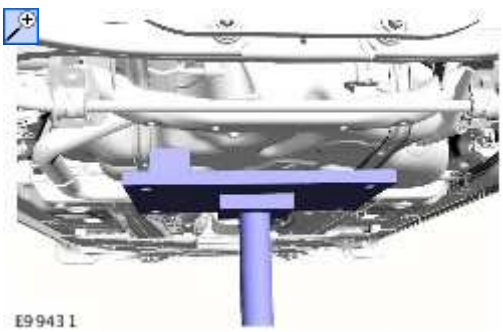


13. WARNING: Be prepared to collect escaping fluid.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles



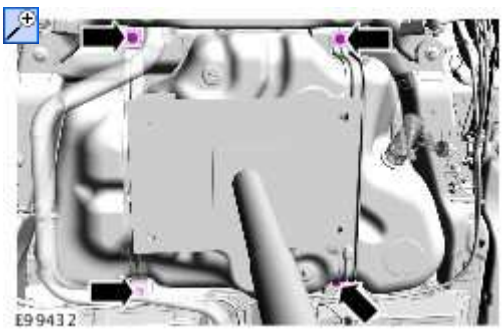
14.



15. CAUTIONS:

Use suitable packing material to prevent damage to the component.

Make sure that no strain is placed on the fuel lines and wiring harnesses.
General Equipment: Transmission jack
General Equipment: Wooden Block



16. *Torque:* 24 Nm

17. *General Equipment:* Retaining Strap

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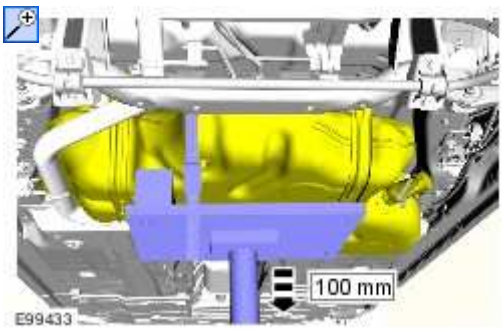
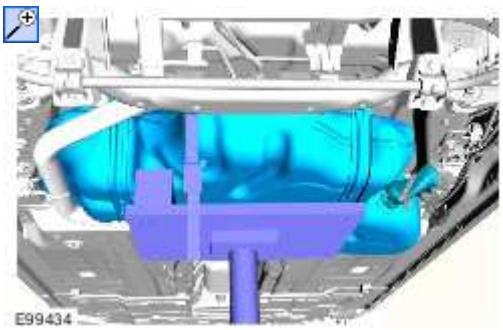
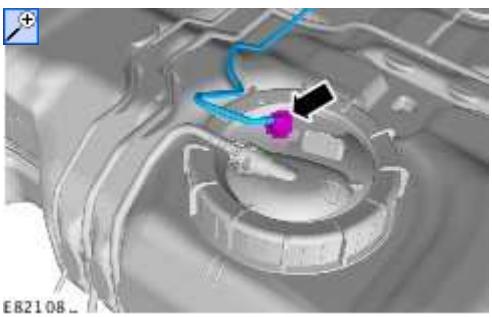


General Equipment: Wooden Block



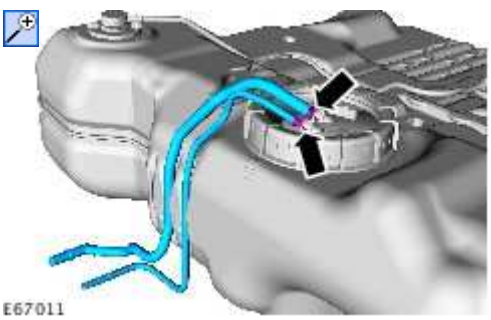
18.

Vehicles with fuel fired booster heater



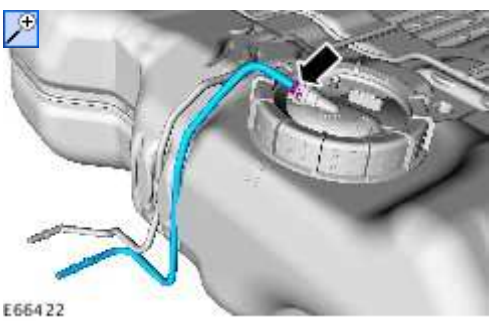
19. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine



20. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All except vehicles with diesel engine



21. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles

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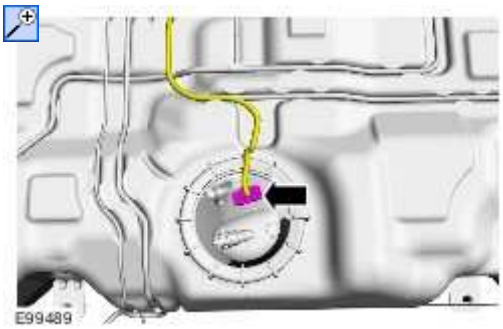
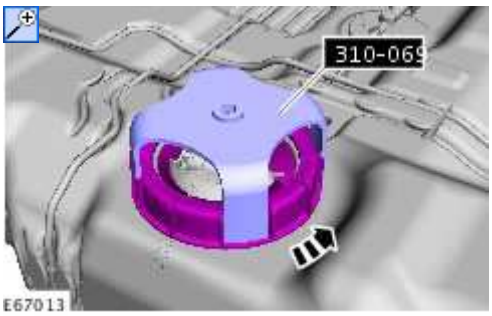
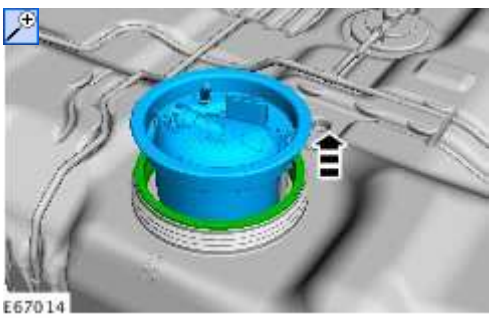


22.



23. *Special Tool(s):* 310-069
Torque: 85 Nm

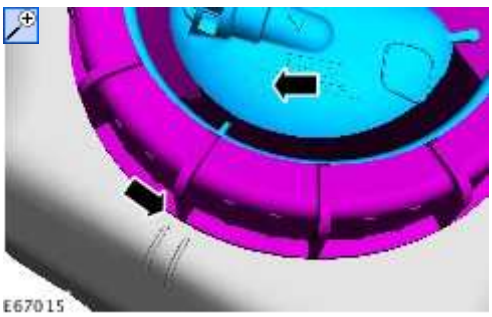


24. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

25. Drain the fuel tank.

General Equipment: Fuel tank draining equipment

Installation



1. To install, reverse the removal procedure.

2. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
NOTE: Make sure that the seal is correctly located.
NOTE: Make sure that the installation marks are aligned.

Vehicles with diesel engine

3. Refer to: Fuel System Bleeding - 1.8L Duratorq-TDCi (Lynx) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.2L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General

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Information, General Procedures).

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Removal and Installation

Removal

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

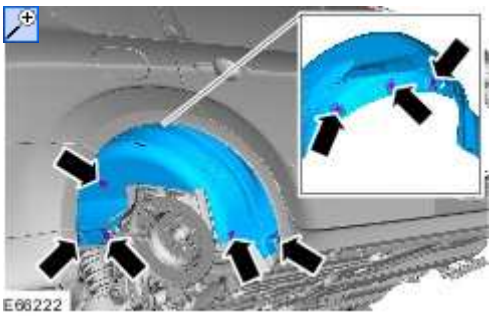
NOTE: Removal steps in this procedure may contain installation details.

2. Drain the fuel tank.

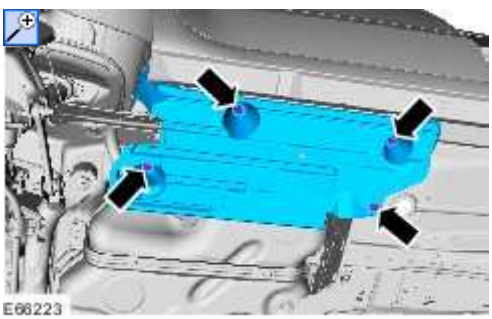
   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the right-hand rear wheel and tire.

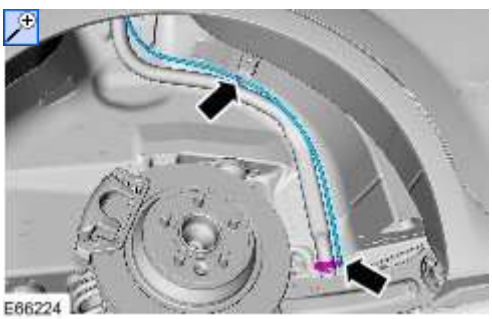
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4.



5. *Torque:* 10 Nm



6.

7. NOTE: Note the orientation of the clamp to

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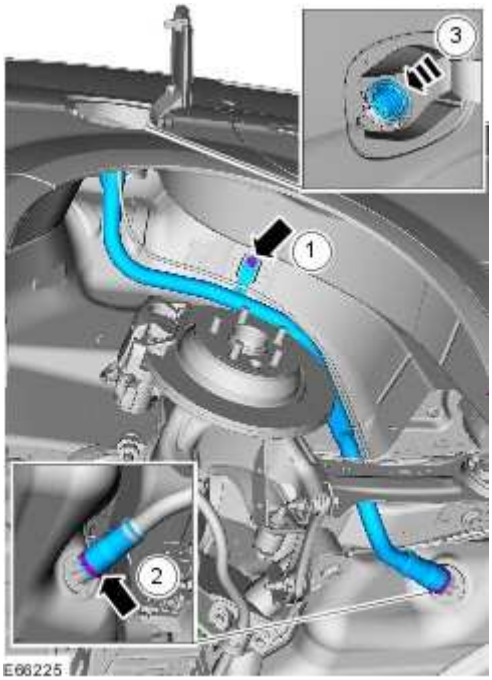

aid installation.

1. *Torque:* 10 Nm
2. Discard the fuel tank filler pipe clamp.

Installation

NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that the clamp is installed to the same orientation as when removed.

1. To install, reverse the removal procedure.

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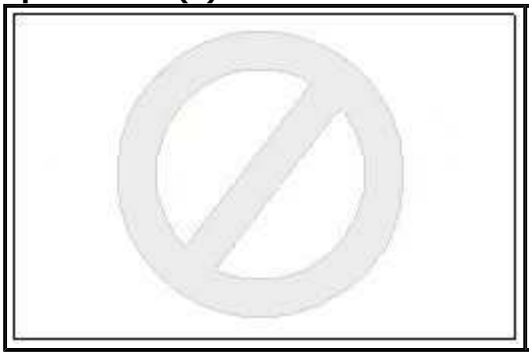
Removal and Installation

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit

General Equipment

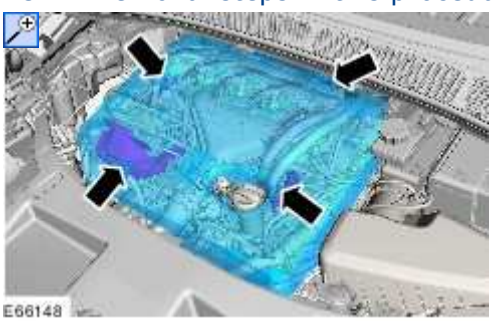
Fluid container

Removal

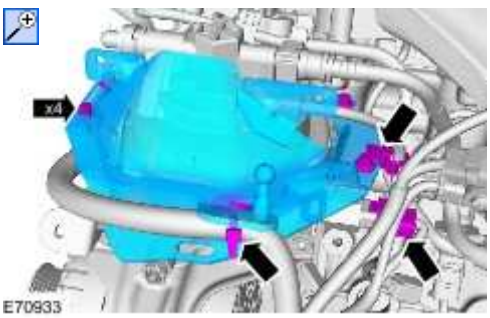
1. Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

CAUTION: Make sure that the ignition key is removed.

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



2.



3.

4. CAUTION: Use lint free cloth.
   Protect the generator to prevent contamination.
5. Using a suitable length of fuel resistant tube, drain the fuel filter.

   General Equipment: Fluid container

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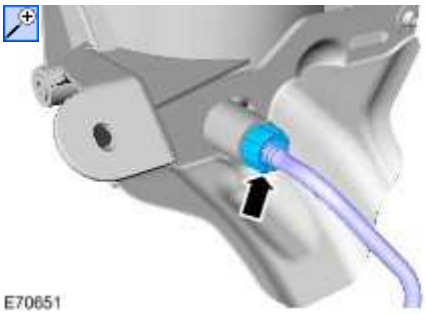
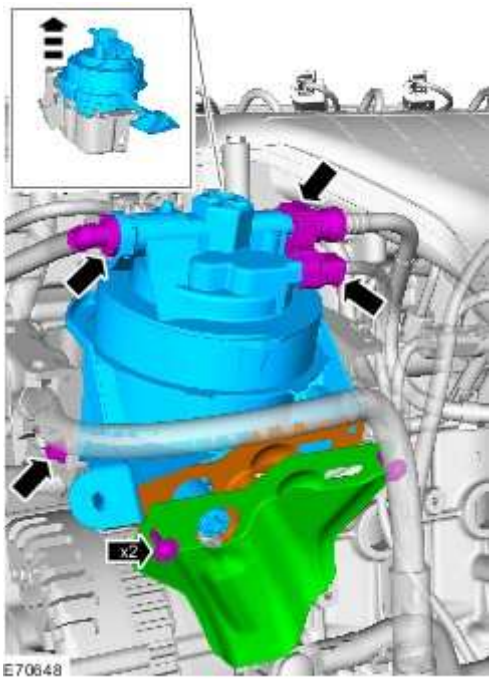


6. Clean the fuel filter and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, General Procedures).



7. CAUTION: Make sure that all openings are sealed. Use new blanking caps.
   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Installation

1. Discard the blanking caps.

   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
   Torque: 10 Nm

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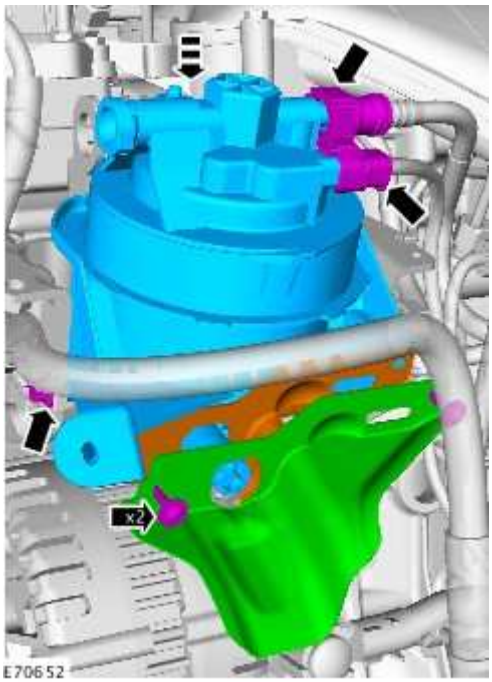
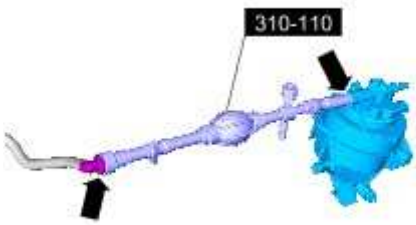


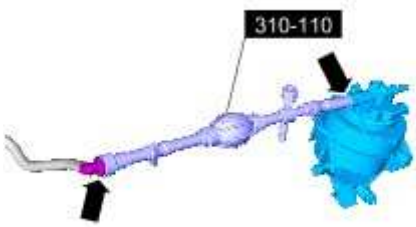
E70652

2. *Special Tool(s):* 310-110A



E70649

3. Operate the hand pressure pump at least 30 times.
4. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
   Start the engine and allow it to idle until it reaches normal operating temperature
5. Stop the engine.
6. *Special Tool(s):* 310-110A



E70649

7. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

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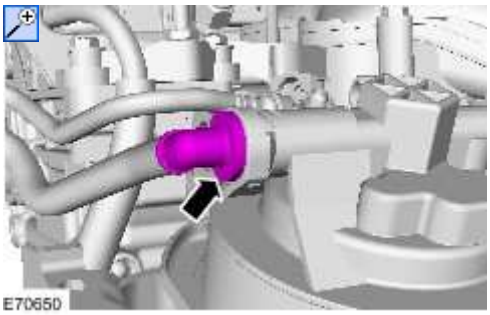
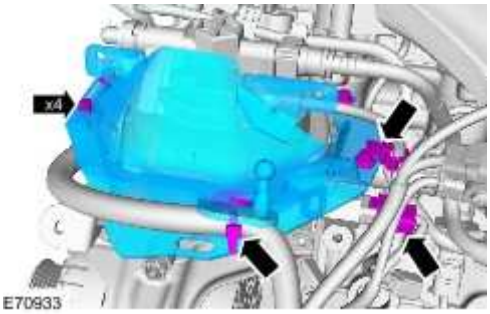
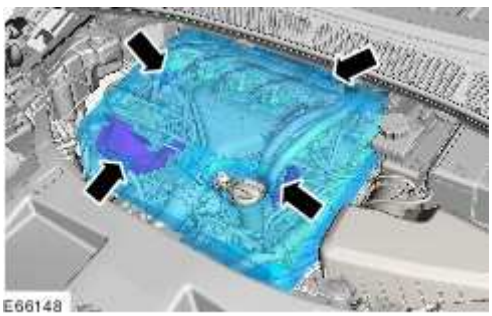


8. Remove the lint-free cloth.
9. *Torque:* 9 Nm





10.

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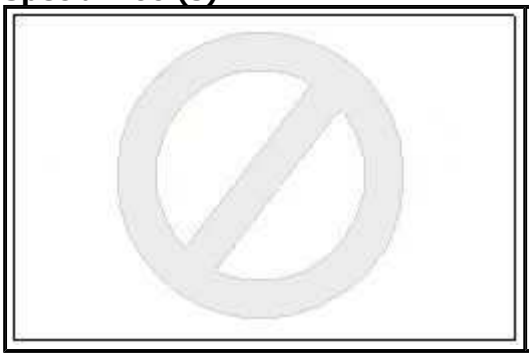
Removal and Installation

Special Tool(s)

	310-110A Hand Pressure Pump with Adapter Kit

General Equipment

Fluid container

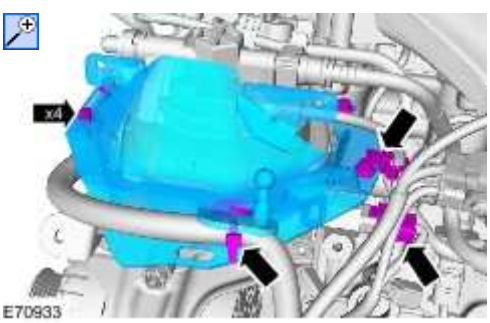
Removal

WARNING: Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

CAUTION: Make sure that the ignition key is removed.

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

1.



2.

3. CAUTION: Use lint free cloth.
   Protect the generator to prevent contamination.
4. Using a suitable length of fuel resistant tube, drain the fuel filter.

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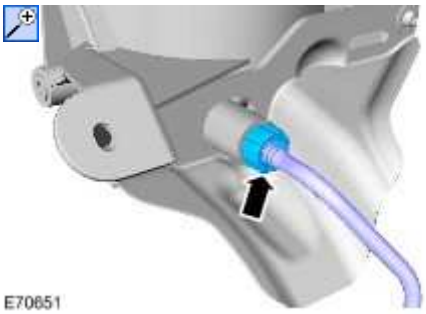
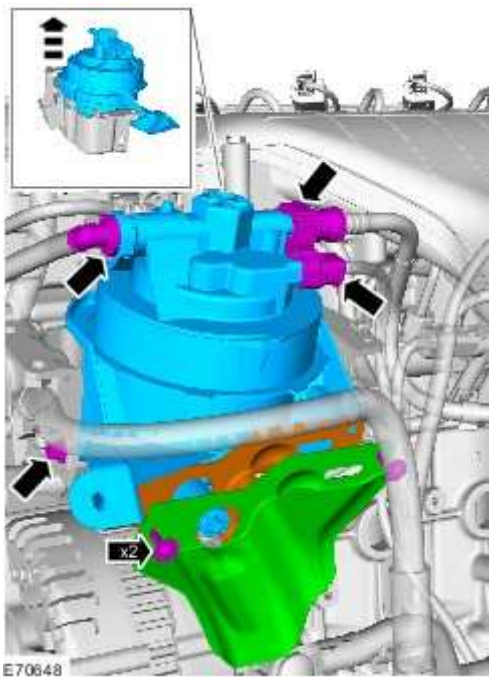

E70651

General Equipment: Fluid container

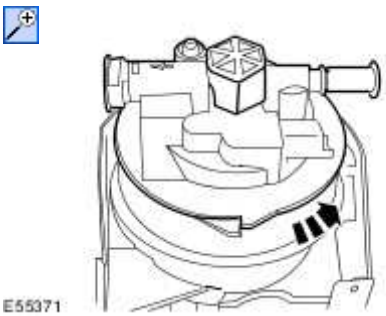
5. Clean the fuel filter and surrounding areas.

   Refer to: Fuel Injection Component Cleaning (303-04E Fuel Charging and Controls - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, General Procedures).



E70648

6. CAUTION: Make sure that all openings are sealed. Use new blanking caps.
   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).


E55371

7.

8.

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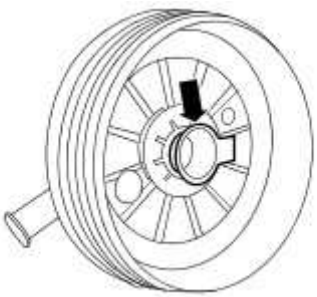
E55372

9.



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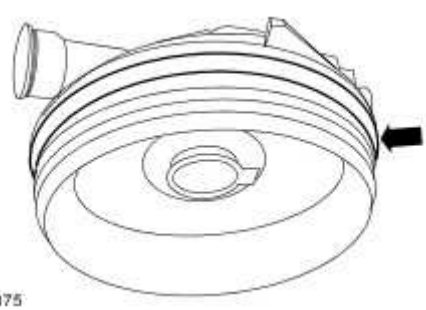
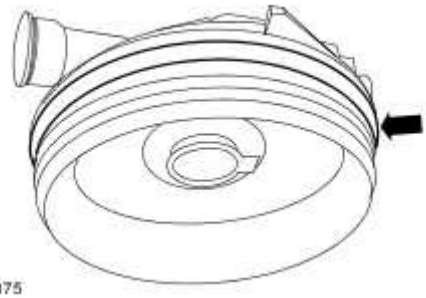


E55375

Installation

1.



E55375

2.

E55374

3.

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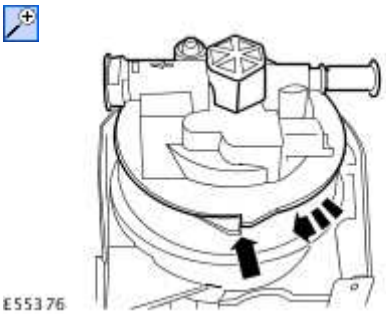
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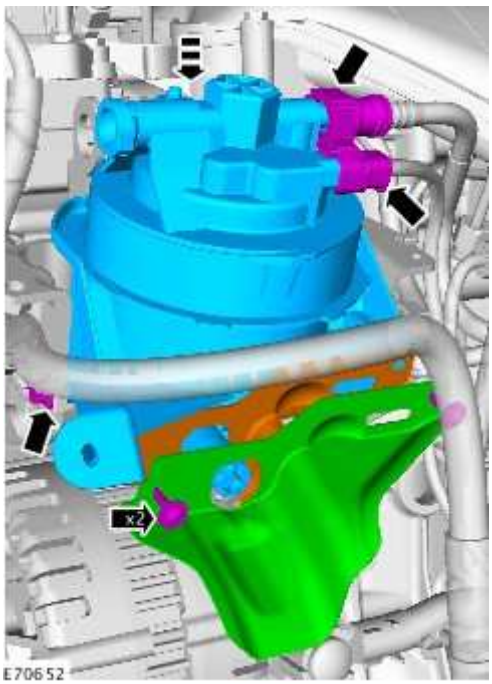
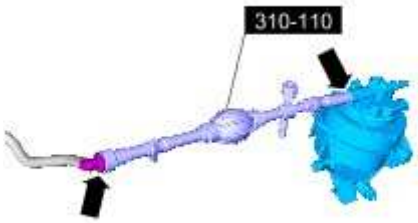


E70652

4. Discard the blanking caps.

   Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
   Torque: 10 Nm



E70649

5. *Special Tool(s):* 310-110A

6. Operate the hand pressure pump at least 30 times.

7. CAUTION: The starter motor operation must not exceed 10 seconds at a time. After 10 seconds turn the ignition switch to position 0 and allow the starter motor to cool for 30 seconds before operating the starter motor again.
   Start the engine and allow to idle until it reaches normal operating temperature
8. Stop the engine.
9. *Special Tool(s):* 310-110A

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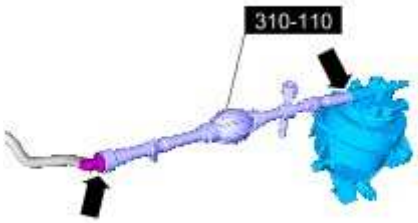

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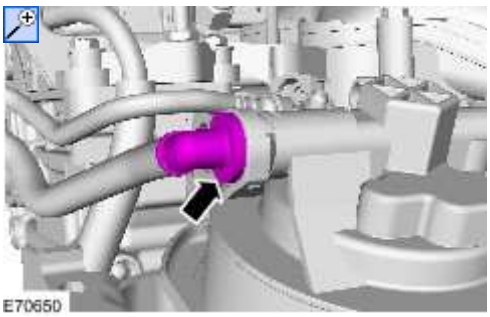
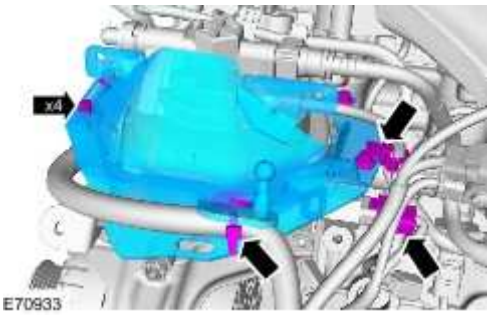

E70650

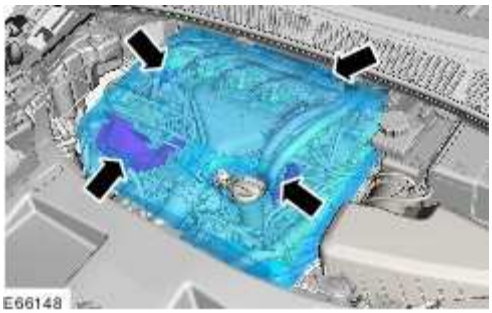
10. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

11. Remove the lint-free material.



E70933

12. *Torque:* 9 Nm


E66148

13.

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

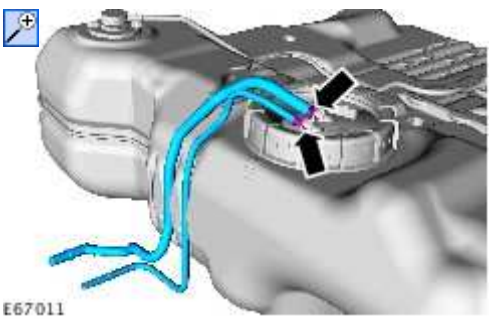
Removal

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

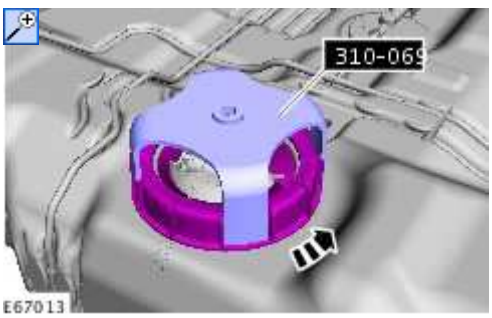
NOTE: Removal steps in this procedure may contain installation details.

2. Remove the fuel tank.

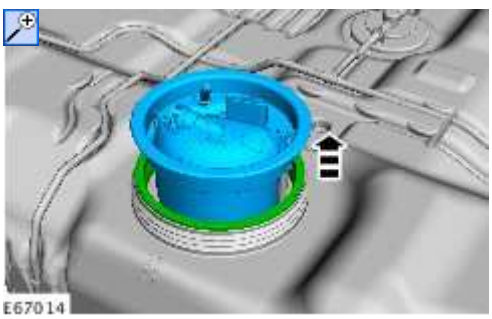
   Refer to: Fuel Tank (310-01B Fuel Tank and Lines - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).



3. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).



4. *Special Tool(s):* 310-069
   Torque: 85 Nm



5. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

Installation

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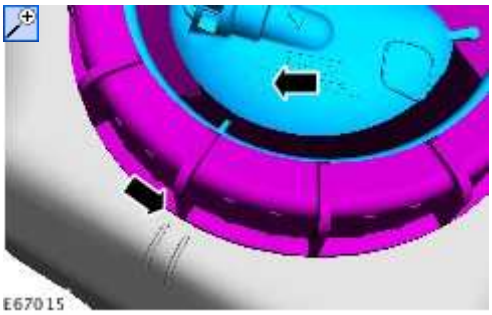

1. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
   NOTE: Make sure that the seal is correctly located.
   NOTE: Make sure that the installation marks are aligned.

2. To install, reverse the removal procedure.

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Removal and Installation

Special Tool(s)

	310-069 Wrench, Fuel Tank Sender Unit

General Equipment

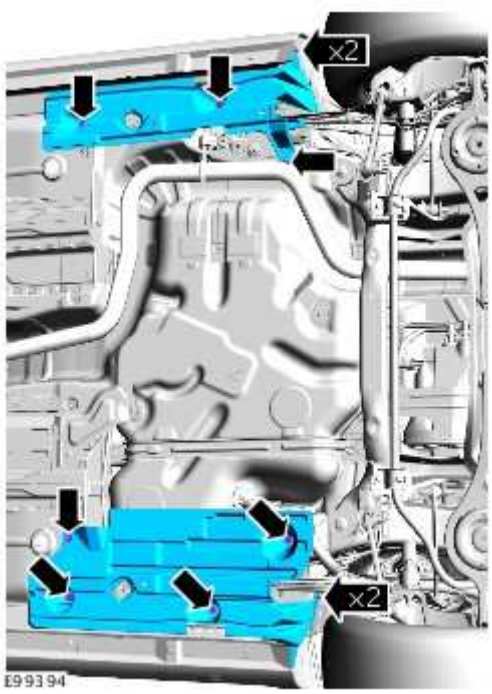
Fuel tank draining equipment
Hose clamp(s)
Hose clamp remover/installer
Retaining Strap
Transmission jack
Wooden Block

Removal

All vehicles

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

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. *Torque:* 10 Nm



Vehicles with 2.5L engine

4.

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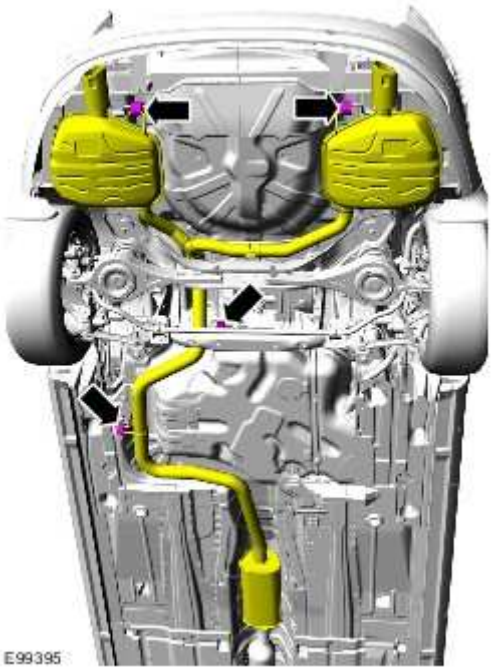
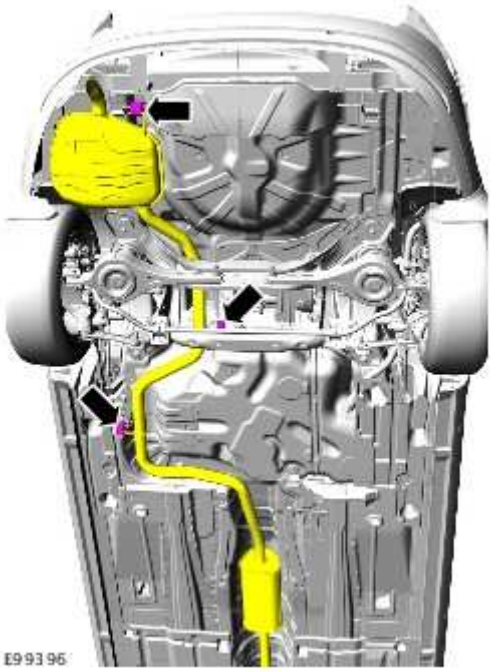


All vehicles

5.



6.

CAUTION: Take extra care when handling the components.
Torque: 5 Nm

7. NOTE: Make sure that a new clamp is installed.

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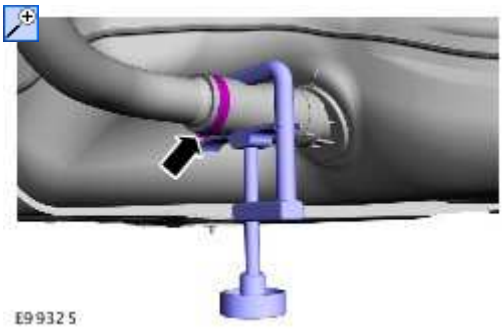
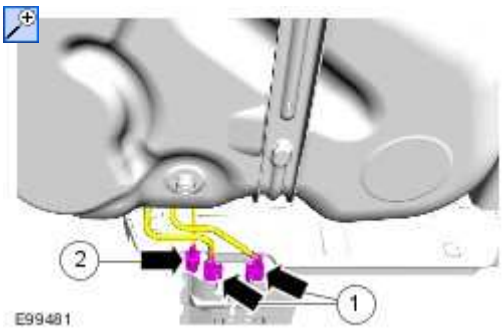


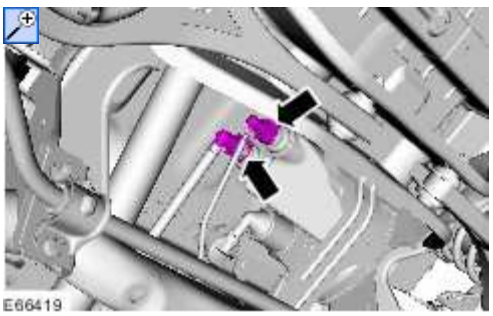
NOTE: Make sure that the clamp is installed to the same orientation as when removed.
General Equipment: Hose clamp(s)

8. WARNING: Be prepared to collect escaping fluid.
NOTE: Make sure that a new component is installed.
General Equipment: Hose clamp remover/installer



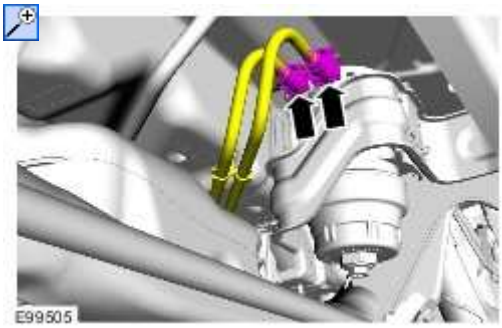
9. WARNING: Be prepared to collect escaping fluid.
    1. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).
    2. If equipped.

All except vehicles with diesel engine



10. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with 2.0L diesel engine



11. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine

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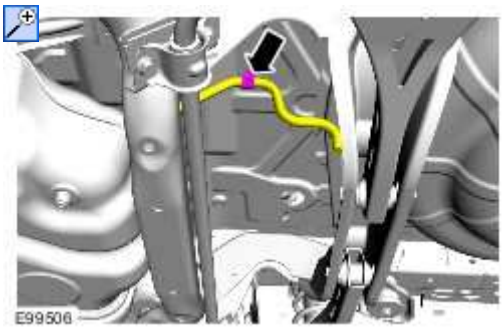
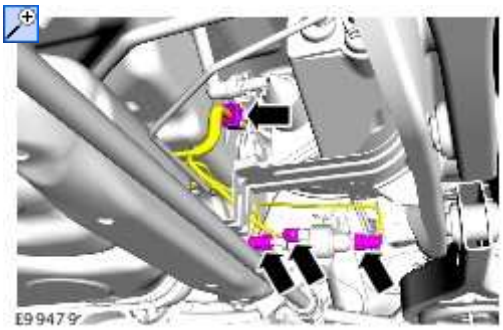


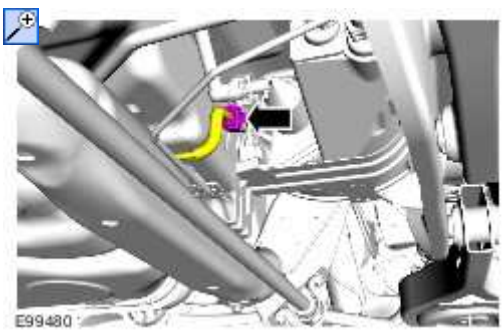
12.

Vehicles with fuel fired booster heater

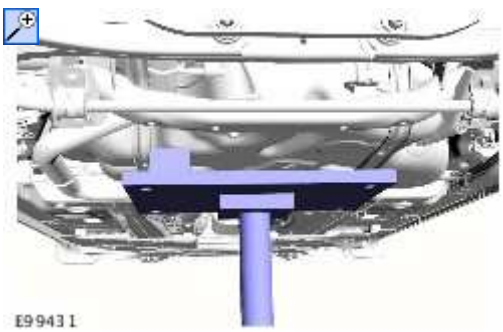


13. WARNING: Be prepared to collect escaping fluid.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles



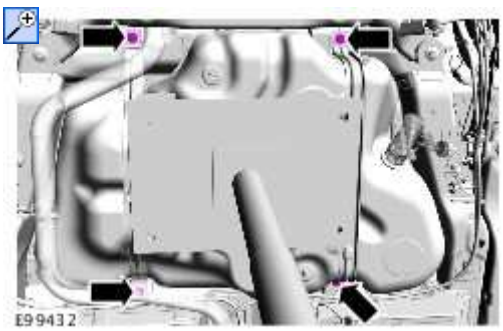
14.



15. CAUTIONS:

Use suitable packing material to prevent damage to the component.

Make sure that no strain is placed on the fuel lines and wiring harnesses.
General Equipment: Transmission jack
General Equipment: Wooden Block



16. *Torque:* 24 Nm

17. *General Equipment:* Retaining Strap

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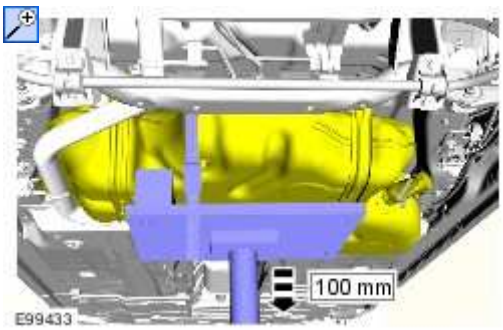
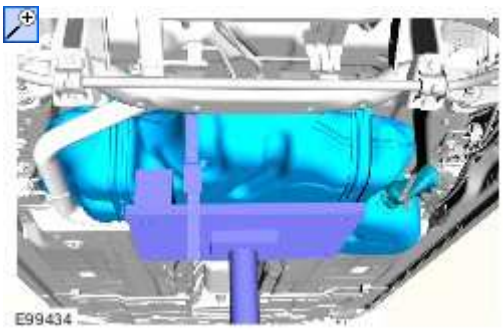
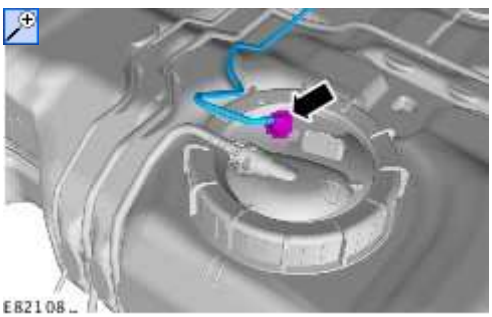


General Equipment: Wooden Block



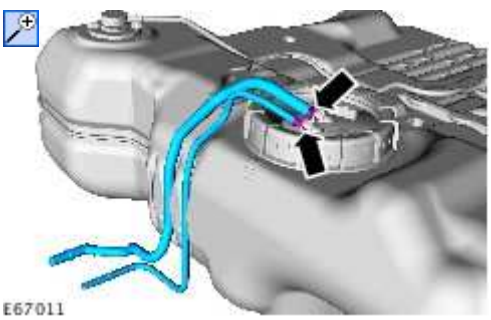
18.

Vehicles with fuel fired booster heater



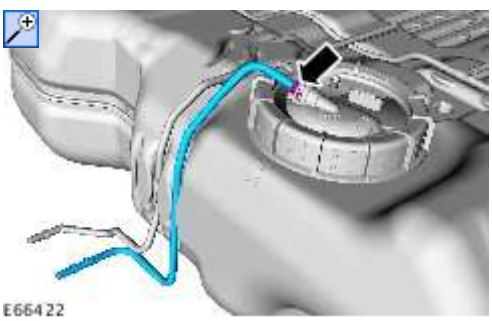
19. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

Vehicles with diesel engine



20. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All except vehicles with diesel engine



21. Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

All vehicles

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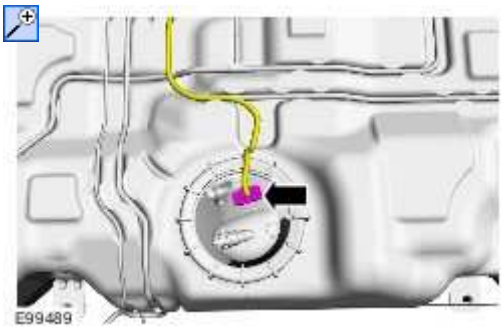
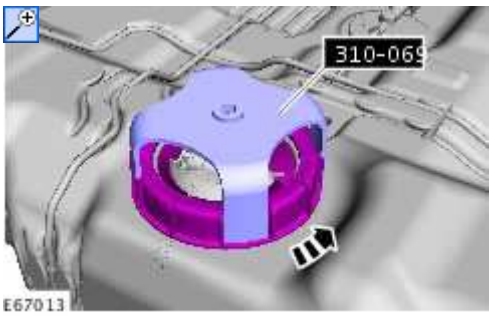
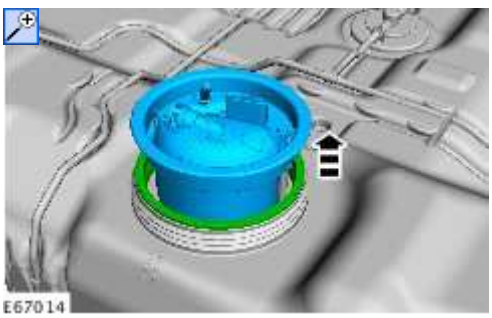


22.



23. *Special Tool(s):* 310-069
Torque: 85 Nm

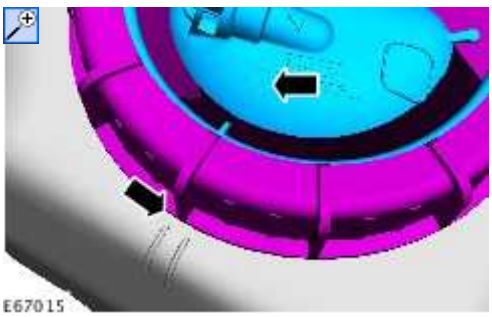


24. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

25. Drain the fuel tank.

General Equipment: Fuel tank draining equipment

Installation



1. To install, reverse the removal procedure.

2. CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.
NOTE: Make sure that the seal is correctly located.
NOTE: Make sure that the installation marks are aligned.

Vehicles with diesel engine

3. Refer to: Fuel System Bleeding - 1.8L Duratorq-TDCi (Lynx) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.0L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, General Procedures).
Refer to: Fuel System Bleeding - 2.2L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General

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Information, General Procedures).

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Removal and Installation

Removal

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

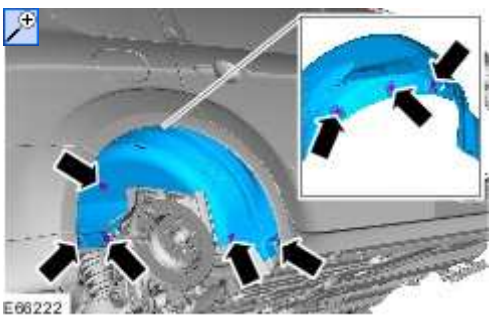
NOTE: Removal steps in this procedure may contain installation details.

2. Drain the fuel tank.

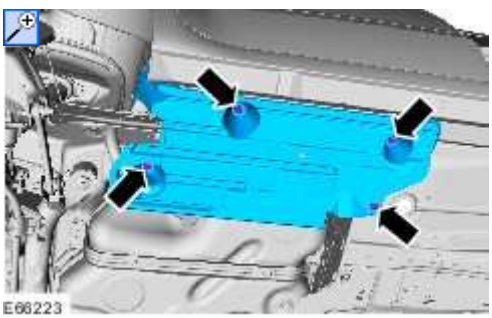
   Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).

3. Remove the right-hand rear wheel and tire.

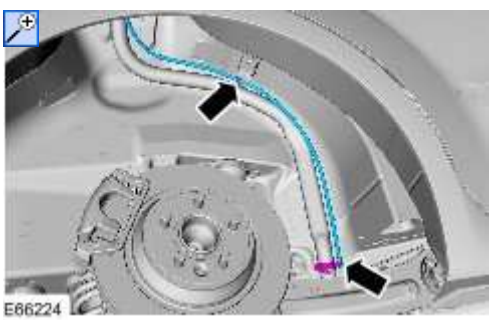
   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



4.



5. *Torque:* 10 Nm



6.

7. NOTE: Note the orientation of the clamp to aid installation.
   1. *Torque:* 10 Nm
   2. Discard the fuel tank filler pipe clamp.

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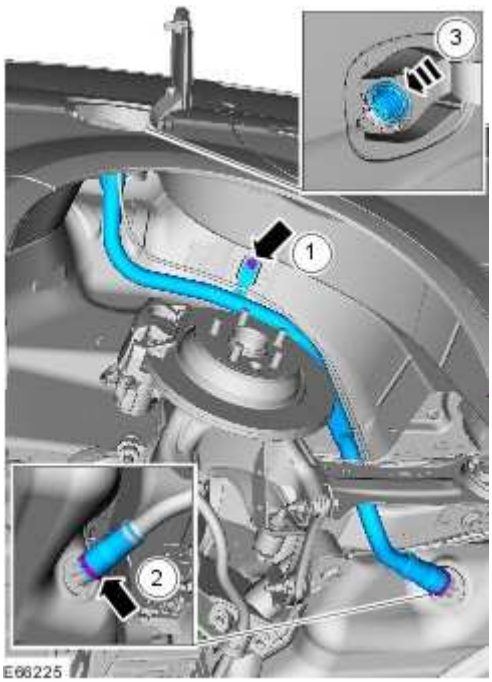

Installation

NOTE: Make sure that a new clamp is installed.
NOTE: Make sure that the clamp is installed to the same orientation as when removed.

1. To install, reverse the removal procedure.

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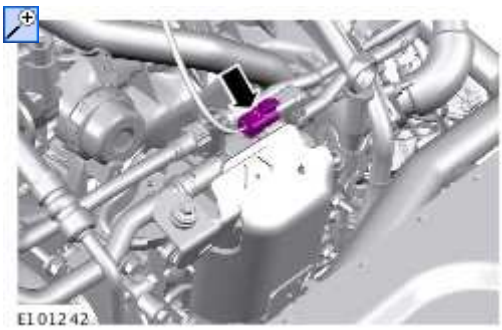
Removal and Installation

Removal

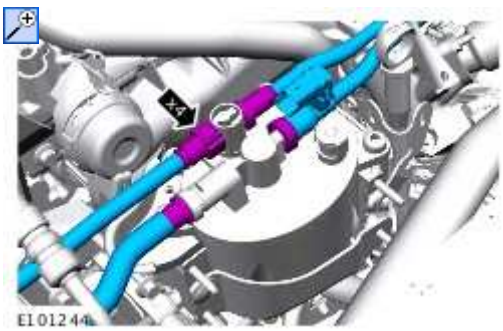
WARNING: Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Refer to: Fuel Injection Component Cleaning (303-04F Fuel Charging and Controls - 2.2L Duratorq-TDCi (129kW/175PS) - DW, General Procedures).



2.

3. *Torque:* 9 Nm



4. CAUTION: Make sure that all openings are sealed. Use new blanking caps.
Refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

5. *Torque:* 9 Nm

6. NOTE: This step is only necessary when

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installing a new component.

Installation

1. To install, reverse the removal procedure.

   Refer to: Fuel System Bleeding - 2.2L Duratorq-TDCi (DW) Diesel (310-00 Fuel System - General Information, General Procedures).

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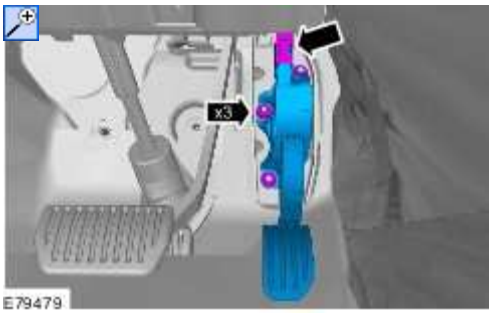
Removal and Installation

Removal

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



1. *Torque:* 9 Nm

Installation

1. To install, reverse the removal procedure

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Description and Operation

For additional information regarding the speed control.
For additional information, refer to: Proximity Warning System (413-09 Warning Devices, Description and Operation).

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Lubricants, Fluids, Sealers and Adhesives

	Specifications
Refrigerant R134a	WSH-M17B19-A
Refrigerant oil	WSH-M1C231-B

Refrigerant Capacities (When Charging)

	Grams
Air Conditioning	600 ± 15
A/C system with Auxiliary A/C system	850 ± 15

Refrigerant Oil Capacities (When Charging)

	Milliliters
Air Conditioning	200
A/C system with Auxiliary A/C system	250

Addition of Refrigerant Oil (When new components are installed)

	Milliliters
Air conditioning compressor if the amount of refrigerant oil taken from the faulty compressor is less than 150 ml	Drain 50 from new compressor.
Air conditioning compressor if the amount of refrigerant oil taken from the faulty compressor is more than 150 ml	Drain 0 from new compressor.
Condenser	add 30.
Evaporator	add 90.
Accumulator/dehydrator	add 90.
Every time refrigerant is evacuated.	add 20.
When all new components are installed.	add 60.

Clutch air gap

	mm
Compressor clutch air gap	0.35 - 0.85

Torque Specifications

Description	Nm	lb-ft	lb-in
Compressor drive plate retaining bolt	13	10	–

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Diagnosis and Testing

Refer to Wiring Diagrams Section 412-00, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 418-S035

General Equipment

Digital Multimeter (compatible with K-type thermocouple)
Ford diagnostic equipment
Refrigerant center
Thermometer - Fluke 80 PK-8 (FSE number 260 4102 001 07)

Inspection and Testing

1. **1.** VERIFY the customer concern.

2. **2.** Visually CHECK for any obvious mechanical or electrical damage.

NOTE: Ensure correct locking of wiring harness connector.

Visual Inspection

Mechanical	Electrical
• Refrigerant lines • Condenser • Coolant level • Drive belt • A/C compressor	• Fuses • Wiring harness • Connector

3. **3.** RECTIFY any obvious causes for a concern found during the visual inspection before performing any further tests. CHECK the operation of the system.

4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis on the electronic engine management, the charging system, the generic electronic module (GEM) and the instrument cluster (vehicles with EATC: also read out the fault memory of the EATC) with the Ford approved diagnostic tool and RECTIFY any displayed faults in accordance with the displayed fault description. CHECK the operation of the system.

5. **5.** On a vehicle without stored fault(s), continue according to the Symptom Chart and the corresponding symptom.

6. **6.** Following checking or elimination of the fault(s) and after completion of operations, the fault memories of all vehicle modules must be READ OUT and any stored faults must be DELETED. READ OUT all fault memories again following a road test.

Fault Memory Interrogation without the Ford approved diagnostic tool - vehicles with electronic automatic temperature control (EATC)

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NOTE: NOTE: On vehicles equipped with a DVD navigation system with touchscreen, interrogation of the fault memory is only possible using the Ford approved diagnostic tool.
The climate control system features a self-diagnosis function which can detect and store both current permanent faults as well as intermittent faults which have occurred during normal operation of the vehicle. It is also possible to read out these faults via the display of the EATC module. To read out the fault memory, the ignition key must be turned to the "ON" position and the battery voltage must be between 9 V and 16 V.

Activation of self-diagnosis

At the control panel for the climate control system, PRESS the "OFF" and "FOOTWELL" buttons simultaneously for **exactly** 2 seconds, then PRESS "AUTO" within 1.5 seconds. The self-diagnosis which then starts lasts a few seconds. An animated display appears in the EATC display during this time. Any faults found are displayed on both displays of the EATC in the form of trouble codes.

Example: Left-hand display indicates "908", right-hand display indicates "100" - trouble code read out 908100 = Circuit of left-hand temperature control flap actuator faulty.

The following table gives information on the possible Self-test codes / DTCs and their corresponding meanings. By PRESSING the "DEFROST" button, the fault memory is cleared and diagnosis mode is ended. To end the diagnostic mode without clearing the DTCs, PRESS any other EATC button.

Reading out of stored faults

At the control panel for the climate control system, PRESS the "OFF" and "FOOTWELL" buttons simultaneously for **exactly** 2 seconds, then PRESS "HEAD AREA" within 1.5 seconds. Any stored faults are shown on the EATC display and should be noted for safety reasons. By PRESSING the "DEFROST" button, the fault memory is cleared and diagnosis mode is ended. To end the diagnostic mode without clearing the DTCs, PRESS any other EATC button.

Reading out the software version

At the control panel for the climate control system, PRESS the "OFF" and "FOOTWELL" buttons simultaneously for **exactly** 2 seconds, then PRESS "A/C" within 1.5 seconds. The software version is shown on the EATC display. The output mode can be exited by PRESSING any operating button of the EATC.

Trouble code table - vehicles with electronic automatic temperature control (EATC)

Trouble code table, electronic automatic temperature control (EATC)

Fault code - diagnostic unit	DTC	Description	Action
908100	B108100	Circuit of left-hand temperature control flap actuator faulty	GO to Pinpoint Test I.
908200	B108200	Circuit of right-hand temperature control flap actuator faulty	GO to Pinpoint Test H.
908300	B108300	Fault in the circuit of the air recirculation flap actuator	GO to Pinpoint Test D.
908600	B108600	Fault in circuit of actuator for air distribution flap	GO to Pinpoint Test G.
90B300	B10B300	Fault in circuit of center vents air outlet temperature sensor	GO to Pinpoint Test J.
90B400	B10B400	Fault in circuit of right-hand footwell air outlet temperature sensor	GO to Pinpoint Test K.
90B500	B10B500	Fault in circuit of left-hand	GO to Pinpoint Test L.

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		center vents air outlet temperature sensor	
90B600	B10B600	Fault in circuit of left-hand footwell air outlet temperature sensor	GO to Pinpoint Test M.
90B800	B10B800	Circuit for push buttons, EATC module faulty	CLEAR the fault memory.
			If the fault occurs again after a functional test, RENEW the EATC module.
90B900	B10B900	Circuit of blower control module faulty	GO to Pinpoint Test B.
9A6100	B1A6100	Fault in circuit of interior temperature sensor	GO to Pinpoint Test O.
9A6300	B1A6300	Circuit of right-hand sun load sensor faulty	GO to Pinpoint Test N.
9A6400	B1A6400	Circuit of left-hand sun load sensor faulty	GO to Pinpoint Test N.
053500	P053500	Fault in circuit of evaporator temperature sensor	GO to Pinpoint Test E.
E10000	U210000	Incomplete vehicle configuration parameters	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
E10100	U210100	Faulty configuration of the EATC module	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
F00000	U300000	Internal control unit fault	CLEAR the fault memory.
			If the fault occurs again after a functional test, RENEW the EATC module.
F00616 / F00617	U300616 / U300617	Supply voltage not within the specified range (9 - 16 V)	GO to Pinpoint Test F.

Trouble code table, programmable fuel-fired booster heater

Fault code - diagnostic unit	DTC	Description	Action
B1A8495	9A8495	Faulty configuration	CHECK and CORRECT the configuration of the system with the Ford approved diagnostic tool. CHECK the operation of the system.
B1D2211	9D2211	Temperature sensor circuit, short to ground	RENEW the fuel-fired booster heater.
B1D2215	9D2215	Temperature sensor circuit, open circuit or short circuit to voltage	RENEW the fuel-fired booster heater.
B1D2313	9D2313	Overheating sensor circuit, open circuit	RENEW the fuel-fired booster heater.
B1D2411	9D2411	Glow plug circuit, short to ground	RENEW the fuel-fired booster heater.
B1D2415	9D2415	Glow plug circuit, open circuit or short circuit to voltage	RENEW the fuel-fired booster heater.
B1D2511	9D2511	Booster heater fuel pump circuit, short circuit to ground	GO to Pinpoint Test S.
B1D2515	9D2515	Booster heater fuel pump circuit, open circuit or short circuit to voltage	GO to Pinpoint Test S.
B1D2611	9D2611	Combustion air blower motor circuit, short to ground	RENEW the fuel-fired booster heater.

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B1D2615	9D2615	Combustion air blower motor circuit, open circuit	RENEW the fuel-fired booster heater.
B1D2692 / B1D2693	9D2692 / 9D2693	Combustion air blower motor speed outside the tolerance range	RENEW the fuel-fired booster heater.
B1D2711	9D2711	Fuel-fired booster heater (coolant pump) circuit, short circuit to ground, overload	GO to Pinpoint Test R.
B1D2715	9D2715	Fuel-fired booster heater coolant pump circuit, open circuit or short circuit to voltage	GO to Pinpoint Test R.
U300017	F00017	Battery voltage too high, voltage greater than 16 V (excess voltage applied for more than 20 seconds)	DIAGNOSE the battery and charging system.
U300016	F00016	Battery voltage too low, voltage less than 10.2 V (undervoltage applied for more than 20 seconds)	DIAGNOSE the battery and charging system. If battery and charging system are OK: GO to Pinpoint Test Q.

Symptom Chart

Symptom	Possible Sources	Action
Blower motor faulty / inoperative	* Fuse(s) * Circuit(s) * Blower relay. * Blower motor * Blower resistor assembly * Blower switch * Blower control module * Electronic automatic temperature control (EATC) module * Central electrical box	* Vehicles with manual temperature control: GO to Pinpoint Test A. * Vehicles with electronic automatic temperature control: GO to Pinpoint Test B.
Air conditioning inoperative (blower motor OK)	* Fuse(s) * Circuit(s) * Quantity of refrigerant * Climate control system control assembly * Electronic automatic temperature control (EATC) module * Refrigerant pressure transducer * A/C clutch relay * Air conditioning clutch * Generic Electronic Module (GEM) * Powertrain control module (PCM) * Ambient air temperature sensor	* GO to Pinpoint Test E.
Faulty operation of the recirculated air flap	* Fuse(s) * Circuit(s) * Actuator – recirculated air flap * Air conditioning control panel * Electronic automatic	* Vehicles with manual temperature control: GO to Pinpoint Test C. * Vehicles with electronic automatic temperature control: GO to Pinpoint Test D.

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	temperature control (EATC) module	
Control panel for the climate control system inoperative - vehicles with electronic automatic temperature control (EATC)	* Fuse(s) * Circuit(s) * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test F.
Malfunction of air distribution valve - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Air distribution flap actuator * Air distribution flap * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test G.
Malfunction of right-hand temperature control flap - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Right-hand temperature control flap actuator * Right-hand temperature control flap * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test H.
Malfunction of left-hand temperature control flap - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Left-hand temperature control flap actuator * Left-hand temperature control flap * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test I.
Fault in right-hand center vents air outlet temperature sensor circuit - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Air outlet temperature sensor - center vents - right side * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test J.
Fault in right-hand footwell air outlet temperature sensor circuit - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Right-hand footwell air outlet temperature sensor * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test K.
Fault in left-hand center vents air outlet temperature sensor circuit - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Air outlet temperature sensor, center vents, left * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test L.
Fault in left-hand footwell air outlet temperature sensor circuit - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Left-hand footwell air outlet temperature sensor * Electronic automatic temperature control	* GO to Pinpoint Test M.

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	(EATC) module	
Sun load sensor circuit faulty - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Sun load sensor * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test N.
Interior temperature sensor circuit faulty - vehicles with electronic automatic temperature control (EATC)	* Circuit(s) * Passenger compartment temperature sensor * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test O.
Electric booster heater inoperative	* Fuse(s) * Circuit(s) * Electric booster heater * Generic Electronic Module (GEM) * Air conditioning control panel * Electronic automatic temperature control (EATC) module	* GO to Pinpoint Test P.
Programmable fuel-fired booster heater inoperative	* Fuse(s) * Circuit(s) * Programmable fuel-fired booster heater	* GO to Pinpoint Test Q.
Fuel-fired booster heater (coolant pump) inoperative - vehicles with programmable fuel-fired booster heater	* Circuit(s) * Fuel-fired booster heater - coolant pump	* GO to Pinpoint Test R.
Booster heater fuel pump inoperative	* Circuit(s) * Auxiliary heater fuel pump	* GO to Pinpoint Test S.

Pinpoint Tests

PINPOINT TEST A : BLOWER MOTOR INOPERATIVE/INCORRECT FUNCTION - VEHICLES WITH MANUAL TEMPERATURE CONTROL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE OPERATION OF THE BLOWER MOTOR	
	1 Ignition switch in position II.
	2 Switch the blower switch through all switch settings.
	Is the blower motor inoperative in all the switch positions? **Yes** GO to A2. **No** - The blower motor is only inoperative in switch position 4:GO to A14. - The blower motor is inoperative in switch positions 1, 2 and/or 3:GO to A15.
A2: CHECK FUSE F28	
	1 Ignition switch in position 0.
	2 CHECK Fuse F28 (EJB).
	Is the fuse OK? **Yes** GO to A3.

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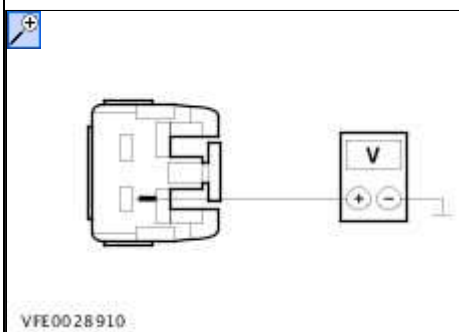
	No RENEW fuse F28 (40 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A3: CHECK THE VOLTAGE AT FUSE F28	
	1 Connect Fuse F28 (EJB).
	2 Measure the voltage between fuse F28 (40 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A4. **No** REPAIR the voltage supply to fuse F28 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A4: CHECK FUSE F33	
	1 Ignition switch in position 0.
	2 CHECK Fuse F33 (EJB).
	Is the fuse OK? **Yes** GO to A5. **No** RENEW fuse F33 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A5: CHECK THE VOLTAGE AT FUSE F33	
	1 Connect Fuse F33 (EJB).
	2 Measure the voltage between fuse F33 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** REPAIR the voltage supply to fuse F33 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK VOLTAGE AT BLOWER MOTOR	
	1 Disconnect Connector C2H123-C from the blower motor.
	2 Ignition switch in position II.
 VFE0028910	3 Measure the voltage between the blower motor, connector C2H123-C, pin 1, circuit CBB28C (GY/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A7. **No** GO to A10.
A7: CHECK GROUND CONNECTION OF BLOWER MOTOR	
	1 Ignition switch in position 0.

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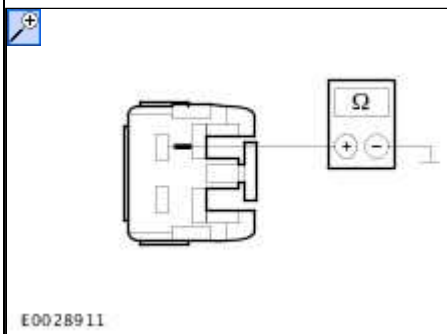
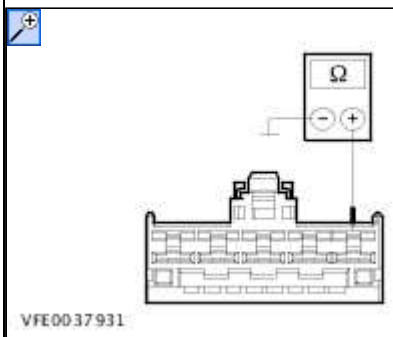
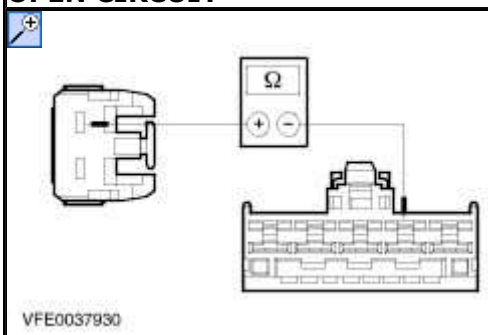
	2 Set the blower switch to position 4.
	3 Measure the resistance between the blower motor, connector C2H123-C, pin 2, circuit CBB28D (WH/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the blower motor. CHECK the operation of the system. **No** GO to A8.
A8: CHECK THE GROUND CONNECTION OF THE BLOWER SWITCH	
	1 Disconnect Connector C2H426 from the blower switch.
	2 Measure the resistance between the blower switch, connector C2H426, pin 5, circuit GD138BY (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A9. **No** LOCATE and REPAIR the break in the circuit between the blower switch and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A9: CHECK CIRCUIT BETWEEN THE BLOWER MOTOR AND THE BLOWER SWITCH FOR OPEN CIRCUIT	
	1 Measure the resistance between the blower motor, connector C2H123-C, pin 2, circuit CBB28D (WH/VT), wiring harness side and the blower switch, connector C2H426, pin 4, circuit CBB28B (WH/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the blower switch. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the blower motor and soldered connection SP175 using the Wiring Diagrams. CHECK the

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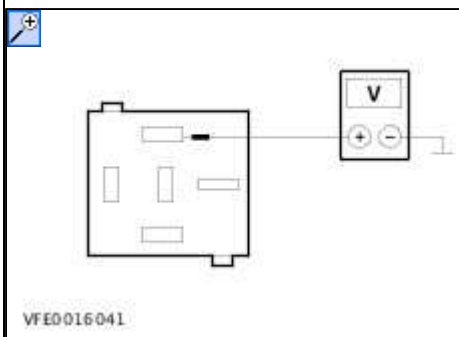
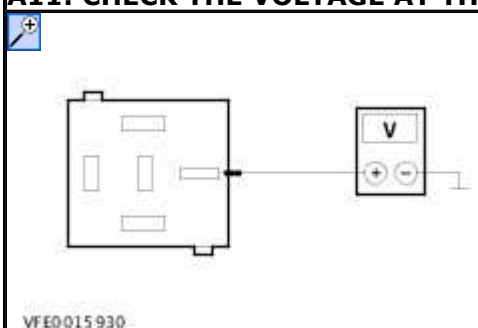
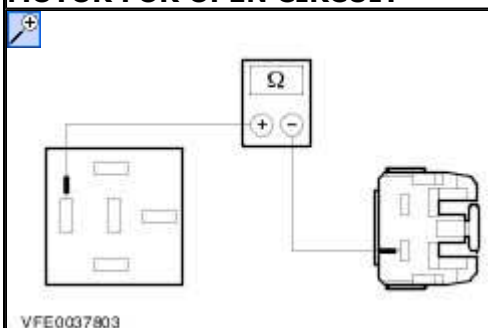
	operation of the system.
A10: CHECK THE VOLTAGE AT THE BLOWER RELAY H402	
	1 Ignition switch in position 0. 2 Disconnect Blower relay H402 from socket C1BB01-A.
 VFE0016041	3 Measure the voltage at the blower relay H402, socket C1BB01-A, pin 39, circuit SBB33E (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A11. **No** LOCATE and REPAIR the break in the circuit between the blower relay H402 and fuse F33 using the Wiring Diagrams. CHECK the operation of the system.
A11: CHECK THE VOLTAGE AT THE BLOWER RELAY H402	
 VFE0015930	1 Measure the voltage at the blower relay H402, socket C1BB01-A, pin 37, circuit SBB28A (RD/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A12. **No** LOCATE and REPAIR the break in the circuit between the blower relay H402 and fuse F28 using the Wiring Diagrams. CHECK the operation of the system.
A12: CHECK THE CIRCUIT BETWEEN THE BLOWER RELAY H402 AND THE BLOWER MOTOR FOR OPEN CIRCUIT	
 VFE0037803	1 Measure the resistance between the blower relay H402, socket C1BB01-A, pin 36, circuit CBB28B GY/VT), wiring harness side and the blower motor, connector C2H123-C, pin 1, circuit CBB28C (GY/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A13.

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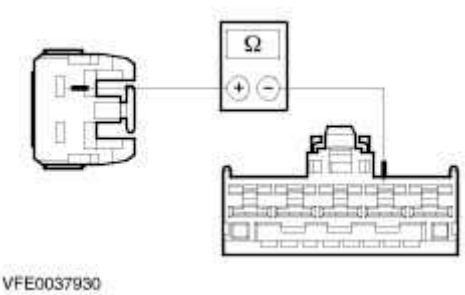
	No LOCATE and REPAIR the break in the circuit between blower relay H402 and the blower motor using the Wiring Diagrams. CHECK the operation of the system.
A13: CHECK THE CIRCUIT BETWEEN BLOWER RELAY H402 AND THE CJB FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-A from the CJB.
	2 Measure the resistance between blower relay H402, socket C1BB01-A, pin 38, wiring harness side and the CJB, connector C1BP02-A, pin 28, circuit CH123A (GN/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK blower relay H402 in accordance with the component checks at the end of the section. If blower relay H402 is OK, CHECK and of necessary RENEW the CJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between blower relay H402 and the CJB using the Wiring Diagrams. CHECK the operation of the system.
A14: CHECK CIRCUIT BETWEEN THE BLOWER MOTOR AND THE BLOWER SWITCH FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H123-C from the blower motor.
	3 Disconnect Connector C2H426 from the blower switch.
	**4** Measure the resistance between the blower motor, connector C2H123-C, pin 2, circuit CBB28D (WH/VT), wiring harness side and the blower switch, connector C2H426, pin 4, circuit CBB28B (WH/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the blower switch. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the blower switch and soldered connection SP175 using the Wiring Diagrams. CHECK the operation of the system.
A15: CHECK THE VOLTAGES AT THE BLOWER SWITCH	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H426 from the blower switch.
	3 Ignition switch in position II.
	4 Measure the voltage between the blower switch, connector C2H426, pin 1, circuit CH427A (BN), wiring harness side and ground.

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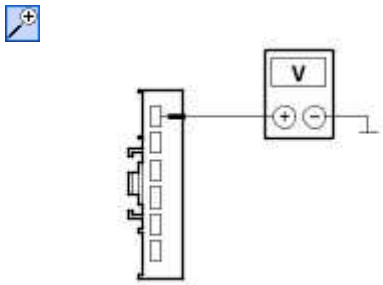

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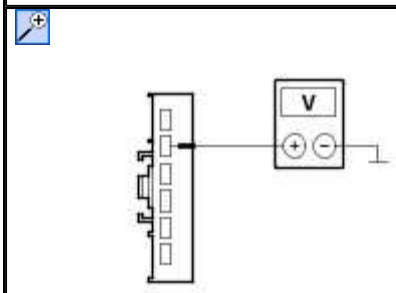
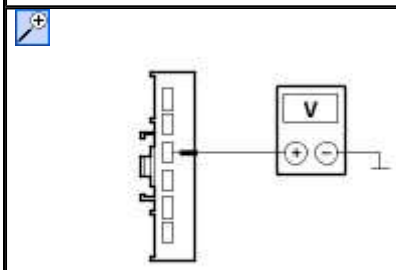


E76193

5 Measure the voltage between the blower switch, connector C2H426, pin 2, circuit CH428A (GN/WH), wiring harness side and ground.



E76194

6 Measure the voltage between the blower switch, connector C2H426, pin 3, circuit CH429A (GY/BN), wiring harness side and ground.

Is battery voltage measured in all cases?

Yes

RENEW the blower switch. CHECK the operation of the system.

No

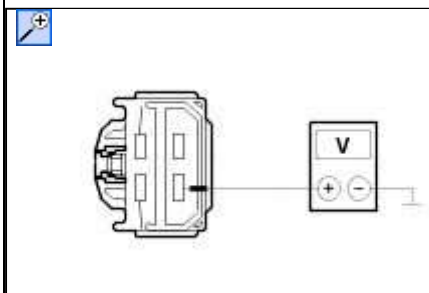
- Battery voltage not measured in one/two cases:GO to A17.
- Battery voltage not measured in any case:GO to A16.

A16: CHECK THE VOLTAGE AT THE BLOWER RESISTOR

1 Ignition switch in position 0.

2 Disconnect Connector C2H434 from the blower resistor.

3 Ignition switch in position II.



E0037933

4 Measure the voltage between the blower resistor, connector C2H434, pin 4, circuit CBB28C (WH/VT), wiring harness side and ground.

Does the meter display battery voltage?

Yes

INSTALL a new heater blower series resistor. CHECK the operation of the system.

No

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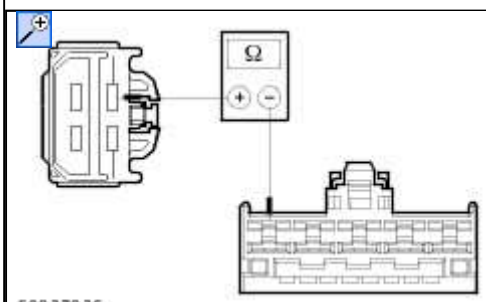
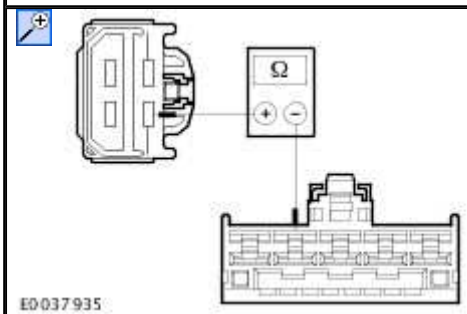
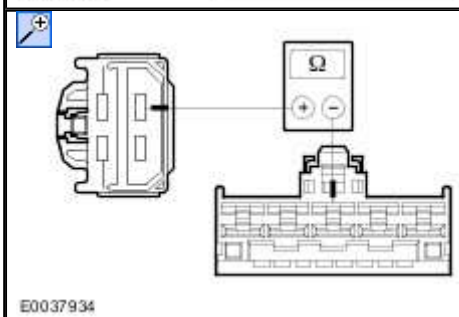
	LOCATE and REPAIR the break in circuit CBB28C (WH/VT) between the blower resistor and soldered connection SP175 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A17: CHECK THE CIRCUITS BETWEEN THE BLOWER RESISTOR AND THE BLOWER SWITCH FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H434 from the blower resistor.
 E0037936	3 Measure the resistance between the blower resistor assembly, connector C2H434, pin 2, circuit CH427A (BN), wiring harness side and the blower switch, connector C2H426, pin 1, circuit CH427A (BN), wiring harness side.
 E0037935	4 Measure the resistance between the blower resistor, connector C2H434, pin 4, circuit CH428A (GN/WH), wiring harness side and the blower switch, connector C2H426, pin 1, circuit CH428A (GN/WH), wiring harness side.
 E0037934	5 Measure the resistance between the blower resistor, connector C2H434, pin 3, circuit CH429A (GY/BN), wiring harness side and the blower switch, connector C2H426, pin 3, circuit CH428A (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** INSTALL a new heater resistor. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the affected circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : BLOWER MOTOR INOPERATIVE/INCORRECT FUNCTION - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE OPERATION OF THE BLOWER MOTOR	
	1 Ignition switch in position II.
	2 Test all of the speeds of the heater blower motor.
	Is the blower motor inoperative in all speed settings? **Yes** GO to B2.

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	No GO to B20.
B2: CHECK FUSE F28	
	1 Ignition switch in position 0. 2 CHECK Fuse F28 (EJB). Is the fuse OK? **Yes** GO to B3. **No** RENEW fuse F28 (40 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
B3: CHECK THE VOLTAGE AT FUSE F28	
	1 Connect Fuse F28 (EJB). 2 Measure the voltage between fuse F28 (40 A) and ground. Does the meter display battery voltage? **Yes** GO to B4. **No** REPAIR the voltage supply to fuse F28 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B4: CHECK FUSE F18	
	1 CHECK Fuse F18 (CJB). Is the fuse OK? **Yes** GO to B5. **No** RENEW fuse F18 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
B5: CHECK THE VOLTAGE AT FUSE F18	
	1 Connect Fuse F18 (CJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse F18 (5 A) and ground. Does the meter display battery voltage? **Yes** GO to B6. **No** CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
B6: CHECK THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE	
	1 Ignition switch in position 0. 2 Disconnect Connector C2H101-B from the EATC module. 3 Ignition switch in position II. Does the blower motor run at its highest speed setting? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** GO to B7.
B7: CHECK VOLTAGE AT BLOWER MOTOR	
	1 Disconnect Connector C2H123-B from the blower motor.

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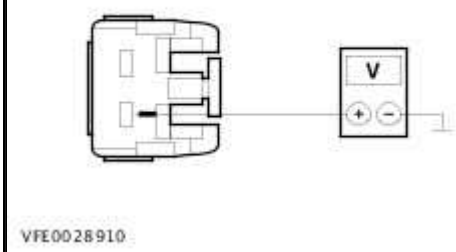
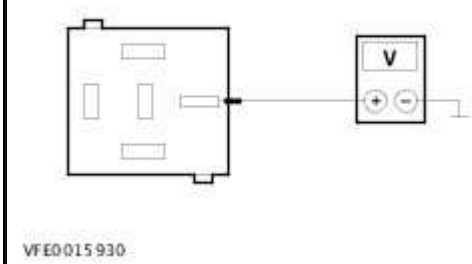
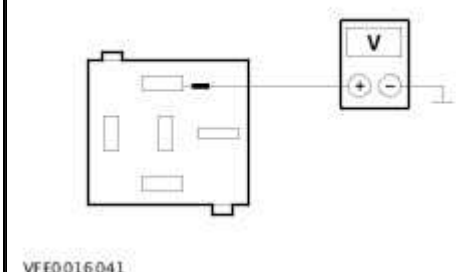
	2 Ignition switch in position II.
	3 Measure the voltage between the blower motor, connector C2H123-B, pin 1, circuit CBB28A (GY/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B14. **No** GO to B8.
B8: CHECK THE VOLTAGE AT THE BLOWER RELAY H402	
	1 Ignition switch in position 0.
	2 Disconnect Blower relay H402 from socket C1BB01-A.
	3 Measure the voltage between the blower relay H402, socket C1BB01-A, pin 36, circuit CBB28A (RD/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B9. **No** LOCATE and REPAIR the break in circuit CBB28A (RD/GN) between blower relay H402 and fuse F28 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B9: CHECK THE VOLTAGE AT THE BLOWER RELAY H402	
	1 Measure the voltage between the blower relay, socket C1BB01-A, pin 39, circuit SBB33E (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B10. **No** LOCATE and REPAIR the break in the circuit between blower relay H402 and fuse F33 using the Wiring Diagrams. CHECK the operation of the system.

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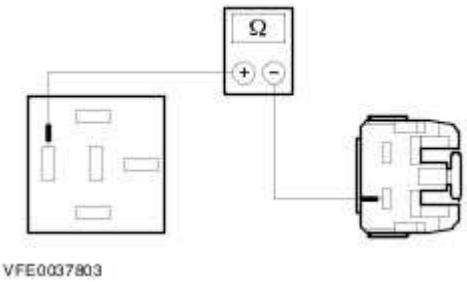
B10: CHECK THE CIRCUIT BETWEEN THE BLOWER RELAY H402 AND THE BLOWER MOTOR FOR OPEN CIRCUIT



1 Measure the resistance between the blower relay H402, socket C1BB01-A, pin 37, circuit CBB28B GY/VT), wiring harness side and the blower motor, connector C2H123-B, pin 1, circuit CBB28A (GY/VT), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to B12.

No

GO to B11.

B11: CHECK THE CIRCUIT BETWEEN THE EJB AND THE BLOWER MOTOR FOR OPEN CIRCUIT

1 Disconnect Connector C1BB01-A from the EJB.

2 Measure the resistance between the EJB, connector C1BB01-A, pin 37, circuit CBB28B (GY/VT), wiring harness side and the blower motor, connector C2H123-B, pin 1, circuit CBB28A (GY/VT), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the EJB and RENEW it if necessary. CHECK the operation of the system.

No

LOCATE and REPAIR the break in the circuit between the EJB and the blower motor using the Wiring Diagrams. CHECK the operation of the system.

B12: CHECK THE CIRCUIT BETWEEN BLOWER RELAY H402 AND THE CJB FOR OPEN CIRCUIT

1 Disconnect Connector C1BP02-A from the CJB.

2 Measure the resistance between blower relay H402, socket C1BB01-A, pin 38, circuit CH123A (VT/GN), wiring harness side and the CJB, connector C1BP02-A, pin 28, circuit CH123A (VT/GN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK blower relay H402 in accordance with the component checks at the end of the section. If blower relay H402 is OK, CHECK and of necessary RENEW the CJB. CHECK the operation of the system.

No

GO to B13.

B13: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE CJB

1 Disconnect Connector C1BB01-A from the EJB.

2 Measure the resistance between the EJB, connector C1BB01-A, pin 38, circuit CH123A (VT/GN), wiring harness side and the CJB, connector C1BP02-A, pin 28, circuit CH123A (VT/GN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

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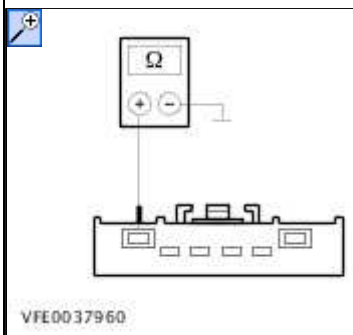
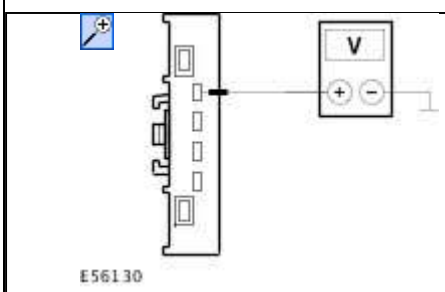
	Yes CHECK the EJB and RENEW it if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CH123A (VT/GN) between the EJB and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
B14: CHECK THE GROUND CONNECTION OF THE BLOWER CONTROL MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H123-A from the blower control module.
	3 Measure the resistance between the blower control module, connector C2H123-A, pin 6, circuit GD138AM (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B15. **No** LOCATE and RECTIFY the break in the circuit between the blower control module and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B15: CHECK THE VOLTAGE AT THE BLOWER CONTROL MODULE	
	1 Ignition switch in position II.
	2 Measure the voltage between the blower control module, connector C2H123-A, pin 2, circuit CBP18B (GY/OG), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B17. **No** GO to B16.
B16: CHECK THE CIRCUIT BETWEEN THE BLOWER CONTROL MODULE AND THE CJB FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the blower control module, connector C2H123-A, pin 2, circuit CBP18B (GY/OG), wiring harness side and the CJB, connector C1BP02-C, pin 69, circuit CBP18B (GY/OG), wiring harness side.

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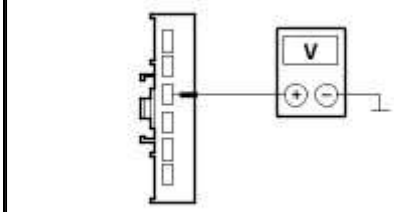


Is a resistance of less than 2 Ohms registered?

Yes

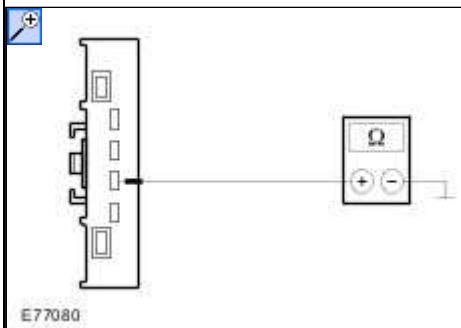
CHECK the CJB and RENEW as necessary. CHECK the operation of the system.

No

LOCATE and REPAIR the break in circuit CBP18B (GY/OG) between the blower control module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

B17: CHECK THE CIRCUIT BETWEEN THE BLOWER CONTROL MODULE AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR SHORT TO GROUND

1 Ignition switch in position 0.



2 Measure the resistance between the blower control module, connector C2H123-A, pin 4, circuit VH101A (WH/VT), wiring harness side and ground.

Is a resistance of more than 10,000 Ohms measured?

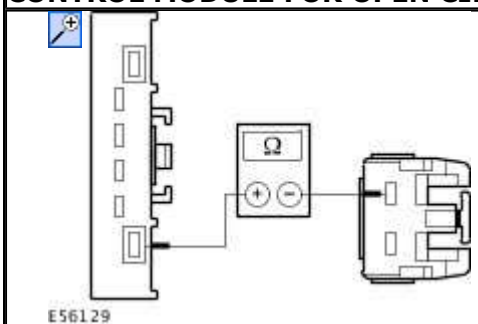
Yes

GO to B18.

No

LOCATE and REPAIR the short to ground in circuit VH101A (WH/VT) between the blower control module and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

B18: CHECK THE CIRCUIT BETWEEN THE BLOWER MOTOR AND THE BLOWER CONTROL MODULE FOR OPEN CIRCUIT



1 Measure the resistance between the blower motor, connector C2H123-B, pin 2, circuit VH301A (YE/BU), wiring harness side and the blower control module, connector C2H123-A, pin 1, circuit VH301A (YE/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to B19.

No

LOCATE and REPAIR the break in circuit VH301A (YE/BU) between the blower motor and the blower

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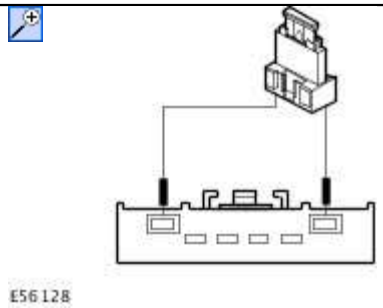
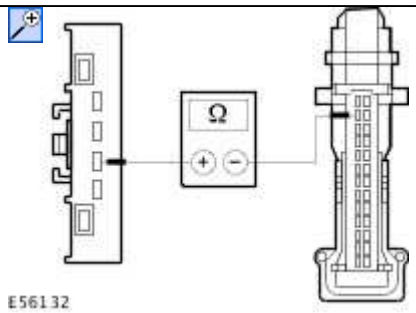
	control module with the aid of the Wiring Diagrams. CHECK the operation of the system.
B19: CHECK THE BLOWER CONTROL MODULE	
	1 Connect Connector C2H123-B to the blower motor.
 E56128	2 Use a fused jumper lead (40 A) to connect the blower control module, connector C2H123-A, between pin 1, circuit VH301A (YE/BU), wiring harness side and pin 6, circuit GD138AM (BK/WH), wiring harness side.
	3 Ignition switch in position II.
	Does the blower motor run at full speed? **Yes** RENEW the blower control module. CHECK the operation of the system. If the system is still not working, CHECK the EATC module and INSTALL A NEW ONE if necessary. **No** RENEW the blower motor. CHECK the operation of the system.
B20: CHECK CIRCUIT BETWEEN THE BLOWER CONTROL MODULE AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H123-A from the blower control module.
	3 Disconnect Connector C2H101-B from the EATC module.
 E56132	4 Measure the resistance between the blower control module, connector C2H123-A, pin 4, circuit VH101A (WH/VT), wiring harness side and the EATC module, connector C2H101-B, pin 15, circuit VH101A (WH/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B21. **No** LOCATE and REPAIR the break in circuit VH101A (WH/VT) between the blower control module and the EATC module with the aid of the Wiring Diagrams. CHECK the operation of the system.
B21: CHECK THE CIRCUIT BETWEEN THE BLOWER CONTROL MODULE AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the EATC module, connector C2H101-B, pin 15, circuit VH101A (WH/VT), wiring harness side and ground.

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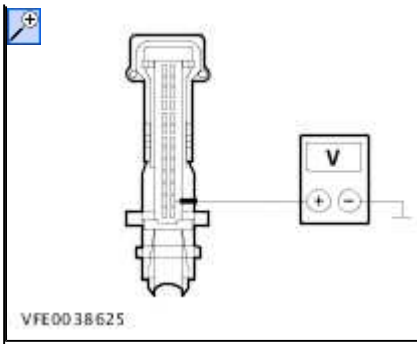

	Is a voltage measured? **Yes** GO to B22. **No** RENEW the blower control module. CHECK the operation of the system. If the system is still not working, CHECK the EATC module and INSTALL A NEW ONE if necessary.

B22: CHECK THE CIRCUIT BETWEEN THE BLOWER CONTROL MODULE AND THE BLOWER MOTOR FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H123-B from the blower motor.
	3 Measure the resistance between the blower control module, connector C2H123-A, pin 1, circuit VH301A (YE/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the blower control module. CHECK the operation of the system. If the system is still not working, CHECK the EATC module and INSTALL A NEW ONE if necessary. **No** LOCATE and REPAIR the short to ground in circuit VH301A (YE/BU) between the blower control module and the blower motor with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST C : MALFUNCTION OF THE RECIRCULATED AIR FLAP - VEHICLES WITH MANUAL AIR CONDITIONING

NOTE: The recirculated air flap is actuated by means of a DC motor. This motor is actuated by the electronic automatic temperature control (EATC) module or automatic temperature control (ATC) module for a maximum of 7 seconds after pressing the air recirculation button. Opening and closing of the air recirculation flap is performed by reversing the polarity of the applied voltage.

NOTE: Recirculated air mode is not available when the "Defrost/demist windscreen" function is active.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FUSE F27	
	1 Ignition switch in position 0.
	2 CHECK Fuse F27 (CJB).
	Is the fuse OK? **Yes** GO to C2. **No** RENEW fuse F27 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and

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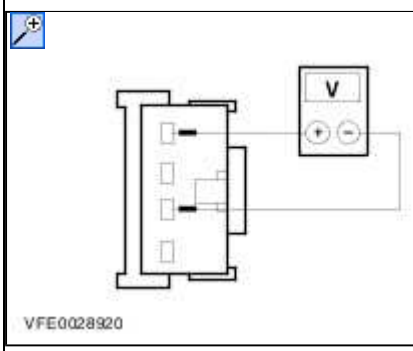
	REPAIR the short using the Wiring Diagrams.
C2: CHECK THE VOLTAGE AT FUSE F27	
	1 Connect Fuse F27 (CJB).
	2 Measure the voltage between fuse F27 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to C5. **No** REPAIR the voltage supply to fuse F27 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C3: CHECK FUSE F4	
	1 CHECK Fuse F4 (CJB).
	Is the fuse OK? **Yes** GO to C4. **No** RENEW fuse F4 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
C4: CHECK THE VOLTAGE AT FUSE F4	
	1 Connect Fuse F4 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F4 (7.5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to C5. **No** REPAIR the voltage supply to fuse F4 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C5: CHECK THE VOLTAGE AT THE RECIRCULATED AIR FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C5H206 (RHD vehicles: Connector C5H206 from the recirculated air flap actuator.
	3 Ignition switch in position II.
 VFE0028920	4 Measure the voltage at the recirculated air flap actuator, connector C5H206 (RHD vehicles: connector C6H206), between pin 2 and pin 4, wiring harness side.
	5 Actuate the recirculated air switch several times during the measurement.
	Is a voltage of at least 10 V measured with alternating polarity? **Yes** CHECK the air recirculation flap for ease of movement and correct operation. If the air recirculation flap is OK, RENEW the air recirculation

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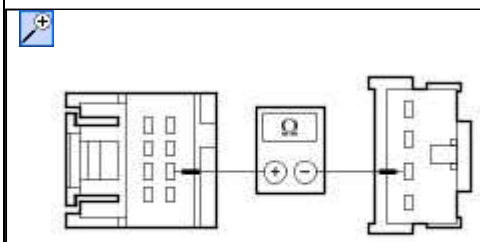
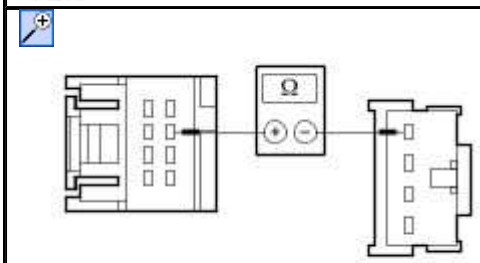
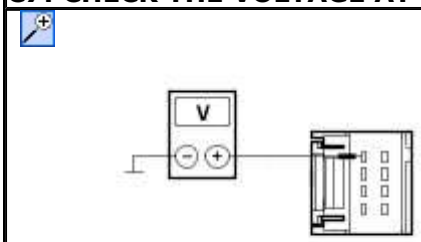
	flap actuator. CHECK the operation of the system. **No** GO to C6.
C6: CHECK FOR OPEN CIRCUIT BETWEEN THE AIR RECIRCULATION FLAP ACTUATOR AND THE A/C CONTROL ASSEMBLY	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-C from the air conditioning control assembly.
 E76196	3 Measure the resistance between the recirculated air flap actuator, connector C5H206, pin 2 (RHD vehicles: connector C6H206, pin 4), circuit CH207C (BU/GY), wiring harness side and the air conditioning control assembly, connector C2H101-C, pin 7, circuit CH207C (BU/GY), wiring harness side.
 E76197	4 Measure the resistance between the recirculated air flap actuator, connector C5H206, pin 4 (RHD vehicles: connector C6H206, pin 2), circuit CH208C (GN/OG), wiring harness side and the air conditioning control assembly, connector C2H101-C, pin 6, circuit CH208C (GN/OG), wiring harness side.
	Is a resistance of less than 2 Ohms measured in both cases? **Yes** GO to C7. **No** LOCATE and REPAIR the break in the corresponding circuit between the recirculated air flap actuator and the air conditioning control assembly with the aid of the Wiring Diagrams. CHECK the operation of the system.
C7: CHECK THE VOLTAGE AT THE AIR CONDITIONING CONTROL ASSEMBLY (PIN 1)	
 E57210	1 Measure the voltage between the air conditioning control assembly, connector C2H101-C, pin 1, circuit CBP27C (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to C9. **No** GO to C8.
C8: CHECK FOR OPEN CIRCUIT BETWEEN THE AIR CONDITIONING CONTROL ASSEMBLY AND THE CJB	
	1 Disconnect Connector C1BP02-C from the CJB.
	2 Measure the resistance between the air conditioning control assembly, connector C2H101-

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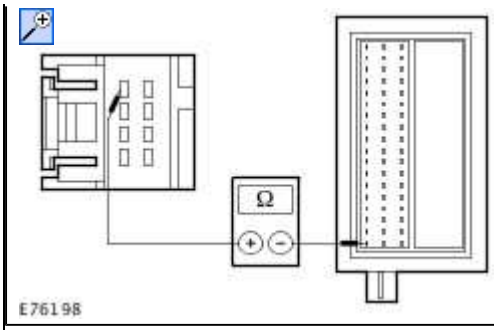
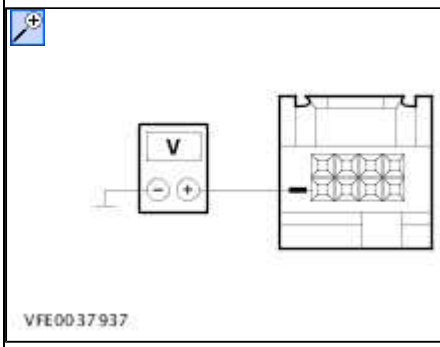
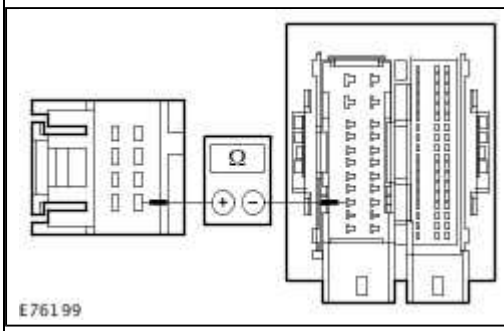
	C, pin 1, circuit SBP27C (BU/RD), wiring harness side and the CJB, connector C1BP02-C, pin 74, circuit SBP27C (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP27C (BU/RD) between the air conditioning control assembly and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
C9: CHECK THE VOLTAGE AT THE AIR CONDITIONING CONTROL ASSEMBLY (PIN 8)	
	1 Ignition switch in position II.
	2 Measure the voltage between the air conditioning control assembly, connector C2H101-C, pin 8, circuit CBP04 (VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to C11. **No** GO to C10.
C10: CHECK FOR OPEN CIRCUIT BETWEEN THE AIR CONDITIONING CONTROL ASSEMBLY AND THE CJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the air conditioning control assembly, connector C2H101-C, pin 8, circuit CBP04 (VT), wiring harness side and the CJB, connector C1BP02-C, pin 68, circuit CBP04T (VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the open circuit between the air conditioning control assembly and the CJB using the Wiring Diagrams. CHECK the operation of the

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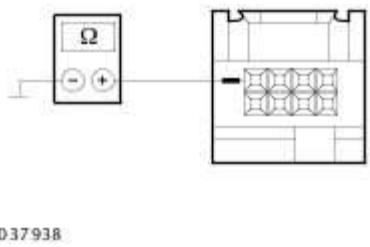
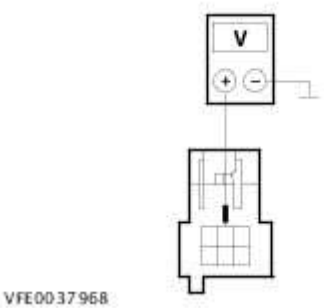
	system.
C11: CHECK THE GROUND CONNECTION OF THE AIR CONDITIONING CONTROL PANEL	
	1 Ignition switch in position 0.
	2 Measure the resistance between the air conditioning control assembly, connector C2H101-C, pin 4, circuit GD133CS (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the A/C control assembly. CHECK the operation of the system. **No** LOCATE and REPAIR the open circuit between the air conditioning control assembly and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST D : MALFUNCTION OF THE RECIRCULATED AIR FLAP - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
NOTE: Air recirculation mode is not available when the "Defrost/demist windscreen" function is active.	
NOTE: Ensure that the recirculated air flap is mechanically OK.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: TEST THE VOLTAGE AT THE RECIRCULATED AIR FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H206 (RHD vehicles: connector C231CX) from the recirculated air flap actuator.
	3 Ignition switch in position II.
	4 Measure the voltage between the recirculated air flap actuator, connector C2H206 (RHD vehicles: connector C231CX), pin 2, circuit CH206A (YE/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** - LHD vehicles:GO to D3. - RHD vehicles:GO to D4. **No** GO to D2.
D2: CHECK CIRCUIT BETWEEN THE RECIRCULATED AIR FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.

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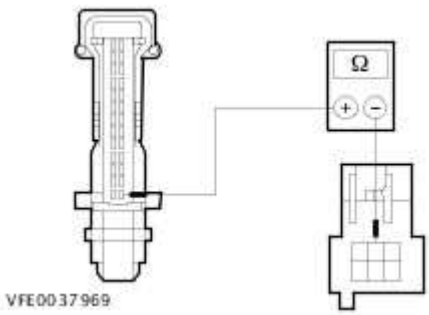
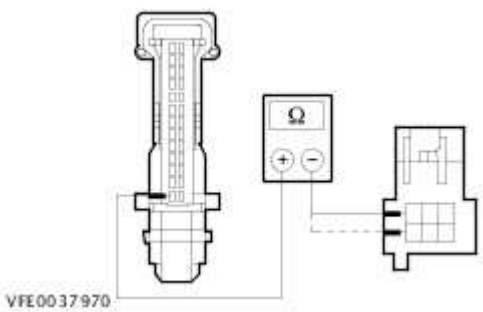
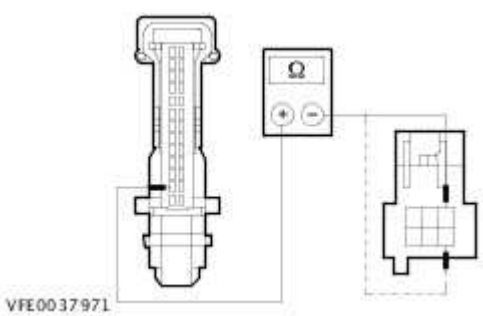
	2 Disconnect Connector C2H101-B from the EATC module.
	3 Measure the resistance between the EATC module, connector C2H101-B, pin 14, circuit CH206A (YE/VT), wiring harness side and the recirculated air flap actuator, connector C2H206, pin 2, circuit CH206A (YE/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CH206A (YE/VT) between the EATC module and the recirculated air flap actuator with the aid of the Wiring Diagrams. CHECK the operation of the system.
D3: CHECK THE CIRCUITS BETWEEN THE RECIRCULATED AIR FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT - LHD VEHICLES	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
	3 Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY), wiring harness side and the recirculated air flap actuator, connector C2H206, pin 1, circuit CH207A (BU/GY), wiring harness side.
	4 Measure the resistance between the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG), wiring harness side and the recirculated air flap actuator, connector C2H206, pin 3, circuit CH208A (GN/OG), wiring harness side.
	5 Measure the resistance between the EATC module, connector C2H101-A, pin 14, circuit CH209A (BN/YE), wiring harness side and the recirculated air flap actuator, connector C2H206, pin 4, circuit CH209A (BN/YE), wiring harness side.

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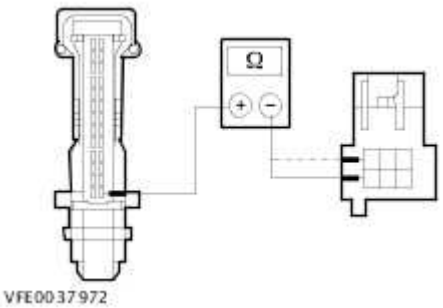
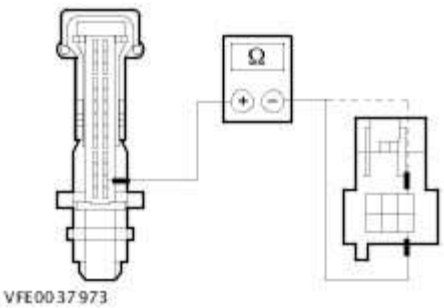
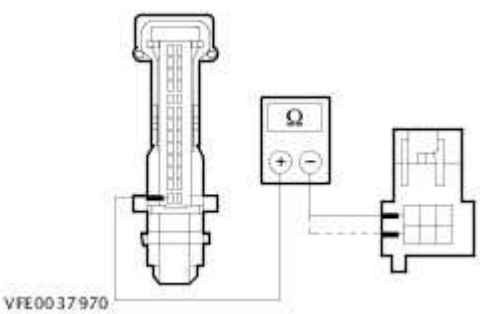
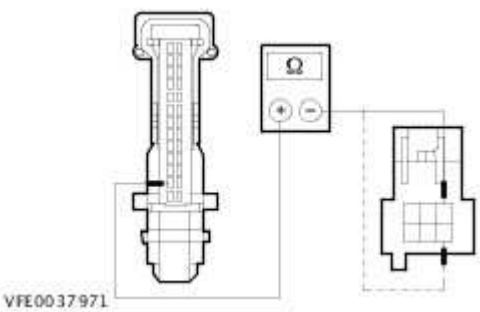
	
	**6** Measure the resistance between the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH), wiring harness side and the recirculated air flap actuator, connector C2H206, pin 6, circuit CH210A (VT/WH), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to D5. **No** LOCATE and REPAIR the break in the relevant circuit between the air recalculation flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
D4: CHECK THE CIRCUITS BETWEEN THE RECIRCULATED AIR FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT - RHD VEHICLES	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207B (BU/GY), wiring harness side and the recirculated air flap actuator, connector C2H101-A, pin 4, circuit CH207B (BU/GY), wiring harness side.
	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 2, circuit CH208B (GN/OG), wiring harness side and the recirculated air flap actuator, connector C2H101-A, pin 6, circuit CH208B (GN/OG), wiring harness side.
	5 Measure the resistance between the EATC module, connector C2H101-A, pin 14, circuit CH209B

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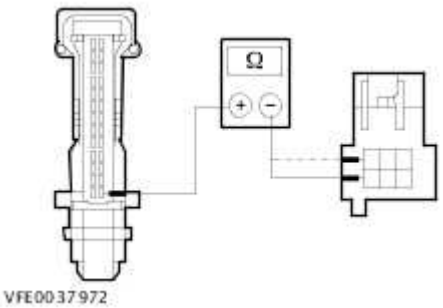
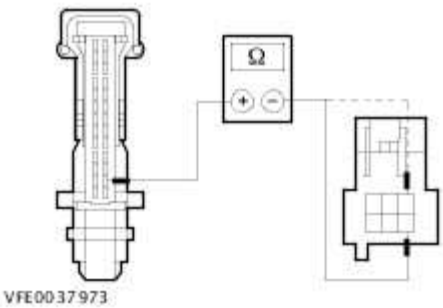
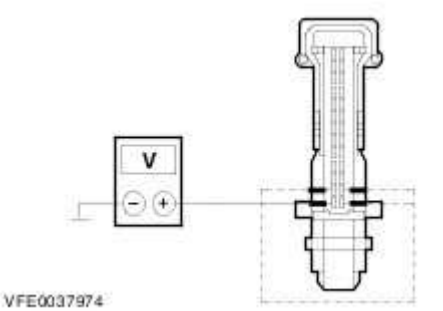
	(GY/RD), wiring harness side and the recirculated air flap actuator, connector C2H101-A, pin 1, circuit CH209B (GY/RD), wiring harness side.
	**6** Measure the resistance between the EATC module, connector C2H101-A, pin 15, circuit CH210B (VT/WH), wiring harness side and the recirculated air flap actuator, connector C2H101-A, pin 3, circuit CH210B (VT/WH), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to D5. **No** LOCATE and REPAIR the break in the relevant circuit between the air recalculation flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
D5: CHECK THE CIRCUITS BETWEEN THE AIR RECIRCULATION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	**2** Measure the voltage between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and ground.
	3 Measure the voltage between the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG) (RHD vehicles: circuit CH208B (GN/OG)), wiring harness side and ground.
	4 Measure the voltage between the EATC module, connector C2H101-A, pin 14, circuit CH209A (BN/YE) (RHD vehicles: circuit CH209B (BN/YE)), wiring harness side and ground.
	5 Measure the voltage between the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side and ground.
	Is a voltage measured during one or more measurements? **Yes**

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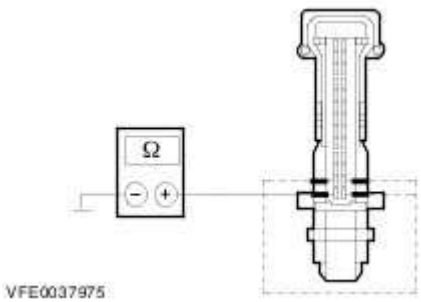
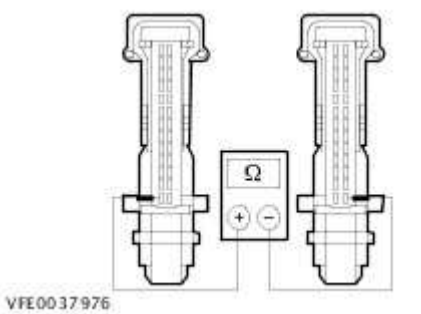
	LOCATE and REPAIR the short to voltage in the relevant circuit(s) between the air recirculation flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to D6.
D6: CHECK THE CIRCUITS BETWEEN THE AIR RECIRCULATION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and ground.
	3 Measure the resistance between the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG) (RHD vehicles: circuit CH208B (GN/OG)), wiring harness side and ground.
	4 Measure the resistance between the EATC module, connector C2H101-A, pin 14, circuit CH209A (BN/YE) (RHD vehicles: circuit CH209B (BN/YE)), wiring harness side and ground.
	5 Measure the resistance between the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** GO to D7. **No** LOCATE and REPAIR the short to ground in the relevant circuit(s) between the air recirculation flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
D7: CHECK THE CIRCUITS BETWEEN THE AIR RECIRCULATION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT CIRCUIT	
	1 Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and the EATC module, connector C2H101-B, pin 14, circuit CH206A (BN/YE), wiring harness side..
	2 Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and the EATC module, connector C2H101-A, pin 2, circuit CH208A (BN/YE) (RHD vehicles: circuit CH208B (BN/YE)),

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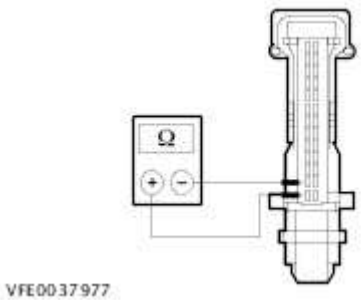
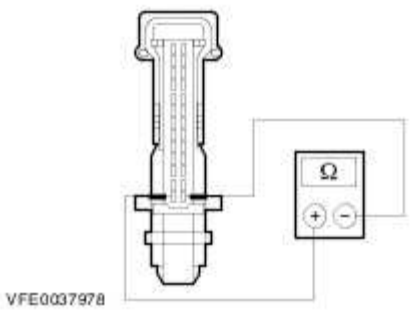
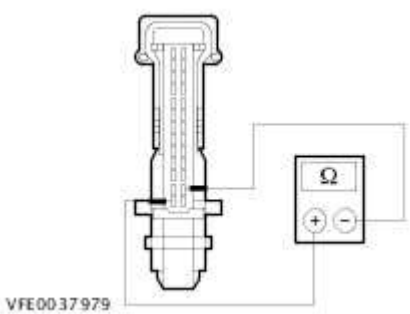
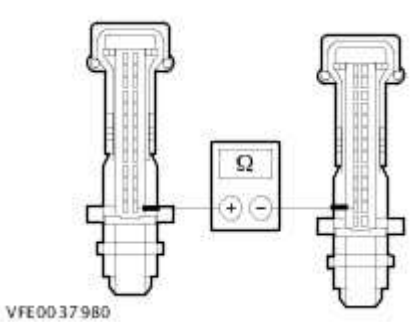
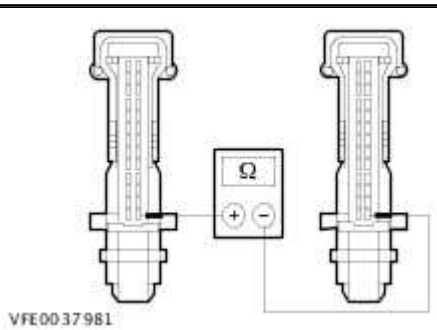
	wiring harness side.
	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and the EATC module, connector C2H101-A, pin 14, circuit CH209A (GY/RD) (RHD vehicles: circuit CH209B (GY/RD)), wiring harness side.
	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 1, circuit CH207A (BU/GY) (RHD vehicles: circuit CH207B (BU/GY)), wiring harness side and the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side.
	**5** Measure the resistance between the EATC module, connector C2H101-B, pin 14, circuit CH206A (BN/YE), wiring harness side and the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG) (RHD vehicles: circuit CH208B (GN/OG)), wiring harness side.
	**6** Measure the resistance between the EATC module, connector C2H101-B, pin 14, circuit CH206A (BN/YE), wiring harness side and the EATC module, connector C2H101-A, pin 14, circuit CH209A (GY/RD) (RHD vehicles: circuit CH209B (GY/RD)), wiring harness side.
	7 Measure the resistance between the EATC module, connector C2H101-B, pin 14, circuit CH206A (BN/YE), wiring harness side and the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side.

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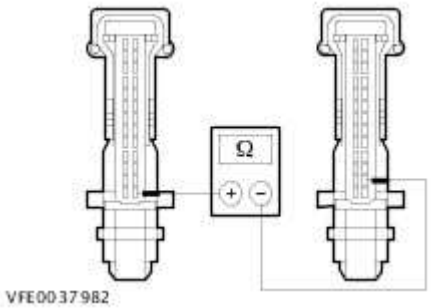
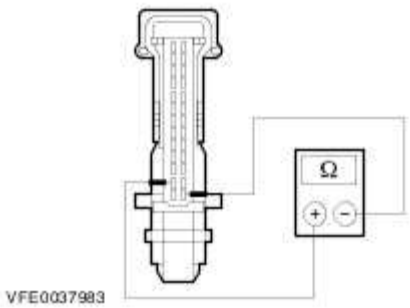
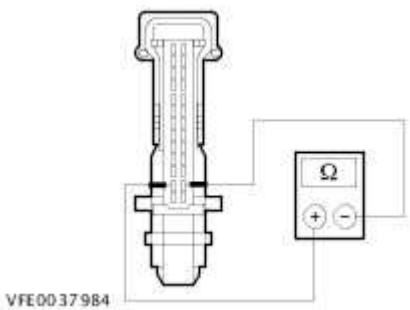
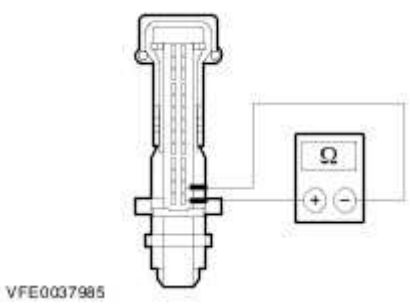
	
	**8** Measure the resistance between the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG) (RHD vehicles: circuit CH208B (GN/OG)), wiring harness side and the EATC module, connector C2H101-A, pin 14, circuit CH209A (BN/YE) (RHD vehicles: circuit CH209B (GY/RD)), wiring harness side.
	**9** Measure the resistance between the EATC module, connector C2H101-A, pin 2, circuit CH208A (GN/OG) (RHD vehicles: circuit CH208B (GN/OG)), wiring harness side and the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side.
	**10** Measure the resistance between the EATC module, connector C2H101-A, pin 14, circuit CH209A (BN/YE) (RHD vehicles: circuit CH209B (GY/RD)), wiring harness side and the EATC module, connector C2H101-A, pin 15, circuit CH210A (VT/WH) (RHD vehicles: circuit CH210B (VT/WH)), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** RENEW the recirculated air flap actuator. CHECK the operation of the system. **No** LOCATE and REPAIR the short in the relevant circuits between the recirculated air flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST E : AIR CONDITIONING INOPERATIVE (BLOWER MOTOR OK)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FUSE F13	
	1 Ignition switch in position 0.
	2 CHECK Fuse F13 (EJB).

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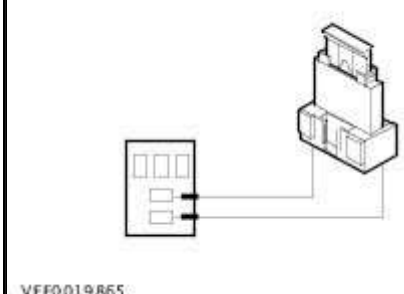
	Is the fuse OK? **Yes** GO to E2. **No** RENEW fuse F13 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
E2: CHECK THE VOLTAGE AT FUSE F13	
	1 Connect Fuse F13 (EJB).
	2 Measure the voltage between fuse F13 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to E3. **No** REPAIR the voltage supply to fuse F13 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E3: CHECK FUSE F7	
	1 CHECK fuse F7 (BJB).
	Is the fuse OK? **Yes** GO to E4. **No** RENEW fuse F7 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
E4: CHECK THE VOLTAGE AT FUSE F7	
	1 Connect fuse F7 (BJB).
	2 Measure the voltage between fuse F7 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to E5. **No** REPAIR the voltage supply to fuse F7 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E5: CHECK THE CIRCUIT OF THE A/C CLUTCH	
	1 Disconnect A/C clutch relay H401 from socket C1BB03-A.
	2 Use a fused test cable (15 A) to bridge A/C clutch relay H401, socket C1BB03-A, pin 28 and pin 29, wiring harness side.
	3 Check the operation of the A/C clutch.
	Does the air conditioning clutch work? **Yes** GO to E11. **No** GO to E6.
E6: CHECK THE VOLTAGE AT A/C CLUTCH RELAY H401	

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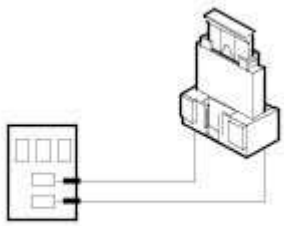
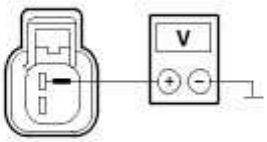
 VFE0016004	1 Measure the voltage between A/C clutch relay H401, socket C1BB03-A, pin 28, circuit SBB13A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** - All except vehicles with a 2.5L engine:GO to E7. - Vehicles with a 2.5L engineGO to E8. **No** LOCATE and RECTIFY the break in circuit SBB13A (RD) between fuse F13 and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E7: CHECK THE VOLTAGE AT THE A/C CLUTCH - ALL EXCEPT VEHICLES WITH A 2.5L ENGINE	
	1 Disconnect Connector C1H302-C from the A/C clutch.
 VFE0019865	2 Use a fused test cable (15 A) to bridge A/C clutch relay H401, socket C1BB03-A, pin 28 and pin 29, wiring harness side.
 E76200	3 Measure the voltage between the A/C clutch, connector C1H302-C, pin 1, circuit CH401A (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to E10. **No** GO to E9.
E8: CHECK THE VOLTAGE AT THE A/C CLUTCH - VEHICLES WITH A 2.5L ENGINE	
	1 Disconnect Connector C1H302-A from the A/C clutch.
	2 Use a fused test cable (15 A) to bridge A/C clutch relay H401, socket C1BB03-A, pin 28 and pin 29, wiring harness side.

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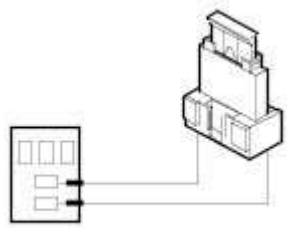
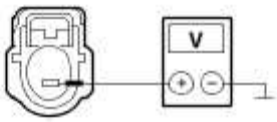
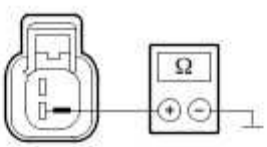
 VFE0019865	
 E76201	3 Measure the voltage between the A/C clutch, connector C1H302-A, pin 1, circuit CH401A (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** CHECK the mounting of the refrigerant compressor. If the component is securely attached, RENEW the A/C clutch. CHECK the operation of the system. **No** GO to E9.
E9: CHECK THE CIRCUIT BETWEEN THE A/C CLUTCH AND THE EJB FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the A/C clutch, connector C1H302-C (vehicles with a 2.5L engine: connector C1H302-A), pin 1, circuit CH401A (VT/WH), wiring harness side and the EJB, connector C1BB03-A, pin 29, circuit CH401A (VT/WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** LOCATE and RECTIFY the break in circuit CH401A (VT/WH) between the EJB and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CH401A (VT/WH) between the EJB and the A/C clutch with the aid of the Wiring Diagrams. CHECK the operation of the system.
E10: CHECK THE GROUND CONNECTION OF THE A/C CLUTCH	
 E76202	1 Measure the resistance between the A/C clutch, connector C1H302-C, pin 2, circuit GN129D (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes**

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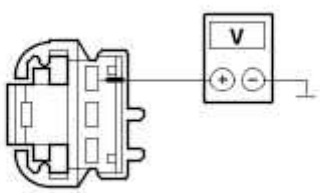
	RENEW the air conditioning clutch. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the A/C clutch and ground connection G1D129 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E11: CHECK THE PLAUSIBILITY OF THE AMBIENT TEMPERATURE	
	1 Connect the diagnostic tool.
	2 Using the Ford approved diagnostic tool, select **PCM/AAT** in data logger and check the ambient air temperature.
	Is the indicated ambient air temperature plausible? **Yes** GO to E12. **No** GO to E51.
E12: CHECK THE A/C SWITCH SIGNAL	
	1 Switch on the blower.
	2 Switch on the air conditioning (A/C).
	3 Using the Ford approved diagnostic tool, select **BCM/AC_SW** in data logger and check the A/C switch signal.
	Is an A/C switch signal displayed in the data logger of the BCM? **Yes** GO to E25. **No** - All except vehicles with electronic automatic temperature control (EATC):GO to E21. - Vehicles with electronic automatic temperature control (EATC)GO to E13.
E13: CHECK THE VOLTAGE AT THE EVAPORATOR TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H406-A from the evaporator temperature sensor.
	3 Ignition switch in position II.
 E76203	4 Measure the voltage between the evaporator temperature sensor, connector C2H406-A, pin 1, circuit VH406A (all except vehicles with electronic automatic temperature control (EATC): circuit VH406C) (VT/BN), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to E18. **No** - The voltage measured is more than 6 Volts:LOCATE and RECTIFY the short to voltage in circuit VH406A (all except vehicles with electronic automatic temperature control (EATC): circuit VH406C) (VT/BN) between the EATC module or GEM and the evaporator temperature sensor with the aid of the Wiring Diagrams. CHECK the

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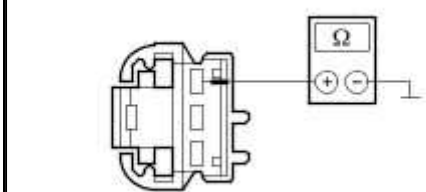
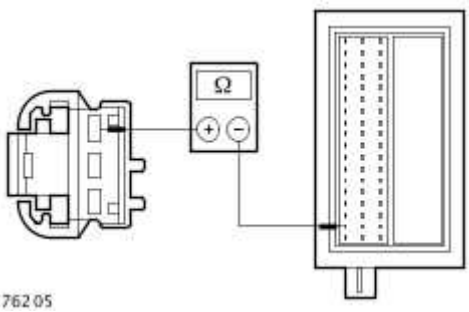
	operation of the system. - No voltage measured:All except vehicles with electronic automatic temperature control (EATC):GO to E14. Vehicles with electronic automatic temperature control (EATC)GO to E16.
E14: CHECK THE CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE GEM FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the GEM.
	3 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 1, circuit VH406C (VT/BN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to E15. **No** LOCATE and REPAIR the short to ground in circuit VH406C (VT/BN) between the GEM and the evaporator temperature sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
E15: CHECK THE CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE GEM FOR OPEN CIRCUIT	
	1 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 1, circuit VH406C (VT/BN), wiring harness side and the GEM, connector C1BP02-C, pin 2, circuit VH406C (VT/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH406C (VT/BN) between the evaporator temperature sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
E16: CHECK THE CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE EATC MODULE FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
	3 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 1, circuit VH406A (VT/BN), wiring harness side and ground.

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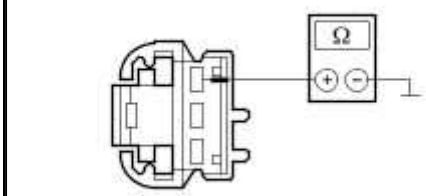
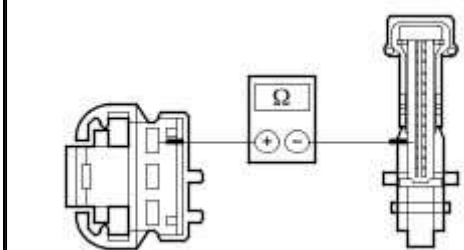
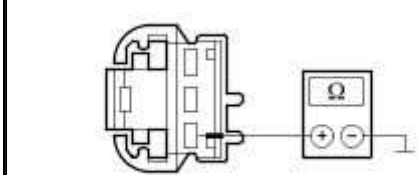
 E76204	
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to E17. **No** LOCATE and REPAIR the short to ground in circuit VH406A (VT/BN) between the EATC module and the evaporator temperature sensor with the aid of the Wiring Diagrams. CHECK the operation of the system.
E17: CHECK FOR OPEN CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE EATC MODULE	
 E76206	1 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 1, circuit VH406A (VT/BN), wiring harness side and the EATC module, connector C2H101-B, pin 4, circuit VH406A (VT/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH406A (VT/BN) between the evaporator temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK the operation of the system.
E18: CHECK THE GROUND CONNECTION OF THE EVAPORATOR TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
 E76207	2 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 3, circuit RH105P (all except vehicles with electronic automatic temperature control (EATC): circuit RH105U) (GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the evaporator temperature sensor. CHECK the operation of the system. **No**

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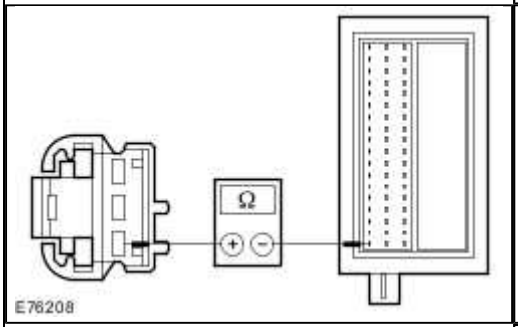
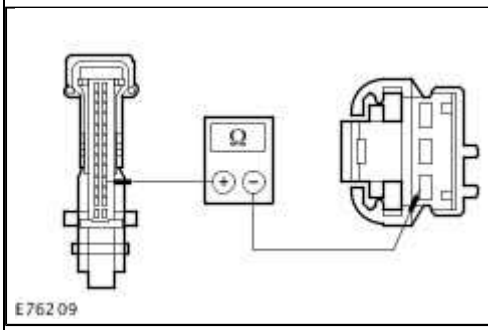
	- All except vehicles with electronic automatic temperature control (EATC):GO to E19. - Vehicles with electronic automatic temperature control (EATC)GO to E20.
E19: CHECK THE CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE GEM FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-C from the GEM.
	2 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 3, circuit RH105U (GN), wiring harness side and the GEM, connector C1BP02-C, pin 1, circuit RH105U (GN),wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit RH105U (GN) between the evaporator temperature sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
E20: CHECK FOR OPEN CIRCUIT BETWEEN THE EVAPORATOR TEMPERATURE SENSOR AND THE EATC MODULE	
	1 Disconnect Connector C2H101-B from the GEM.
	2 Measure the resistance between the evaporator temperature sensor, connector C2H406-A, pin 3, circuit RH105P (GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit RH105U (GN) between the evaporator temperature sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
E21: CHECK THE A/C REQUEST SIGNAL IN THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Set the blower switch to position 1. 2 Switch on the air conditioning (A/C). 3 Using the diagnostic tester, select the GEM and check in the data logger whether an A/C request signal is displayed.
	Is an A/C request signal displayed in the data logger of the GEM? **Yes** GO to E13.

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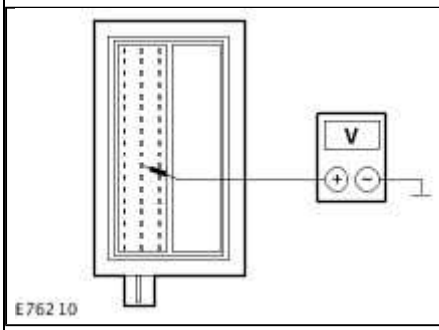
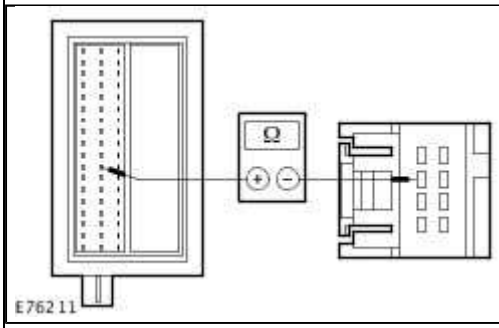
	No GO to E22.
E22: CHECK THE SIGNAL FROM THE A/C ON/OFF SWITCH AT THE CJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Ignition switch in position II.
	4 Set the blower switch to position 1.
	5 Switch on the air conditioning (A/C).
 E76210	6 Measure the voltage between the CJB, connector C1BP02-C, pin 26, circuit CH434A (GY/YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** GO to E23.
E23: CHECK THE CIRCUIT BETWEEN THE A/C CONTROL ASSEMBLY AND THE CJB FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect connector C2H101-C from the A/C control assembly
 E76211	3 Measure the resistance between the air conditioning control assembly, connector C2H101-C, pin 2, circuit CH434A (GY/YE), wiring harness side and the CJB, connector C1BP02-C, pin 26, circuit CH434A (GY/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to E24. **No** LOCATE and RECTIFY the break in circuit CH434A (GY/YE) between the air conditioning control assembly and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E24: CHECK THE CIRCUIT BETWEEN THE A/C CONTROL ASSEMBLY AND THE CJB FOR SHORT TO GROUND	
	1 Measure the resistance between the air conditioning control assembly, connector C2H101-C, pin 2, circuit CH434A (GY/YE), wiring harness side and ground.

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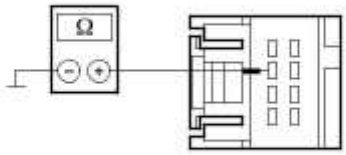
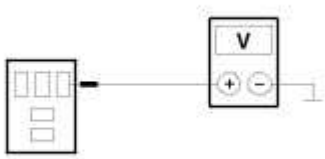
 E76212	
	Is a resistance of more than 10,000 Ohms measured? **Yes** CHECK and if necessary RENEW the air conditioning control panel. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit CH434A (GY/YE) between the air conditioning control assembly and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E25: CHECK THE REFRIGERANT QUANTITY	
	1 CHECK the quantity of refrigerant. REFER to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
	Is the quantity of refrigerant in the system in accordance with the manufacturer's specifications? **Yes** GO to E26. **No** Fill up the required quantity of refrigerant in accordance with the manufacturer's specifications. REFER to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures). TEST the system for normal operation.
E26: CHECK THE CONTROL VOLTAGE AT A/C CLUTCH RELAY H401	
 VFE0016104	1 Measure the voltage between A/C clutch relay H401, socket C1BB03-A, pin 31, circuit SBB07C (RD/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to E27. **No** LOCATE and RECTIFY the break in the circuit between fuse F7 and the A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E27: CHECK AIR CONDITIONING CLUTCH RELAY H401	
	1 Check A/C clutch relay H401 according to the

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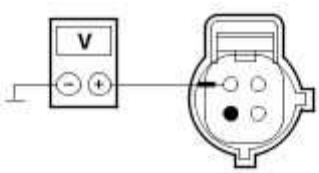
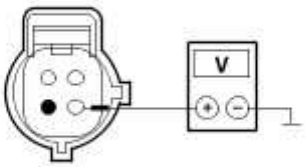
	component check at the end of the section.
	Is air conditioning clutch relay H401 OK? **Yes** GO to E28. **No** RENEW air conditioning clutch relay H401. CHECK the operation of the system.
E28: CHECK THE VOLTAGE AT THE REFRIGERANT PRESSURE TRANSDUCER	
	1 Disconnect Connector C1H433 from the refrigerant pressure transducer.
	2 Ignition switch in position II.
 E76213	3 Measure the voltage between the refrigerant pressure transducer, connector C1H433, pin 2, circuit VH442B (GN/BN), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to E29. **No** - Vehicles with a 1.8L diesel engine:GO to E39. - Vehicles with a 2.0L diesel engine:GO to E42. - Vehicles with a 2.0L engine:GO to E45. - Vehicles with a 2.5L engineGO to E48.
E29: CHECK THE CONTROL VOLTAGE AT THE REFRIGERANT PRESSURE TRANSDUCER	
 E76214	1 Measure the voltage between the refrigerant pressure transducer, connector C1H433, pin 3, circuit LH108B (GY/BN), wiring harness side and ground.
	Is a voltage of approx. 4 volts measured? **Yes** GO to E30. **No** - Vehicles with a 1.8L diesel engine:GO to E40. - Vehicles with a 2.0L diesel engine:GO to E43. - Vehicles with a 2.0L engine:GO to E46. - Vehicles with a 2.5L engineGO to E49.
E30: CHECK THE GROUND CONNECTION OF THE REFRIGERANT PRESSURE TRANSDUCER	
	1 Ignition switch in position 0.
	2 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 1, circuit RH108D (BU/RD) (vehicles with a 1.8L diesel engine: circuit RH108G (BU/RD)), wiring harness side and ground.

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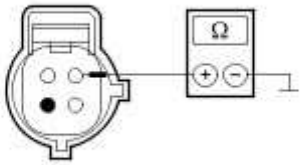
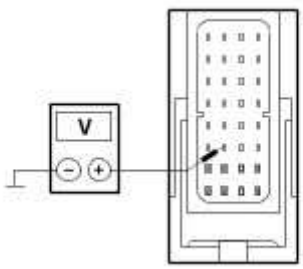
 E76215	
	Is a resistance of less than 2 Ohms registered? **Yes** - Vehicles with a 1.8L diesel engine:GO to E31. - Vehicles with a 2.0L diesel engine:GO to E33. - Vehicles with a 2.0L engine:GO to E35. - Vehicles with a 2.5L engineGO to E37. **No** - Vehicles with a 1.8L diesel engine:GO to E41. - Vehicles with a 2.0L diesel engine:GO to E44. - Vehicles with a 2.0L engine:GO to E47. - Vehicles with a 2.5L engineGO to E50.
E31: CHECK THE CIRCUIT BETWEEN A/C CLUTCH RELAY H401 AND THE POWERTRAIN CONTROL MODULE (PCM) FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE	
	1 Connect A/C clutch relay H401 to socket C1BB03-A.
	2 Disconnect Connector C1E108-K from the PCM.
 E76216	3 Measure the voltage between the PCM, connector C1E108-K, pin F2, circuit CH109B (YE/BK), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** RENEW the refrigerant pressure transducer. CHECK the operation of the system. If the system is still inoperative, CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** GO to E32.
E32: CHECK THE CIRCUIT BETWEEN THE PCM AND THE EJB FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-K, pin F2, circuit CH109B (YE/BK), wiring harness side and the EJB, connector C1BB03-A, pin 30, circuit CH109B (YE/BK), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** LOCATE and RECTIFY the break in circuit CH109B (YE/BK) between the EJB and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system.

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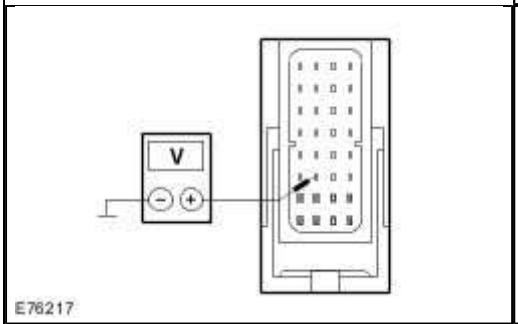
	No LOCATE and RECTIFY the break in circuit CH109B (YE/BK) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E33: CHECK THE CIRCUIT BETWEEN A/C CLUTCH RELAY H401 AND THE POWERTRAIN CONTROL MODULE (PCM) FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Connect A/C clutch relay H401 to socket C1BB03-A.
	2 Disconnect Connector C1E108-D from the PCM.
 E76217	3 Measure the voltage between the PCM, connector C1E108-D, pin F2, circuit CH109A (YE/BK), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** RENEW the refrigerant pressure transducer. CHECK the operation of the system. If the system is still inoperative, CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** GO to E34.
E34: CHECK THE CIRCUIT BETWEEN THE PCM AND THE EJB FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-D, pin F2, circuit CH109A (YE/BK), wiring harness side and the EJB, connector C1BB03-A, pin 30, circuit CH109A (YE/BK), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** LOCATE and RECTIFY the break in circuit CH109A (YE/BK) between the EJB and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CH109A (YE/BK) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E35: CHECK THE CIRCUIT BETWEEN A/C CLUTCH RELAY H401 AND THE POWERTRAIN CONTROL MODULE (PCM) FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE	
	1 Connect A/C clutch relay H401 to socket C1BB03-A.
	2 Disconnect Connector C1E104-E from the PCM.
	3 Measure the voltage between the PCM, connector C1E104-E, pin B2, circuit CH109C (YE/BK), wiring harness side and ground.

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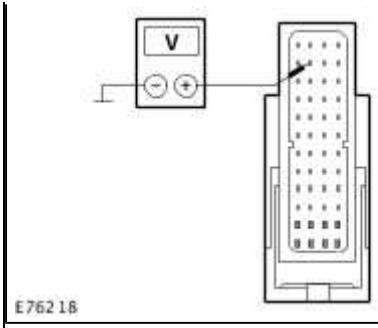


Does the meter display battery voltage?

Yes

RENEW the refrigerant pressure transducer. CHECK the operation of the system. If the system is still inoperative, CHECK the PCM and RENEW if necessary. CHECK the operation of the system.

No

GO to E36.

E36: CHECK THE CIRCUIT BETWEEN THE PCM AND THE EJB FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE

1. Disconnect Connector C1BB03-A from the EJB.
2. Measure the resistance between the PCM, connector C1E104-E, pin B2, circuit CH109C (YE/BK), wiring harness side and the EJB, connector C1BB03-A, pin 30, circuit CH109C (YE/BK), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

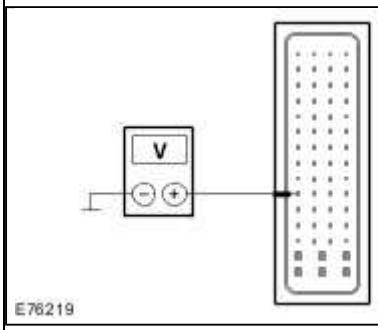
LOCATE and RECTIFY the break in circuit CH109C (YE/BK) between the EJB and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in circuit CH109C (YE/BK) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

E37: CHECK THE CIRCUIT BETWEEN A/C CLUTCH RELAY H401 AND THE POWERTRAIN CONTROL MODULE (PCM) FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE

1. Connect A/C clutch relay H401 to socket C1BB03-A.
2. Disconnect Connector C1E108-B from the PCM.
3. Measure the voltage between the PCM, connector C1E108-B, pin 10, circuit CH109D (WH/OG), wiring harness side and ground.



Does the meter display battery voltage?

Yes

RENEW the refrigerant pressure transducer. CHECK the operation of the system. If the system is still inoperative, CHECK the PCM and RENEW if necessary. CHECK the operation of the system.

No

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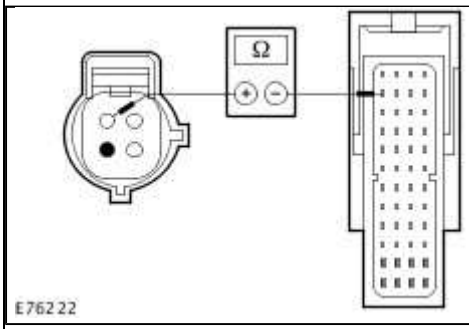
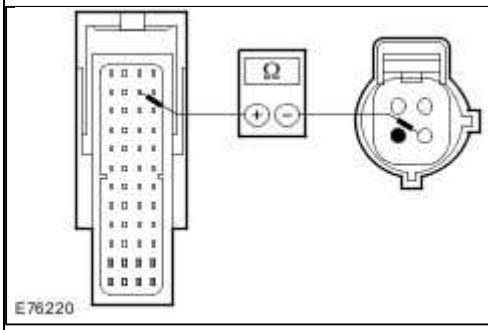
	GO to E38.
E38: CHECK THE CIRCUIT BETWEEN THE PCM AND THE EJB FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-B, pin 10, circuit CH109D (WH/OG), wiring harness side and the EJB, connector C1BB03-A, pin 30, circuit CH109D (WH/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** LOCATE and RECTIFY the break in circuit CH109D (WH/OG) between the EJB and A/C clutch relay H401 with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CH109D (WH/OG) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E39: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-L from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 2, circuit VH442B (GN/BN), wiring harness side and the PCM, connector C1E108-L, pin B1, circuit VH442B (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH442B (GN/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E40: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-L from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 3, circuit LH108B (GY/BN), wiring harness side and the PCM, connector C1E108-L, pin B3, circuit LH108B (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered?

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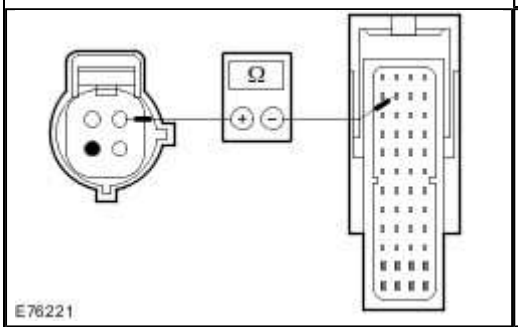
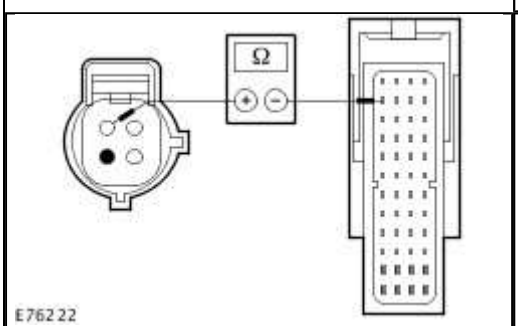
	Yes CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit LH108B (GY/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E41: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-L from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 1, circuit RH108G (BN), wiring harness side and the PCM, connector C1E108-L, pin B2, circuit RH108G (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit RH108G (BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E42: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-E from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 2, circuit VH442B (GN/BN), wiring harness side and the PCM, connector C1E108-E, pin B1, circuit VH442B (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH442B (GN/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E43: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-E from the PCM.

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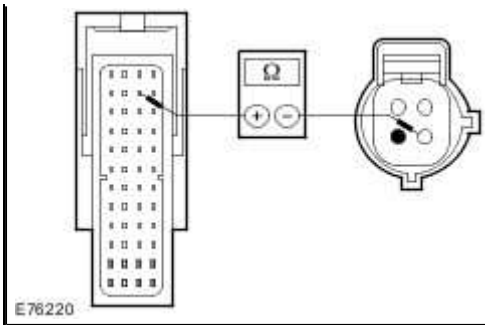
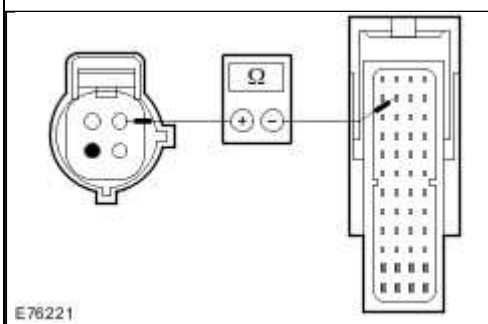
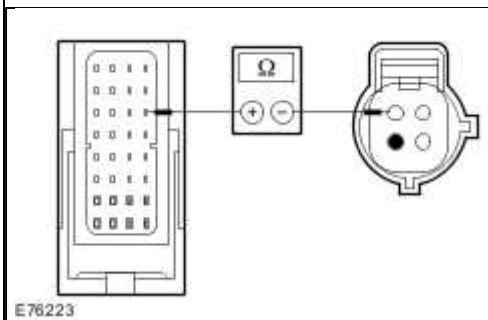
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 3, circuit LH108B (GY/BN), wiring harness side and the PCM, connector C1E108-E, pin B3, circuit LH108B (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit LH108B (GY/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E44: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-E from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 1, circuit RH108H (BN), wiring harness side and the PCM, connector C1E108-E, pin B2, circuit RH108H (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit RH108H (BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E45: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E104-F from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 2, circuit VH442B (GN/BN), wiring harness side and the PCM, connector C1E104-F, pin C4, circuit VH442C (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK

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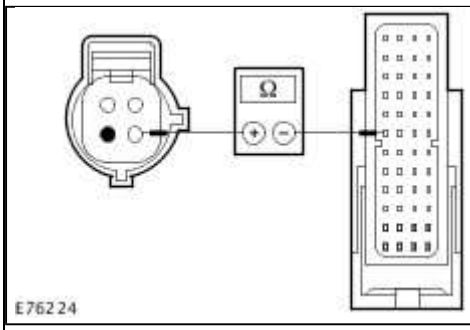
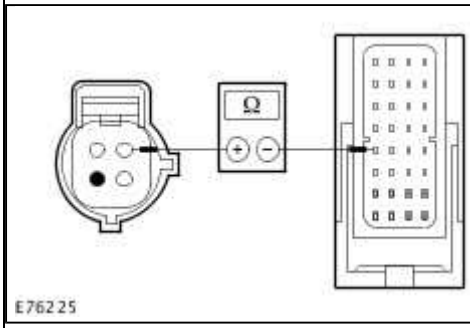
	the operation of the system. **No** LOCATE and REPAIR the break in circuit VH442C (GN/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E46: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E104-E from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 3, circuit LH108B (GY/BN), wiring harness side and the PCM, connector C1E104-E, pin F1, circuit LH108B (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit LH108B (GY/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E47: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E104-F from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 1, circuit RH108D (BN), wiring harness side and the PCM, connector C1E104-F, pin E1, circuit RH108A (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open circuit between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E48: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-B from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 2,

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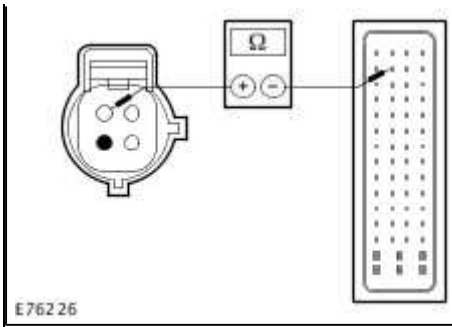
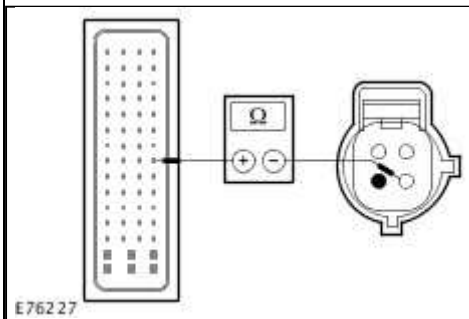
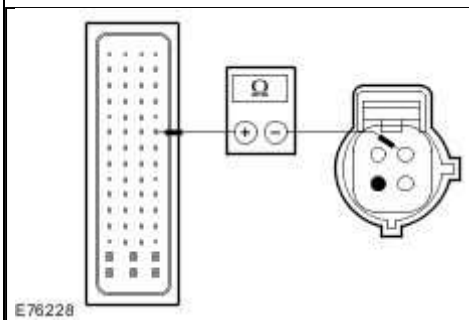
	circuit VH442B (GN/BN), wiring harness side and the PCM, connector C1E108-B, pin 31, circuit VH442B (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH442B (GN/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E49: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-B from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 3, circuit LH108B (GY/BN), wiring harness side and the PCM, connector C1E108-B, pin 51, circuit LH108B (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit LH108B (GY/BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E50: CHECK THE CIRCUIT BETWEEN THE REFRIGERANT PRESSURE TRANSDUCER AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-B from the PCM.
	3 Measure the resistance between the refrigerant pressure transducer, connector C1H433, pin 1, circuit RH108F (BN), wiring harness side and the PCM, connector C1E108-B, pin 53, circuit RH108F (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK

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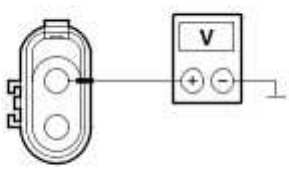
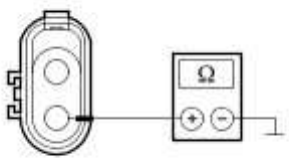
	the operation of the system. **No** LOCATE and REPAIR the break in circuit RH108F (BN) between the refrigerant pressure transducer and the PCM using the Wiring Diagrams. CHECK the operation of the system.
E51: CHECK THE VOLTAGE AT THE AMBIENT AIR TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1H407 from the ambient air temperature sensor.
	3 Ignition switch in position II.
 E76229	4 Measure the voltage at the ambient air temperature sensor, connector C1H407, pin 1, circuit VH407A (YE/GN), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to E52. **No** - Vehicles with a 2.0L diesel engine:GO to E56. - Vehicles with a 1.8L diesel engine:GO to E57. - Vehicles with a 2.0L engine:GO to E58. - Vehicles with a 2.5L engineGO to E59.
E52: CHECK THE GROUND CONNECTION OF THE AMBIENT AIR TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
 E76230	2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 2, circuit RH107A (GN/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the ambient air temperature sensor. CHECK the operation of the system. **No** - Vehicles with a 2.0L engine:LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and ground connection G1D108-D with the aid of the Wiring Diagrams. CHECK the operation of the system. - Vehicles with a 2.0L diesel engine:GO to E53. - Vehicles with a 1.8L diesel engine:GO to E54. - Vehicles with a 2.5L engineGO to E55.
E53: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE	
	1 Disconnect Connector C1E108-C from the PCM.

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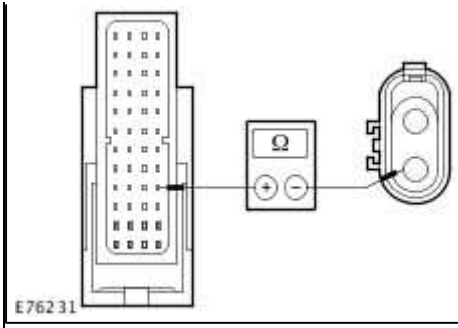


2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 2, circuit RH107A (GN/BU), wiring harness side and the PCM, connector C1E108-C, pin J4, circuit RH107B (GN/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the PCM and RENEW it as necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

E54: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE

1 Disconnect Connector C1E108-J from the PCM.

2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 2, circuit RH107A (GN/BU), wiring harness side and the PCM, connector C1E108-J, pin J4, circuit RH107B (GN/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

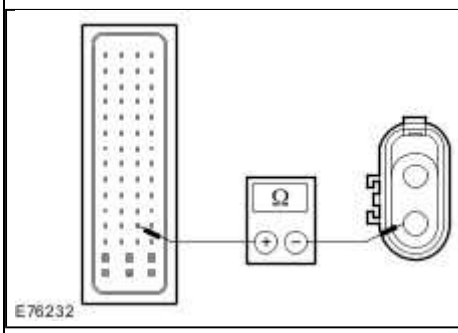
CHECK the PCM and RENEW it as necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

E55: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE

1 Disconnect Connector C1E108-B from the PCM.



2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 2, circuit RH107A (GN/BU), wiring harness side and the PCM, connector C1E108-B, pin 34, circuit RH107B (GN/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the PCM and RENEW it as necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

E56: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND

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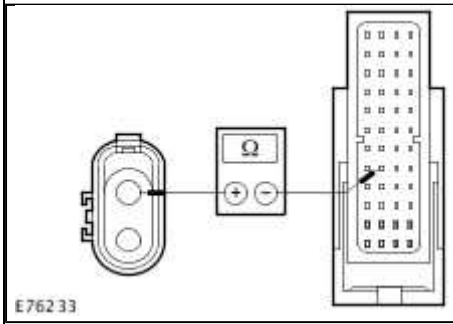
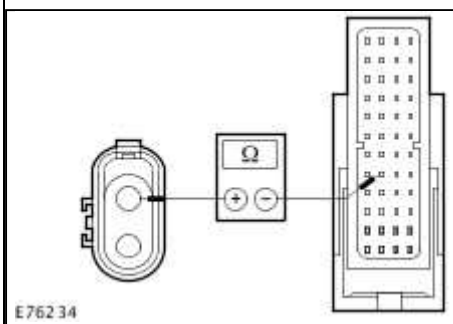
THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L DIESEL ENGINE

	1 Disconnect Connector C1E108-C from the PCM.
 E76233	2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 1, circuit VH407A (YE/GN), wiring harness side and the PCM, connector C1E108-C, Pin H2, circuit VH407B (YE/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW it as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

E57: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 1.8L DIESEL ENGINE

	1 Disconnect Connector C1E108-J from the PCM.
	2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 1, circuit VH407A (YE/GN), wiring harness side and the PCM, connector C1E108-J, Pin H2, circuit VH407B (YE/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW it as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

E58: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.0L ENGINE

	1 Disconnect Connector C1E104-E from the PCM.
 E76234	2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 1, circuit VH407A (YE/GN), wiring harness side and the PCM, connector C1E104-E, Pin H2, circuit VH407B (YE/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW it as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams.

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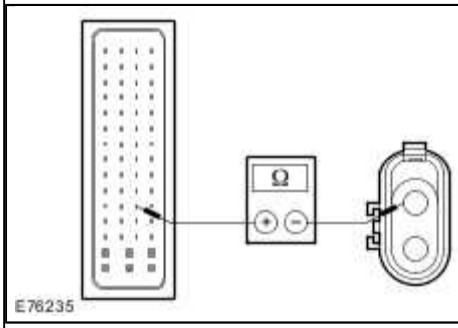
	CHECK the operation of the system.
E59: CHECK THE CIRCUIT BETWEEN THE AMBIENT AIR TEMPERATURE SENSOR AND THE PCM FOR OPEN CIRCUIT - VEHICLES WITH A 2.5L ENGINE	
	1 Disconnect Connector C1E108-B from the PCM.
	2 Measure the resistance between the ambient air temperature sensor, connector C1H407, pin 1, circuit VH407A (YE/GN), wiring harness side and the PCM, connector C1E108-B, Pin 35, circuit VH407B (YE/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW it as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the ambient air temperature sensor and the PCM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST F : CONTROL PANEL FOR THE CLIMATE CONTROL SYSTEM INOPERATIVE - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK FUSE F27	
	1 Ignition switch in position 0.
	2 CHECK Fuse F27 (CJB).
	Is the fuse OK? **Yes** GO to F2. **No** RENEW fuse F27 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
F2: CHECK THE VOLTAGE AT FUSE F27	
	1 Connect Fuse F27 (CJB).
	2 Measure the voltage between fuse F27 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to F3. **No** REPAIR the voltage supply to fuse F43 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F3: CHECK THE VOLTAGE AT THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE	
	1 Disconnect Connector C2H101-B from the EATC module.
	2 Measure the voltage between the EATC module, connector C2H101-B, pin 14, circuit SBP27B (BU/RD), wiring harness side and ground.

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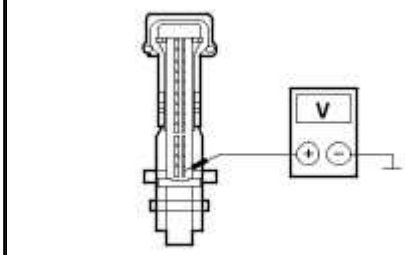
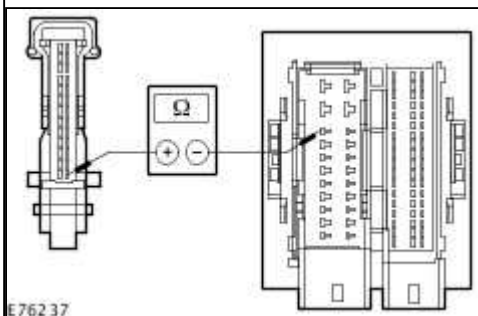
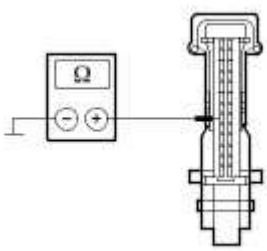
 E76236	
	Does the meter display battery voltage? **Yes** GO to F5. **No** GO to F4.
F4: CHECK THE CIRCUIT BETWEEN THE EATC MODULE AND THE CJB FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-C from the CJB.
 E76237	2 Measure the resistance between the EATC module, connector C2H101-B, pin 14, circuit SBP27B (GN/BN), wiring harness side and the CJB, connector C1BP02-C, pin 74, circuit SBP27B (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP27B (BU/RD) between the EATC module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
F5: CHECK THE GROUND CONNECTION OF THE EATC MODULE	
 E76238	1 Measure the resistance between the EATC module, connector C2H101-B, pin 6, circuit GD133BE (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** Check the communications via the MS CAN bus, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit between the EATC module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.

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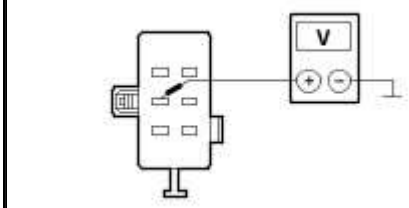
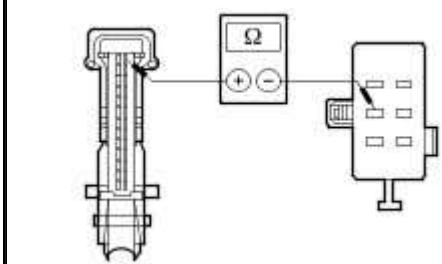
PINPOINT TEST G : MALFUNCTION OF AIR DISTRIBUTION FLAP - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)

NOTE: Ensure that the air distribution flap is mechanically OK.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK VOLTAGE AT AIR DISTRIBUTION FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H201 from the air distribution flap actuator.
	3 Ignition switch in position II.
 E76239	4 Measure the voltage between the air distribution flap actuator, connector C2H201, pin 2, circuit CH201A (BN/BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to G3. **No** GO to G2.
G2: CHECK THE CIRCUIT BETWEEN THE AIR DISTRIBUTION FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
 E76240	3 Measure the resistance between the EATC module, connector C2H101-A, pin 26, circuit CH201A (BN/BU), wiring harness side and the air distribution flap actuator, connector C2H201, pin 2, circuit CH201A (BN/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CH201A (BN/BU) between the EATC module and the air distribution flap actuator with the aid of the Wiring Diagrams. CHECK the operation of the system.
G3: CHECK THE CIRCUITS BETWEEN THE AIR DISTRIBUTION FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
	3 Measure the resistance between the EATC module,

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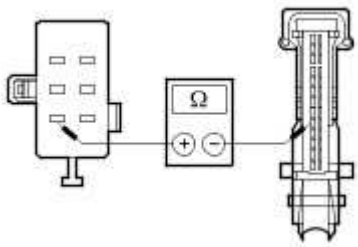
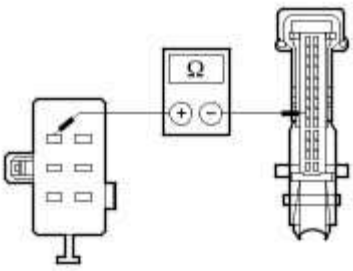
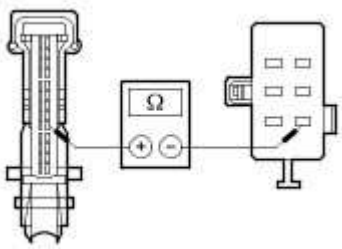
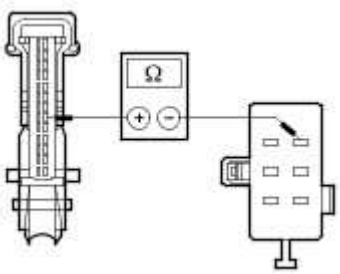
 E76241	connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and the air distribution flap actuator, connector C2H201, pin 1, circuit CH202A (BU/GN), wiring harness side.
 E76242	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side and the air distribution flap actuator, connector C2H201, pin 3, circuit CH203A (GN/BN), wiring harness side.
 E76243	**5** Measure the resistance between the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side and the air distribution flap actuator, connector C2H201, pin 4, circuit CH204A (GY/OG), wiring harness side.
 E76244	**6** Measure the resistance between the EATC module, connector C2H101-A, pin 19, circuit CH205A (VT/RD), wiring harness side and the air distribution flap actuator, connector C2H201, pin 6, circuit CH205A (VT/RD), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to G4. **No** LOCATE and REPAIR the break in the relevant circuit between the air distribution flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
G4: CHECK THE CIRCUITS BETWEEN THE AIR DISTRIBUTION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and ground.

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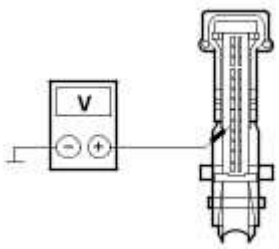
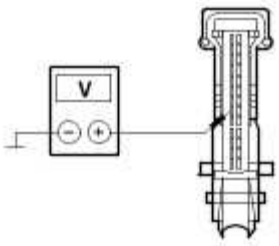
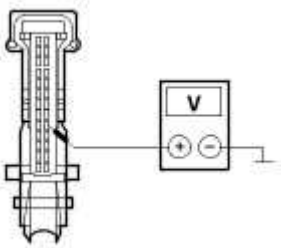
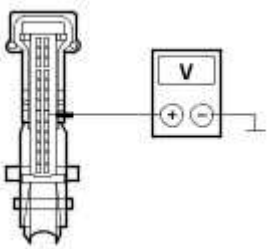
 E76245	
 E76787	3 Measure the voltage between the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side and ground.
 E76246	4 Measure the voltage between the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side and ground.
 E76247	5 Measure the voltage between the EATC module, connector C2H101-A, pin 19, circuit CH205A (BN/WH), wiring harness side and ground.
	Is a voltage measured during one or more measurements? **Yes** LOCATE and REPAIR the short to voltage in the relevant circuit(s) between the air distribution flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to G5.
G5: CHECK THE CIRCUITS BETWEEN THE AIR DISTRIBUTION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and ground.

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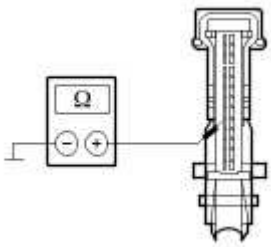
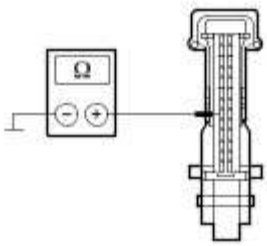
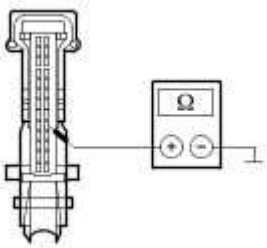
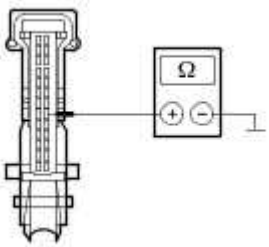
 E76248	
 E76238	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side and ground.
 E76249	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side and ground.
 E76250	**5** Measure the resistance between the EATC module, connector C2H101-A, pin 19, circuit CH205A (BN/WH), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** GO to G6. **No** LOCATE and REPAIR the short to ground in the relevant circuit(s) between the air distribution flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
G6: CHECK THE CIRCUITS BETWEEN THE AIR DISTRIBUTION FLAP ACTUATOR AND THE EATC MODULE FOR SHORT CIRCUIT	
	1 Measure the resistance between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and the EATC module, connector C2H101-A, pin 26, circuit CH201A (YE/RD), wiring harness side.

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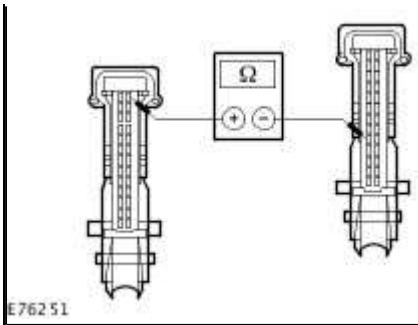
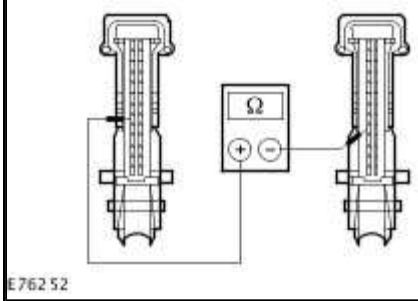
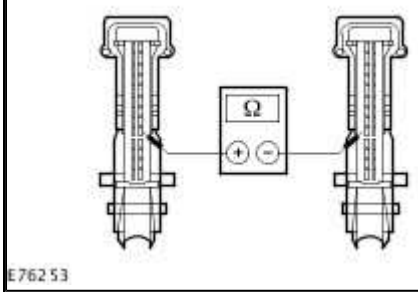
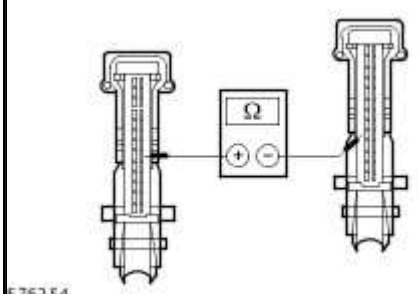
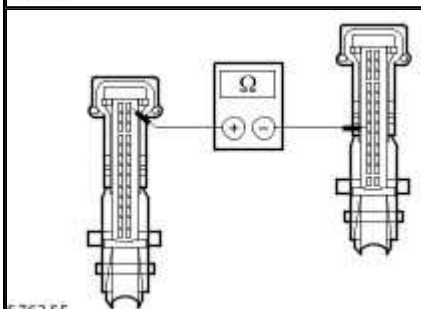
 E76251	
 E76252	2 Measure the resistance between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side.
 E76253	3 Measure the resistance between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side.
 E76254	4 Measure the resistance between the EATC module, connector C2H101-A, pin 5, circuit CH202A (BU/GN), wiring harness side and the EATC module, connector C1MC40, pin 19, circuit CH205A (BN/WH), wiring harness side.
 E76255	5 Measure the resistance between the EATC module, connector C2H101-A, pin 26, circuit CH201A (YE/RD), wiring harness side and the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side.
	6 Measure the resistance between the EATC module, connector C2H101-A, pin 26, circuit CH201A (YE/RD), wiring harness side and the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side.

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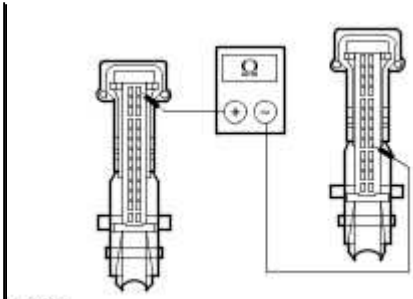
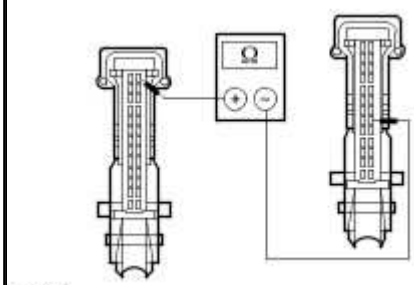
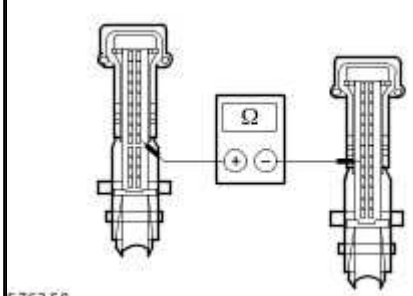
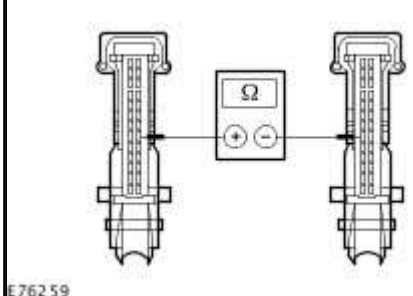
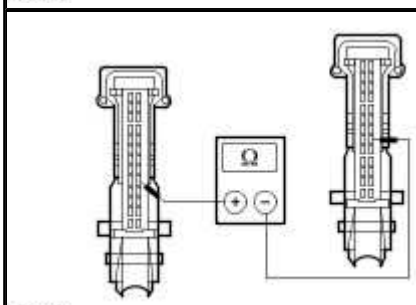
 E76256	
 E76257	**7** Measure the resistance between the EATC module, connector C2H101-A, pin 26, circuit CH201A (YE/RD), wiring harness side and the EATC module, connector C2H101-A, pin 19, circuit CH205A (BN/WH), wiring harness side.
 E76258	**8** Measure the resistance between the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side and the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side.
 E76259	**9** Measure the resistance between the EATC module, connector C2H101-A, pin 6, circuit CH203A (GN/BN), wiring harness side and the EATC module, connector C2H101-A, pin 19, circuit CH205A (BN/WH), wiring harness side.
 E76260	**10** Measure the resistance between the EATC module, connector C2H101-A, pin 18, circuit CH204A (GY/OG), wiring harness side and the EATC module, connector C2H101-A, pin 19, circuit CH205A (BN/WH), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** RENEW the air distribution flap actuator. CHECK the operation of the system. **No** LOCATE and REPAIR the short between the relevant circuits between the air distribution flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

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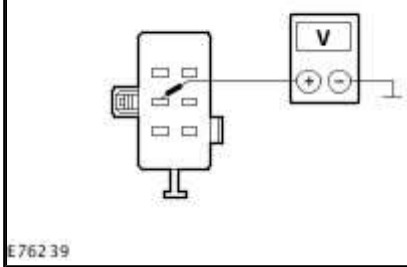
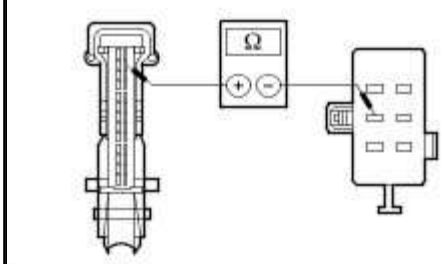
PINPOINT TEST H : MALFUNCTION OF RIGHT-HAND TEMPERATURE CONTROL FLAP - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)

NOTE: Ensure that the right-hand temperature control flap is mechanically OK.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK THE VOLTAGE AT THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C6H211 from the right-hand temperature control flap actuator.
	3 Ignition switch in position II.
 E76239	4 Measure the voltage between the right-hand temperature control flap actuator, connector C6H211, pin 2, circuit CH211A (YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to H3. **No** GO to H2.
H2: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
 E76261	3 Measure the resistance between the EATC module, connector C2H101-A, pin 25, circuit CH211A (YE), wiring harness side and the right-hand temperature control flap actuator, connector C6H211, pin 2, circuit CH211A (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CH211A (YE) between the EATC module and the right-hand temperature control flap actuator with the aid of the Wiring Diagrams. CHECK the operation of the system.
H3: CHECK THE CIRCUITS BETWEEN THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.

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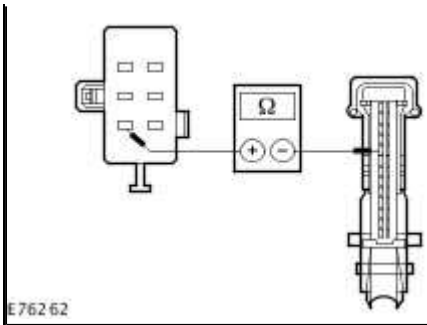
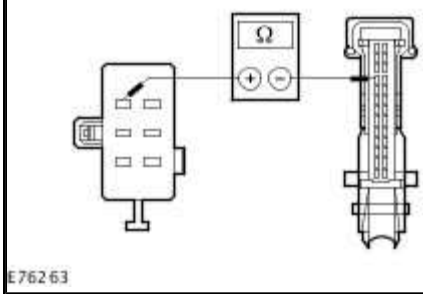
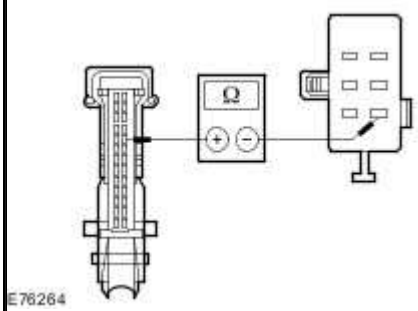
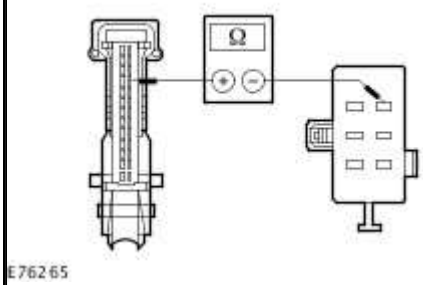
 E76262	3 Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and the right-hand temperature control flap actuator, connector C6H211, pin 1, circuit CH212A (BU/OG), wiring harness side.
 E76263	4 Measure the resistance between the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side and the right-hand temperature control flap actuator, connector C6H211, pin 3, circuit CH213A (BN/GN), wiring harness side.
 E76264	5 Measure the resistance between the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side and the right-hand temperature control flap actuator, connector C6H211, pin 4, circuit CH214A (GY/VT), wiring harness side.
 E76265	6 Measure the resistance between the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side and the right-hand temperature control flap actuator, connector C6H211, pin 6, circuit CH215A (VT), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to H4. **No** LOCATE and REPAIR the break in the relevant circuit between the right-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
H4: CHECK THE CIRCUITS BETWEEN THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and ground.

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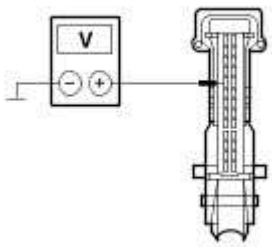
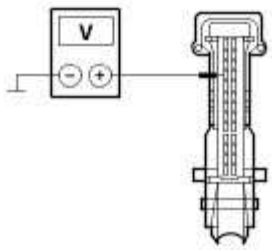
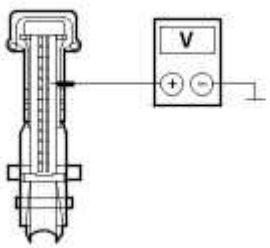
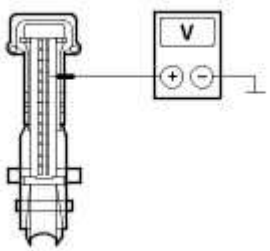
 E76266	
 E76267	**3** Measure the voltage between the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side and ground.
 E76788	**4** Measure the voltage between the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side and ground.
 E76789	**5** Measure the voltage between the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side and ground.
	Is a voltage measured during one or more measurements? **Yes** LOCATE and REPAIR the short to voltage in the relevant circuit(s) between the right-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to H5.
H5: CHECK THE CIRCUITS BETWEEN THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and ground.

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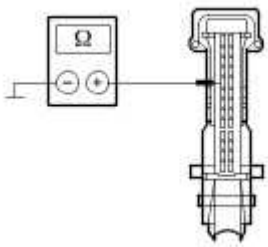
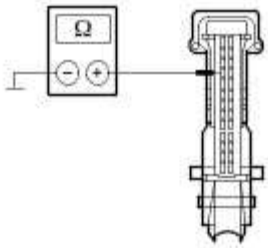
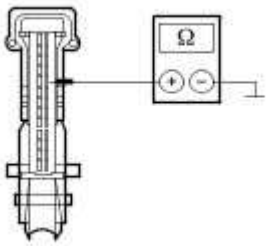
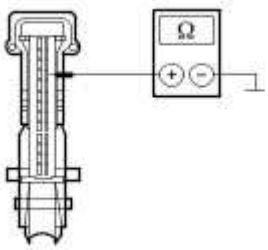
 E76270	
 E76271	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side and ground.
 E76268	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side and ground.
 E76269	**5** Measure the resistance between the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** GO to H6. **No** LOCATE and REPAIR the short to ground in the relevant circuit(s) between the right-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
H6: CHECK THE CIRCUITS BETWEEN THE RIGHT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT CIRCUIT	
	1 Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and the EATC module, connector C2H101-A, pin 25, circuit CH211A (YE), wiring harness side.

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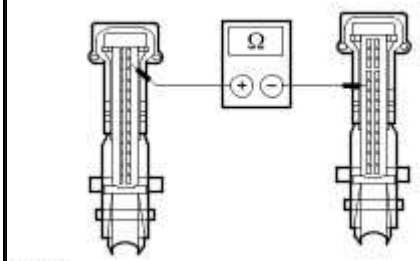
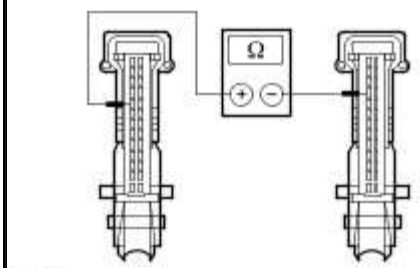
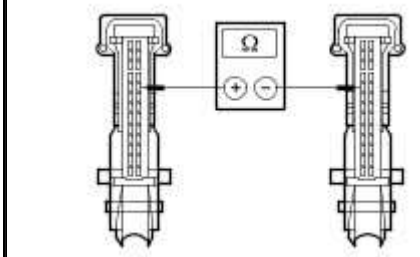
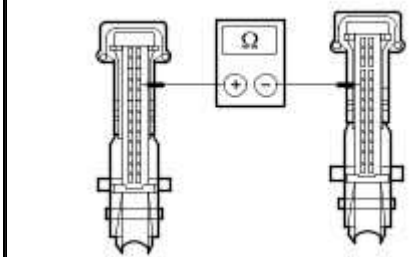
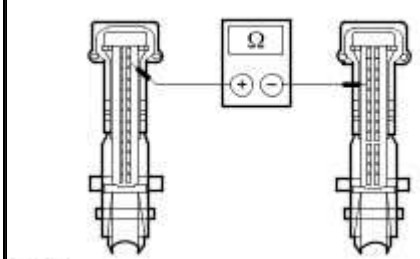
 E76272	
 E76273	**2** Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side.
 E76274	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side.
 E76275	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 9, circuit CH212A (BU/OG), wiring harness side and the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side.
 E76276	**5** Measure the resistance between the EATC module, connector C2H101-A, pin 25, circuit CH211A (YE), wiring harness side and the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side.
	6 Measure the resistance between the EATC module, connector C2H101-A, pin 25, circuit CH211A (YE), wiring harness side and the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side.

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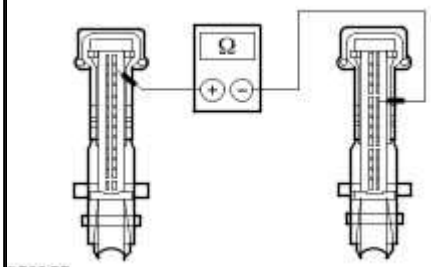
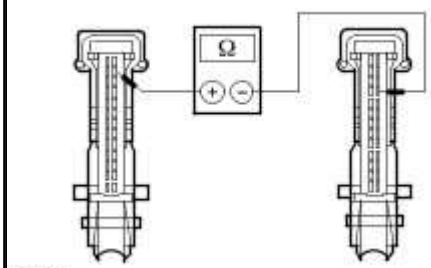
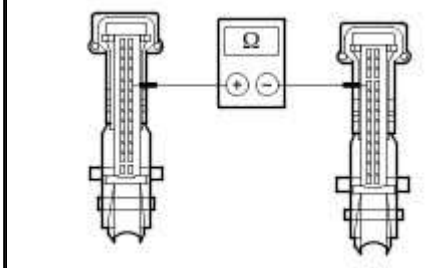
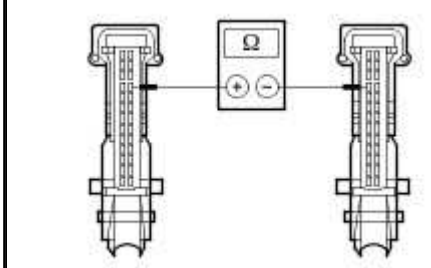
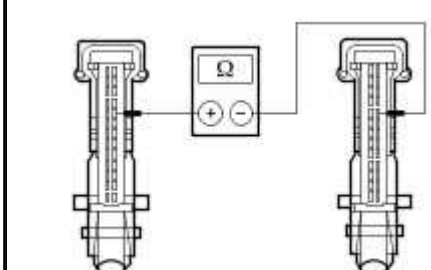
 E76277	
 E76278	**7** Measure the resistance between the EATC module, connector C2H101-A, pin 25, circuit CH211A (YE), wiring harness side and the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side.
 E76279	**8** Measure the resistance between the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side and the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side.
 E76280	**9** Measure the resistance between the EATC module, connector C2H101-A, pin 10, circuit CH213A (BN/GN), wiring harness side and the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side.
 E76281	**10** Measure the resistance between the EATC module, connector C2H101-A, pin 22, circuit CH214A (GY/VT), wiring harness side and the EATC module, connector C2H101-A, pin 23, circuit CH215A (VT), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** RENEW the right-hand temperature control flap actuator CHECK the operation of the system. **No** LOCATE and REPAIR the short between the relevant circuits between the right-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

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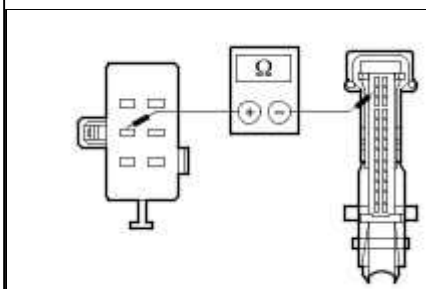
PINPOINT TEST I : MALFUNCTION OF LEFT-HAND TEMPERATURE CONTROL FLAP - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)

NOTE: Ensure that the left-hand temperature control flap is mechanically OK.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK THE VOLTAGE AT THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C5H237 from the left-hand temperature control flap actuator.
	3 Ignition switch in position II.
	4 Measure the voltage between the left-hand temperature control flap actuator, connector C5H237, pin 2, circuit CH237A (VT/GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to I3. **No** GO to I2.
I2: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
 E76282	3 Measure the resistance between the EATC module, connector C2H101-A, pin 12, circuit CH237A (VT/GY), wiring harness side and the left-hand temperature control flap actuator, connector C5H237, pin 2, circuit CH237A (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CH237A (VT/GY) between the EATC module and the left-hand temperature control flap actuator with the aid of the Wiring Diagrams. CHECK the operation of the system.
I3: CHECK THE CIRCUITS BETWEEN THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-A from the EATC module.
	3 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and the left-hand temperature control flap actuator, connector C5H237, pin 1, circuit CH238A (YE/OG), wiring harness side.

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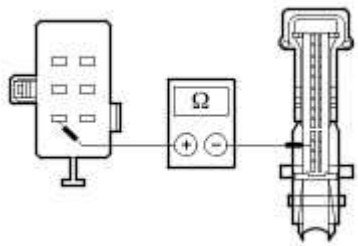
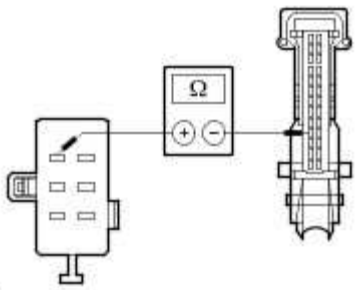
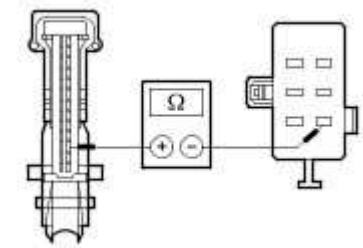
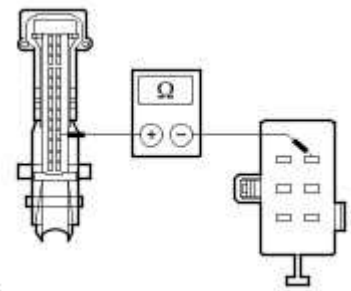
 E76283	
 E76284	4 Measure the resistance between the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side and the left-hand temperature control flap actuator, connector C5H237, pin 3, circuit CH239A (BU/WH), wiring harness side.
 E76285	5 Measure the resistance between the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side and the left-hand temperature control flap actuator, connector C5H237, pin 4, circuit CH240A (GN/WH), wiring harness side.
 E76286	6 Measure the resistance between the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side and the left-hand temperature control flap actuator, connector C5H237, pin 6, circuit CH241A (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to I4. **No** LOCATE and REPAIR the break in the relevant circuit between the left-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
I4: CHECK THE CIRCUITS BETWEEN THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and ground.

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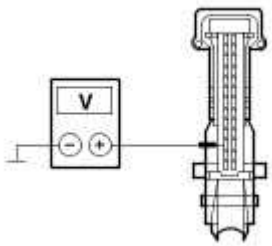
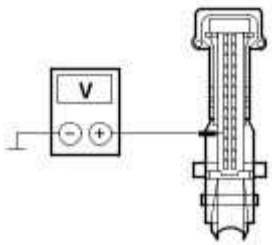
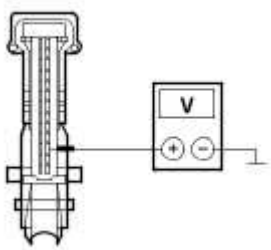
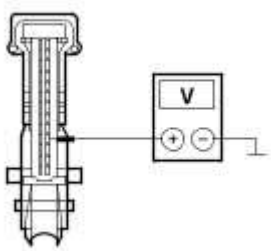
 E76287	
 E76288	3 Measure the voltage between the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side and ground.
 E76289	4 Measure the voltage between the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side and ground.
 E76290	5 Measure the voltage between the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side and ground.
	Is a voltage measured during one or more measurements? **Yes** LOCATE and REPAIR the short to voltage in the relevant circuit(s) between the left-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to I5.
I5: CHECK THE CIRCUITS BETWEEN THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and ground.

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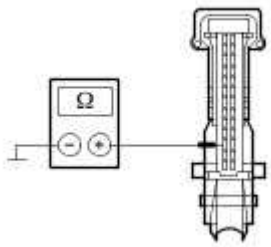
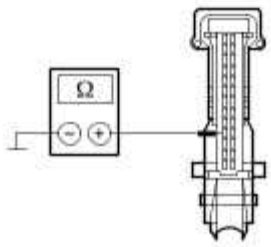
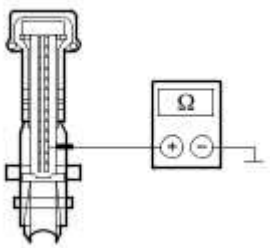
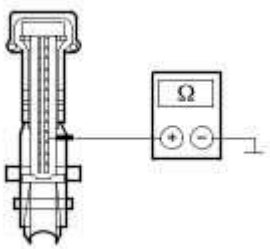
 E76291	
 E76292	**3** Measure the resistance between the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side and ground.
 E76293	**4** Measure the resistance between the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side and ground.
 E76294	**5** Measure the resistance between the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** GO to I6. **No** LOCATE and REPAIR the short to ground in the relevant circuit(s) between the left-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
I6: CHECK THE CIRCUITS BETWEEN THE LEFT-HAND TEMPERATURE CONTROL FLAP ACTUATOR AND THE EATC MODULE FOR SHORT CIRCUIT	
	1 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and the EATC module, connector C2H101-A, pin 12, circuit CH237A (VT/GY), wiring harness side.

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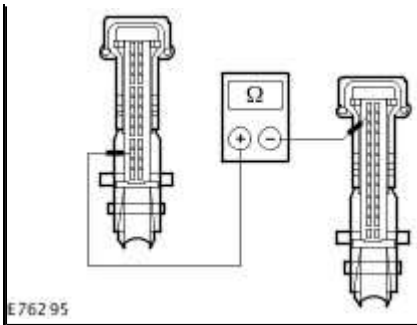
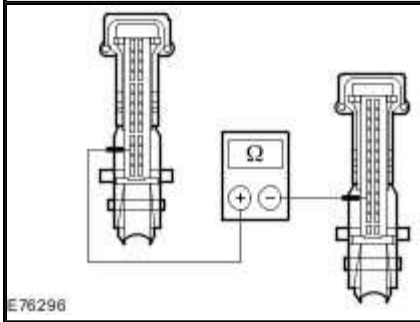
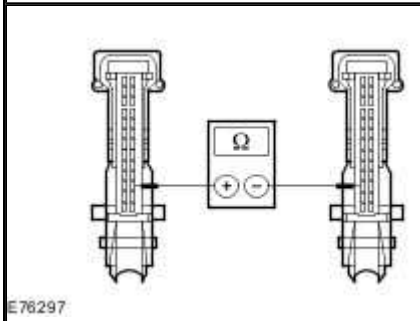
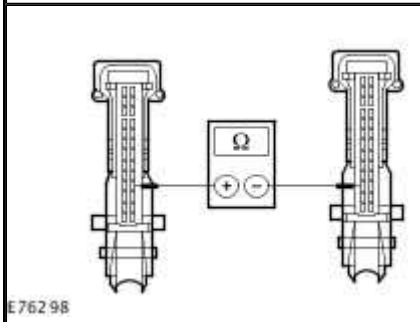
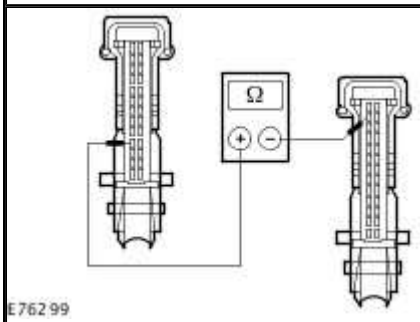
 E76295	
 E76296	2 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side.
 E76297	3 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side.
 E76298	4 Measure the resistance between the EATC module, connector C2H101-A, pin 3, circuit CH238A (YE/OG), wiring harness side and the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side.
 E76299	5 Measure the resistance between the EATC module, connector C2H101-A, pin 12, circuit CH237A (VT/GY), wiring harness side and the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side.
	6 Measure the resistance between the EATC module, connector C2H101-A, pin 12, circuit CH237A (VT/GY), wiring harness side and the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side.

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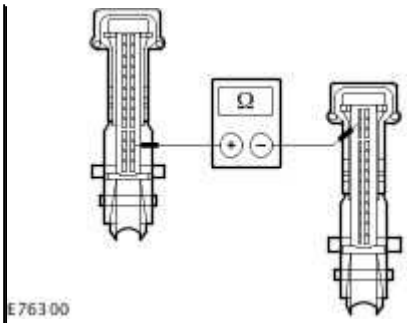
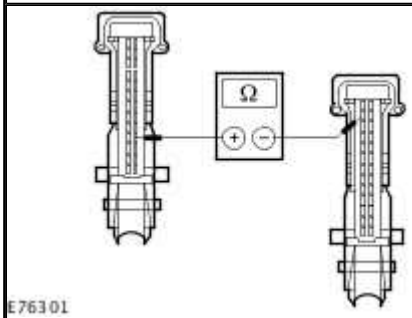
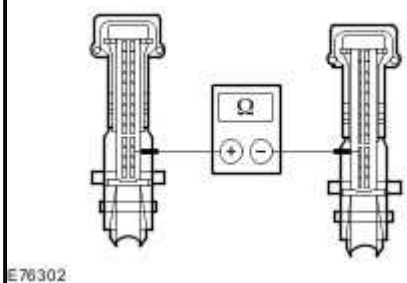
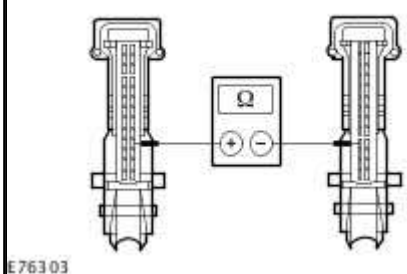
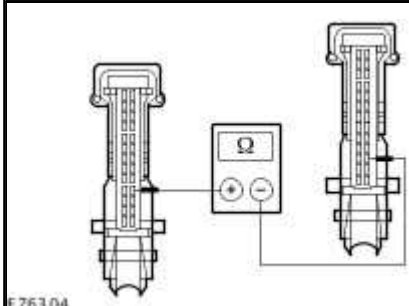
 E76300	
 E76301	**7** Measure the resistance between the EATC module, connector C2H101-A, pin 12, circuit CH237A (VT/GY), wiring harness side and the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side.
 E76302	**8** Measure the resistance between the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side and the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side.
 E76303	**9** Measure the resistance between the EATC module, connector C2H101-A, pin 4, circuit CH239A (BU/WH), wiring harness side and the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side.
 E76304	**10** Measure the resistance between the EATC module, connector C2H101-A, pin 16, circuit CH240A (GN/WH), wiring harness side and the EATC module, connector C2H101-A, pin 17, circuit CH241A (GY/BN), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured in all of the measurements? **Yes** RENEW the left-hand temperature control flap actuator CHECK the operation of the system. **No** LOCATE and REPAIR the short between the relevant circuits between the left-hand temperature control flap actuator and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

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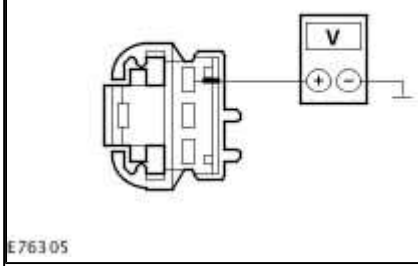
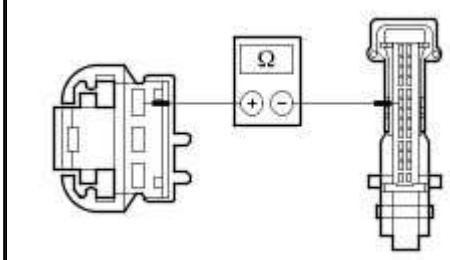
PINPOINT TEST J : FAULT IN RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR CIRCUIT - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK VOLTAGE AT RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H414-B from right-hand centre vents air outlet temperature sensor.
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
 E76305	5 Measure the voltage between the right-hand centre vents air outlet temperature sensor, connector C2H414-B, pin 1, circuit VH411A (VT/GN), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to J3. **No** GO to J2.
J2: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76306	3 Measure the resistance between the right-hand centre vents air outlet temperature sensor, connector C2H414-B, pin 1, circuit VH411A (VT/GN), wiring harness side and the EATC module, connector C2H101-B, pin 8, circuit VH411A (VT/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH411A (VT/GN) between the right-hand center vents air outlet temperature sensor and the EATC module with the aid of the Wiring Diagrams. CHECK the operation of the system.
J3: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC

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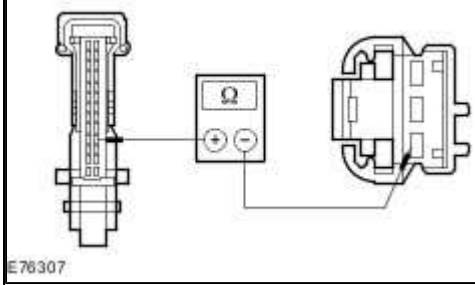
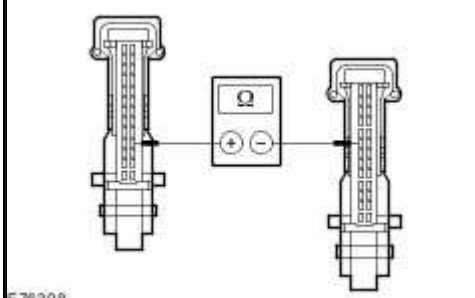
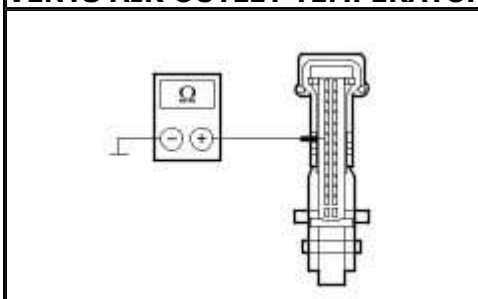
	module.
 E76307	3 Measure the resistance between the right-hand centre vents air outlet temperature sensor, connector C2H414-B, pin 3, circuit RH105M (GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to J4. **No** LOCATE and REPAIR the break in the circuit between the right-hand center vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
J4: CHECK FOR SHORT CIRCUIT BETWEEN THE RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76308	1 Measure the resistance between the EATC module, connector C2H101-B, pin 8, circuit VH411A (VT/GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to J5. **No** LOCATE and REPAIR the short in the circuits between the right-hand centre vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
J5: CHECK FOR SHORT CIRCUIT TO GROUND BETWEEN THE RIGHT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76309	1 Measure the resistance between the EATC module, connector C2H101-B, pin 8, circuit VH411A (VT/GN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the right-hand centre vents air outlet temperature sensor. CHECK the operation of the system. **No** LOCATE and REPAIR the short to ground in the circuits between the right-hand center vents air outlet temperature sensor and the EATC module

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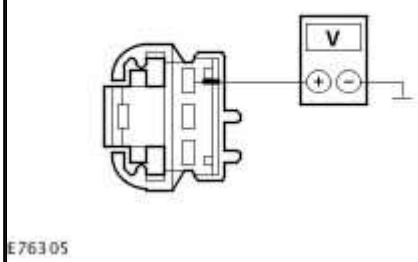
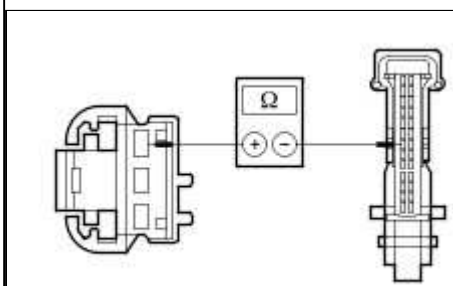
	using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST K : FAULT IN RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR CIRCUIT - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK VOLTAGE AT RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H414-D from right-hand footwell air outlet temperature sensor.
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
 E76305	5 Measure the voltage between the right-hand footwell air outlet temperature sensor, connector C2H414-D, pin 1, circuit VH412A (YE/GY), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to K3. **No** GO to K2.
K2: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76310	3 Measure the resistance between the right-hand footwell air outlet temperature sensor, connector C2H414-D, pin 1, circuit VH412A (YE/GY), wiring harness side and the EATC module, connector C2H101-B, Pin 7, circuit VH412A (YE/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH412A (YE/GY) between the right-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
K3: CHECK THE CIRCUIT BETWEEN THE RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.

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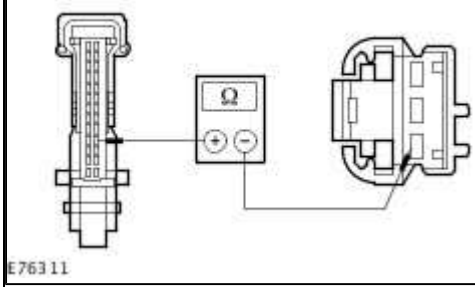
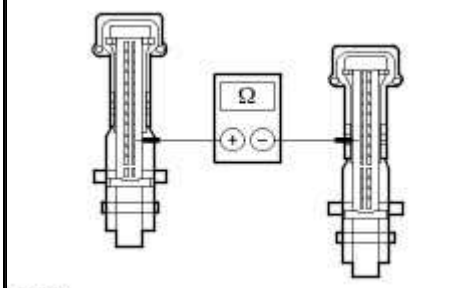
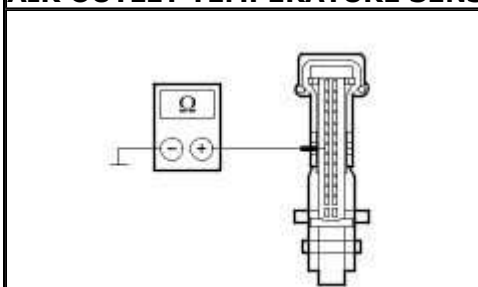
	2 Disconnect Connector C2H101-B from the EATC module.
 E76311	3 Measure the resistance between the right-hand footwell air outlet temperature sensor, connector C2H414-B, pin 3, circuit RH105N (GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to K4. **No** LOCATE and REPAIR the break in the circuit between the right-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
K4: CHECK FOR SHORT CIRCUIT BETWEEN THE RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76312	1 Measure the resistance between the EATC module, connector C2H101-B, pin 7, circuit VH412A (YE/GY), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to K5. **No** LOCATE and REPAIR the short in the circuits between the right-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
K5: CHECK FOR SHORT CIRCUIT TO GROUND BETWEEN THE RIGHT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76313	1 Measure the resistance between the EATC module, connector C2H101-B, pin 7, circuit VH412A (YE/GY), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the right-hand footwell air outlet temperature sensor. CHECK the operation of the system. **No** LOCATE and REPAIR the short to ground in the circuits between the right-hand footwell air outlet temperature sensor and the EATC module using the

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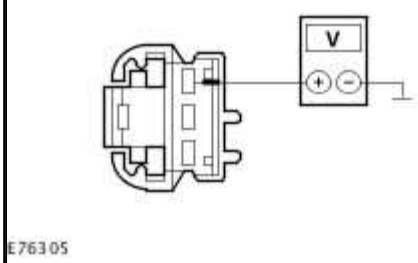
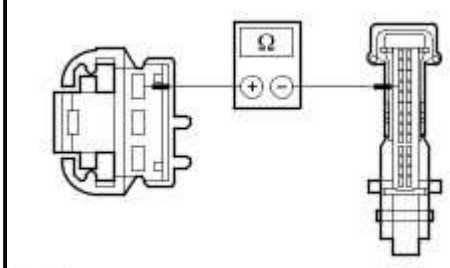
	Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST L : FAULT IN LEFT-HAND CENTRE VENTS AIR OUTLET TEMPERATURE SENSOR CIRCUIT - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK VOLTAGE AT LEFT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H414-A from left-hand centre vents air outlet temperature sensor.
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
 E76305	5 Measure the voltage between the left-hand centre vents air outlet temperature sensor, connector C2H414-A, pin 1, circuit VH409A (WH), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to L3. **No** GO to L2.
L2: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76314	3 Measure the resistance between the left-hand centre vents air outlet temperature sensor, connector C2H414-A, pin 1, circuit VH409A (WH),wiring harness side and the EATC module, connector C2H101-B, pin 10, circuit VH409A (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH409A (WH) between the left-hand centre vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
L3: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	

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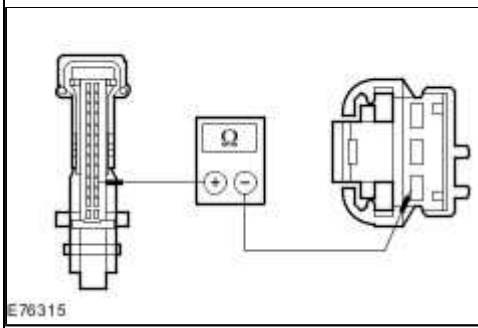
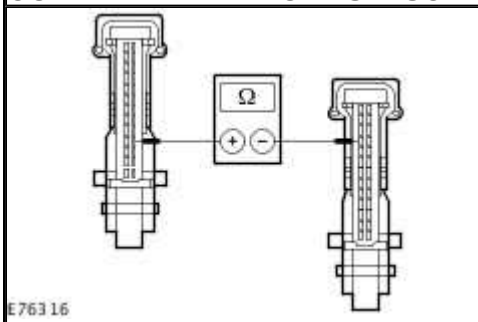
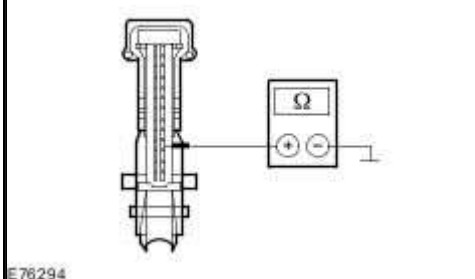
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76315	3 Measure the resistance between the left-hand centre vents air outlet temperature sensor, connector C2H414-A, pin 3, circuit RH105R (GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to L4. **No** LOCATE and REPAIR the break in the circuit between the left-hand center vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
L4: CHECK FOR SHORT CIRCUIT BETWEEN THE LEFT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76316	1 Measure the resistance between the EATC module, connector C2H101-B, pin 10, circuit VH409A (WH), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to L5. **No** LOCATE and REPAIR the short in the circuits between the left-hand centre vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
L5: CHECK FOR SHORT CIRCUIT TO GROUND BETWEEN THE LEFT-HAND CENTER VENTS AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE	
 E76294	1 Measure the resistance between the EATC module, connector C2H101-B, pin 10, circuit VH409A (WH), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the left-hand centre vents air outlet temperature sensor. CHECK the operation of the system. **No**

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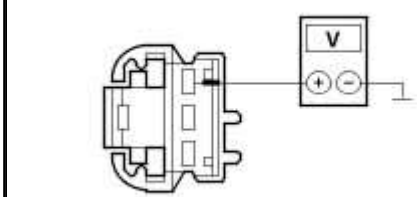
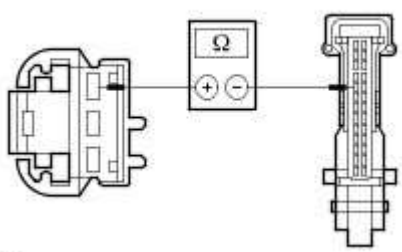
	LOCATE and REPAIR the short to ground in the circuits between the left-hand center vents air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST M : FAULT IN LEFT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR CIRCUIT - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK VOLTAGE AT LEFT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H414-C from left-hand footwell air outlet temperature sensor.
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
 E76305	5 Measure the voltage between the left-hand footwell air outlet temperature sensor, connector C2H414-C, pin 1, circuit VH410A (GY/BU), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to M3. **No** GO to M2.
M2: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76317	3 Measure the resistance between the left-hand footwell air outlet temperature sensor, connector C2H414-C, pin 1, circuit VH410A (GY/BU), wiring harness side and the EATC module, connector C2H101-B, Pin 9, circuit VH410A (GY/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VH410A (GY/BU) between the left-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
M3: CHECK THE CIRCUIT BETWEEN THE LEFT-HAND FOOTWELL AIR OUTLET	

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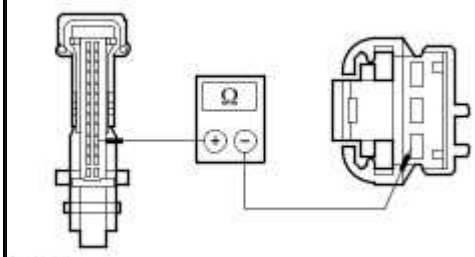
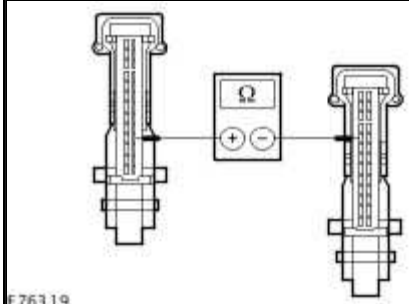
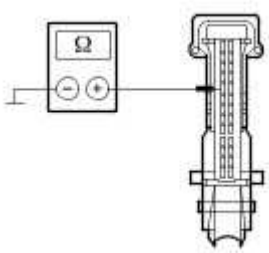
TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76318	3 Measure the resistance between the left-hand footwell air outlet temperature sensor, connector C2H414-C, pin 3, circuit RH105S (GN), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to M4. **No** LOCATE and REPAIR the break in the circuit between the left-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

M4: CHECK FOR SHORT CIRCUIT BETWEEN THE LEFT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE

 E76319	1 Measure the resistance between the EATC module, connector C2H101-B, pin 9, circuit VH410A (GY/BU), wiring harness side and the EATC module, connector C2H101-B, pin 17, circuit RH105T (GN), wiring harness side.
	Is a resistance of more than 10,000 Ohms measured? **Yes** GO to M5. **No** LOCATE and REPAIR the short in the circuits between the left-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

M5: CHECK FOR SHORT CIRCUIT TO GROUND BETWEEN THE LEFT-HAND FOOTWELL AIR OUTLET TEMPERATURE SENSOR AND THE EATC MODULE

 E76270	1 Measure the resistance between the EATC module, connector C2H101-B, pin 9, circuit VH410A (GY/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the left-hand footwell air outlet temperature sensor. CHECK the operation of the system.

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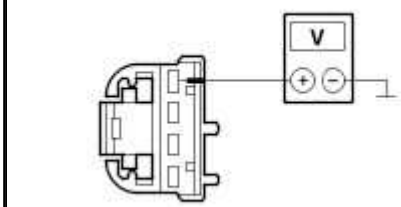
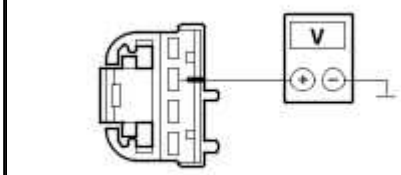
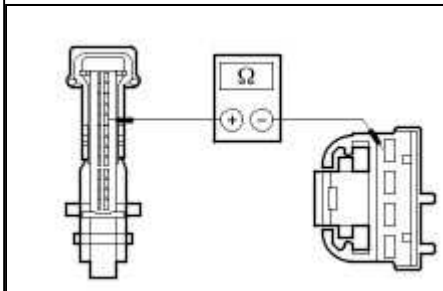
	No LOCATE and REPAIR the short to ground in the circuits between the left-hand footwell air outlet temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST N : SUN LOAD SENSOR CIRCUIT FAULTY - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK THE VOLTAGE AT THE SUN LOAD SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H415 from the sun load sensor.
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
 E76320	5 Measure the voltage between the sun load sensor, connector C2H415, pin 1, circuit VH416B (VT/GY), wiring harness side and ground.
 E76321	6 Measure the voltage between the sun load sensor, connector C2H415, pin 2, circuit VH417B (YE/OG), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured in both measurements? **Yes** GO to N4. **No** GO to N2.
N2: CHECK THE CIRCUITS BETWEEN THE SUN LOAD SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H101-B from the EATC module.
 E76322	3 Measure the resistance between the sun load sensor, connector C2H415, pin 1, circuit VH416B (VT/GY), wiring harness side and the EATC module, connector C2H101-B, Pin 22, circuit VH416A (VT/GY), wiring harness side.
	4 Measure the resistance between the sun load sensor,

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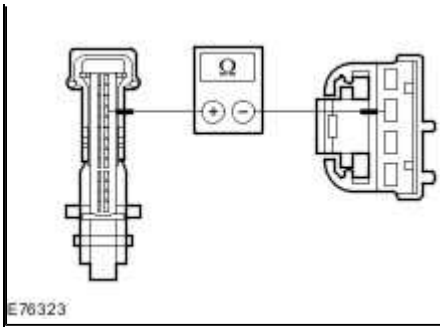
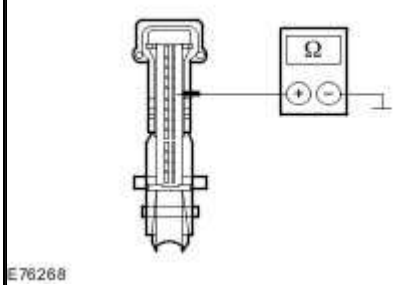
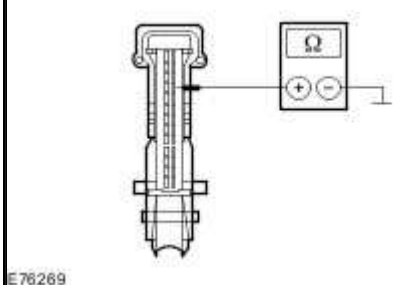
 E76323	connector C2H415, pin 2, circuit VH417B (YE/OG), wiring harness side and the EATC module, connector C2H101-B, Pin 23, circuit VH417A (YE/OG), wiring harness side.
	Is a resistance of less than 2 Ohms measured in both cases? **Yes** GO to N3. **No** LOCATE and REPAIR the break in the relevant circuit between the sun load sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.
N3: CHECK THE CIRCUITS BETWEEN THE SUN LOAD SENSOR AND THE EATC MODULE FOR SHORT TO GROUND	
 E76268	1 Measure the resistance between the EATC module, connector C2H101-B, pin 22, circuit VH416A (VT/GY), wiring harness side and ground.
 E76269	2 Measure the resistance between the EATC module, connector C2H101-B, pin 23, circuit VH417A (YE/OG), wiring harness side and ground.
	Is a resistance greater than 10,000 Ohms measured in both cases? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the short to ground in the relevant circuit using the Wiring Diagrams. CHECK the operation of the system.
N4: CHECK THE GROUND CONNECTION OF THE SUN LOAD SENSOR	
	1 Ignition switch in position 0.
	2 Measure the resistance between the sun load sensor, connector C2H415, pin 3, circuit RH104FA (BU/BN), wiring harness side and ground.

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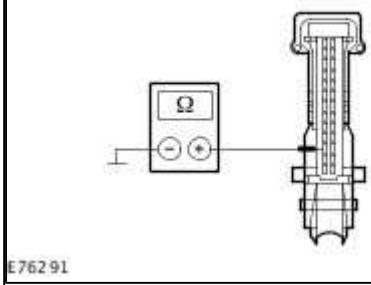
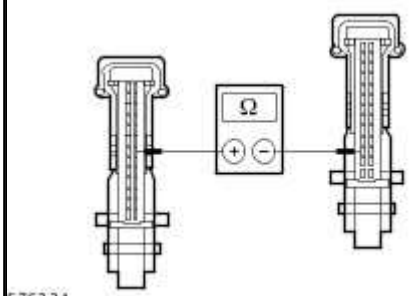
 E76291	
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL a new sun load sensor. CHECK the operation of the system. **No** GO to N5.
N5: CHECK THE CIRCUIT BETWEEN THE SUN LOAD SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C2H101-B from the EATC module.
 E76324	2 Measure the resistance between the sun load sensor, connector C2H415, pin 3, circuit RH104FA (BU/BN), wiring harness side and the EATC module, connector C2H101-B, Pin 20, circuit RH104F (BU/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the sun load sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST O : INTERIOR TEMPERATURE SENSOR CIRCUIT FAULTY - VEHICLES WITH ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC)	
NOTE: The interior temperature sensor is integrated in the sun load sensor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE VOLTAGE AT THE PASSENGER COMPARTMENT TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2H415 from the interior temperature sensor .
	3 Ignition switch in position II.
	4 Switch on the air conditioning (A/C).
	5 Measure the voltage between the interior temperature sensor, connector C2H415, pin 4, circuit VH414B (GN/BU), wiring harness side and ground.

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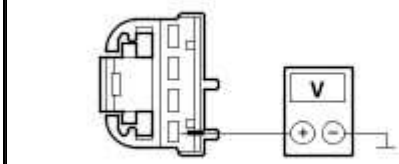


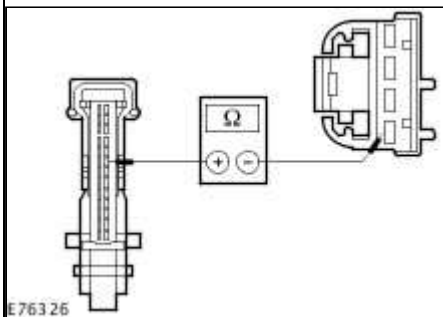
E76325

Is a voltage of approx. 5 volts measured?
Yes
GO to O3.
No
GO to O2.

O2: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT

1 Ignition switch in position 0.

2 Disconnect Connector C2H101-B from the EATC module.



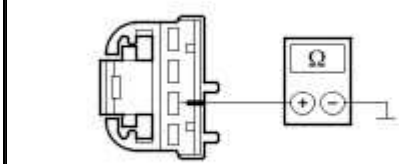
E76326

3 Measure the resistance between the interior temperature sensor, connector C2H415, pin 4, circuit VH414B (GN/BU), wiring harness side and the EATC module, connector C2H101-B, Pin 21, circuit VH414A (GN/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system.
No
LOCATE and REPAIR the break in the circuit between the passenger compartment temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

O3: CHECK GROUND CONNECTION OF PASSENGER COMPARTMENT TEMPERATURE SENSOR

1 Ignition switch in position 0.



E76327

2 Measure the resistance between the interior temperature sensor, connector C2H415, pin 3, circuit RH104FA (BU/GN), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?
Yes
INSTALL NEW interior temperature sensor. CHECK the operation of the system.
No
GO to O4.

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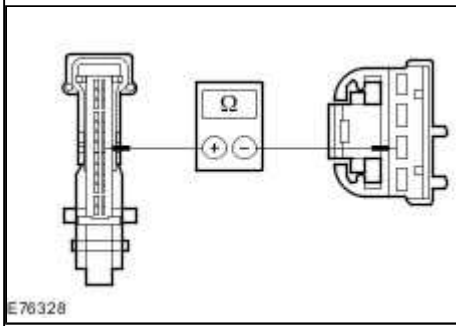
O4: CHECK THE CIRCUIT BETWEEN THE INTERIOR TEMPERATURE SENSOR AND THE ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C2H101-B from the EATC module.
	2 Measure the resistance between the interior temperature sensor, connector C2H415, pin 3, circuit RH104FA (BU/GN), wiring harness side and the EATC module, connector C2H101-B, Pin 20, circuit RH104FA (BU/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the EATC module, if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the passenger compartment temperature sensor and the EATC module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST P : ELECTRIC BOOSTER HEATER INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK FUSE F16	
	1 Ignition switch in position 0.
	2 CHECK F16 (EJB).
	Is the fuse OK? **Yes** GO to P2. **No** RENEW fuse F16 (80 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
P2: CHECK THE VOLTAGE AT FUSE F16	
	1 Connect F16 (EJB).
	2 Measure the voltage between fuse F16 (80 A) and ground.
	Does the meter display battery voltage? **Yes** GO to P3. **No** REPAIR the voltage supply to fuse F16. CHECK the operation of the system.
P3: CHECK FUSE F4	
	1 CHECK F4 (CJB).
	Is the fuse OK? **Yes** GO to P4. **No** RENEW fuse F4 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
P4: CHECK THE VOLTAGE AT FUSE F4	
	1 Connect F4 (CJB).

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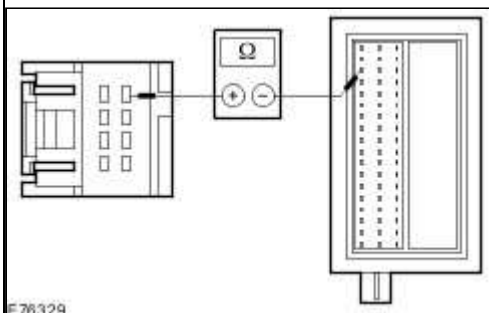
	2 Ignition switch in position II. 3 Measure the voltage between fuse F4 (7.5 A) and ground. Does the meter display battery voltage? **Yes** GO to P5. **No** REPAIR the voltage supply to fuse F4. CHECK the operation of the system.
P5: CHECK THE REQUEST SIGNAL "ELECTRIC BOOSTER HEATER ON" WITH THE FORD APPROVED DIAGNOSTIC TOOL	
	1 Ignition switch in position 0. 2 Connect the diagnostic tool. 3 Select the generic electronic module (GEM) with the diagnostic tester. 4 Set the interior temperature to HI or the temperature controls to their highest setting. 5 Check whether an "electric booster heater ON" request signal is displayed in the data logger. Is an "electric booster heater ON" request signal displayed in the data logger of the GEM? **Yes** GO to P7. **No** - Vehicles with electronic automatic temperature control:CHECK the EATC module with the Ford approved diagnostic tool. RENEW the EATC module as required. CHECK the operation of the system. - Vehicles without electronic automatic temperature control:GO to P6.
P6: TEST THE CIRCUIT BETWEEN THE A/C CONTROL ASSEMBLY AND THE GEM FOR OPEN CIRCUIT	
	1 Ignition switch in position 0. 2 Disconnect Connector C1BP02-C from the GEM. 3 Disconnect Connector C2H101-C from the air conditioning control assembly.
	4 Measure the resistance between the GEM, connector C1BP02-C, pin 16, circuit CHP03A (GN/BN), wiring harness side and the A/C control assembly, connector C2H101-C, pin 5, circuit CHP03A (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the A/C control assembly. CHECK the operation of the system. If the system is still inoperative, CHECK the GEM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CHP03A (GN/BN) between the GEM and the A/C control assembly using the Wiring Diagrams. CHECK the operation of the system.
P7: CHECK THE VOLTAGE AT THE ELECTRIC BOOSTER HEATER	

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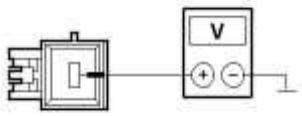
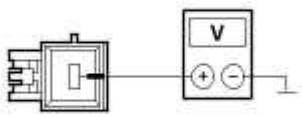
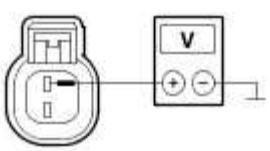
	1 Ignition switch in position 0.
	2 Disconnect Connector C2HP01-A from the electric booster heater.
 E76330	3 Measure the voltage between the electric booster heater, connector C2HP01-A, pin 1, circuit SBB16A (VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to P8. **No** LOCATE and REPAIR the break in circuit SBB16A (VT) between the EJB and the electric booster heater with the aid of the Wiring Diagrams. CHECK the operation of the system.
P8: CHECK THE ELECTRIC BOOSTER HEATER GROUND CONNECTION	
	1 Disconnect Connector C2HP01-B from the electric booster heater.
 E76330	2 Measure the resistance between the electric booster heater, connector C2HP01-B, pin 1, circuit GD121A (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to P9. **No** LOCATE and REPAIR the break in circuit GD121A (BK/YE) between the electric booster heater and ground connection G1D131-A with the aid of the Wiring Diagrams. CHECK the operation of the system.
P9: CHECK CONTROL VOLTAGE AT ELECTRIC BOOSTER HEATER	
	1 Disconnect Connector C2HP03 from the electric booster heater.
	2 Ignition switch in position II.
 E76331	3 Measure the voltage between the electric booster heater, connector C2HP03, pin 1, circuit CBP04P (VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes**

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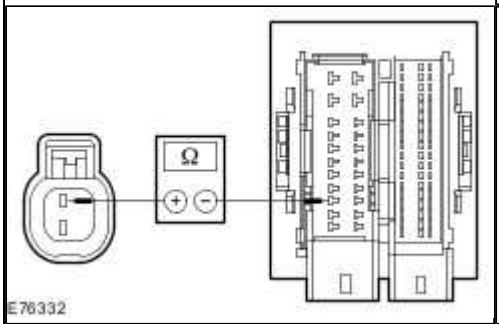
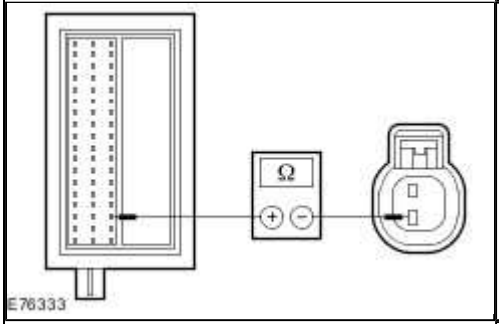
	GO to P11. **No** GO to P10.
P10: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRIC BOOSTER HEATER AND THE GEM (TERMINAL 15)	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the GEM.
	3 Measure the resistance between the electric booster heater, connector C2HP03, pin 1, circuit CBP04P (VT), wiring harness side and the GEM, connector C1BP02-C, pin 68, circuit CBP04T (VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the GEM and the electric booster heater using the Wiring Diagrams. CHECK the operation of the system.
P11: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRIC BOOSTER HEATER AND THE GEM (PWM)	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the GEM.
	3 Measure the resistance between the electric booster heater, connector C2HP03, pin 2, circuit CBP01A (BU/GN), wiring harness side and the GEM, connector C1BP02-C, pin 39, circuit CBP01A (BU/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to P12. **No** LOCATE and RECTIFY the break in circuit CBP01A (BU/GN) between the GEM and the electric booster heater using the Wiring Diagrams. CHECK the operation of the system.
P12: CHECK THE CIRCUIT BETWEEN THE ELECTRIC BOOSTER HEATER AND THE GEM FOR A SHORT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the electric booster heater, connector C2HP03, pin 2, circuit CBP01A (BU/GN), wiring harness side and ground.

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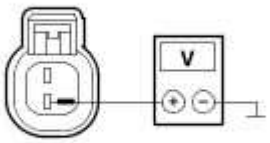
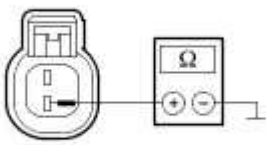
 E76334	
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in circuit CBP01A (BU/GN) between the GEM and the electric booster heater using the Wiring Diagrams. CHECK the operation of the system. **No** GO to P13.
P13: CHECK THE CIRCUIT BETWEEN THE ELECTRIC BOOSTER HEATER AND THE GEM FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
 E76335	2 Measure the resistance between the electric booster heater, connector C2HP03, pin 2, circuit CBP01A (BU/GN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohms measured? **Yes** RENEW the electric booster heater. CHECK the operation of the system. If the system is still inoperative, CHECK the GEM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit CBP01A (BU/GN) between the GEM and the electric booster heater using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST Q : PROGRAMMABLE FUEL-FIRED BOOSTER HEATER INOPERATIVE	
NOTE: The fuel fired booster heater is equipped with an integrated undervoltage protection. This switches off the fuel-fired booster heater when the supply voltage falls below 10 V for longer than 20 seconds. Before performing further checks, ensure that the vehicle battery is OK and that the charge state is sufficient.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK FUSE F277	
	1 Ignition switch in position 0. 2 CHECK F27 (EJB). Is the fuse OK? **Yes** GO to Q2. **No** RENEW fuse F27 (30 A). CHECK the operation of the

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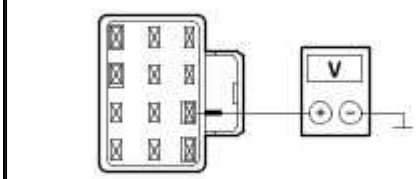
	system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
Q2: CHECK THE VOLTAGE AT FUSE F27	
	1 Connect Fuse F27 (EJB).
	2 Measure the voltage between fuse F27 (30 A) and ground.
	Does the meter display battery voltage? **Yes** GO to Q3. **No** REPAIR the voltage supply to fuse F27. CHECK the operation of the system.
Q3: CHECK THE VOLTAGE AT THE PROGRAMMABLE FUEL-FIRED BOOSTER HEATER	
	1 Disconnect Connector C1HF01-C from the programmable fuel-fired booster heater.
 E76336	2 Measure the voltage between the programmable fuel-fired booster heater, connector C1HF01-C, pin 3, circuit SBB27A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to Q5. **No** GO to Q4.
Q4: CHECK FOR OPEN CIRCUIT BETWEEN THE PROGRAMMABLE FUEL-FIRED BOOSTER HEATER AND THE EJB	
	1 Disconnect Connector C1BB01-A from the EJB.
	2 Measure the resistance between the programmable fuel-fired booster heater, connector C1HF01-C, pin 3, circuit SBB27A (BU/RD), wiring harness side and the EJB, connector C1BB01-A, circuit SBB32A (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms measured? **Yes** CHECK the EJB and RENEW it if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit SBB27A (VT/RD) between the programmable fuel-fired booster heater and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
Q5: CHECK THE GROUND CONNECTION OF THE PROGRAMMABLE FUEL-FIRED BOOSTER HEATER	
	1 Measure the resistance between the programmable fuel-fired booster heater, connector C1HF01-C, pin 4, circuit GD132L (BK/VT), wiring harness side and ground.

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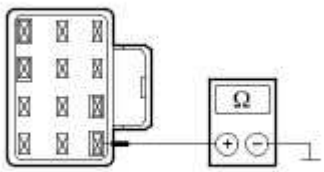

E76337

Is a resistance of less than 2 Ohms measured?

Yes

CHECK and if necessary RENEW the programmable fuel-fired booster heater. CHECK the operation of the system.

No

LOCATE and REPAIR the open circuit between the programmable fuel-fired booster heater and ground connection G1D132-A with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST R : FUEL-FIRED BOOSTER HEATER (COOLANT PUMP) INOPERATIVE - VEHICLES WITH PROGRAMMABLE FUEL-FIRED BOOSTER HEATER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
R1: CHECK THE CIRCUIT BETWEEN THE FUEL-FIRED BOOSTER HEATER (COOLANT PUMP) AND THE PROGRAMMABLE FUEL-FIRED BOOSTER HEATER FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1HF02 from the fuel-fired booster heater (coolant pump).
	3 Disconnect Connector C1HF01-C from the programmable fuel-fired booster heater.
	4 Measure the resistance between the programmable fuel-fired booster heater, connector C1HF01-C, pin 9, circuit RHF03A (WH/VT), wiring harness side and the fuel-fired booster heater (coolant pump), connector C1HF02, pin 2, circuit RHF03A (WH/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to R2. **No** LOCATE and REPAIR the break in circuit RHF03A (WH/VT) between the programmable fuel-fired booster heater and the fuel-fired booster heater (coolant pump) with the aid of the Wiring Diagrams. CHECK the operation of the system.
R2: CHECK THE CIRCUIT BETWEEN THE FUEL-FIRED BOOSTER HEATER (COOLANT PUMP) AND THE PROGRAMMABLE FUEL-FIRED BOOSTER HEATER FOR OPEN CIRCUIT	
	1 Measure the resistance between the programmable fuel-fired booster heater, connector C1HF01-C, pin 10, circuit CHF03A (GN/OG), wiring harness side and the fuel-fired booster heater (coolant pump), connector C1HF02, pin 1, circuit CHF03A (GN/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the fuel-fired booster heater (coolant pump). CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CHF03A (GN/OG) between the programmable fuel-fired booster heater and the fuel-fired booster heater (coolant pump) with the aid of the Wiring Diagrams. CHECK the operation

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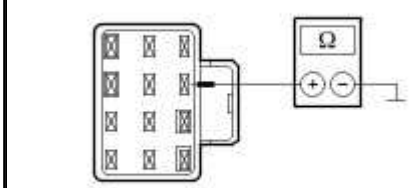
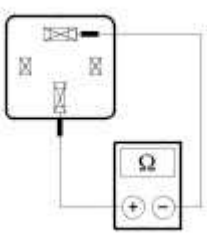
	of the system.

PINPOINT TEST S : BOOSTER HEATER FUEL PUMP INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK FOR OPEN CIRCUIT BETWEEN THE BOOSTER HEATER FUEL PUMP AND THE FUEL-FIRED BOOSTER HEATER	
	1 Ignition switch in position 0.
	2 Disconnect Connector C3HF02 from the booster heater fuel pump.
	3 Disconnect Connector C1HF01-C from the fuel-fired booster heater.
	4 Measure the resistance between the programmable fuel-fired booster heater, connector C1HF01-C, pin 7, circuit CHF01A (BN/BU), wiring harness side and the booster heater fuel pump, connector C3HF02, pin 1, circuit CHF01C (BN/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to S2. **No** LOCATE and REPAIR the open circuit between the programmable fuel-fired booster heater and the booster heater fuel pump with the aid of the Wiring Diagrams. CHECK the operation of the system.
S2: CHECK THE GROUND CONNECTION OF THE BOOSTER HEATER FUEL PUMP	
 E76338	1 Measure the resistance between the booster heater fuel pump, connector C3HF02, pin 2, circuit GD152F (BK/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the booster heater fuel pump. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between ground connection G4D151 and the booster heater fuel pump with the aid of the Wiring Diagrams. CHECK the operation of the system.

Component Tests

Blower relay H402



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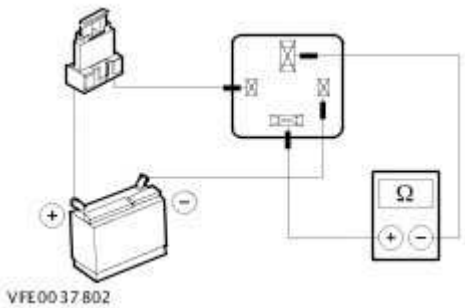
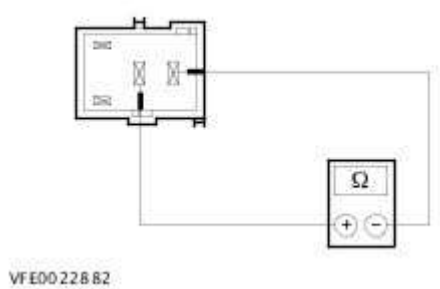
1. **1.** Check the normally open contact in the unswitched state:
    1. Measure the resistance at blower relay H402, between pin 37 and pin 36, component side.
    2. Is a resistance of more than 10,000 Ohms measured?
    3. If yes, go to 4.
    4. If no, RENEW blower relay H402.



2. **2.** Check the normally open contact in the switched state:
    1. Using a fused test cable (1 A), connect pin 39 of blower relay H402, component side, to the battery positive terminal.
    2. Use a test cable to connect pin 38 of blower relay H402, component side, to the battery negative terminal.
    3. Measure the resistance at blower relay H402, between pin 37 and pin 36, component side.
    4. Is a resistance of less than 2 Ohms registered?
    5. If yes, then blower relay H402 is OK.
    6. If no, RENEW blower relay H402.

A/C clutch relay H401



1. **1.** Check the normally open contact in the unswitched state:
    1. Measure the resistance at A/C clutch relay H401, between pin 28 and pin 29, component side.
    2. Is a resistance of more than 10,000 Ohms measured?
    3. If yes, go to 4.
    4. If no, RENEW A/C clutch relay H401.

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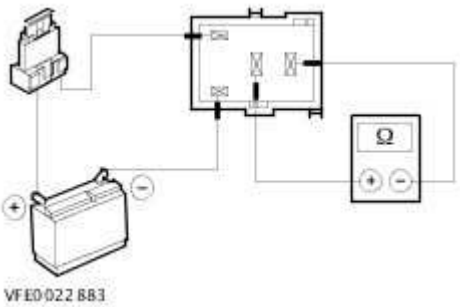

2. **2.** Check the normally open contact in the switched state:
    1. Use a fused test cable (1 A) to connect pin 31 of A/C clutch relay H401, component side, to the battery positive terminal.
    2. Use a test cable to connect pin 30 of A/C clutch relay H401, component side, to the battery negative terminal.
    3. Measure the resistance at A/C clutch relay H401, between pin 28 and pin 29, component side.
    4. Is a resistance of less than 2 Ohms registered?
    5. If yes, then A/C clutch relay H401 is OK.
    6. If no, RENEW A/C clutch relay H401.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 412-03A, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 418-S035

General Equipment

Digital Multimeter (compatible with K-type thermocouple)
Worldwide Diagnostic System (WDS)
Refrigerant center
Thermometer - Fluke 80 PK-8 (FSE number 260 4102 001 07)

Inspection and Testing

1. **1.** VERIFY the customer concern.

2. **2.** Visually CHECK for any obvious mechanical or electrical damage.

NOTE: Ensure correct locking of wiring harness connectors.

Visual Inspection

Mechanical	Electrical
• Refrigerant lines • Condenser • Drive belt • A/C compressor	• Fuses • Wiring harness • Connector

3. **3.** RECTIFY any obvious causes for a concern found during the visual inspection before performing any further tests. CHECK the operation of the system.

4. **4.** If the concern is still present after the visual inspection, perform fault diagnosis on the electronic engine management, the charging system, the generic electronic module (GEM), the instrument cluster, the electronic automatic temperature control (EATC) and the auxiliary climate control module using WDS and RECTIFY the fault (s) displayed in accordance with the fault description. CHECK the operation of the system.

5. **5.** On a vehicle without stored fault(s), continue according to the Symptom Chart and the corresponding symptom.

6. **6.** Following checking or elimination of the fault(s) and after completion of operations, the fault memories of all vehicle modules must be READ OUT and any stored faults must be DELETED. READ OUT all fault memories again following a road test.

Trouble code table - vehicles with auxiliary climate control

Trouble code table - auxiliary climate control

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Diagnostic trouble code.	Description	Action
B10BA11	Auxiliary climate control blower control module, short-circuited (short to ground)	GO to Pinpoint Test A.
B10BA12	Auxiliary climate control blower control module, short circuit to voltage	GO to Pinpoint Test A.
B10BA13	Auxiliary climate control blower control module, open circuit	GO to Pinpoint Test A.
B10B012	Auxiliary climate control blower relay circuit, short circuit to voltage	GO to Pinpoint Test A.
B10B014	Auxiliary climate control blower relay circuit, open circuit or short-circuited (short to ground)	GO to Pinpoint Test A.
B10B711	Auxiliary climate control air outlet temperature sensor circuit, short-circuited (short to ground)	GO to Pinpoint Test D.
B10B715	Auxiliary climate control air outlet temperature sensor circuit, open circuit or short to voltage	GO to Pinpoint Test D.
B102D12	Auxiliary climate control temperature control flap actuator circuit, short circuit to voltage	GO to Pinpoint Test C.
B102D14	Auxiliary climate control temperature control flap actuator circuit, open circuit or short-circuited (short to ground)	GO to Pinpoint Test C.
B1B7A12	Auxiliary climate control expansion/cut-out valve circuit, short circuit to voltage	GO to Pinpoint Test B.
B1B7A14	Auxiliary climate control expansion/cut-out valve circuit, open circuit or short-circuited (short to ground)	GO to Pinpoint Test B.
B1B8111	Auxiliary climate control evaporator temperature sensor circuit, short-circuited (short to ground)	GO to Pinpoint Test B.
B1B8115	Auxiliary climate control evaporator temperatures sensor circuit, open circuit or short to voltage	GO to Pinpoint Test B.
P9B6916	Power supply voltage below limit	GO to Pinpoint Test B.
P9B6917	Power supply voltage above limit	GO to Pinpoint Test B.
U014000	No communication possible with the generic electronic module (GEM)	REFER to: Kommunikations-Netzwerk (418-00, Diagnosis and Testing).
U001000	No communications possible via the MS CAN bus.	REFER to: Kommunikations-Netzwerk (418-00, Diagnosis and Testing).

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
Auxiliary climate control blower motor inoperative/not operating correctly	* Fuse(s) * Circuit(s) * Auxiliary climate control blower relay * Auxiliary climate control blower motor * Blower switch * Auxiliary climate control blower control module * Auxiliary climate control module * CJB (Central Junction Box)	* GO to Pinpoint Test A.

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	* Rear junction box (RJB)	
Auxiliary climate control inoperative (blower OK)	* Fuse(s) * Circuit(s) * Quantity of refrigerant * Climate control assembly * Electronic automatic temperature control (EATC) module * Auxiliary climate control module * Refrigerant pressure transducer * A/C clutch relay * Air conditioning clutch * Generic Electronic Module (GEM) * Powertrain control module (PCM) * Ambient temperature sensor * Expansion/cut-out valve	* GO to Pinpoint Test B.
Malfunction - auxiliary climate control temperature control flap	* Circuit(s) * Auxiliary climate control temperature control flap actuator * Auxiliary climate control temperature control flap * Auxiliary climate control module	* GO to Pinpoint Test C.
Circuit of auxiliary climate control air outlet temperature sensor, faulty	* Circuit(s) * Auxiliary climate control air outlet temperature sensor * Auxiliary climate control module	* GO to Pinpoint Test D.

System Checks

PINPOINT TEST A : AUXILIARY CLIMATE CONTROL BLOWER MOTOR INOPERATIVE/NOT OPERATING CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUNCTION OF AUXILIARY CLIMATE CONTROL BLOWER MOTOR	
	1 Ignition switch in position II.
	2 SWITCH ON auxiliary climate control.
	3 Check all speed settings of the auxiliary climate control blower motor.
	Is the auxiliary climate control blower motor inoperative in all of the speed settings? **Yes** GO to A2. **No** GO to A18.
A2: CHECK FUSE FC6 (20 A) (RJB).	
	1 Ignition switch in position 0.
	2 Disconnect Fuse FC6 (20 A) (RJB)..
	3 CHECK Fuse FC6 (20 A) (RJB)..
	Is the fuse OK? **Yes** GO to A3. **No** RENEW fuse FC6 (20 A) (RJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY short using the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK VOLTAGE AT FUSE FC6 (20 A) (RJB).	
	1 Connect Fuse FC6 (20 A) (RJB)..
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FC6 (20 A)

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	(RJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A4. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse FC6 (20 A) (RJB) using the Wiring Diagrams. CHECK the operation of the system.
A4: CHECK FUSE FB6 (10 A) (RJB).	
	1 Ignition switch in position 0.
	2 Disconnect Fuse FB6 (10 A) (RJB)..
	3 CHECK Fuse FB6 (10 A) (RJB)..
	Is the fuse OK? **Yes** GO to A5. **No** RENEW fuse FB6 (10 A) (RJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY short using the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK VOLTAGE AT FUSE FB6 (10 A) (RJB).	
	1 Connect Fuse FB6 (10 A) (RJB)..
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FB6 (10 A) (RJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse FB6 (10 A) (RJB) using the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL BLOWER MOTOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA19 from auxiliary climate control blower motor.
	3 Ignition switch in position II.
	4 Measure the voltage between the auxiliary climate control blower motor, connector C4HA19, pin 2, circuit B_CBR11D (BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A13. **No** GO to A7.
A7: CHECK THE VOLTAGE AT THE AUXILIARY CLIMATE CONTROL BLOWER RELAY (PIN 3)	
	1 Ignition switch in position 0.
	2 Disconnect Auxiliary climate control blower relay from socket RC1.
	3 Ignition switch in position II.
	4 Measure the voltage between the auxiliary climate control blower relay, socket RC1, pin 3, circuit C_SBR06A (BN/RD), wiring harness side and ground.

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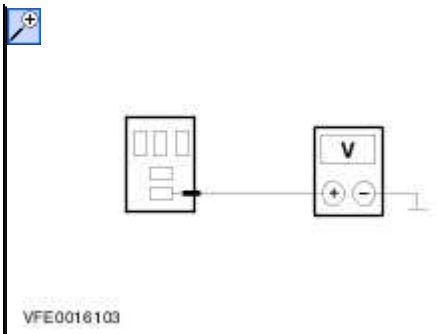


Does the meter display battery voltage?

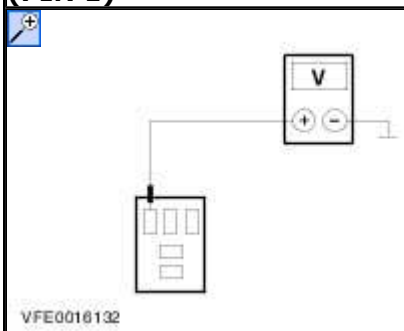
Yes

GO to A8.

No

LOCATE AND RECTIFY the break in the circuit between the auxiliary climate control blower relay and fuse FC6 (20 A) (RJB) using the Wiring Diagrams. CHECK the operation of the system.

A8: CHECK THE VOLTAGE AT THE AUXILIARY CLIMATE CONTROL BLOWER RELAY (PIN 1)



1 Measure the voltage between the auxiliary climate control blower relay, socket RC1, pin 1, circuit B_CBR06C (WH/BU), wiring harness side and ground.

Does the meter display battery voltage?

Yes

GO to A9.

No

LOCATE AND RECTIFY the break in the circuit between the auxiliary climate control blower relay and fuse FB6 (10 A) (RJB) using the Wiring Diagrams. CHECK the operation of the system.

A9: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER RELAY AND THE AUXILIARY CLIMATE CONTROL BLOWER MOTOR FOR OPEN CIRCUIT

1 Ignition switch in position 0.

2 Measure the resistance between the auxiliary climate control blower relay, socket RC1, pin 5, circuit C_CBR06A (WH/BU), wiring harness side and the auxiliary climate control blower motor, connector C4HA19, pin 2, circuit B_CBR11D (BN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to A11.

No

GO to A10.

A10: CHECK THE CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL BLOWER MOTOR FOR OPEN CIRCUIT

1 Disconnect Connector C4BR02-B from RJB.

2 Measure the resistance between the RJB, connector C4BR02-B, pin 312, circuit C_CBR06A (WH/BU), wiring harness side and the auxiliary climate control

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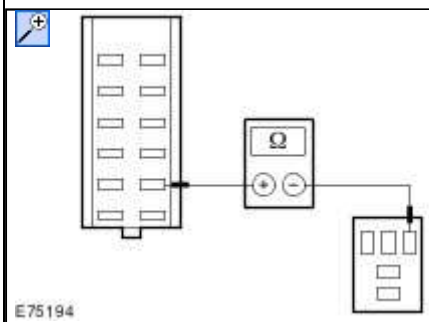
	blower motor, connector C4HA19, pin 2, circuit B_CBR11D (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK RJB and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the RJB and the auxiliary climate control blower motor using the Wiring Diagrams. CHECK the operation of the system.
A11: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER RELAY AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect C3H101-A from auxiliary climate control module.
	2 Measure the resistance between the auxiliary climate control blower relay, socket RC1, pin 2, circuit CHA05A (BN/WH), socket side and the auxiliary climate control module, connector C3H101-A, pin 11, circuit CHA05A (BN/WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK auxiliary climate control blower relay in accordance with the Component Checks at the end of this section. If the auxiliary climate control blower relay is OK, CHECK RJB and RENEW if necessary. CHECK the operation of the system. **No** GO to A12.
A12: CHECK THE CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C4BR02-C from RJB.
	2 Measure the resistance between the RJB, connector C4BR02-C, pin 313, circuit CHA05A (BN/WH), wiring harness side and the auxiliary climate control module, connector C3H101-A, pin 11, circuit CHA05A (BN/WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK RJB and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the RJB and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
A13: CHECK THE GROUND CONNECTION OF THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA25 from auxiliary climate control blower control module.
	3 Measure the resistance between the auxiliary climate control blower control module, connector C4HA25, pin 1, circuit GD150AH (BK/WH), wiring

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	harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A14. **No** LOCATE and RECTIFY the break in the circuit between the auxiliary climate control blower control module and ground connection G4D149 using the Wiring Diagrams. CHECK the operation of the system.
A14: CHECK THE VOLTAGE AT THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE	
	1 Ignition switch in position II.
	2 Measure the voltage between the auxiliary climate control blower control module, connector C4HA25, pin 4, circuit B_CBR11C (BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A16. **No** GO to A15.
A15: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE AND THE RJB FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4BR02-B from RJB.
	3 Measure the resistance between the auxiliary climate control blower control module, connector C4HA25, pin 4, circuit B_CBR11C (BN), wiring harness side and RJB, connector C4BR02-B, pin 312, circuit C_CBR06A (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK RJB and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the auxiliary climate control blower control module and the RJB using the Wiring Diagrams. CHECK the operation of the system.
A16: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER MOTOR AND THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA19 from auxiliary climate control blower motor.
	3 Measure the resistance between the auxiliary climate control blower motor, connector C4HA19, pin 1, circuit VHA19A (BN), wiring harness side and the auxiliary climate control blower control module, connector C4HA25, pin 3, wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A17. **No** LOCATE and RECTIFY the break in circuit VHA19A (BN) between the auxiliary climate control blower

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	motor and the auxiliary climate control blower control module using the Wiring Diagrams. CHECK the operation of the system.
A17: CHECK AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE	
	1 Connect Connector C4HA19 to auxiliary climate control blower motor.
	2 Using a fused test cable (40 A), bridge connector C4HA25 on the auxiliary climate control blower control module between pin 3, circuit VHA19A (BN), wiring harness side and pin 1, circuit GD150AH (BK/WH), wiring harness side.
	3 Ignition switch in position II.
	Does the auxiliary climate control blower motor run at full speed? **Yes** GO to A18. **No** RENEW the auxiliary climate control blower motor. CHECK the operation of the system.
A18: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA25 from auxiliary climate control blower control module.
	3 Disconnect Connector C3H101-R from auxiliary climate control module.
	4 Measure the resistance between the auxiliary climate control blower control module, connector C4HA25, pin 2, circuit VHA25A (BN/VT), wiring harness side and the auxiliary climate control module, connector C3H101-R, pin 13, circuit VHA25A (BN/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A19. **No** LOCATE and RECTIFY the break in circuit VHA25A (BN/VT) between the auxiliary climate control blower control module and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
A19: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR SHORT CIRCUIT TO VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the auxiliary climate control module, connector C3H101-R, pin 13, circuit VHA25A (BN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to voltage in circuit VHA25A (BN/VT) between the auxiliary climate control blower control module and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to A20.

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A20: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL BLOWER CONTROL MODULE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR SHORT CIRCUIT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 13, circuit VHA25A (BN/VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** RENEW auxiliary climate control blower control module. CHECK the operation of the system. If the system is still inoperative, CHECK the auxiliary climate control module using WDS and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit VHA25A (BN/VT) between the auxiliary climate control blower control module and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : AUXILIARY CLIMATE CONTROL INOPERATIVE (BLOWER OK)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK FUSE FC4 (10 A) (RJB).	
	1 Ignition switch in position 0.
	2 CHECK Fuse FC4 (10 A) (RJB)..
	Is the fuse OK? **Yes** GO to B2. **No** RENEW fuse FC4 (10 A) (RJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY short using the Wiring Diagrams. CHECK the operation of the system.
B2: CHECK VOLTAGE AT FUSE FC4 (10 A) (RJB).	
	1 Connect Fuse FC4 (10 A) (RJB)..
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FC4 (10 A) (RJB) and ground.
	Does the meter display battery voltage? **Yes** GO to B3. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse FC4 (10 A) (RJB) using the Wiring Diagrams. CHECK the operation of the system.
B3: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL MODULE, PIN 1	
	1 Ignition switch in position 0.
	2 Disconnect Connector C3H101-A from auxiliary climate control module.
	3 Measure the voltage between the auxiliary climate control module, connector C3H101-A, pin 1, circuit C_SBR04A (GN/RD), wiring harness side and ground.

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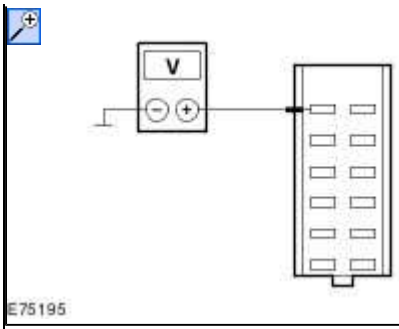


Does the meter display battery voltage?
Yes
GO to B5.
No
GO to B4.

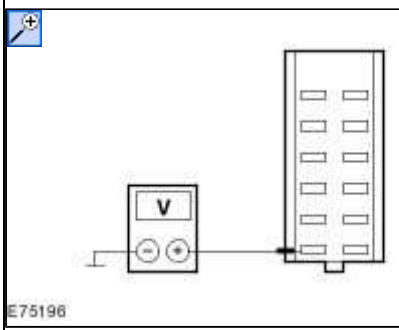
B4: CHECK THE CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT

1. Disconnect Connector C4BR02-C from RJB.
2. Measure the resistance between the RJB, connector C4BR02-C, pin 305, circuit C_SBR04A (GN/RD), wiring harness side and the auxiliary climate control module, connector C3H101-A, pin 1, wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
CHECK RJB and RENEW if necessary. CHECK the operation of the system.
No
LOCATE and RECTIFY the break in the circuit between the RJB and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.

B5: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL MODULE, PIN 6

1. Ignition switch in position II.
2. SWITCH ON auxiliary climate control.



3. Measure the voltage between the auxiliary climate control module, connector C3H101-A, pin 6, circuit B_CBR06B (WH/BU), wiring harness side and ground.

Does the meter display battery voltage?
Yes
GO to B7.
No
GO to B6.

B6: CHECK THE CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect Connector C4BR02-B from RJB.
3. Measure the resistance between the RJB, connector C4BR02-B, pin 221, circuit B_CBR06B (WH/BU), wiring harness side and the auxiliary climate control module, connector C3H101-A, pin 6, wiring harness

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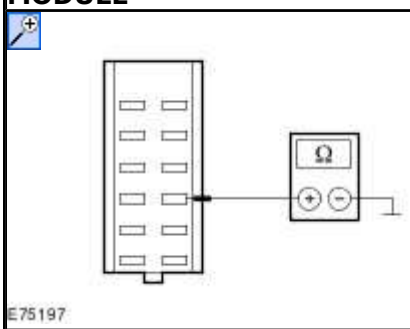
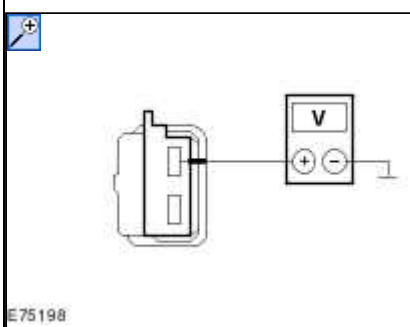
	side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK RJB and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the RJB and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
B7: CHECK THE GROUND CONNECTION OF THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Measure the resistance between the auxiliary climate control module, connector C3H101-A, pin 10, circuit GD150L (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B8. **No** LOCATE and RECTIFY the break in the circuit between the auxiliary climate control module and ground connection G4D149 using the Wiring Diagrams. CHECK the operation of the system.
B8: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL EVAPORATOR TEMPERATURE SENSOR	
	1 Disconnect Connector C4HA30 from auxiliary climate control evaporator temperature sensor.
	2 Ignition switch in position II.
	3 SWITCH ON auxiliary climate control.
	4 Measure the voltage between the auxiliary climate control evaporator temperature sensor, connector C4HA30, pin 1, circuit VHA30A (BN/YE), wiring harness side and ground.
	Is a voltage of approx. 5 volts measured? **Yes** GO to B11. **No** - The voltage measured is more than 6 Volts:LOCATE and RECTIFY the short to voltage in circuit VHA30A (BN/YE) between the auxiliary climate control module and the auxiliary climate control evaporator temperature sensor using the Wiring Diagrams. CHECK the operation of the system. - No voltage measured:GO to B9.
B9: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL EVAPORATOR TEMPERATURE SENSOR AND THE AUXILIARY CLIMATE CONTROL MODULE FOR	

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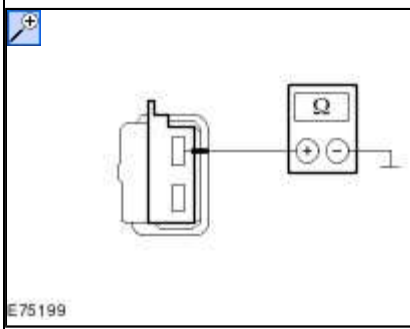
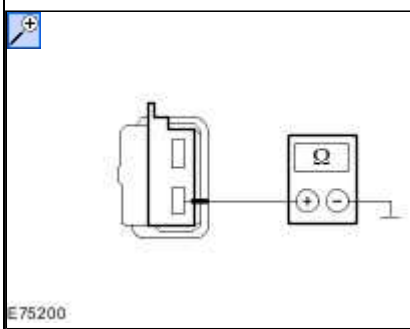
SHORT CIRCUIT TO GROUND

	1 Ignition switch in position 0.
	2 Disconnect Connector C3H101-R from auxiliary climate control module.
 E75199	3 Measure the resistance between the auxiliary climate control evaporator temperature sensor, connector C4HA30, pin 1, circuit VHA30A (BN/YE), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to B10. **No** LOCATE and RECTIFY the short to ground in circuit VHA30A (BN/YE) between the auxiliary climate control module and the auxiliary climate control evaporator temperature sensor using the Wiring Diagrams. CHECK the operation of the system.

B10: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL EVAPORATOR TEMPERATURE SENSOR AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT

	1 Measure the resistance between the auxiliary climate control evaporator temperature sensor, connector C4HA30, pin 1, circuit VHA30A (BN/YE), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 5, wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the auxiliary climate control module using WDS, RENEW if necessary. **No** LOCATE and RECTIFY the break in circuit VHA30A (BN/YE) between the auxiliary climate control evaporator temperature sensor and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.

B11: CHECK GROUND CONNECTION FROM AUXILIARY CLIMATE CONTROL EVAPORATOR TEMPERATURE SENSOR

	1 Ignition switch in position 0.
 E75200	2 Measure the resistance between the auxiliary climate control evaporator temperature sensor, connector C4HA30, pin 2, circuit RHA26A (BU/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW auxiliary climate control evaporator temperature sensor. CHECK the operation of the system.

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	No GO to B12.
B12: CHECK THE CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL EVAPORATOR TEMPERATURE SENSOR AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C3H101-R from auxiliary climate control module.
	2 Measure the resistance between the auxiliary climate control evaporator temperature sensor, connector C4HA30, pin 2, circuit RHA26A (BU/WH), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 15, wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B13. **No** LOCATE and RECTIFY the break in circuit RHA26A (BU/WH) between the auxiliary climate control evaporator temperature sensor and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
B13: CHECK VOLTAGE AT EXPANSION/CUT-OUT VALVE	
	1 Ignition switch in position 0.
	2 Connect Connector C3H101-R from auxiliary climate control module.
	3 Disconnect Connector C4HA28 from expansion/cut-out valve.
	4 Ignition switch in position II.
	5 Measure the voltage between the expansion/cut-out valve, connector C4HA28, pin 2, circuit CHA28A (VT/OG), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B16. **No** GO to B14.
B14: CHECK THE CIRCUIT BETWEEN THE EXPANSION/CUT-OUT VALVE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR SHORT CIRCUIT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Connector C3H101-R from auxiliary climate control module.
	3 Measure the resistance between the expansion/cut-out valve, connector C4HA28, pin 2, circuit CHA28A (VT/OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to B15. **No** LOCATE and RECTIFY the short to ground in circuit CHA28A (VT/OG) between the auxiliary climate control module and the expansion/cut-out valve using the Wiring Diagrams. CHECK the operation of the system.
B15: CHECK THE CIRCUIT BETWEEN THE EXPANSION/CUT-OUT VALVE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Measure the resistance between the expansion/cut-out valve, connector C4HA28, pin 2, circuit CHA28A (VT/OG), wiring harness side and auxiliary climate

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	control module, connector C3H101-R, pin 11, wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the auxiliary climate control module using WDS, RENEW if necessary. **No** LOCATE and RECTIFY the break in circuit CHA28A (VT/OG) between the expansion/cut-out valve and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
B16: CHECK GROUND CONNECTION FROM EXPANSION/CUT-OUT VALVE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the expansion/cut-out valve, connector C4HA28, pin 1, circuit RHA29A (WH/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW expansion/cut-out valve. CHECK the operation of the system. **No** GO to B17.
B17: CHECK THE CIRCUIT BETWEEN THE EXPANSION/CUT-OUT VALVE AND THE AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C3H101-R from auxiliary climate control module.
	2 Measure the resistance between the expansion/cut-out valve, connector C4HA28, pin 1, circuit RHA29A (WH/VT), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 10, wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the auxiliary climate control module using WDS, RENEW if necessary. **No** LOCATE and RECTIFY the break in circuit RHA29A (WH/VT) between the expansion/cut-out valve and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST C : MALFUNCTION - AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP	
NOTE: Ensure that the auxiliary climate control temperature control flap is mechanically OK.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA20 from auxiliary climate control temperature control flap actuator.
	3 Ignition switch in position II.
	4 SWITCH ON auxiliary climate control.
	5 Measure the voltage between the auxiliary climate control temperature control flap actuator, connector C4HA20, pin 2, circuit CHA24A (WH/GN), wiring harness side and ground.

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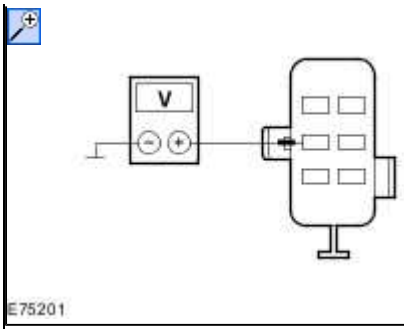

Does the meter display battery voltage?

Yes

GO to C3.

No

GO to C2.

C2: CHECK CIRCUIT BETWEEN AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR AND AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect Connector C3H101-R from auxiliary climate control module.
3. Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 1, circuit CHA24A (WH/GN), wiring harness side and auxiliary climate control temperature control flap actuator, connector C4HA20, pin 2, circuit CHA24A (WH/GN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the auxiliary climate control module using WDS, RENEW if necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in circuit CHA24A (WH/GN) between the auxiliary climate control module and the auxiliary climate control temperature control flap actuator using the Wiring Diagrams. CHECK the operation of the system.

C3: CHECK CIRCUITS BETWEEN AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR AND AUXILIARY CLIMATE CONTROL MODULE FOR SHORT TO VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Connector C3H101-R from auxiliary climate control module.
3. Ignition switch in position II.
4. Measure the voltage between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and ground.
5. Measure the voltage between the auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side and ground.
6. Measure the voltage between the auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side and ground.
7. Measure the voltage between the auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side and ground.

Is a voltage measured during one or more

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	measurements? **Yes** LOCATE and REPAIR short to voltage in the relevant circuit(s) between the auxiliary climate control temperature control flap actuator and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system. **No** GO to C4.
C4: CHECK CIRCUITS BETWEEN AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR AND AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side and auxiliary climate control temperature control flap actuator, connector C4HA20, pin 6, circuit CHA23A (YE), wiring harness side.
	3 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side and auxiliary climate control temperature control flap actuator, connector C4HA20, pin 4, circuit CHA22A (VT), wiring harness side.
	4 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side and auxiliary climate control temperature control flap actuator, connector C4HA20, pin 3, circuit CHA21A (GY), wiring harness side.
	5 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and auxiliary climate control temperature control flap actuator, connector C4HA20, pin 1, circuit CHA20A (BU/GN), wiring harness side.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to C5. **No** LOCATE and REPAIR break in the relevant circuit between the auxiliary climate control temperature control flap actuator and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
C5: CHECK CIRCUITS BETWEEN AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR AND AUXILIARY CLIMATE CONTROL MODULE FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and ground.
	3 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side and ground.
	4 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 8, circuit

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	CHA22A (VT), wiring harness side and ground.
	5 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured in all of the measurements? **Yes** GO to C6. **No** LOCATE and REPAIR short to ground in the relevant circuit(s) between the auxiliary climate control temperature control flap actuator and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
C6: CHECK CIRCUITS BETWEEN AUXILIARY CLIMATE CONTROL TEMPERATURE CONTROL FLAP ACTUATOR AND AUXILIARY CLIMATE CONTROL MODULE FOR SHORT TO EACH OTHER	
	1 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 1, circuit CHA24A (WH/GN), wiring harness side.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side.
	3 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side.
	4 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 6, circuit CHA20A (BU/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side.
	5 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 1, circuit CHA24A (WH/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side.
	6 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 1, circuit CHA24A (WH/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side.
	7 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 1, circuit CHA24A (WH/GN), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side.
	8 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 7, circuit CHA21A (GY), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side.
	9 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 7, circuit

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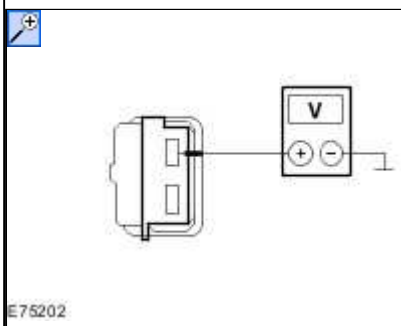
	CHA21A (GY), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side.
	10 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 8, circuit CHA22A (VT), wiring harness side and auxiliary climate control module, connector C3H101-R, pin 9, circuit CHA23A (YE), wiring harness side.
	Is a resistance of more than 10,000 ohms measured in all of the measurements? **Yes** RENEW auxiliary climate control temperature control flap actuator. CHECK the operation of the system.If the concern persists, CHECK the auxiliary climate control module using WDS and RENEW if necessary. **No** LOCATE and REPAIR short circuit in the relevant circuits between the auxiliary climate control temperature control flap actuator and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST D : CIRCUIT OF AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR FAULTY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK VOLTAGE AT AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4HA09-A from auxiliary climate control air outlet temperature sensor.
	3 Ignition switch in position II.
	4 SWITCH ON auxiliary climate control.
	**5** Measure the voltage between the auxiliary climate control air outlet temperature sensor, connector C4HA09-A, pin 1, circuit VHA31A (GN/BN), wiring harness side and ground.
	Is a voltage of approx. 5 V measured? **Yes** GO to D3. **No** GO to D2.
D2: CHECK CIRCUIT BETWEEN AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR AND AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C3H101-R from auxiliary climate control module.
	3 Measure the resistance between the auxiliary climate control air outlet temperature sensor, C4HA09-A, pin 1, circuit VHA31A (GN/BN), wiring harness side and the auxiliary climate control module, connector C3H101-R, pin 4, circuit VHA31A (GN/BN), wiring

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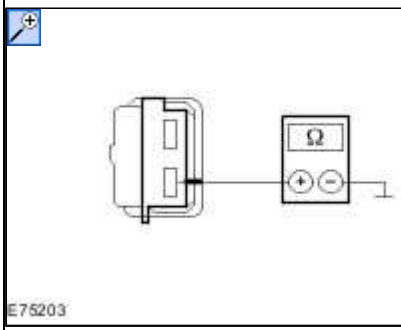
	harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the auxiliary climate control module using WDS, RENEW if necessary. **No** LOCATE and RECTIFY the break in circuit VHA31A (GN/BN) between the auxiliary climate control air outlet temperature sensor and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
D3: CHECK GROUND CONNECTION FROM AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR	
	1 Ignition switch in position 0.
	2 Measure the resistance between the auxiliary climate control air outlet temperature sensor, connector C4HA09-A, pin 2, circuit RHA27A (GY/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to D5. **No** GO to D4.
D4: CHECK CIRCUIT BETWEEN AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR AND AUXILIARY CLIMATE CONTROL MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C3H101-R from auxiliary climate control module.
	2 Measure the resistance between the auxiliary climate control air outlet temperature sensor, connector C4HA09-A, pin 2, circuit RHA27A (GY/BU), wiring harness side and the auxiliary climate control module, connector C3H101-R, pin 14, circuit RHA27A (GY/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to D5. **No** LOCATE and RECTIFY the break in circuit RHA27A (GY/BU) between the auxiliary climate control air outlet temperature sensor and the auxiliary climate control module using the Wiring Diagrams. CHECK the operation of the system.
D5: CHECK CIRCUIT BETWEEN AUXILIARY CLIMATE CONTROL AIR OUTLET TEMPERATURE SENSOR AND AUXILIARY CLIMATE CONTROL MODULE FOR SHORT TO GROUND	
	1 Disconnect Connector C3H101-R from auxiliary climate control module.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-R, pin 14, circuit RHA27A (GY/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes**

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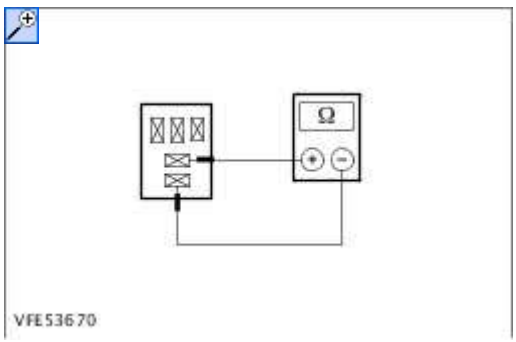
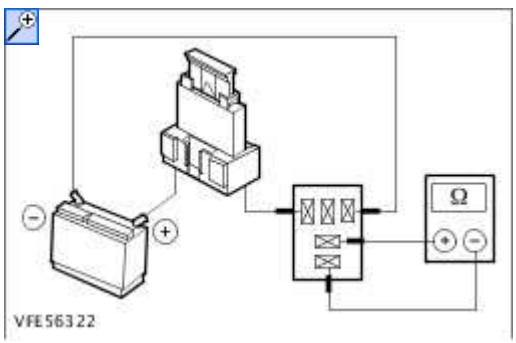
	RENEW the auxiliary climate control air outlet temperature sensor. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit RHA27A (GY/BU) between the auxiliary climate control module and the auxiliary climate control air outlet temperature sensor using the Wiring Diagrams. CHECK the operation of the system.

Component Tests

Blower relay, auxiliary climate control



1. **1.** Check the normally open contact in the unswitched state:
    1. Measure the resistance at the auxiliary climate control blower relay, between pin 3 and pin 5, component side.
    2. Is a resistance of more than 10,000 Ohm measured?
    3. If yes, goto 2.
    4. If no, RENEW the auxiliary climate control blower relay.



2. **2.** Check the normally open contact in the switched state:
    1. Using a fused test cable (1 A), connect pin 1 of the auxiliary climate control blower relay, component side, to the battery positive terminal.
    2. Using a test cable, connect pin 2 of the auxiliary climate control blower relay, component side, with the battery negative pole.
    3. Measure the resistance at the auxiliary climate control blower relay, between pin 3 and pin 5, component side.
    4. Is a resistance of less than 2 Ohms registered?
    5. If yes, then the auxiliary climate control blower relay is OK.
    6. If no, RENEW the auxiliary climate control blower relay.

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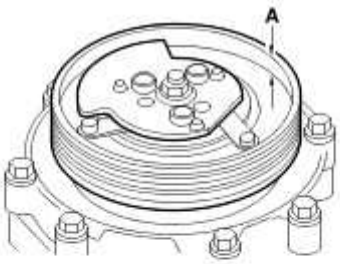
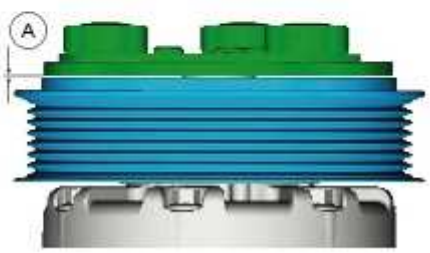
General Procedures





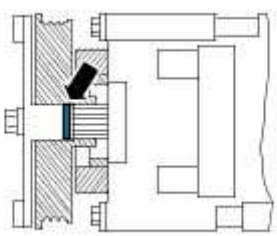
E92144

1. Check the gap A (measure the difference between the engaged and disengaged positions of the air conditioning clutch) at 60° intervals around the circumference of the pulley. Operate the air conditioning clutch several times with the aid of a 5 A fused cable. Refer to the relevant wiring diagram for the correct electrical connection.

   Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

E68442

2.



E68470

3. If necessary correct the gap A using spacer washers.

E68442

4. Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

5. Check the gap A as described in step 1. If necessary, repeat steps 2-5.

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General Procedures

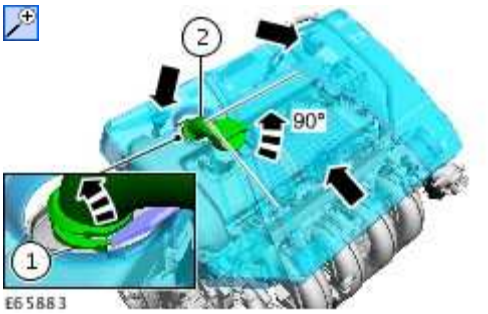
General Equipment

Adapter for air conditioning service unit
Air conditioning service unit
Automatic calibration halogen leak detector
Electronic leak detector
UV leak detector

1. Refer to: Air Conditioning (A/C) System Health and Safety Precautions (100-00 General Information, Description and Operation).

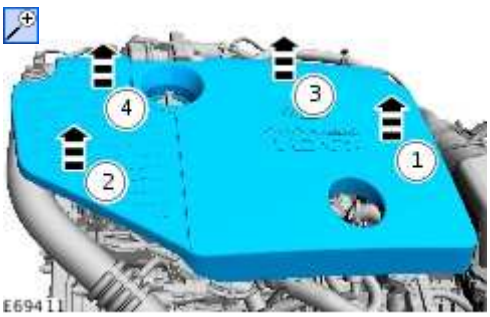
Vehicles with 2.0L engine

2.



Vehicles with a diesel engine

3.



All vehicles

4.

1. Low pressure filling connection
2. High pressure filling connection

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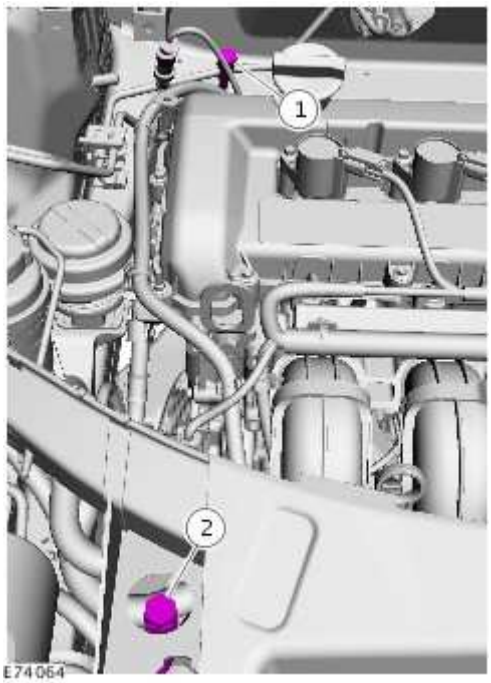

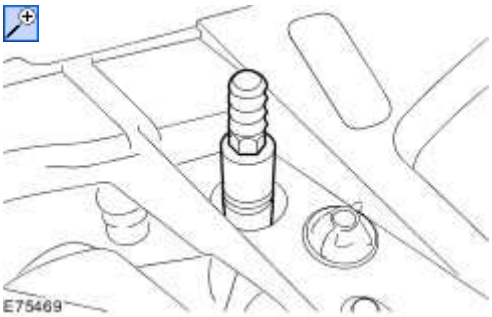

5. Connect the service unit lines to the filling connection of the air conditioning system. Install adapter for evacuation and charging equipment (air conditioning) FSE number: UCN050500004, if required.

   General Equipment: Air conditioning service unit
   General Equipment: Adapter for air conditioning service unit

6. Drain the air conditioning system via the low pressure connection in accordance with the service unit manufacturer's instructions.

NOTE: This step is only required when installing a new component.

7. CAUTION: Make sure that the specified amount of refrigerant oil is added.
   Fill up with refrigerant oil.

   Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).
   Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

8. Evacuate the air conditioning system in accordance with the service unit manufacturer's instructions.

9. NOTE: The system is leak-tight if the pressure increase does not exceed 20 mbar.
   Perform the leak test by closing the hand valves on the gauge set, switching off the service unit vacuum pump and observing the low pressure gauge.

10. NOTE: This step is only necessary if the pressure increase exceeds 20 mbar.
    Locate and rectify any leaks in the A/C

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refrigerant circuit using a leak tester.

General Equipment: UV leak detector
General Equipment: Electronic leak detector
General Equipment: Automatic calibration halogen leak detector

11. Fill up the air conditioning system with refrigerant oil.

    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).
    Refer to: Refrigerant Oil Adding (412-00 Climate Control System - General Information, General Procedures).

12. Fill the air conditioning system with liquid through the high pressure connection.

    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

13.
    1. Open the shut-off valve on the high pressure side.
    2. Switch the service unit to "Fill" mode and fill the system with the prescribed quantity of liquid refrigerant (R134a).

14. Fill the air conditioning system with gas through the low pressure connection.

    Refer to: Specifications (412-00 Climate Control System - General Information, Specifications).

15.
    1. Open the shut-off valve on the low pressure side.
    2. Switch the service unit to "Fill" mode and fill the system with the prescribed quantity of gaseous refrigerant.
    3. Add the remaining amount of refrigerant with the air conditioning switched on. To do so run the engine at about 1200-1500 rev/min. Set the air conditioning system to full cooling power and fresh air mode. Set the blower to the highest setting. Fill with the remainder of the prescribed fill capacity.

16. Disconnect the service unit.

17.
    1. Close the shut-off valve.
    2. Switch off the service unit.
    3. Disconnect the service unit lines from the filling connections of the air conditioning system.
    4. Screw the protective caps onto the filling connections.

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18. To install, reverse the removal procedure.

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General Procedures

CAUTION: Collect the refrigerant oil in a clean measuring cylinder.

1. NOTE: This step only needs to be carried out when removing the A/C compressor.
   NOTE: Rotate the compressor shaft at least 6 to 8 turns when draining the refrigerant oil.
   Drain the refrigerant oil from the defective A/C compressor and dispose of it.
2. CAUTIONS:

   The refrigerant oil top-up quantity must not exceed the refrigerant oil fill quantity.

   If other A/C components are being renewed in addition to the A/C compressor, there is no need to top up with additional refrigerant oil, apart from filling the compressor.
   Top up with the calculated quantity of new refrigerant oil. See: Specifications (412-00 Heating, Ventilation, Air-Conditioning - General information, Specifications).

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General Procedures

1. CAUTION: Any R134a or R12 refrigerant which is contaminated with unsuitable refrigerant should be extracted only by means of a suitable servicing unit designed for the purpose of collecting and storing contaminated refrigerant, so that the spread to other vehicles can be prevented.
   Use refrigerant identification equipment to check that there is contaminated refrigerant in the air conditioning system.
2. Inform the customer about the additional costs involved to repair the system because of the contamination.
3. Extract the contaminated refrigerant.

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A/C compressor

	Description
A/C compressor (vehicles with 2.0L Duratec-HE (MI4), 1.8L Duratorq-TDCi (Lynx), 2.0L Duratorq-TDCi (DW) engines)	Visteon VS16
A/C compressor (vehicles with 2.5L Duratec-ST (VI5) engine)	Zexel KC88

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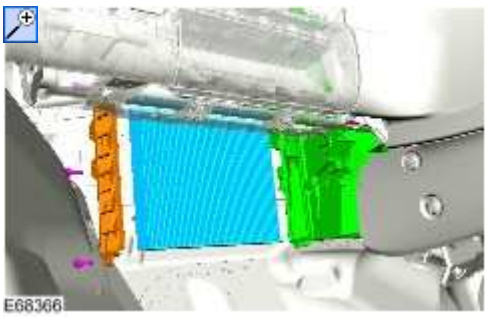
Description and Operation

Pollen filter

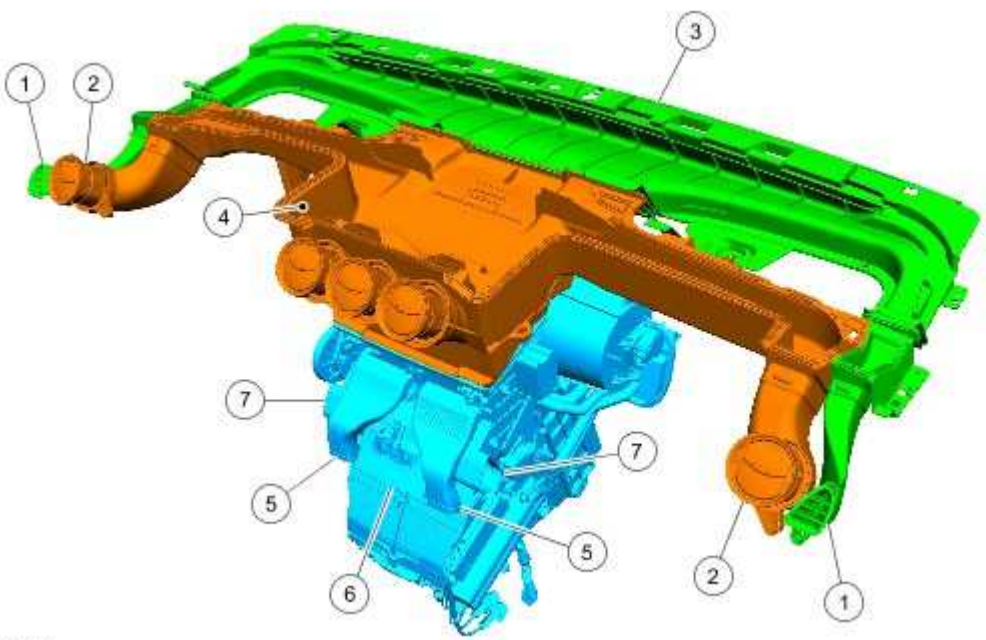


The fresh air flowing into the vehicle through the air inlet housing passes through a pollen filter which is located on the left-hand side of the climate control housing (LHD and RHD) and removes pollen and dust particles measuring 0.003 mm or more.

The pollen filter must be changed at intervals in accordance with the service schedule.

A special production pollen filter is installed in the factory, and this must be cut through when the filter is changed. The service pollen filter is flexible and can be pushed together during installation or removal.

Air distribution, instrument cluster



Item	Part Number	Description
1	-	Air ducts, side window demister vents
2	-	Air ducts, side vents (adjustable)
3	-	Air ducts, demister vents
4	-	Center register duct
5	-	Air ducts, B-pillars
6	-	Air duct, middle/rear footwell
	-	

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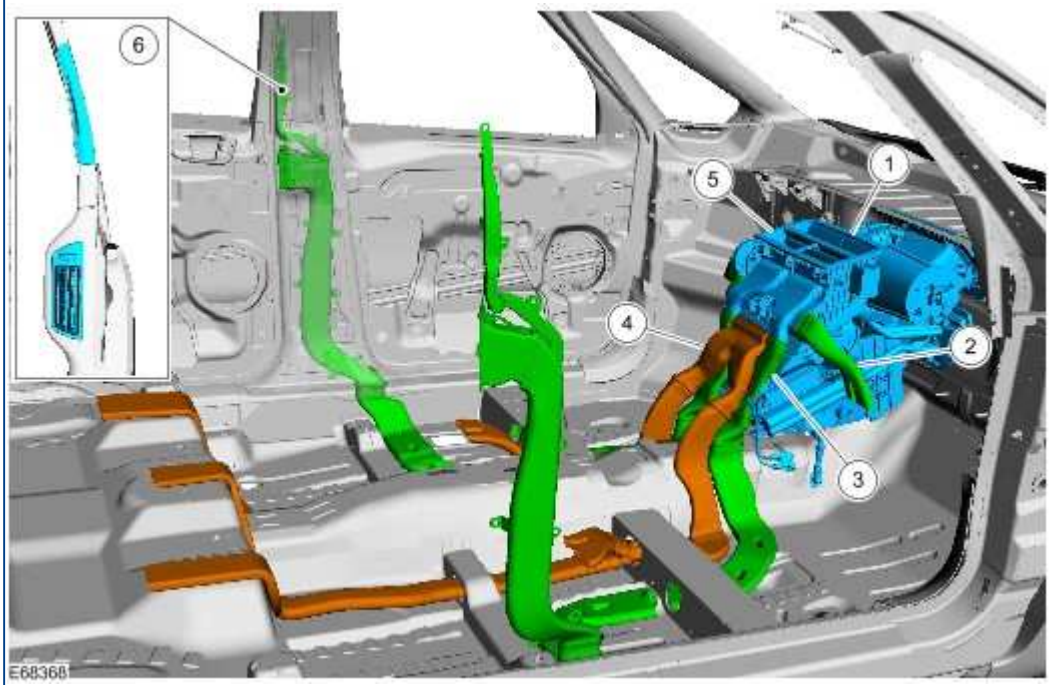
7		Air ducts, front footwell

Air distribution, passenger compartment



Item	Part Number	Description
1	-	Air duct, demister vents
2	-	Air ducts, front footwell
3	-	Air ducts, B-pillars
4	-	Air ducts, middle/rear footwell
5	-	Center register duct
6	-	Outlet vents, B-pillars

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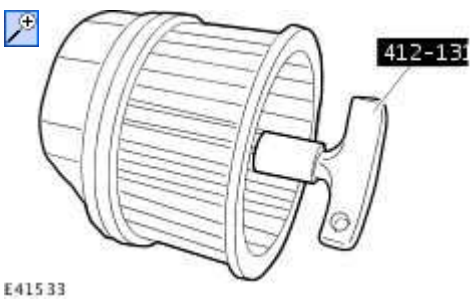
Description and Operation

The climate control housing contains the blower motor, the pollen filter, the heat exchanger, he evaporator (on vehicles with air conditioning (A/C)), the electric booster heater (if equipped) and various air deflection flaps.

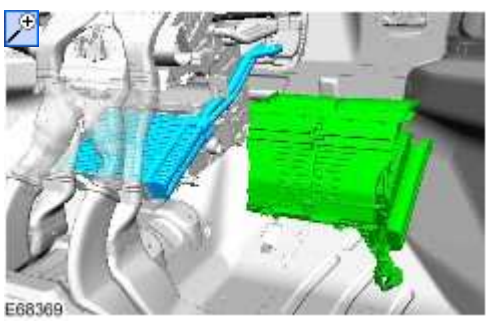
Blower motor

CAUTION: Do not put the blower motor down on the blower motor fan wheel.



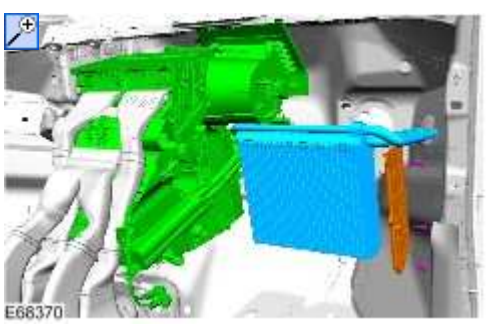
To prevent damage to the fan wheel vanes, the fan wheel must not be touched. For this reason, a special tool (412-131) has been introduced for removal and installation of the blower motor. This tool is pushed onto the central shaft in order to lift out the blower motor.

Heat exchanger



The heat exchanger is accessible from the right-hand side of the climate control housing (LHD and RHD). It can be removed and installed with the climate control housing still installed in the vehicle. During removal, the coolant pipes of the production heater core must be sawn through. During servicing, a heater core with separate coolant pipes is installed.

Evaporator



The evaporator is located on the right-hand side of the climate control housing (LHD and RHD). It can be removed and installed with the climate control housing still installed in the vehicle, although the heat exchanger does need to be removed first. The refrigerant lines of

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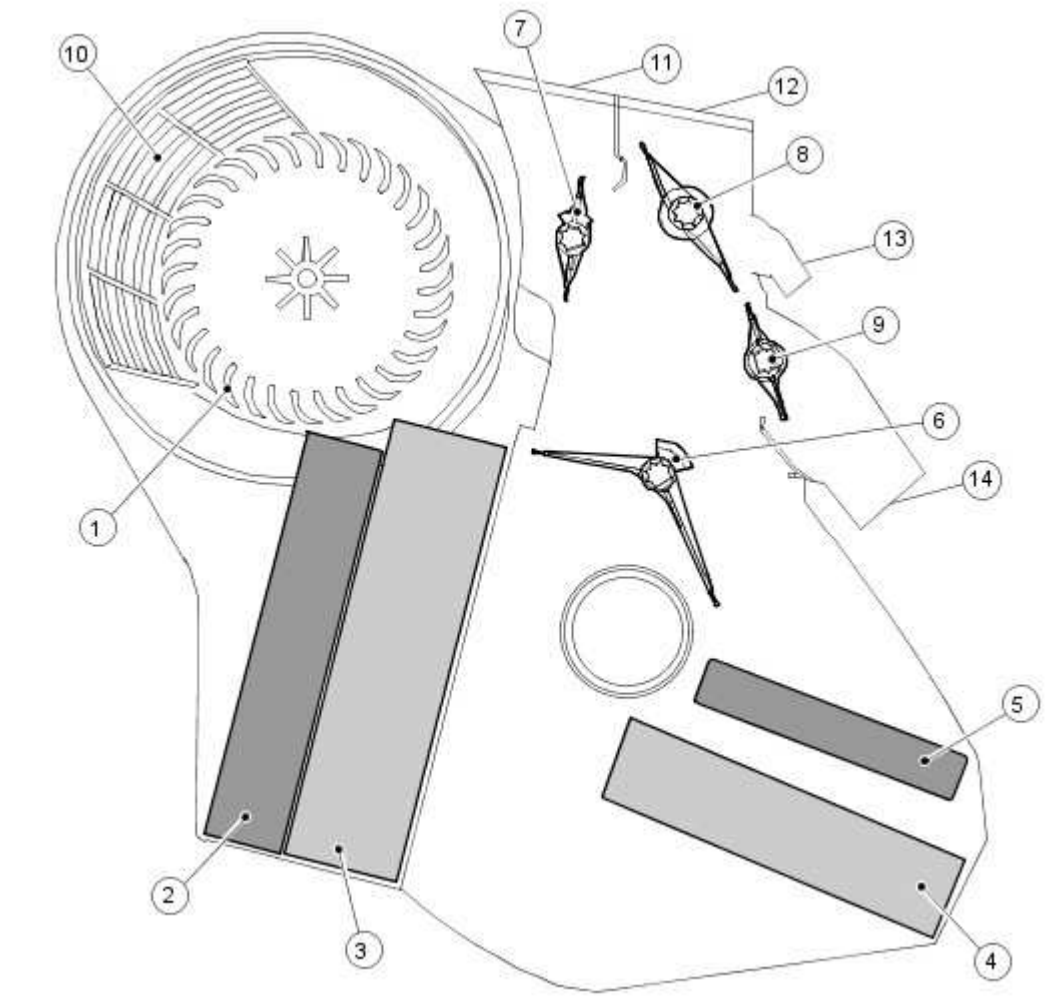
the production evaporator must be sawn through during removal. An evaporator with separate refrigerant lines is installed in service.

Overview of the climate control housing



E69658

Item	Part Number	Description
1	-	Blower motor
2	-	Pollen filter
3	-	Evaporator
4	-	Heat exchanger
5	-	Electric booster heater (if equipped)
6	-	Temperature control flap
7	-	Air distribution flap, demister vents
8	-	Air distribution flap, center vents / outlet vents on the B-pillars (if fitted)
9	-	Air distribution flap - footwell
10	-	Air inlet flap
11	-	Air duct, demister vents
12	-	Center duct
13	-	Air ducts, B-pillars (if fitted)
14	-	Air ducts, rear footwell

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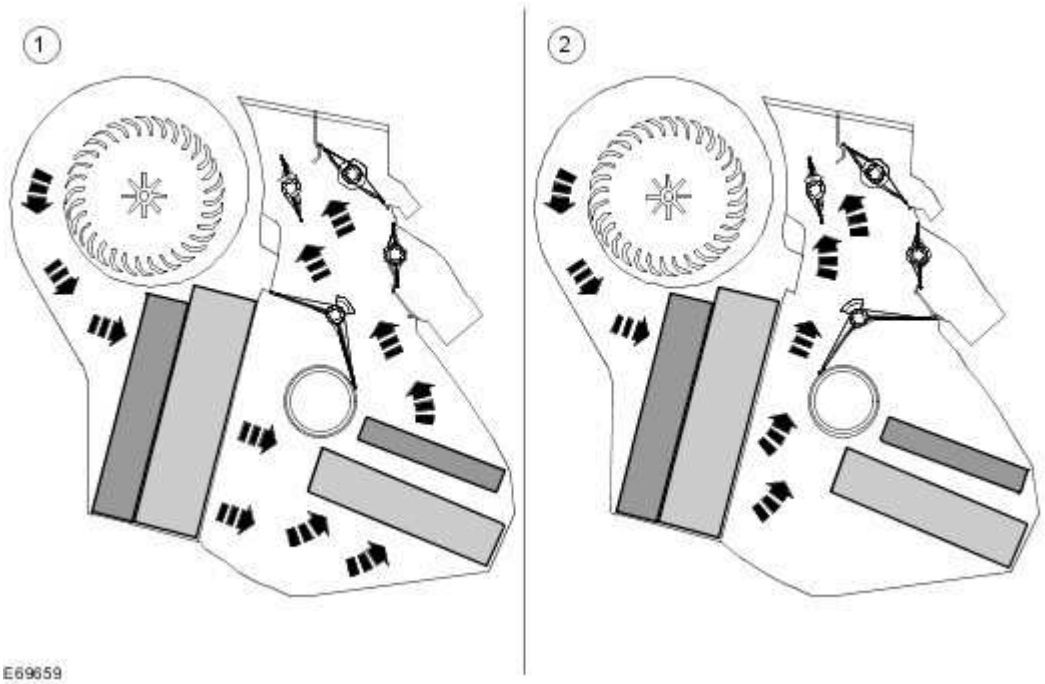
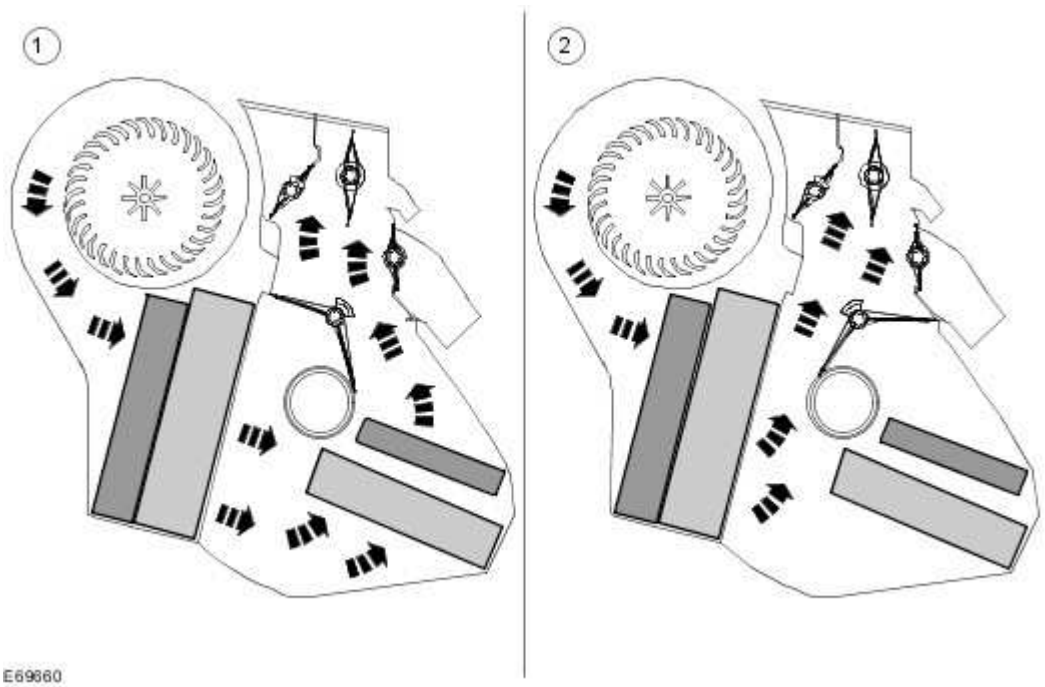
Air flow - defroster vents



E69659

Item	Part Number	Description
1	-	Warm air
2	-	Cold air

Air flow, center vents / outlet vents on the B-pillars



E69660

Item	Part Number	Description
1	-	Warm air
2	-	Cold air

Air flow – footwell

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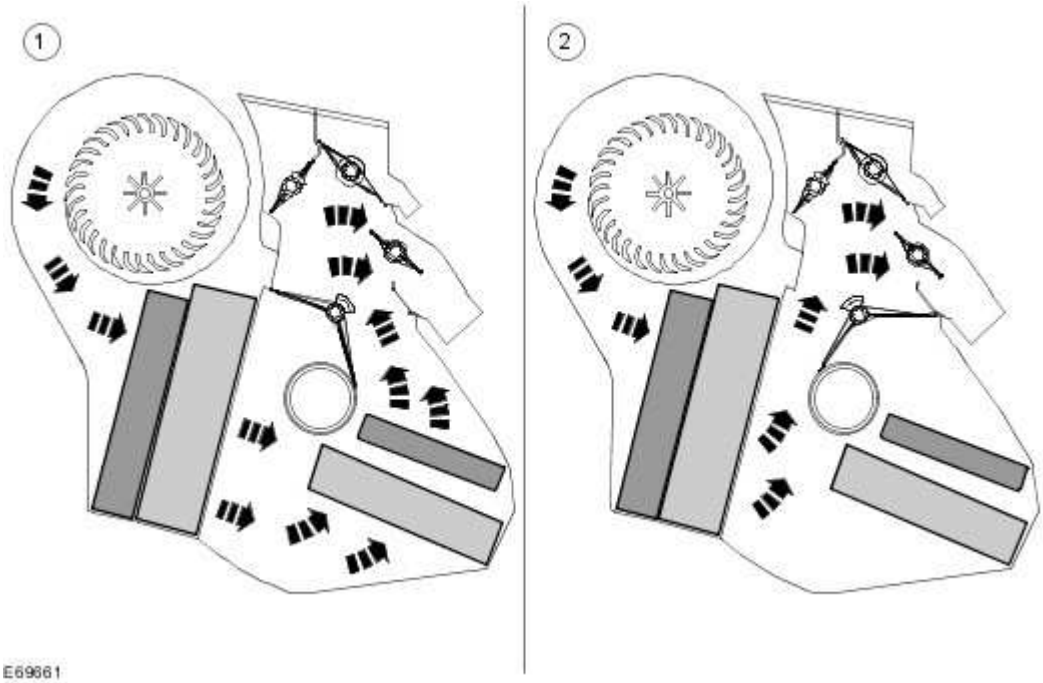

E69661

Item	Part Number	Description
1	-	Warm air
2	-	Cold air

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Description and Operation

The air conditioning system is controlled by an thermostatic expansion valve. R134a refrigerant is used.

There are three different variants available:

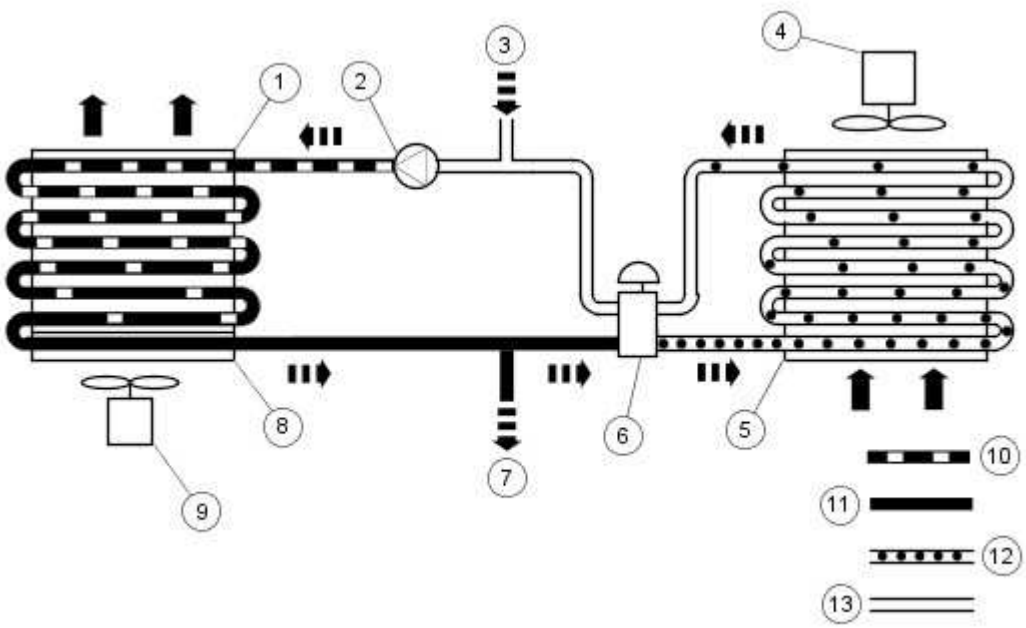
- Front air conditioning system with manual temperature control
- Front air conditioning system with automatic temperature control (DEATC)
- Front and rear air conditioning system with automatic temperature control (TEATC)

Depending on the engine variant, two different air conditioning compressors are used:

- Visteon VS16 compressor with variable stroke for 2.0L Duratec-HE (MI4), 1.8L Duratorq-TDCi (Lynx) and 2.0L Duratorq-TDCi (DW) engines
- Zexel KC88 compressor with variable stroke and electronically regulated control valve for 2.5L Duratec-ST (VI5) engines

In order to prevent icing of the evaporator, the vehicles are equipped with a temperature sensor on the evaporator. The sensor measures the surface temperature of the cooling fins on the evaporator. If the measured temperature drops below a temperature of approx. 2 °C then the compressor clutch is deactivated. If the temperature increases above +4 °C the compressor is switched back on again. On systems with manual temperature control, the sensor signal is sent via the generic electronic module (GEM) and the CAN bus to the powertrain control module (PCM), which then switches the compressor clutch on and off. On systems with automatic temperature control (DEATC / TEATC) the sensor signal is first sent to the air conditioning module and then via the CAN bus to the PCM, which then switches the compressor clutch on and off.

Refrigerant circuit



E69431

Item	Description
1	Condenser
2	A/C compressor
3	Outlet line for the additional evaporator (if equipped)

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4	Blower motor
5	Evaporator
6	Expansion valve
7	Inlet line for the additional evaporator (if equipped)
8	Refrigerant drier
9	Cooling fan
10	High pressure (gaseous and hot)
11	High - pressure (liquid and warm)
12	Low - pressure (liquid and cool)
13	Low-pressure (gaseous and cool)

Operation

The refrigerant compressor (2) which is driven by the engine sucks in the gaseous refrigerant from the evaporator (5) and compresses it. The temperature of the refrigerant increases to a value between 70 °C and 110 °C. It is directed under high pressure to the condenser (1). At this point heat is drawn from the refrigerant by the air being forced past the cooling fins. Because of this heat loss, the refrigerant liquifies and leaves the condenser.

The refrigerant then passes under high pressure to the refrigerant drier (8). This serves as a storage medium and filters out any moisture contained in the refrigerant.

The expansion valve (6) regulates the quantity of refrigerant injected into the evaporator (5) as a function of the pressure and temperature in the evaporator. The liquid refrigerant is vaporized in the evaporator. As a result, heat is extracted from the air before it enters the passenger compartment. The air therefore cools down and the moisture it contained is given up at the evaporator core.

The gaseous flow of refrigerant which comes out from the evaporator at low pressure enters the expansion valve at the upper opening, from where it is sucked in by the refrigerant compressor.

The A/C pressure convertor sensor sends an analog signal to the PCM. After evaluating the different input signals, the PCM sends a control signal to the A/C clutch relay, which engages and disengages the compressor clutch. The PCM input signals come from the blower motor switch via the evaporator temperature sensor (vehicles with manual temperature control), via the A/C module (vehicles with automatic temperature control), the A/C pressure convertor sensor and the PCM.

Overview of the air conditioning system

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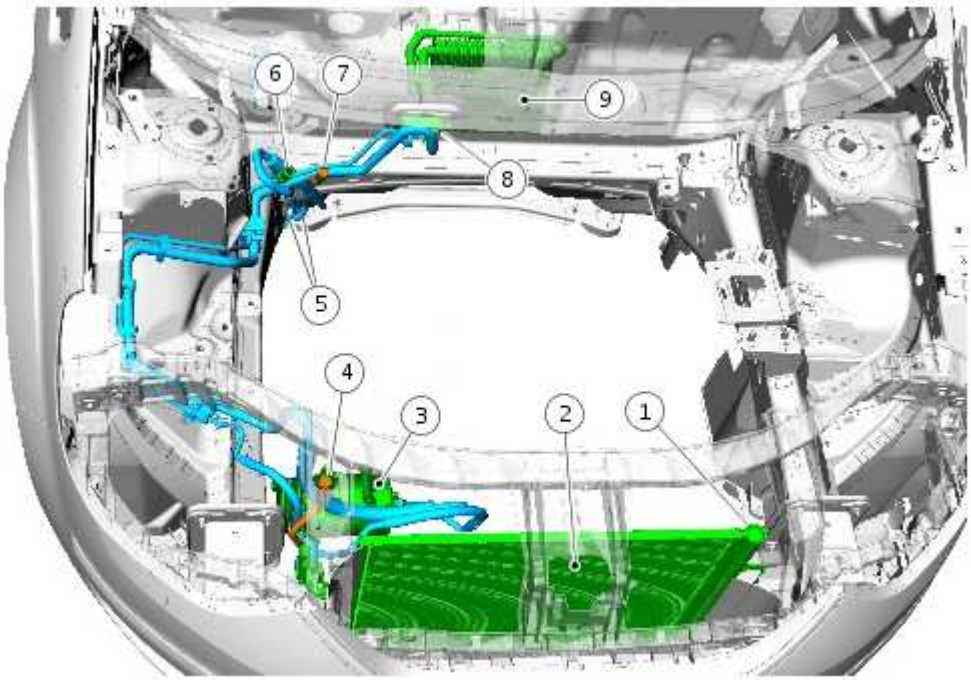
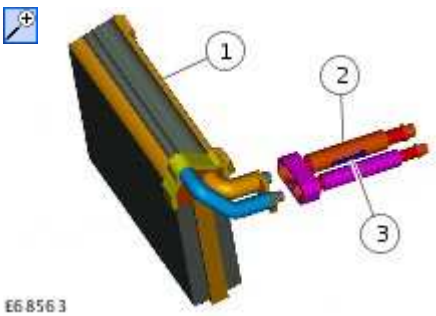


E68562

Item	Part Number	Description
1	-	Refrigerant drier
2	-	Condenser
3	-	A/C compressor
4	-	High pressure charging connection
5	-	Refrigerant lines for the additional air conditioning system (if equipped)
6	-	A/C pressure convertor sensor
7	-	Low pressure charging connection
8	-	Expansion valve
9	-	Evaporator

Service evaporator



E68563

Item	Part Number	Description
1	-	Evaporator
2	-	A/C lines
3	-	Retaining bolt

The evaporator is located on the right-hand side of the climate control housing (LHD and RHD). It can be removed and installed with the climate control housing still installed in the vehicle, although the heat exchanger does need to be removed first. The refrigerant lines of the production evaporator must be sawn through during removal. An evaporator with

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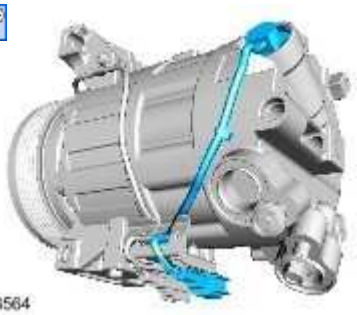
separate refrigerant lines is installed in service.

Electronic refrigerant compressor control valve


E68564

On vehicles with a 2.5L Duratec-ST (VI5) engine a refrigerant compressor with electronic control valve is used. The control valve regulates the delivery rate of the refrigerant compressor according to the request received from the A/C module.

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Description and Operation

Control assembly, climate control - vehicles with manual temperature control

The heating and air conditioning is controlled by three rotary switches on vehicles equipped with manual temperature control. The air distribution flaps are actuated via the air distribution flap/temperature control flap actuating unit, which is connected via a rod to the control assembly for the climate control. The temperature control flap is also actuated via the air distribution flap/temperature control flap actuating unit, which is connected via a cable to the control assembly.

In addition, the operating switch for recirculated air mode and the on/off switch for the air conditioning are located on the control assembly.

Control assembly, climate control - vehicles with automatic temperature control

Vehicles with automatic temperature control have a control assembly with the following button operated functions:

- Switching the air conditioning system on and off
- Temperature adjustment for the driver's side / front passenger's side
- Switching the windshield defrost function on and off
- Switching the electronic automatic climate control and the dual mode on and off
- Air distribution
- Blower control
- Switching off the dual automatic climate control
- Recirculated air control

Control assembly, climate control - vehicles with DVD navigation system with a touch screen

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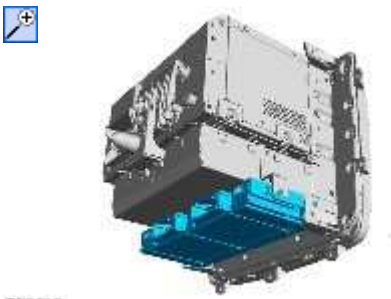
E68599

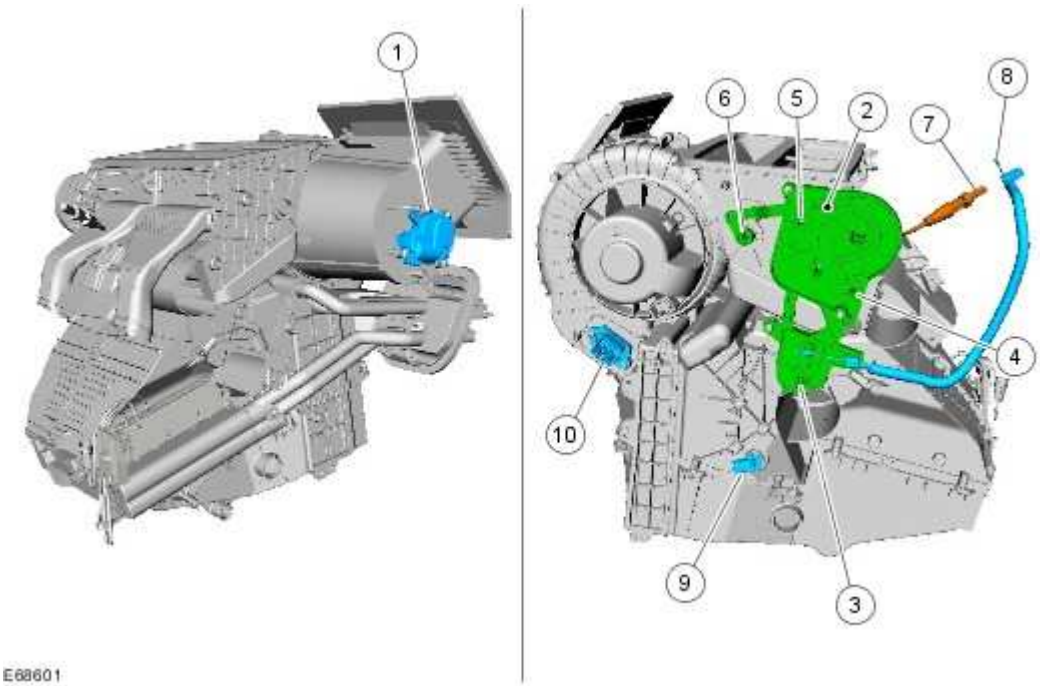
On vehicles with a DVD navigation system with a touch screen, the control buttons for the automatic temperature control (climate control) are integrated in this unit. In addition, all heating and air conditioning functions can be controlled via the touch screen.

Climate control module - vehicles with DVD navigation system with a touch screen


E68600

On vehicles with a DVD navigation system with a touch screen, the climate control module is provided as a separate component underneath the DVD navigation unit. It is actuated via control buttons or via the navigation touch screen.

Overview of the climate control housing - vehicles with manual temperature control



E68601

Item	Part Number	Description
1	-	Air flap actuator
2	-	Air distribution flap/temperature control flap actuator
	-	

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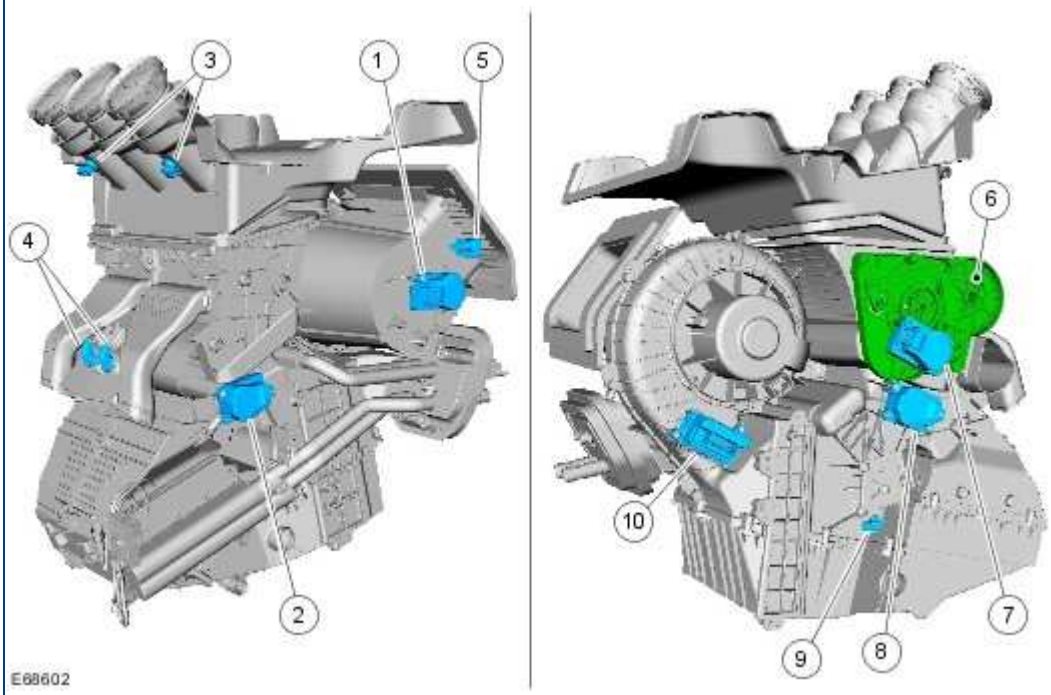
3		Operating lever - temperature control flap
	4 -	Operating lever - air distribution flap - footwell
5	-	Operating lever - air distribution flap - center vents / outlet vents on the B-pillars
6	-	Operating lever - air distribution flap - demister nozzle
7	-	Rod - air distribution flap
8	-	Operating cable - temperature control flap
9	-	Defrosting switch.
10	-	Blower motor resistor

Overview of the climate control housing - vehicles with automatic temperature control



Item	Part Number	Description
1	-	Air flap actuator
2	-	Actuator - right-hand temperature control flap
3	-	Air outlet temperature sensors - center vents
4	-	Air outlet temperature sensors - footwell
5	-	Ambient air quality sensor (if equipped)
6	-	Air distribution flap actuator
7	-	Air flap actuator - demister/center vents/footwell
8	-	Actuator - left-hand temperature control flap
9	-	Defrosting switch.
10	-	Blower control module

Sun load sensor/interior temperature sensor - vehicles with automatic temperature control

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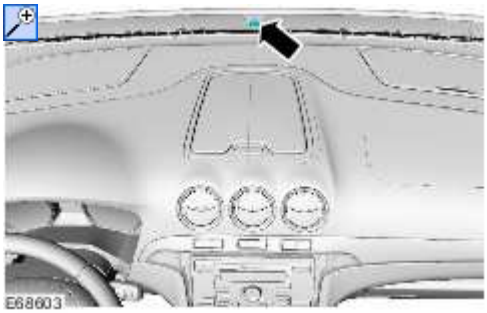

On vehicles with automatic temperature control, the sun load sensor measures the intensity of the sunlight reaching the vehicle and passes the values on to the A/C module, which then corrects the blower speed and flap position as required in automatic mode.

On vehicles with automatic temperature control the interior temperature sensor measures the temperature in the passenger compartment. These values are also used by the A/C module to regulate the pre-selected interior temperature.

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Removal and Installation

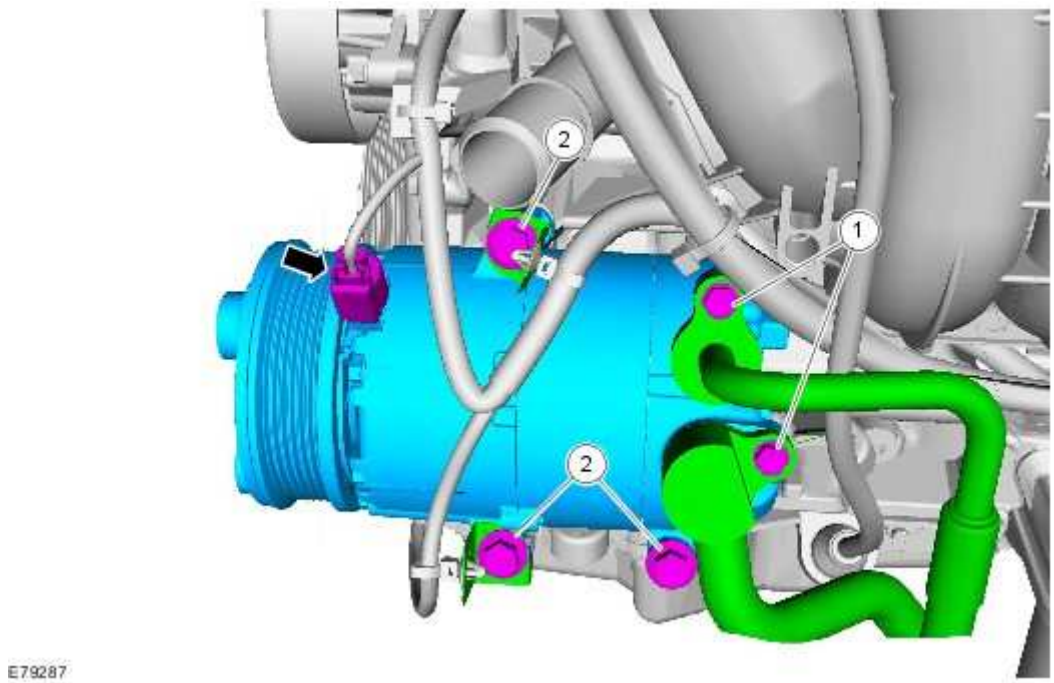
Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Refer to: Accessory Drive Belt (303-05A Accessory Drive - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
3.
   1. *Torq* 24 N
   2. *Torq* 25 N



E79287

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

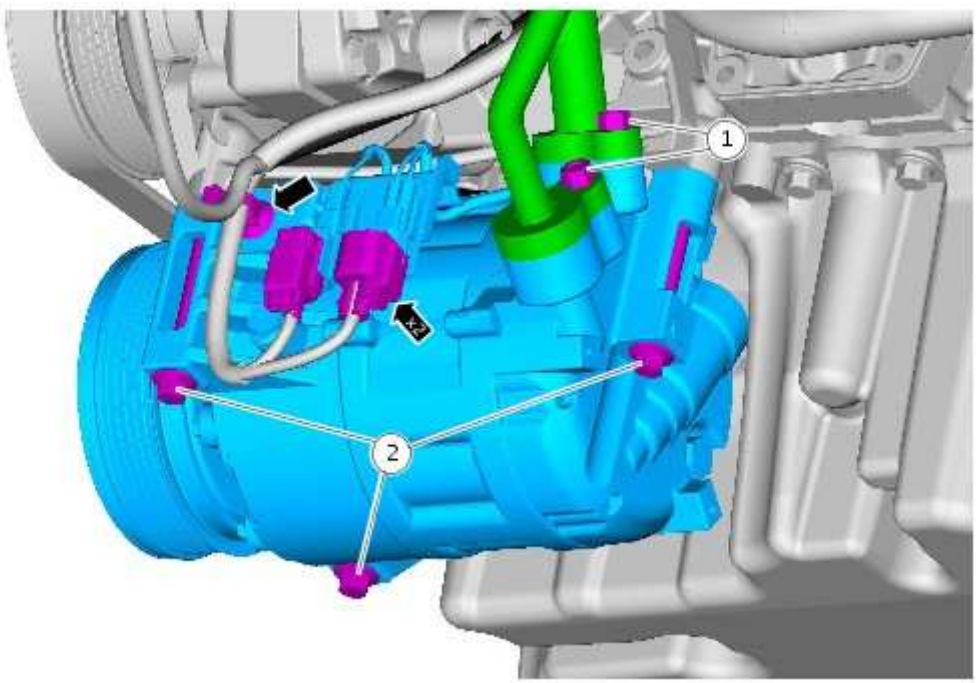
Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the air conditioning (A/C) compressor belt.

   Refer to: Air Conditioning (A/C) Compressor Belt (30 05C Accessory Drive - 2.5L Duratec (162kW/220PS) VI5, Removal and Installation).



3.
   1. *Torq* 24 N
   2. *Torq* 25 N

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)
2. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

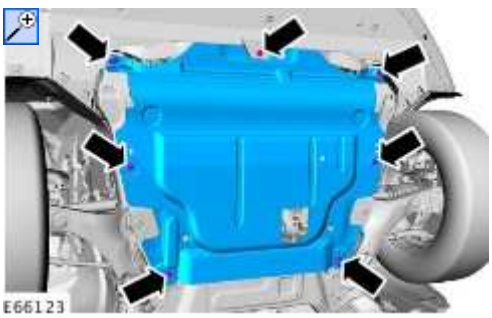
Removal

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

1. Drain the air conditioning system

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the auxiliary drive belt.

   Refer to: Accessory Drive Belt (303-05D Accessory Drive - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1. Duratorq-TDCi (92kW/125PS) - Lynx, Removal and Installation).
   Refer to: Accessory Drive Belt (303-05E Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0 Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
3. Lifting

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
4. 

5.
   1. *Torq* 24 N
   2. *Torq* 25 N

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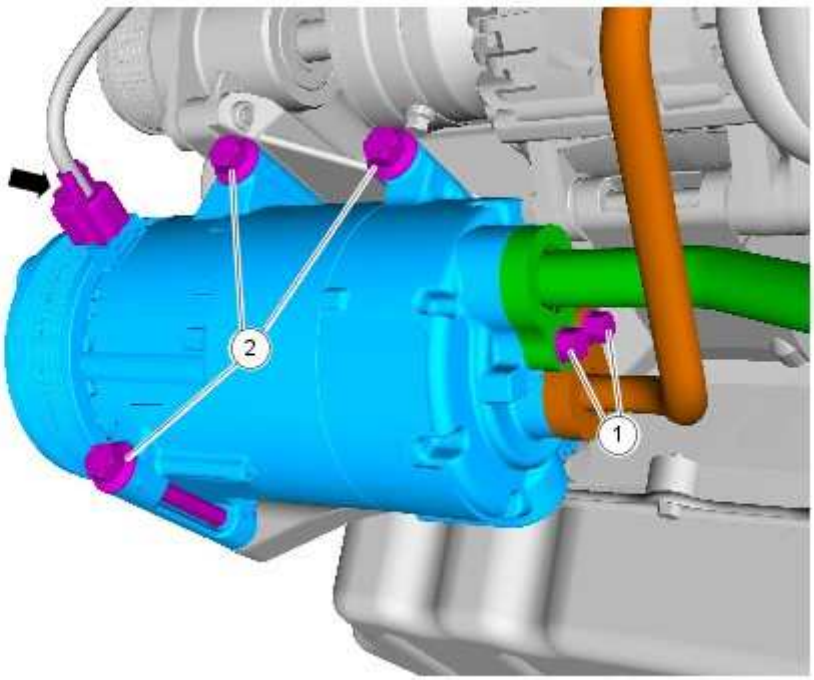

E79289

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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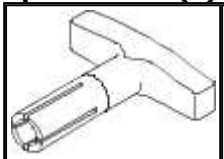
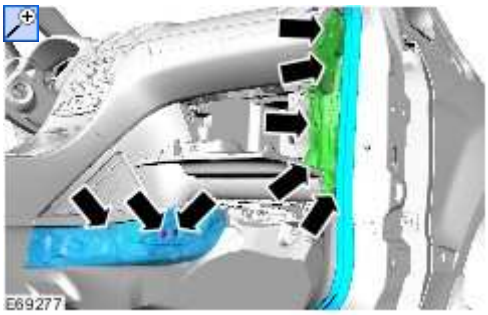
Removal and Installation

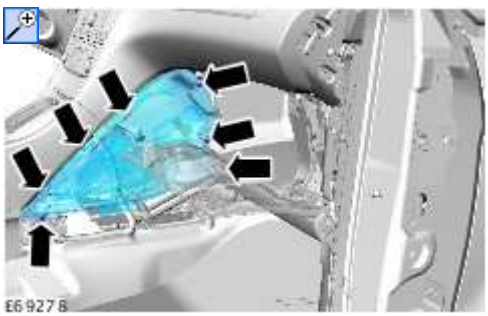
Special Tool(s)

 E42948	412-131 Remover/Installer, Blower Engine

Removal

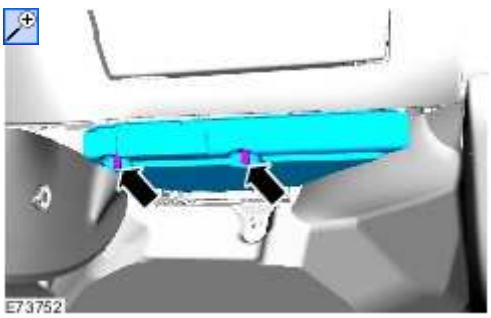

E69277

1.


E69278

2.

Vehicles with glove compartment cooling


E73752

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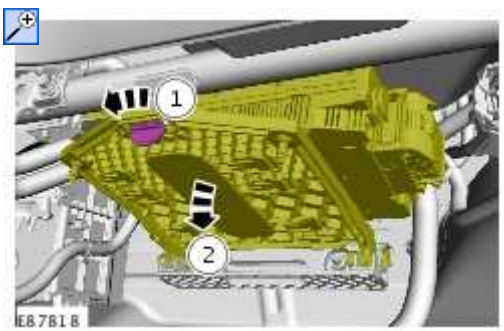
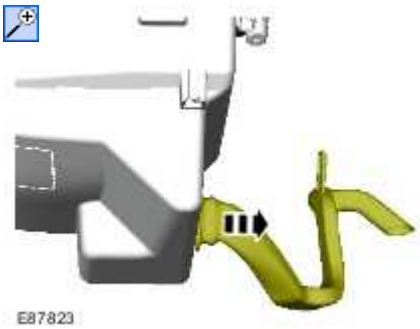


E87818

4.

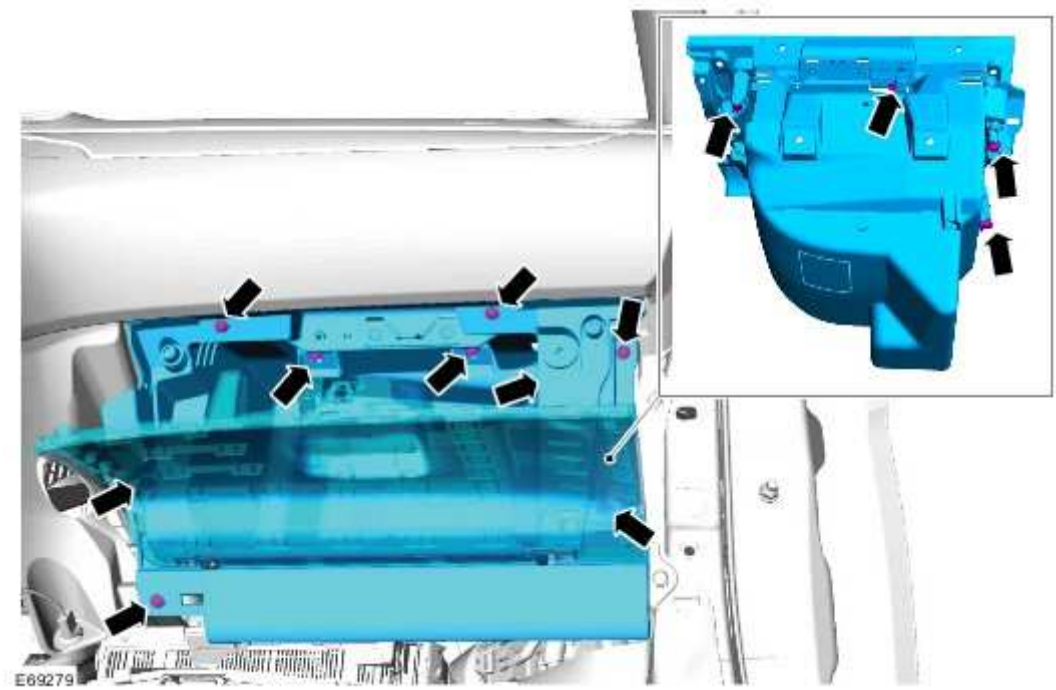
5.

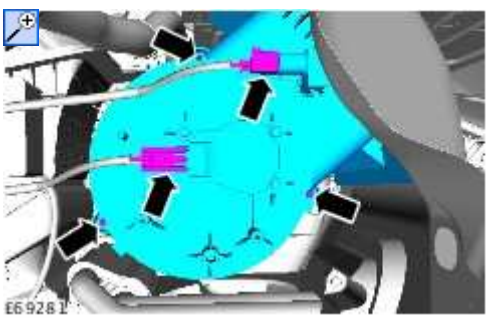
http://vnx.su



All vehicles

6.





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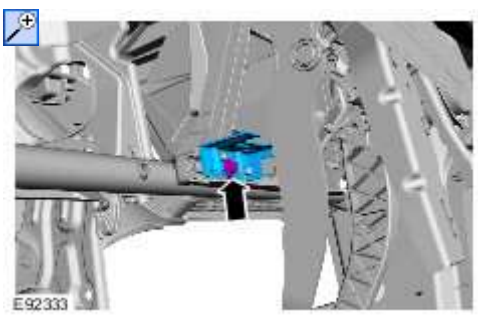

8. *Torque:* 25 Nm

9. *Torque:* 9 Nm

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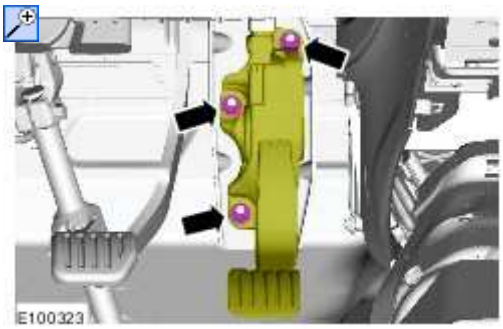
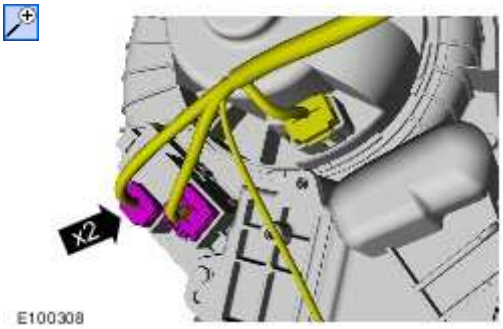
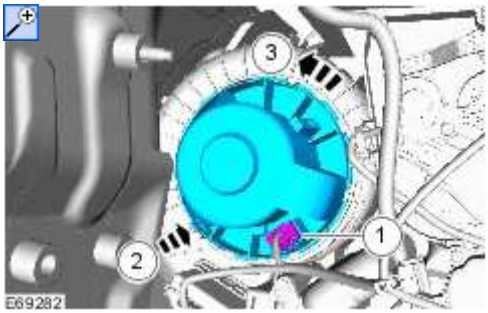
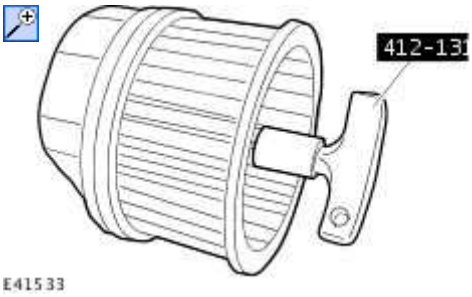




10. If equipped



11. NOTE: This step requires the aid of another technician.
Special Tool(s): 412-131



12. CAUTION: The blower motor must only be set down on the workbench with the fan wheel facing upward.
Using the special tool, remove the blower motor from the passenger's side.

Installation

1. NOTE: The component can only be installed in one position.
Install the components in reverse order.

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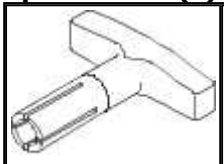
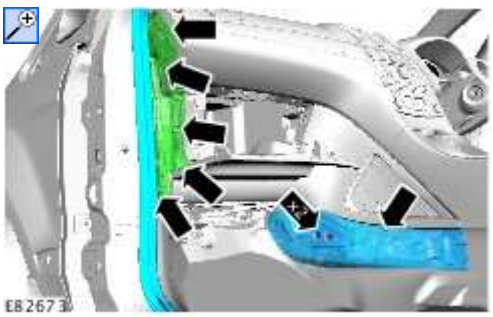
Removal and Installation

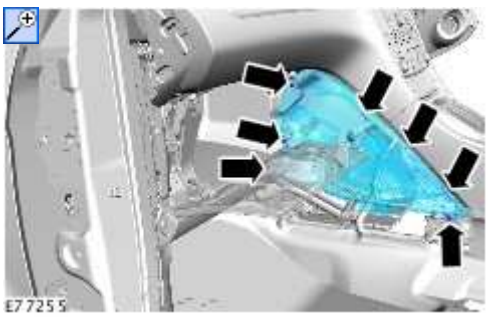
Special Tool(s)

 E42948	412-131 Remover/Installer, Blower Engine

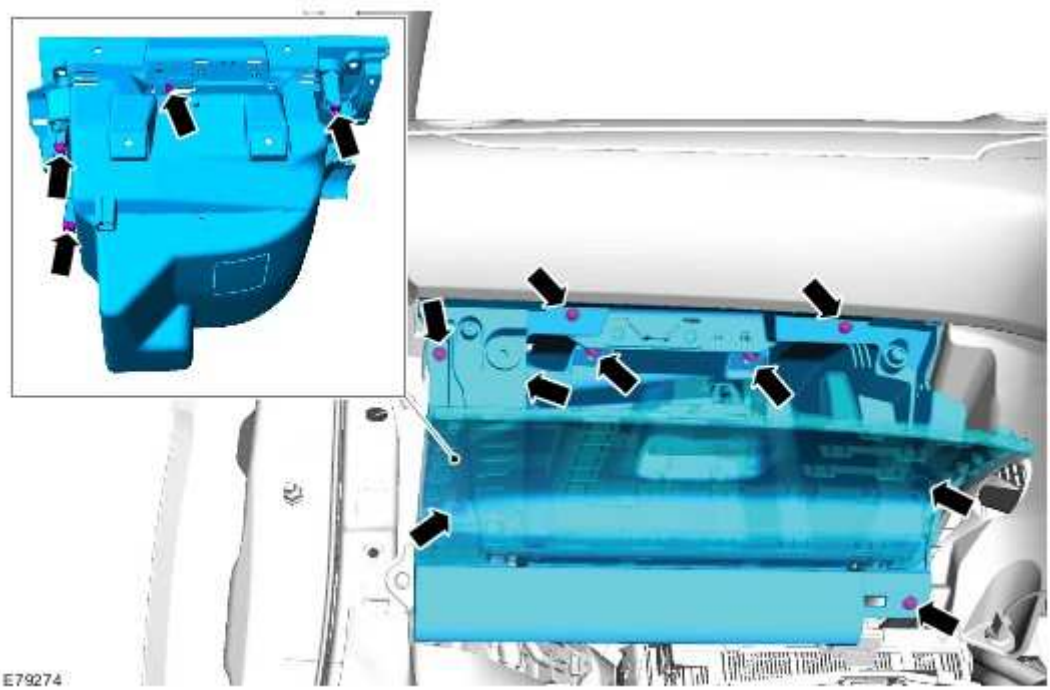
Removal


E82673

1.


E77255

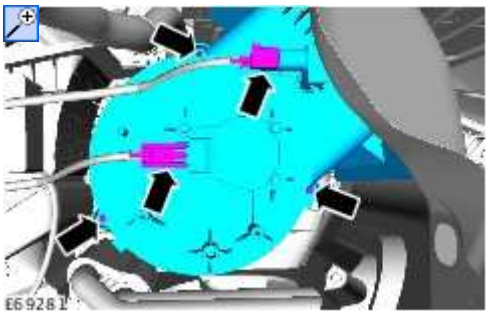
2.


E79274

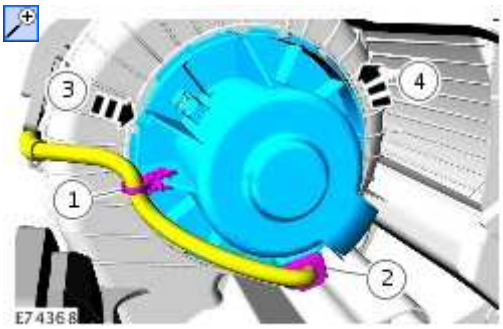
3.

4.

http://vnx.su

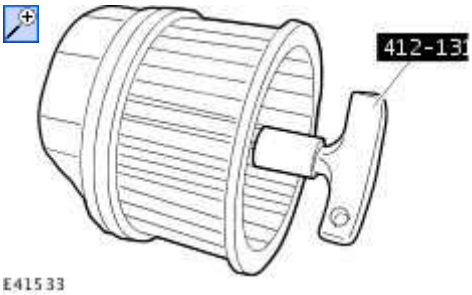


5. Refer to: Clutch Master Cylinder (308-02A, Removal and Installation).
Refer to: Clutch Master Cylinder (308-02C, Removal and Installation).



6. NOTE: This step requires the aid of another technician.
Special Tool(s): 412-131

7.
   1. If equipped.



8. CAUTION: Make sure that the blower motor and fan assembly is placed on the bench with the fan pointing upwards.
Using the special tool, remove the blower motor from the passenger's side.

Installation

1. NOTE: The component can only be installed in 1 position.
To install, reverse the removal procedure.

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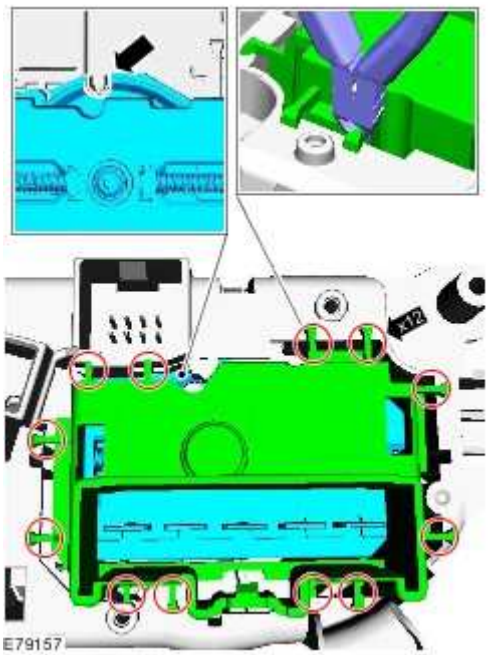
Removal and Installation

Removal

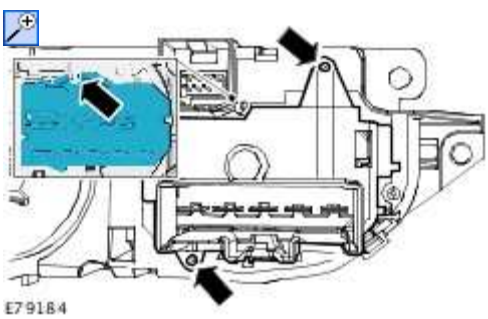
1. Remove the heater/air conditioning control unit.

   Refer to: Climate Control Assembly - Vehicles With: Manual Temperature Control (412-01 Climate Control, Removal and Installation).

2.



Installation



1.

2. To install, reverse the removal procedure.

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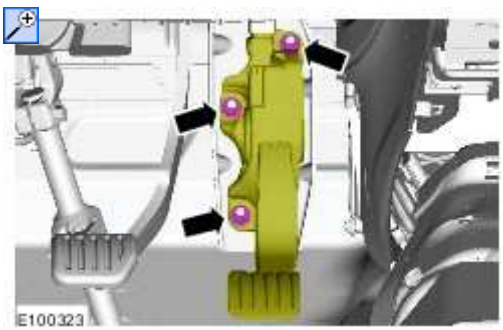
Removal and Installation

Removal

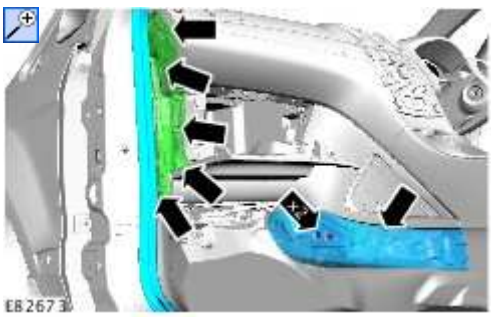
NOTE: Removal steps in this procedure may contain installation details.

LHD Vehicles



1. *Torque:* 9 Nm

Right-hand drive vehicles



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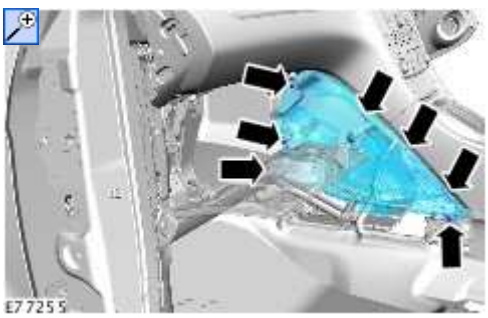

3.

4.

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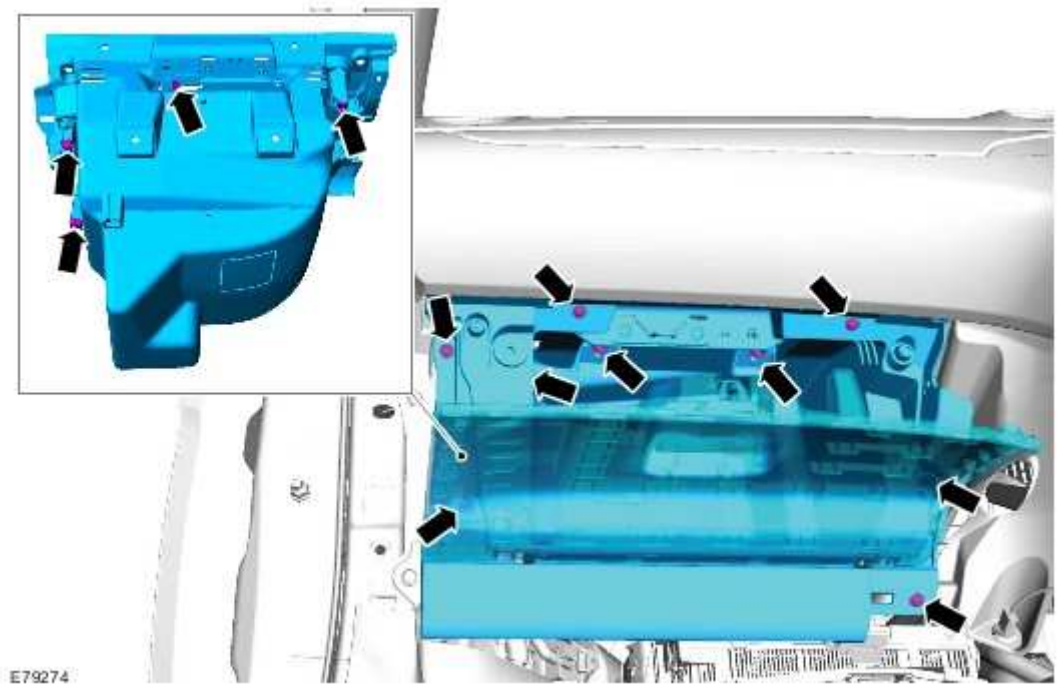
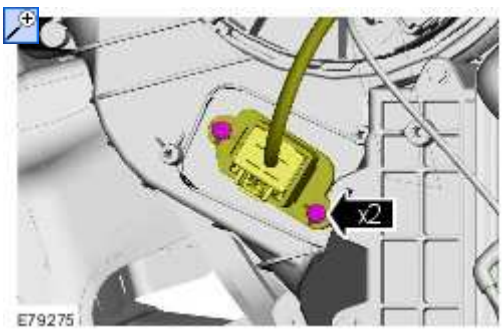


All vehicles



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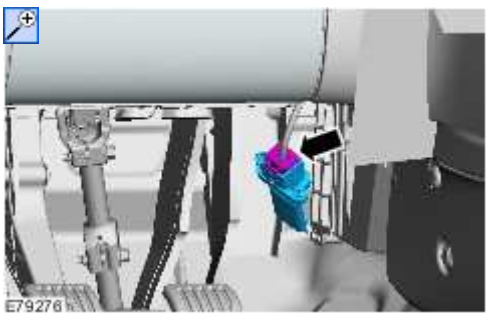

6.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

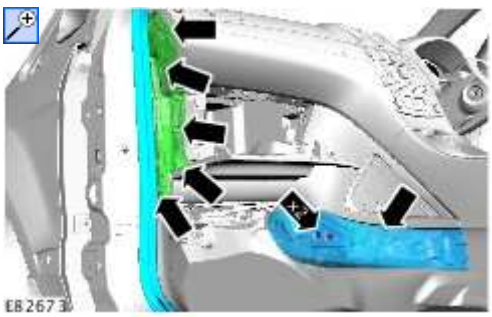
Removal

Left-hand drive vehicles

1. Remove the dashboard crossmember.

   Refer to: Armaturenbrettquerträger (501-12, Removal and Installation).

Right-hand drive vehicles



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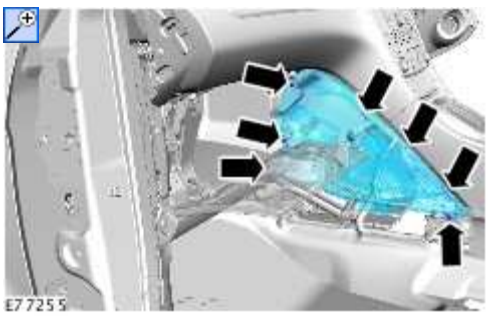

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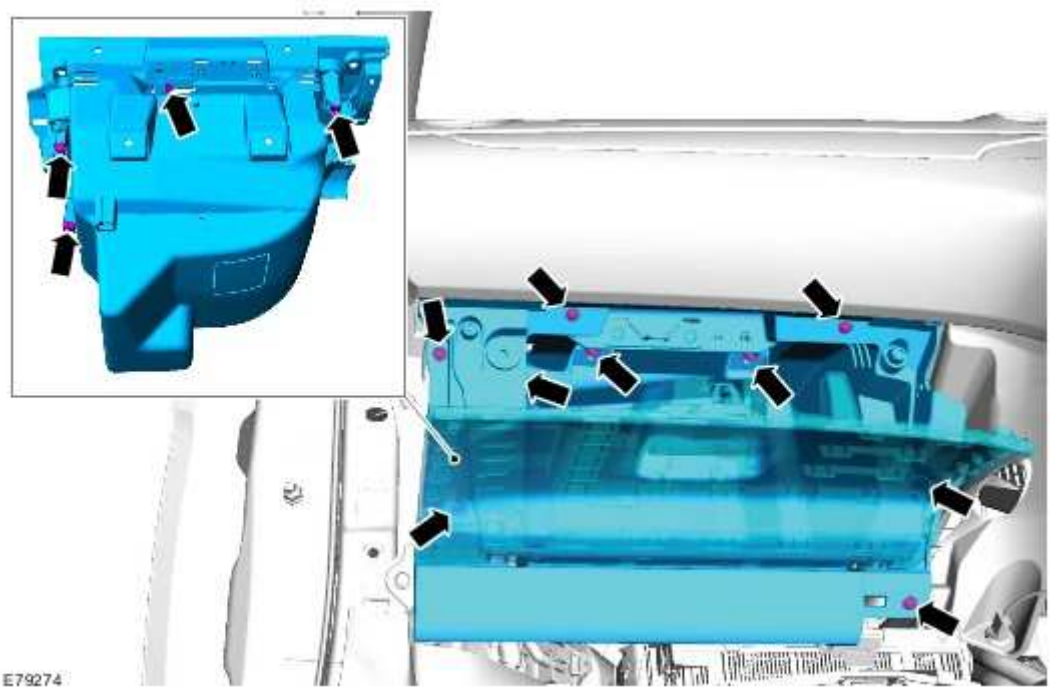

4.

5.

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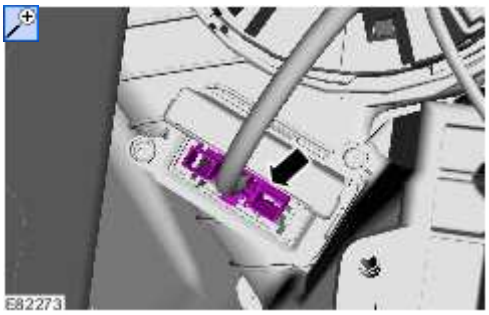
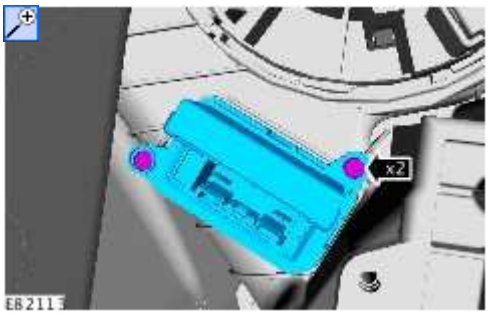


All vehicles

6.



Installation

1. To install, reverse the removal procedure.

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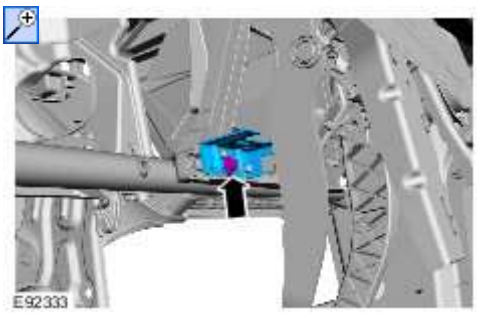
Climate Control - Blower Motor Resistor—LHD FWD, Vehicles Built From: 02/2007, Vehicles With: Dual Automatic Temperature Control	S-MAX/Galaxy 2006.5 (02/2006-)

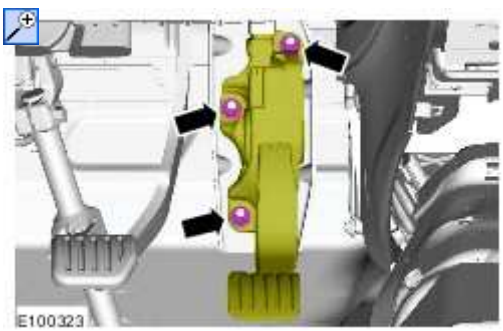
Print

Removal and Installation

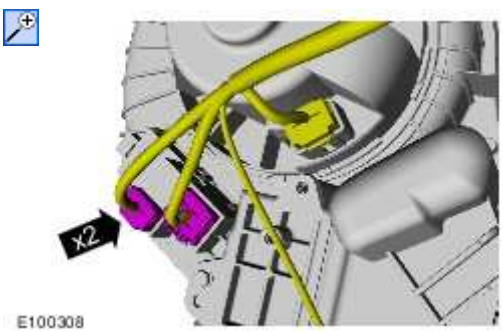
Removal



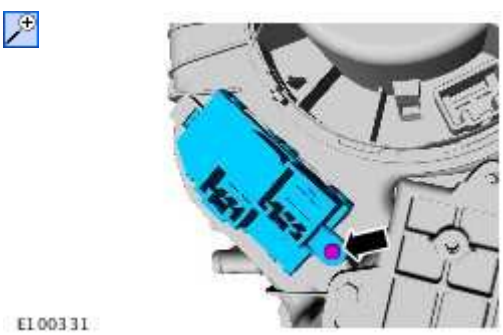
1. *Torque:* 25 Nm



2. *Torque:* 9 Nm



3.



4.

Installation

1. To install, reverse the removal procedure.

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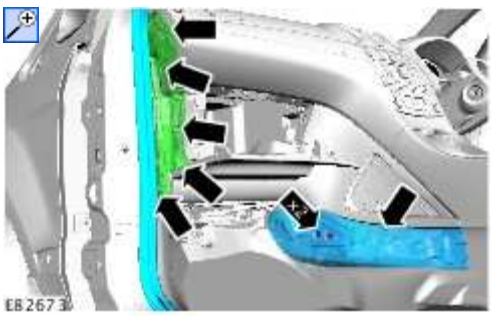
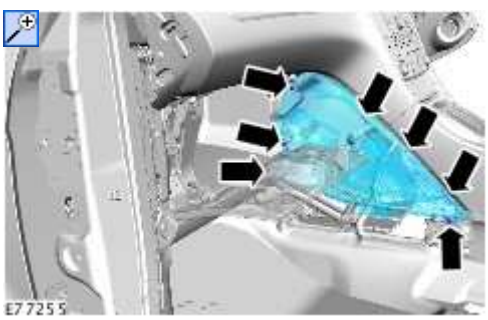
Print

Removal and Installation

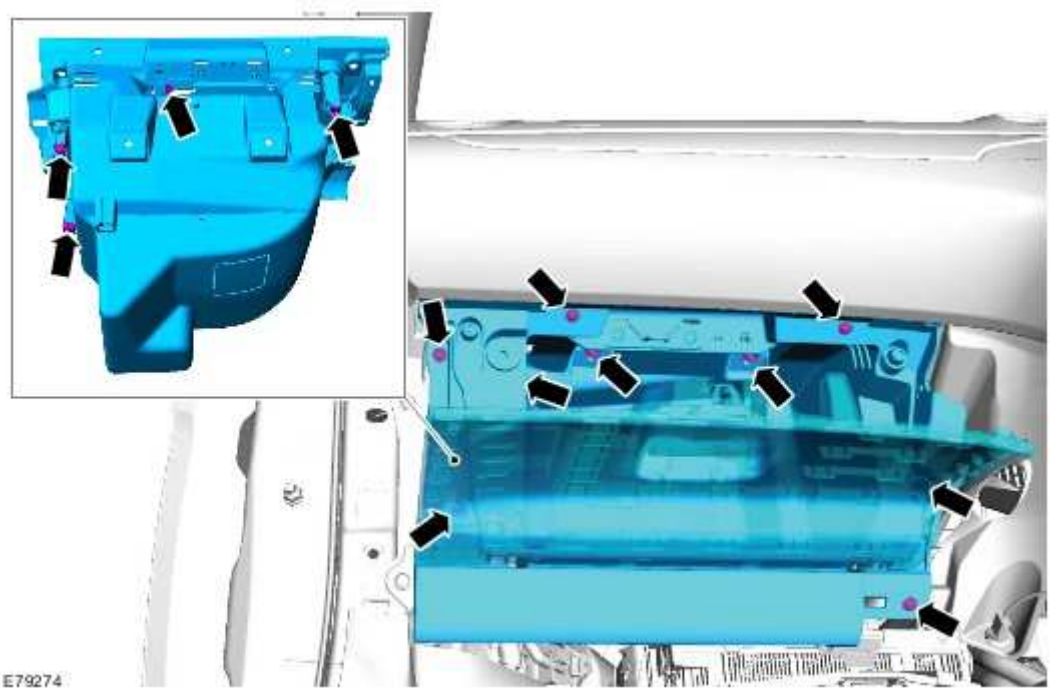
Removal



1.



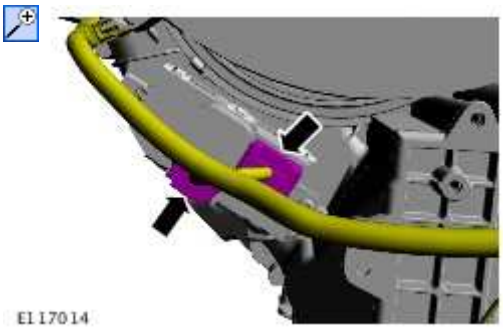
2.

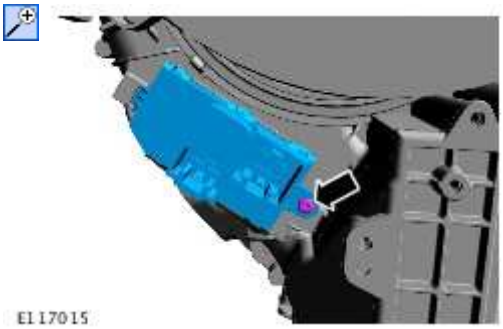


3.

4.

http://vnx.su





5.

Installation

1. To install, reverse the removal procedure.

http://vnx.su

Climate Control - Blower Motor Resistor— LHD FWD, Vehicles With: Dual Automatic Temperature Control, VIN Plate Body Style Code: M	S-MAX/Galaxy 2006.5 (02/2006-)

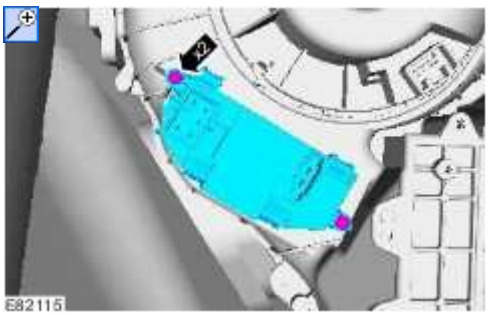
Print

Removal and Installation

Removal

1. Remove the dashboard crossmember.

   Refer to: Armaturenbrettquerträger (501-12, Removal and Installation).



2.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

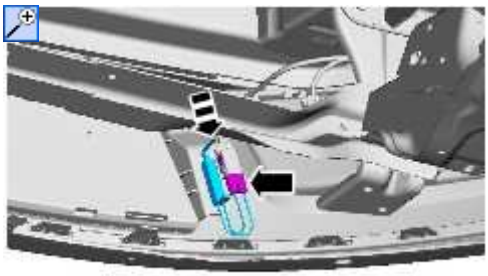
1. Raise the vehicle for access.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2.

E73060

3.



E73841

Installation

1. Install the components in reverse order.

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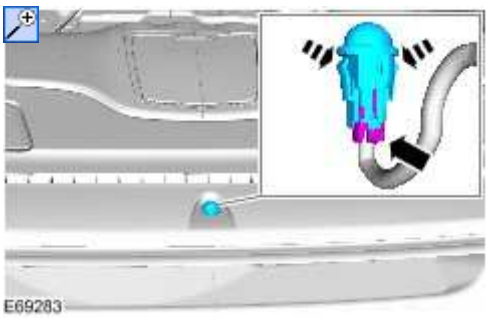
Removal and Installation

General Equipment

Schlitzschraubendreher

Removal



1. CAUTION: Take extra care not to scratch the support surface.
   General Equipment: Schlitzschraubendreher

Installation

1. Install the components in reverse order.

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Removal and Installation

Removal

1. Refer to: Sunload Sensor (412-01 Climate Control, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

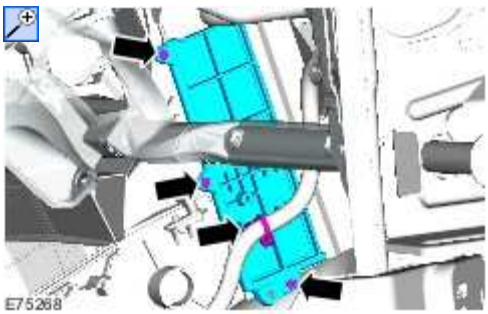
Materials

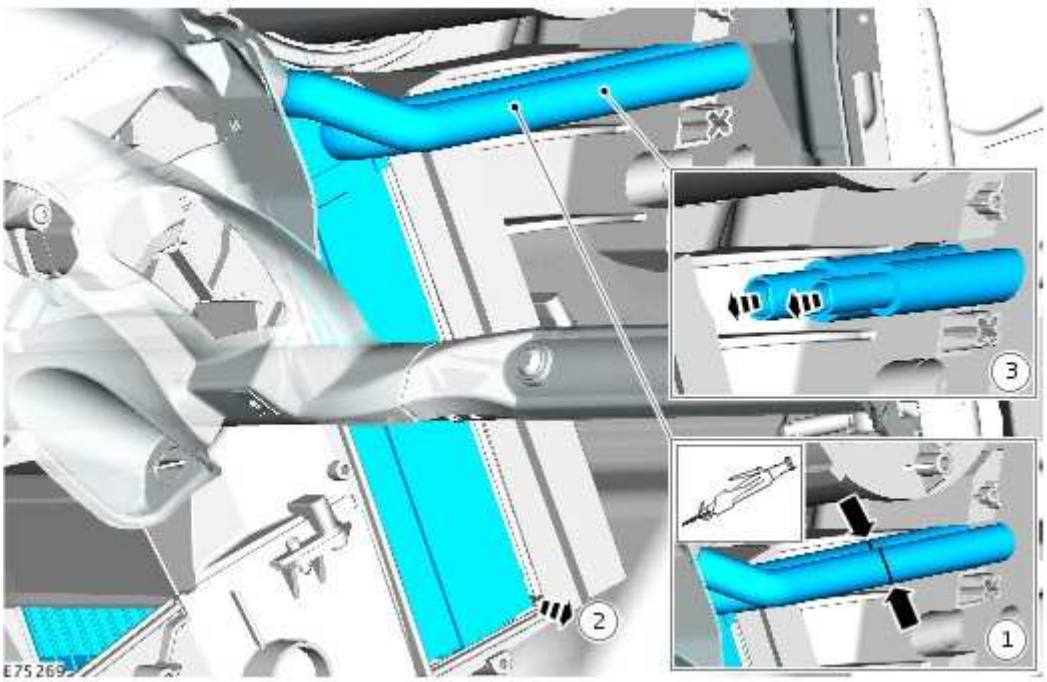
Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

1. Remove the expansion valve.

   Refer to: Thermostatic Expansion Valve (412-01 Clir Control, Removal and Installation).
2. Remove heater matrix.

   Refer to: Heater Core (412-01 Climate Control, Rem and Installation).
3. 

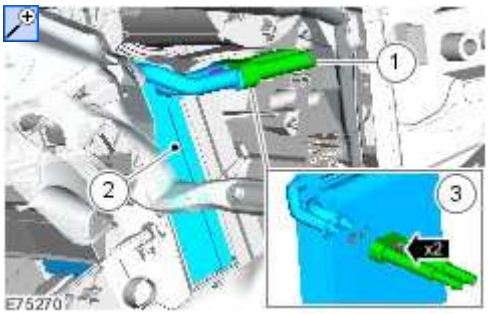
4. 

   1. Saw thro the refri lines

Installation

1. *Torque:* 8 Nm

http://vnx.su



2. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

3. To install, reverse the removal procedure.

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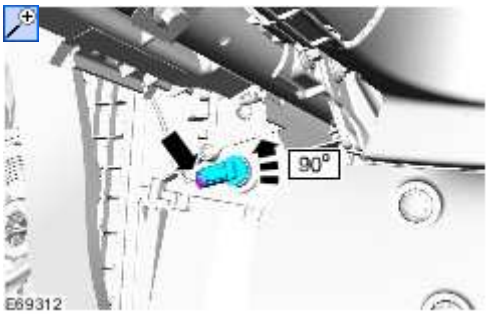
Print

Removal and Installation

Removal

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



1.

Installation

1. Install the components in reverse order.

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Print

Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

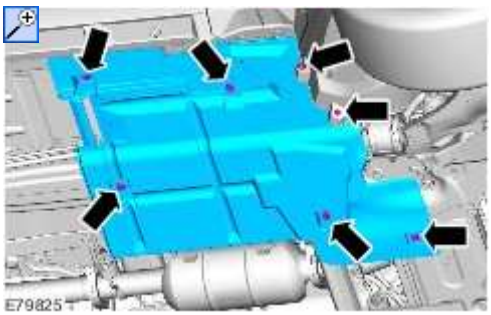
2. Remove the right-hand head lamp unit.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

3. Raise vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

Vehicles with additional air conditioning system



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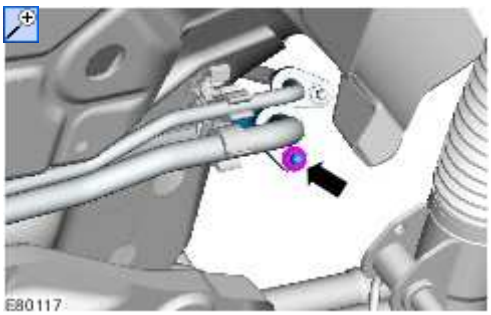
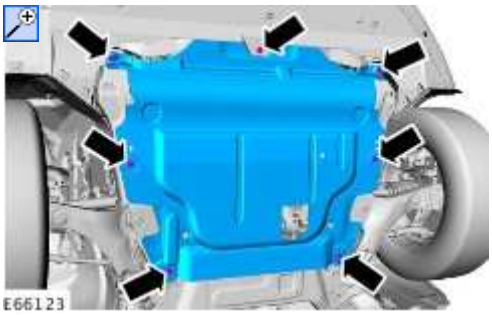


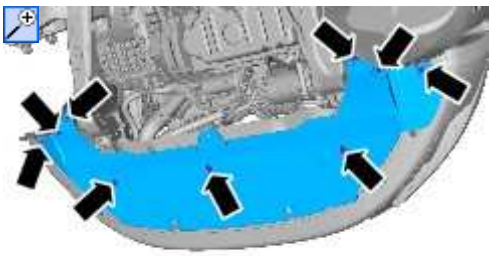
5. *Torque:* 8 Nm

All vehicles

6.

http://vnx.su


E66123


E68962

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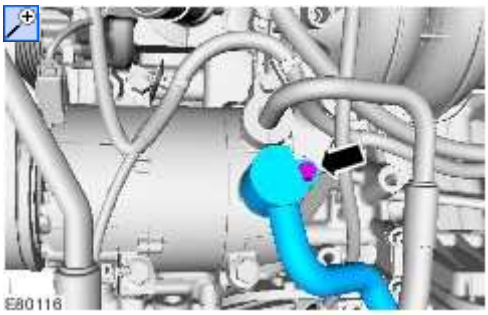
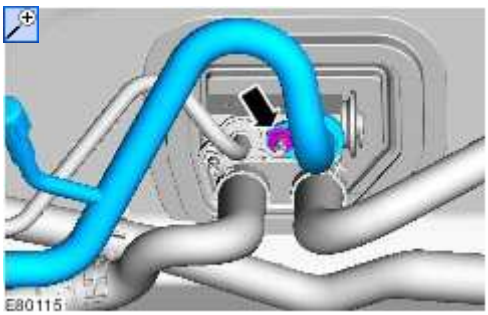

E80116

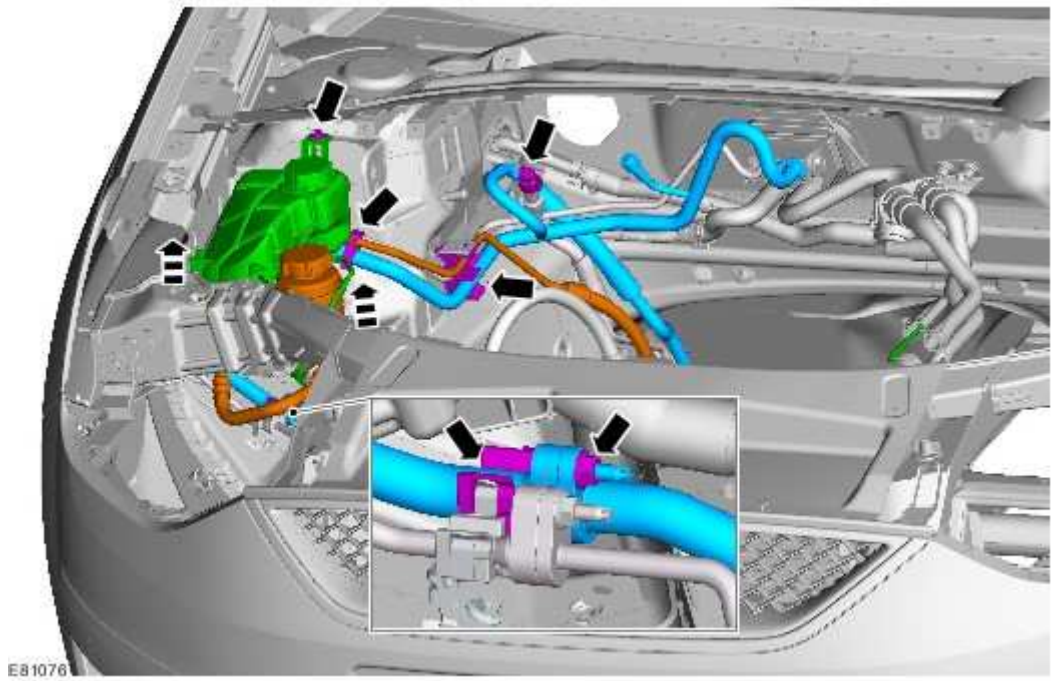
8. *Torque:* 24 Nm


E80115

9. *Torque:* 8 Nm

10. *Torque:* 8 Nm

http://vnx.su



Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)
2. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

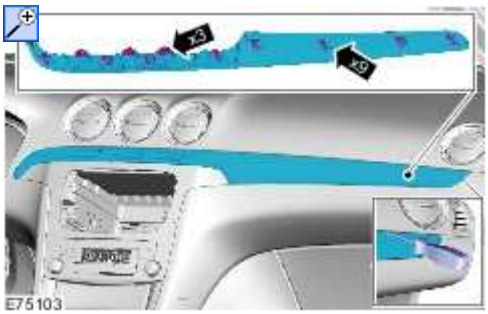
Schlitzschraubendreher

Removal

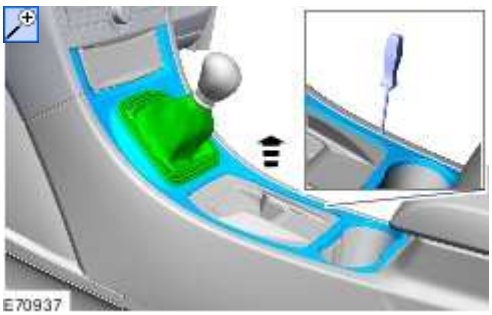
Vehicles built up to 05/2007

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).



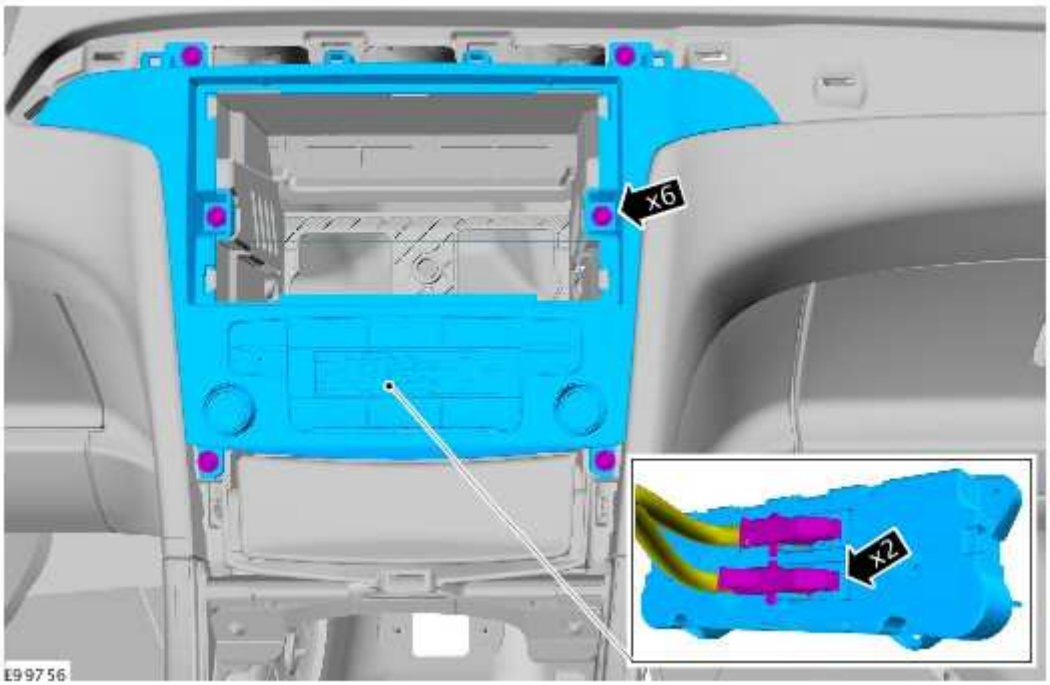
2. CAUTION: Use suitable packing material to prevent damage to the component.
   General Equipment: Schlitzschraubendreher



3. CAUTION: Use suitable packing material to prevent damage to the component.
   General Equipment: Schlitzschraubendreher

4.

http://vnx.su

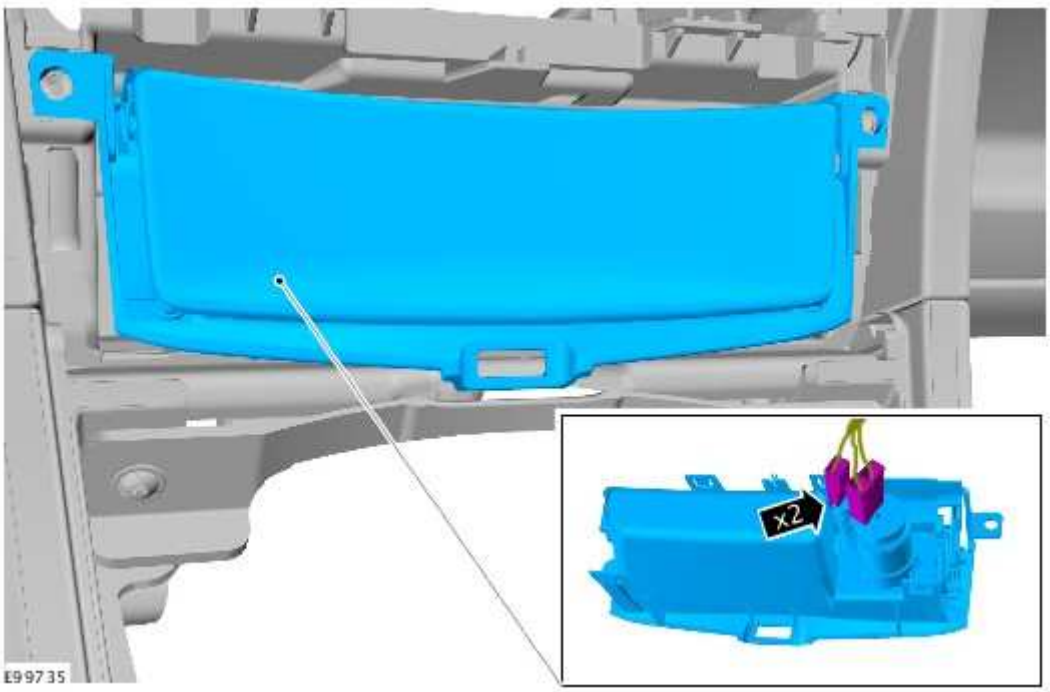


Vehicles built from 05/2007

5. Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).

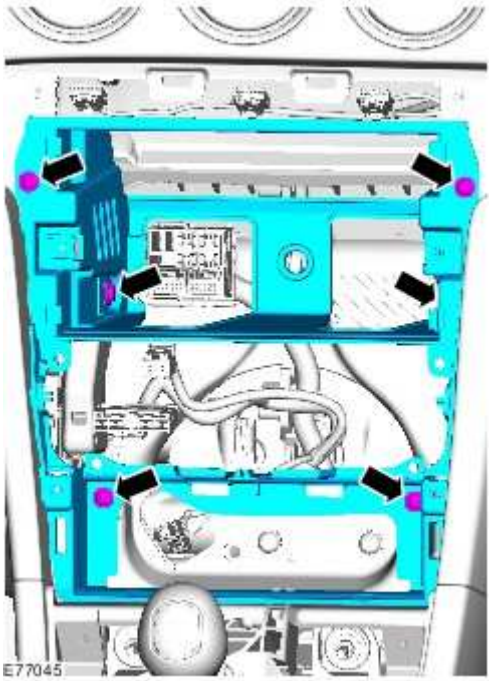
All vehicles

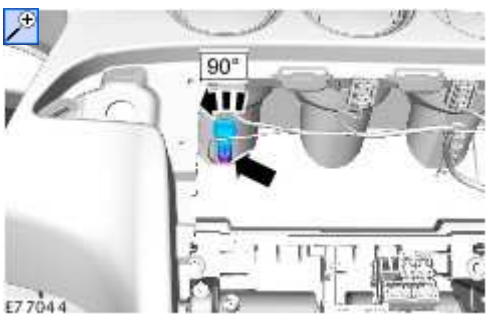
6.



7.

http://vnx.su





8.

Installation

1. To install, reverse the removal procedure.

http://vnx.su

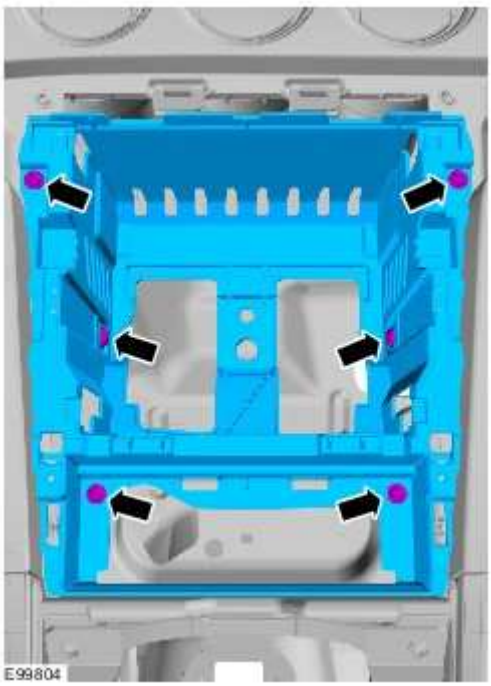
Climate Control - Center Register Air Discharge Temperature Sensor—Vehicles With: Digital Versatile Disc (DVD) Navigation System	S-MAX/Galaxy 2006.5 (02/2006-)

Print

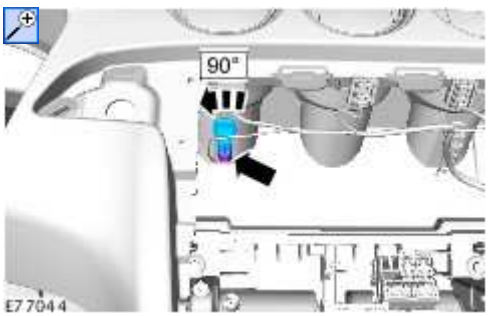
Removal and Installation

Removal

1. Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).



2.



3.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

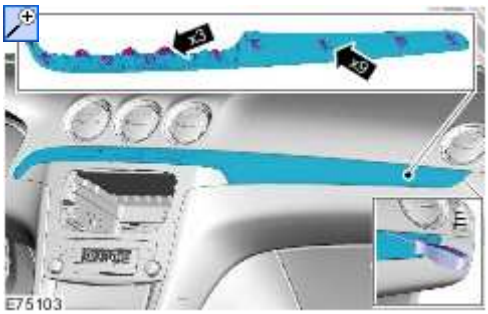
General Equipment

Schlitzschraubendreher

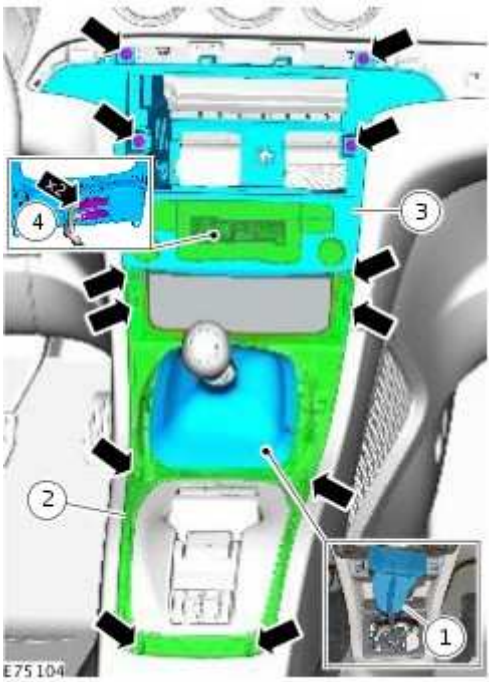
Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).



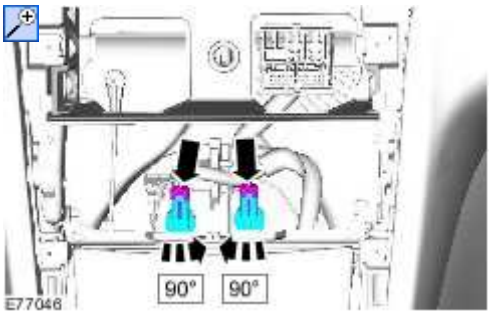
2. CAUTION: Take extra care not to damage the mating faces.
   General Equipment: Schlitzschraubendreher



3.

4.

http://vnx.su



Installation

1. To install, reverse the removal procedure.

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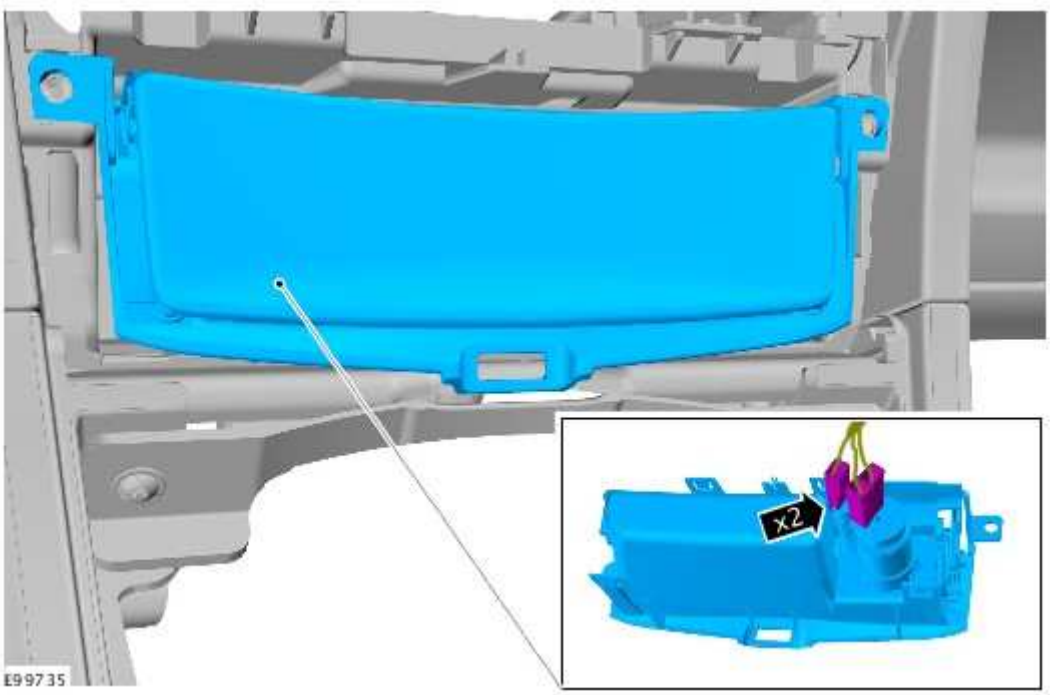
Removal and Installation

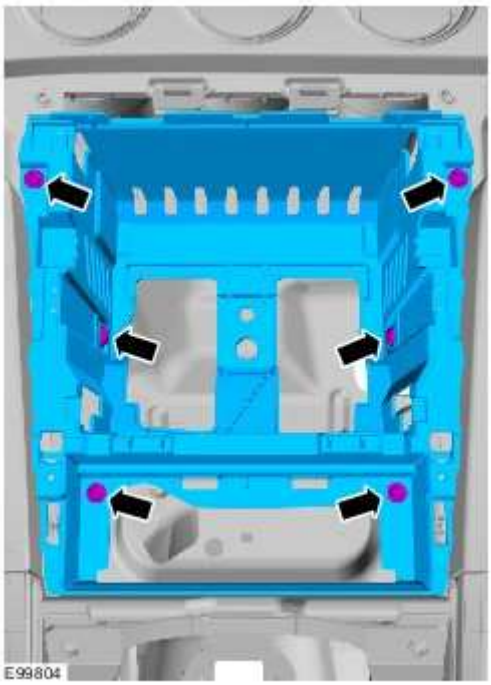
Removal

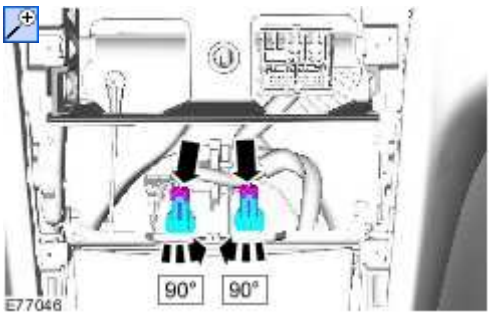
1. Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
2.



3.

http://vnx.su





4.

Installation

1. To install, reverse the removal procedure.

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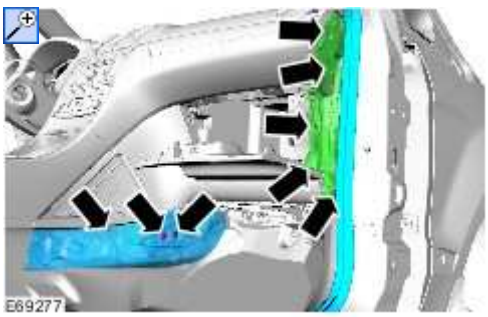
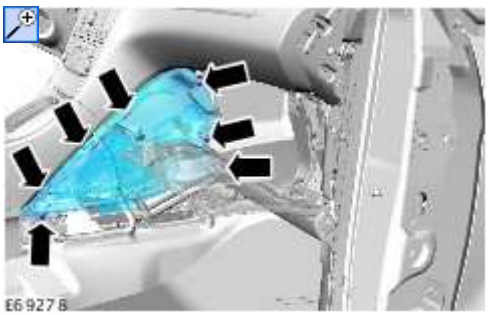
Print

Removal and Installation

Removal

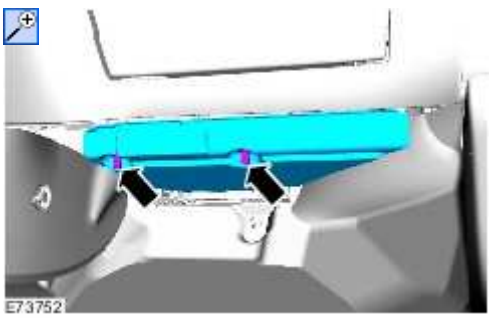


1.

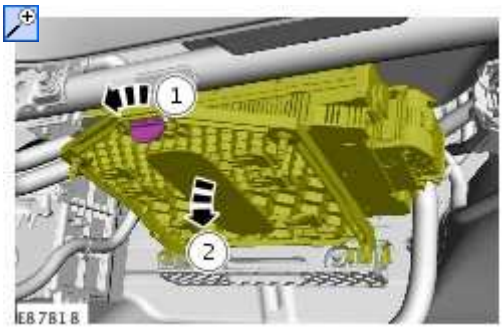


2.

Vehicles with glove compartment cooling



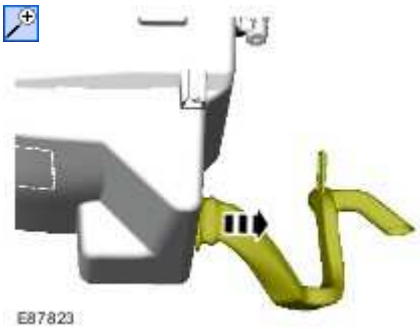
3.



4.

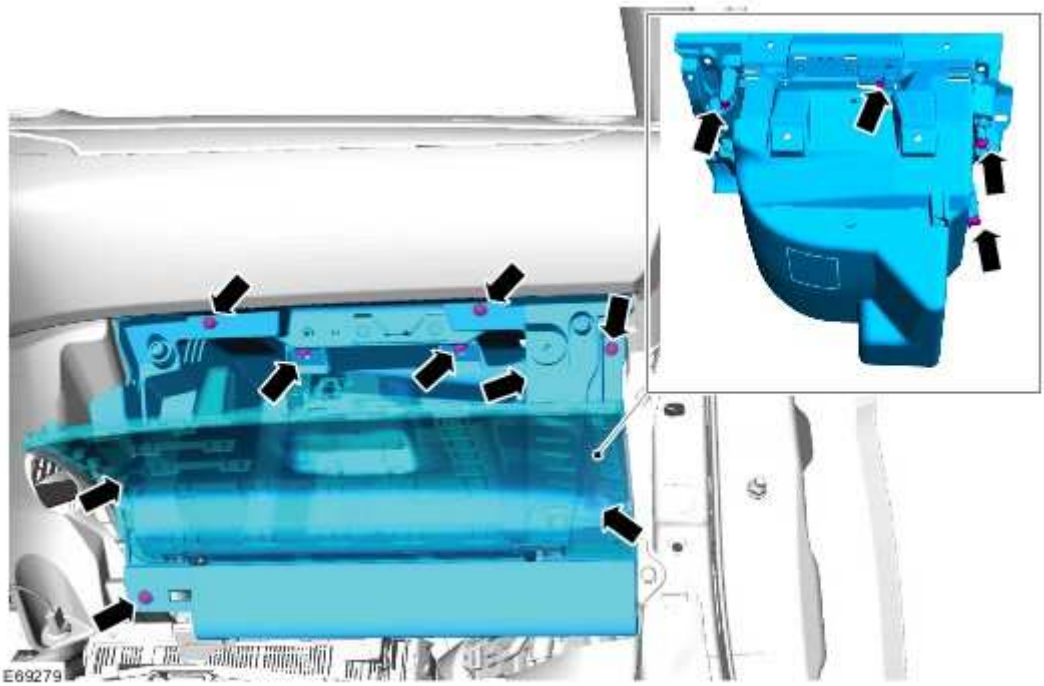
5.

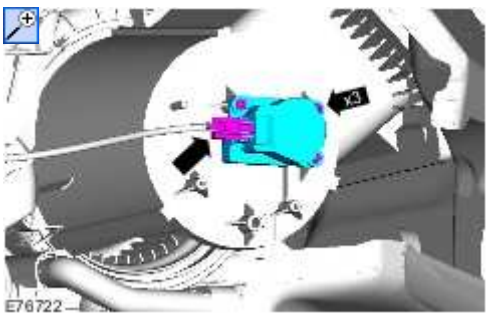
http://vnx.su



All vehicles

6.





7.

Installation

1. To install, reverse the removal procedure.

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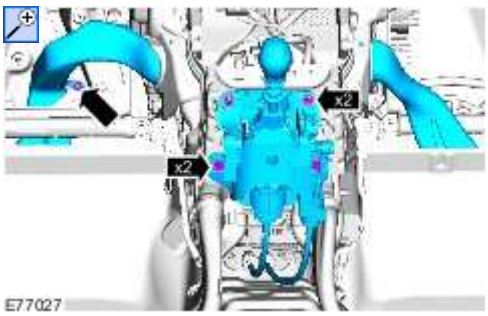
Removal and Installation

Removal

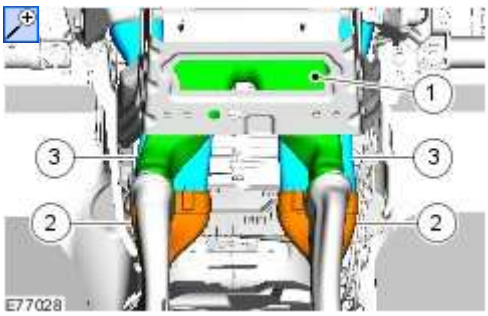
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the instrument panel.

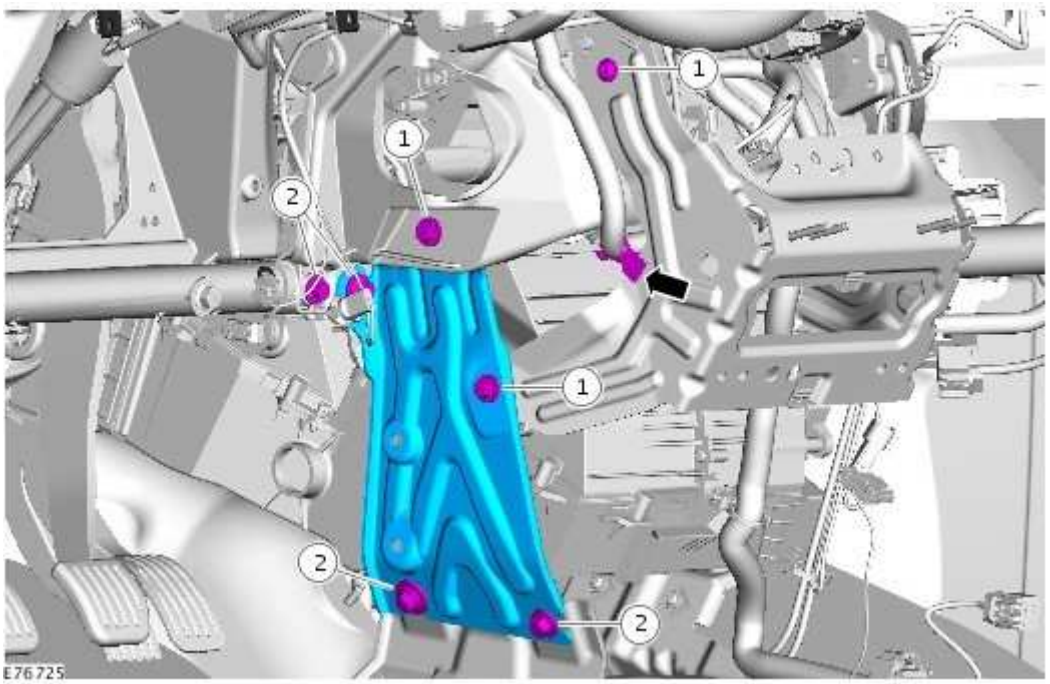
   Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).



2. *Torque:* 9 Nm



3.

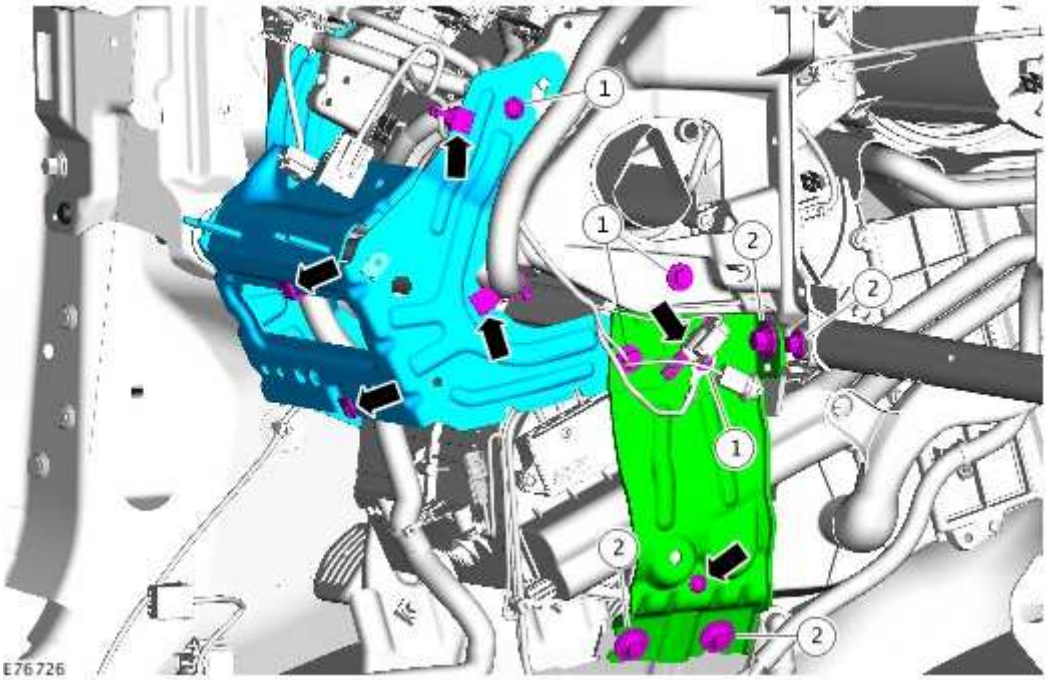


4.
   1. *Torq* 9 Nr
   2. *Torq* 25 N

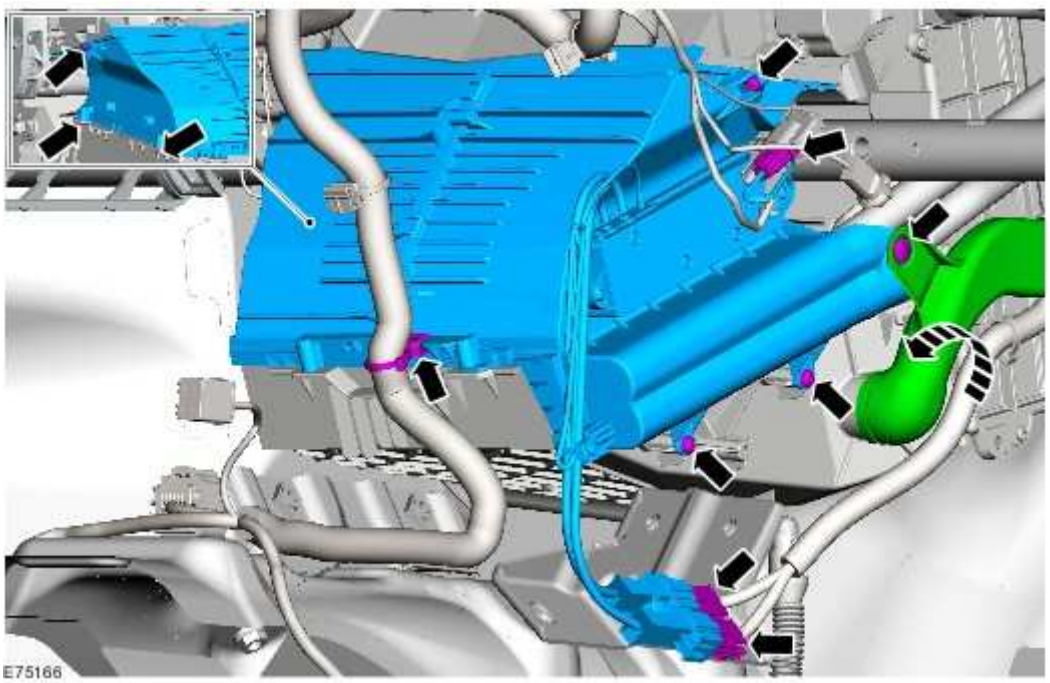
5.
   1. *Torq* 9 Nr
   2. *Torq*

http://vnx.su

25 N



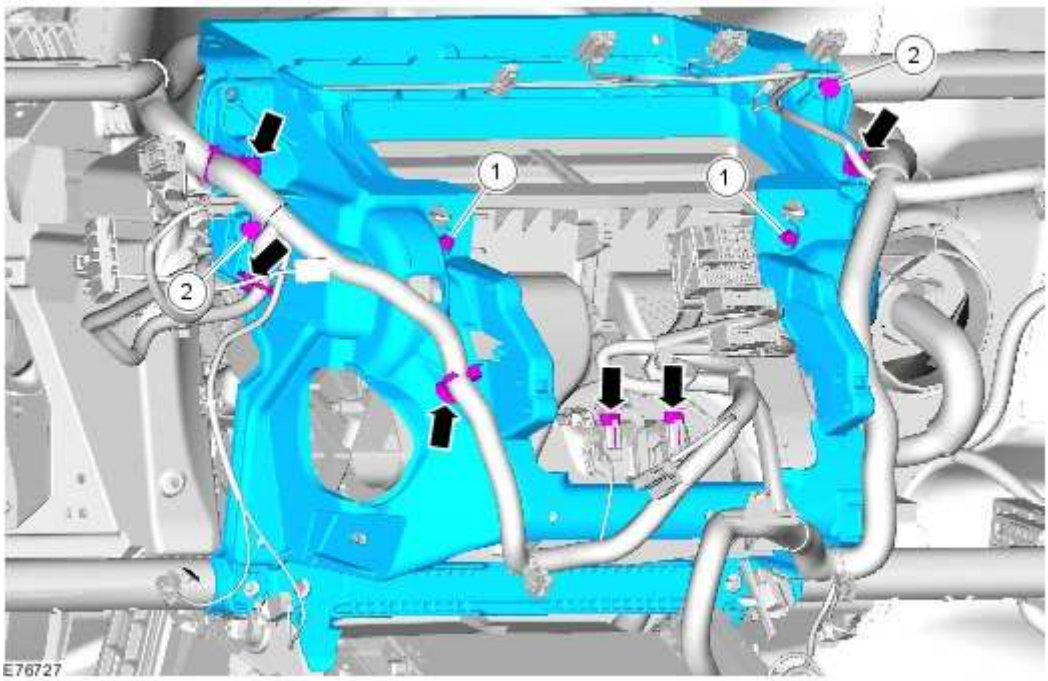
6.

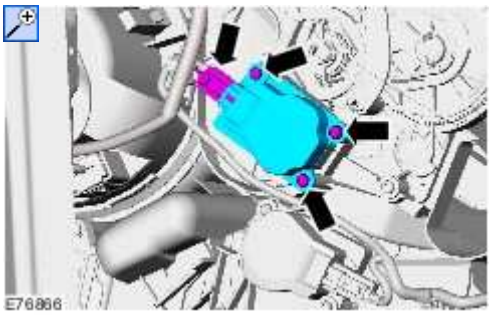


7.

1. *Torq*
   9 Nr
2. *Torq*
   25 N

http://vnx.su





8.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

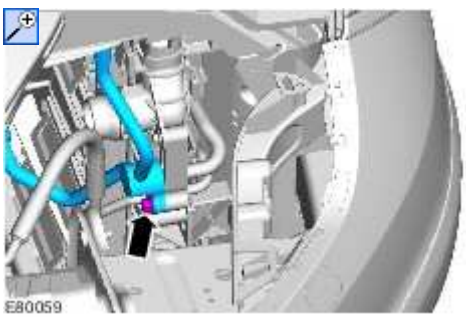
Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

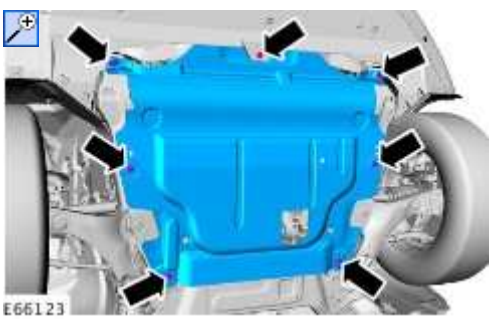
   Refer to: Klimaanlage entleeren, evakuieren und befüllen (412-00 Innenraumklimatisierung - Allgemeine Informationen, General Procedures).
2. Remove the right-hand head lamp unit.

   Refer to: Scheinwerfer (417-01 Außenbeleuchtung, Removal and Installation).

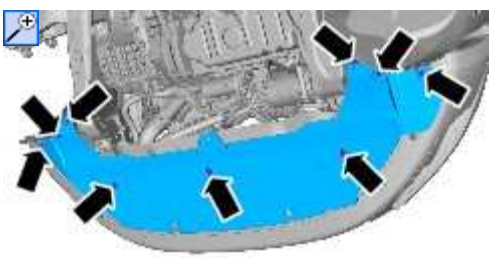

E80059

3. *Torque:* 24 Nm
4. Raise the vehicle.

   Refer to: Anheben mit Hebebühne (100-02 Fahrzeug anheben, Description and Operation).

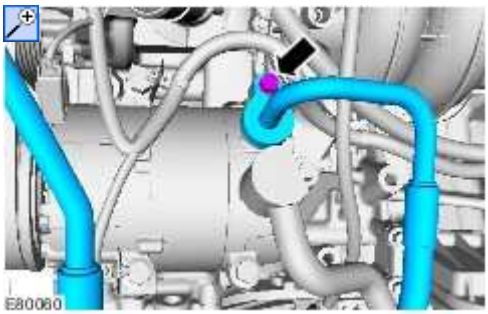

E66123

5.


E68962

6.
7. *Torque:* 24 Nm

http://vnx.su



Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)
2. To install, reverse the removal procedure.

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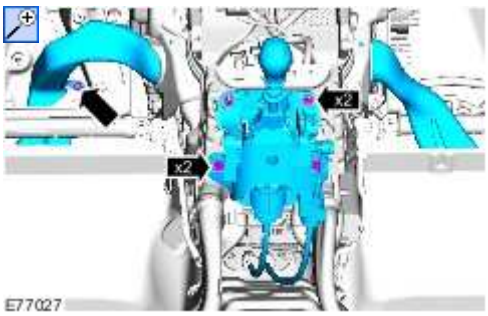
Removal and Installation

Removal

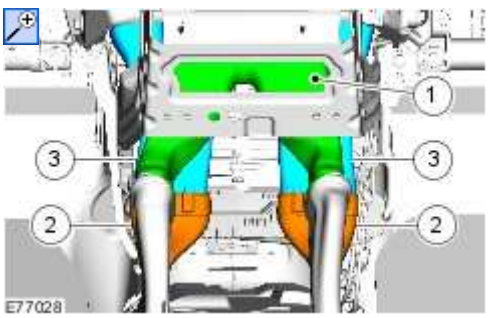
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the instrument panel.

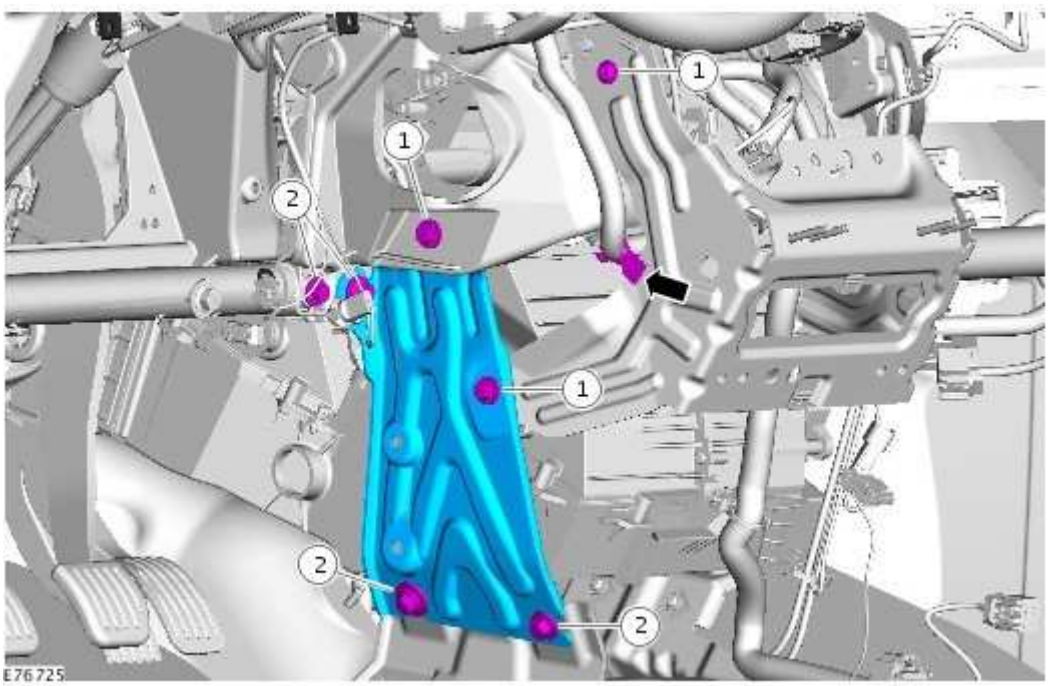
   Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).



2. *Torque:* 9 Nm



3.



4.
   1. *Torq* 9 Nr
   2. *Torq* 25 N

5.
   1. *Torq* 9 Nr
   2. *Torq*

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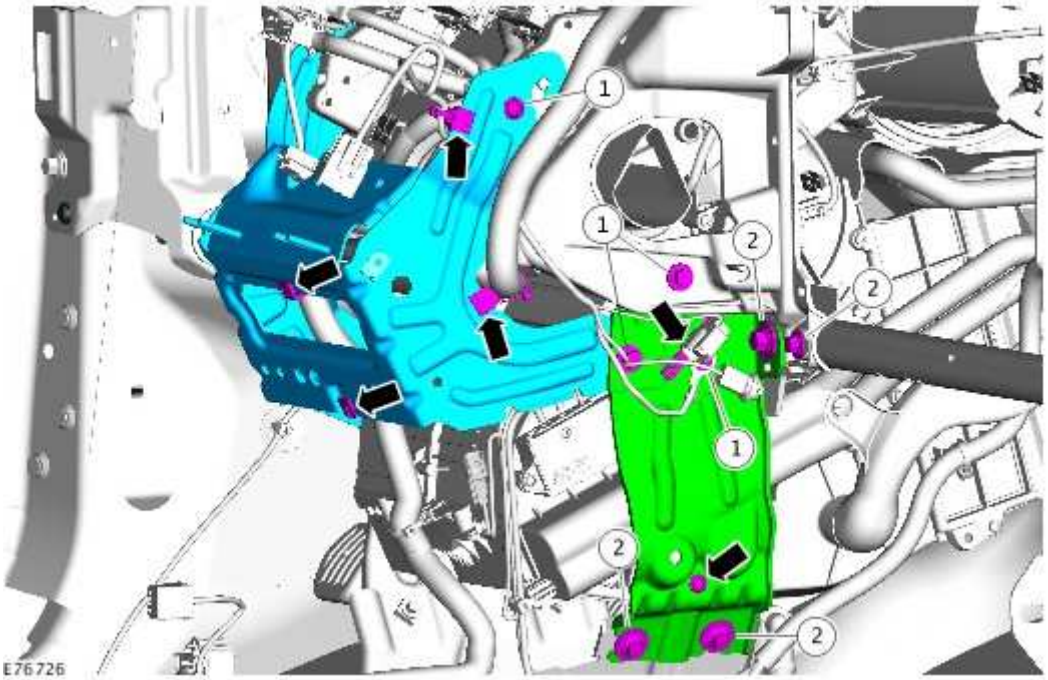
25 N



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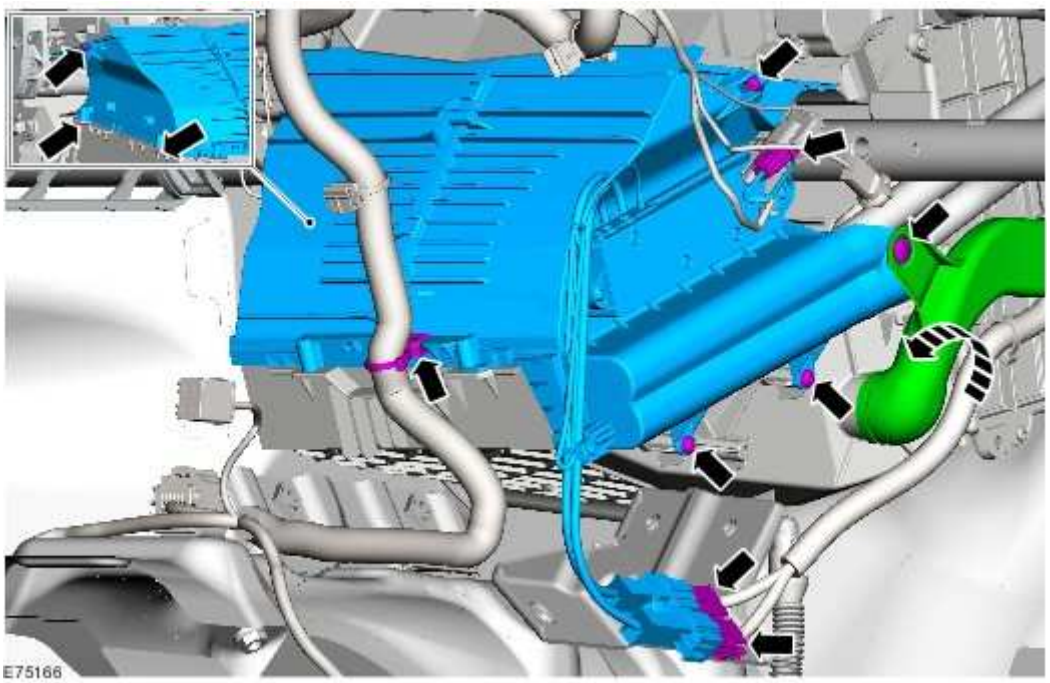
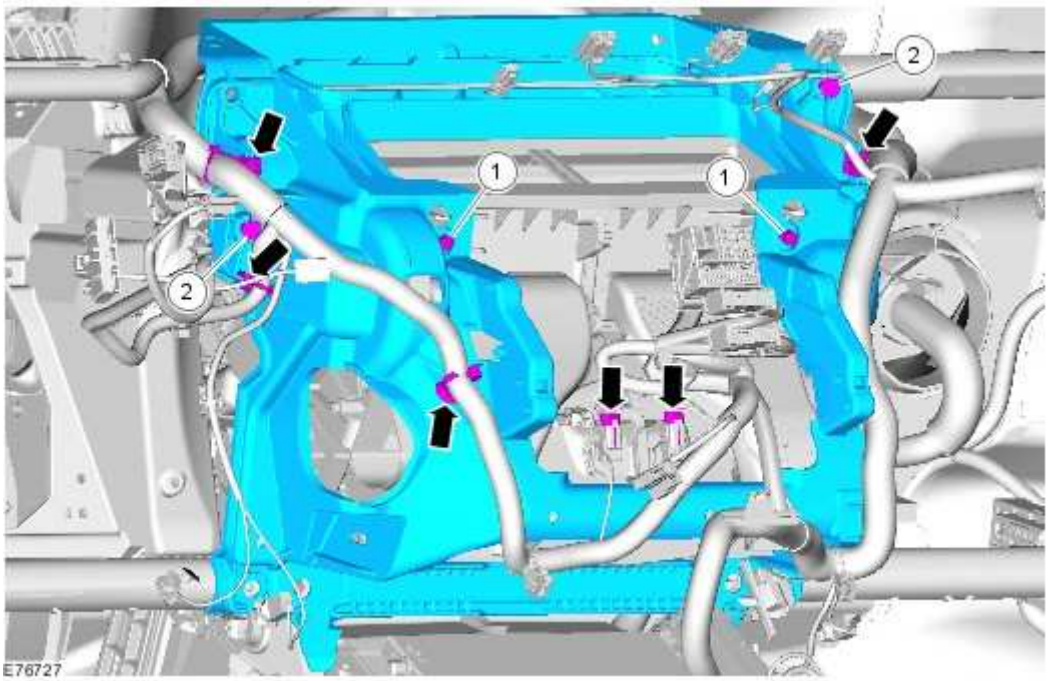
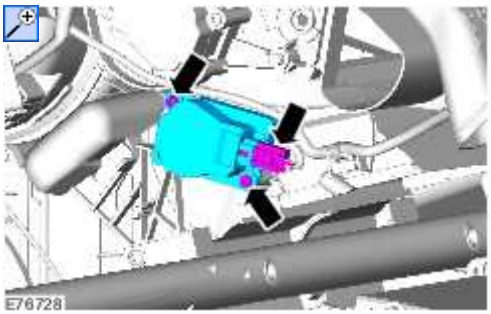


7.

1. *Torq*
   9 Nr
2. *Torq*
   25 N

http://vnx.su





8.

Installation

1. To install, reverse the removal procedure.

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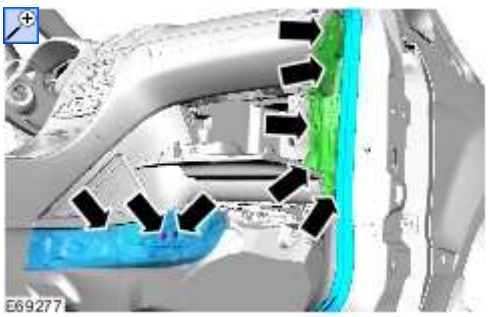
Print

Removal and Installation

Removal



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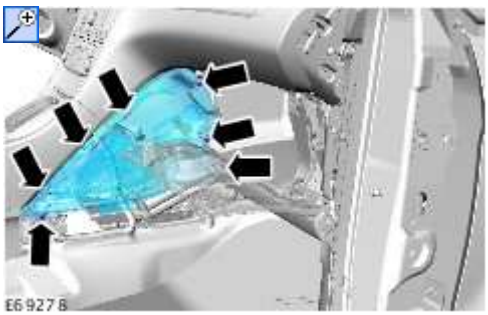
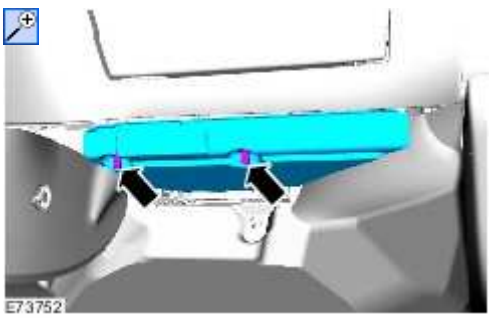


2.

Vehicles with glove compartment cooling



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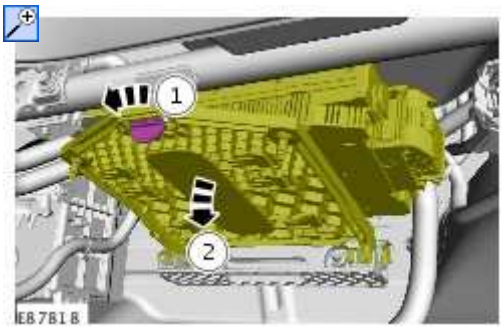

4.

5.

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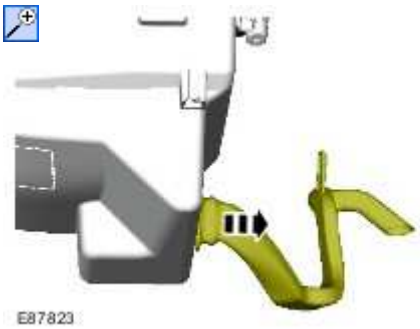
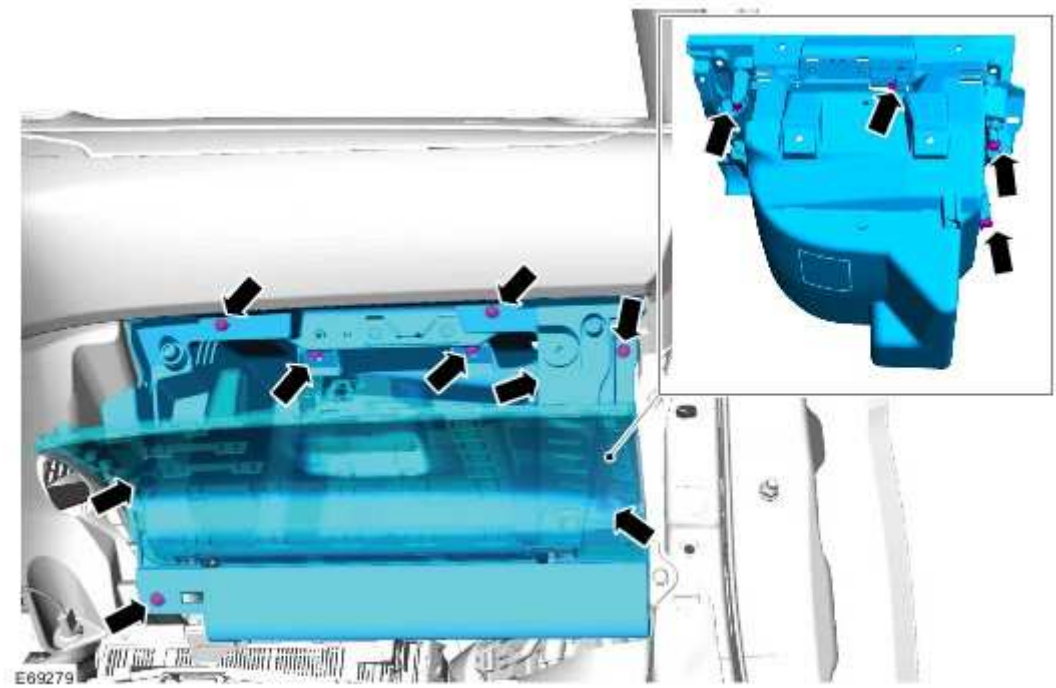
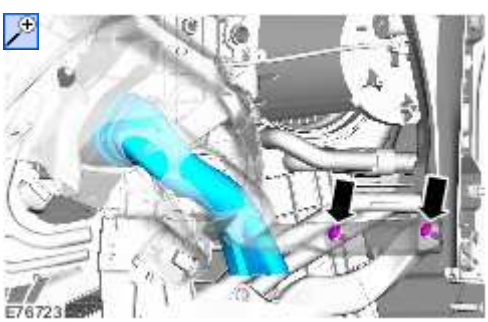


All vehicles

6.





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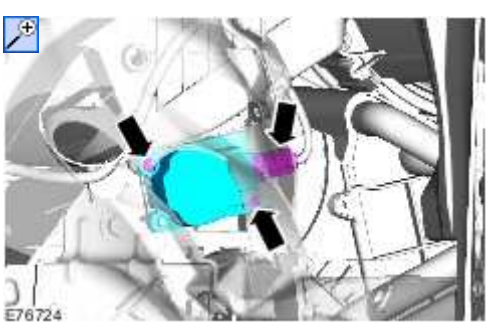

8.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

General Equipment

Hose clamp remover/installer

Removal

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

1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Descriptio and Operation).
2. Drain the air conditioning system.

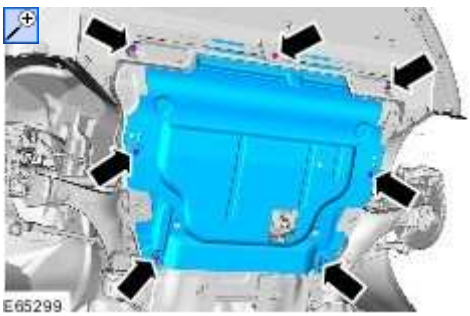
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Vehicles with a 1.8L diesel engine.

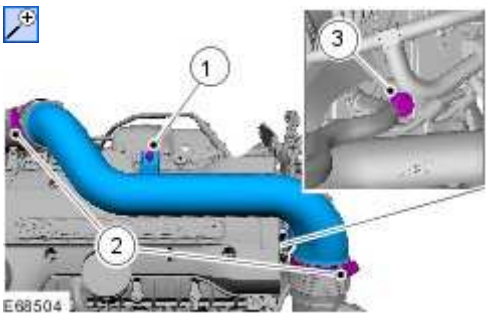
3. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

4.



Vehicles with a 2.5L engine



5. CAUTION: The insides of the pipe ends must b clean and free of oil residue.
   Torque: 10 Nm

Vehicles with 2.0L engine

6.

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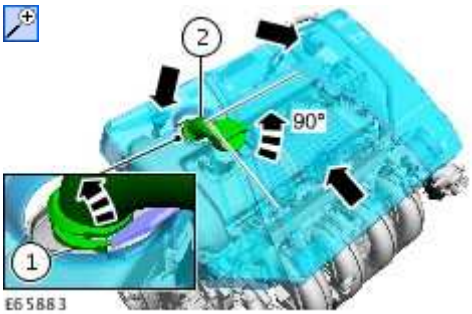
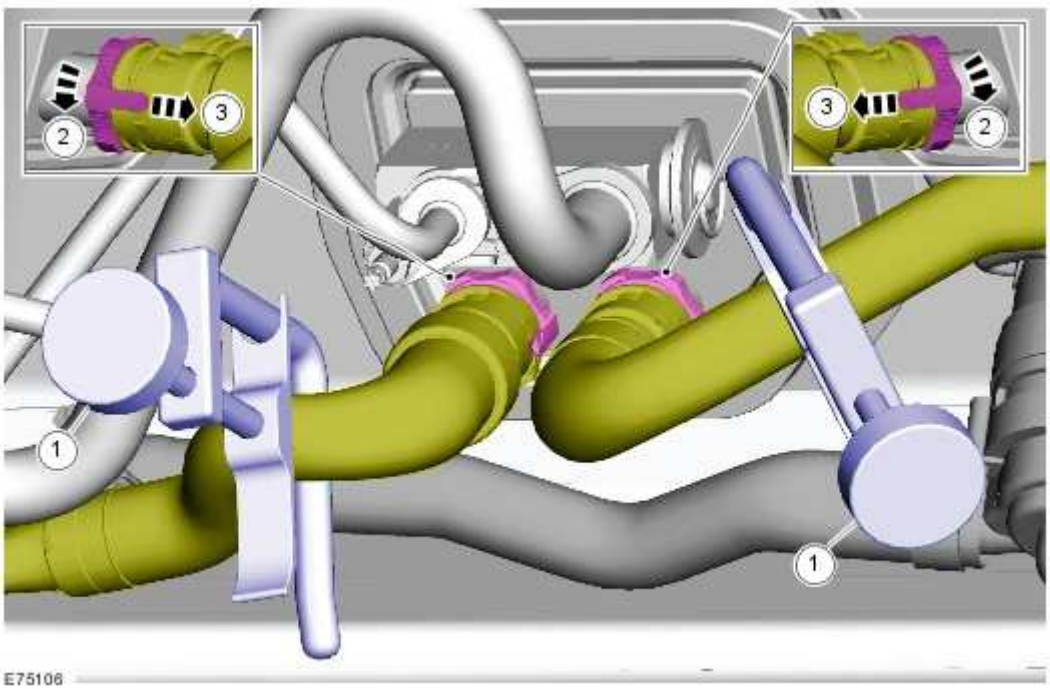


Vehicles with a 2.0L diesel engine

7.

Vehicles built up to 04/2006

8.



Vehicles built from 04/2006

9. *General Equipment:* H clamp remover/inst

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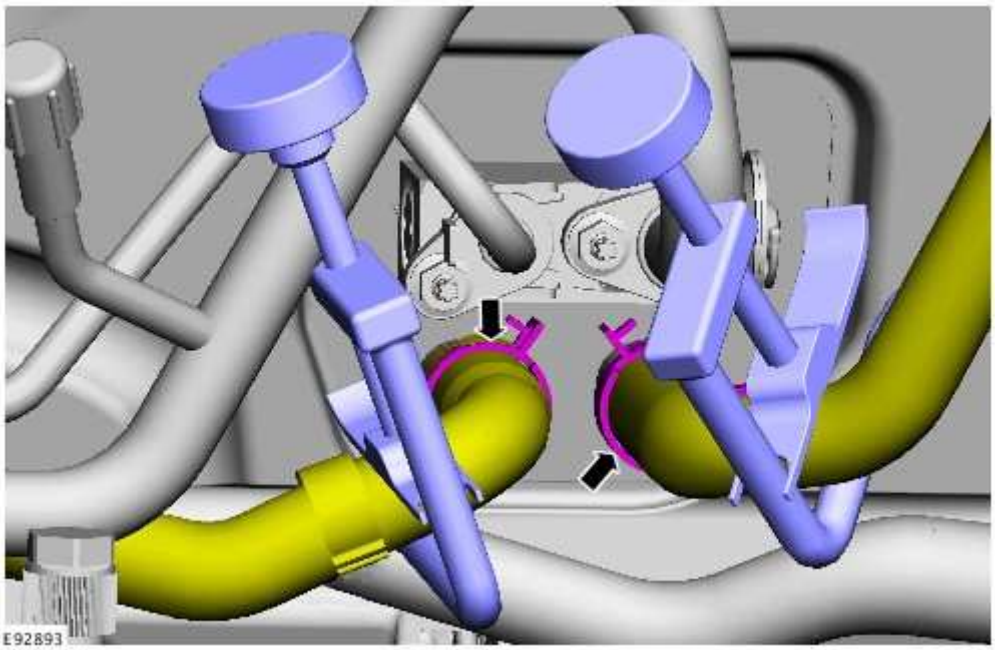
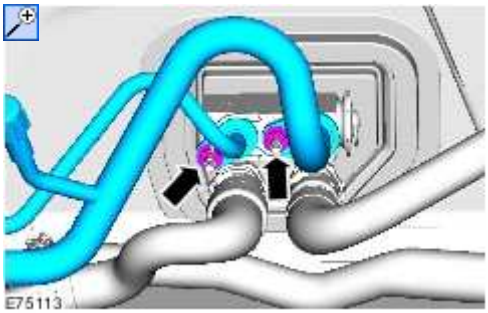


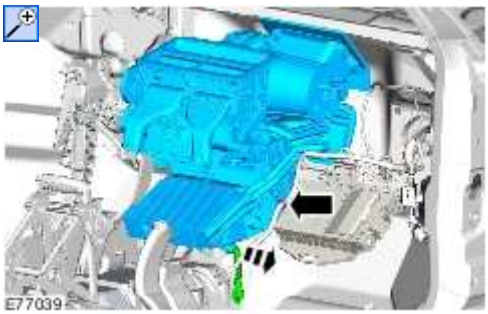
All vehicles



10. *Torque:* 8 Nm

11. Remove the dashboard crossmember.

    Refer to: In-Vehicle Crossbeam (501-12 Instrument Panel and Console, Removal and Installation).



12.

Installation

1. Coat the refrigerant line O-rings.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.
3. Inspect the coolant level.

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	Refer to: Cooling System Draining, Filling and Bleedi (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160 - MI4, General Procedures). Refer to: Cooling System Draining, Filling and Bleedi (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures). Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

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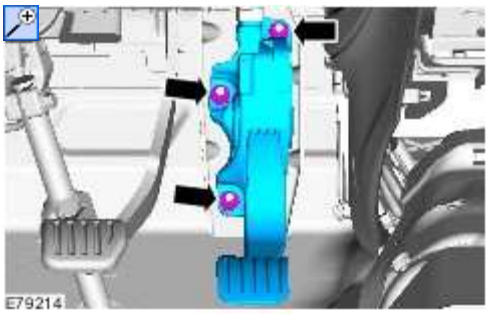
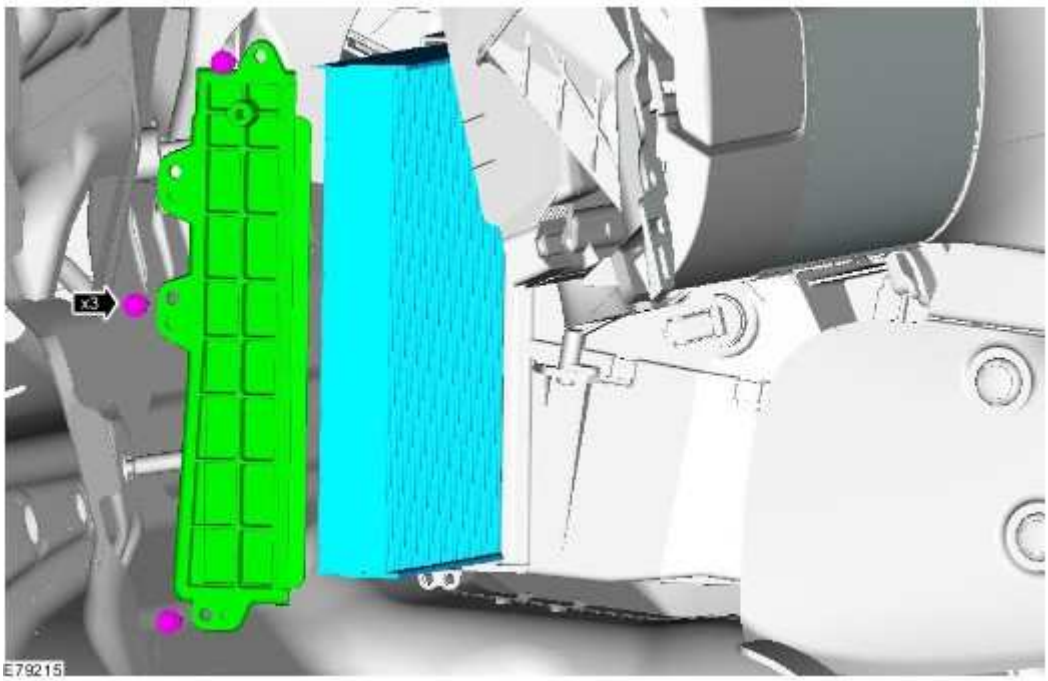
Removal and Installation

Removal

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



1. *Torque:* 9 Nm



2.

Installation

1. Install all components in reverse order.

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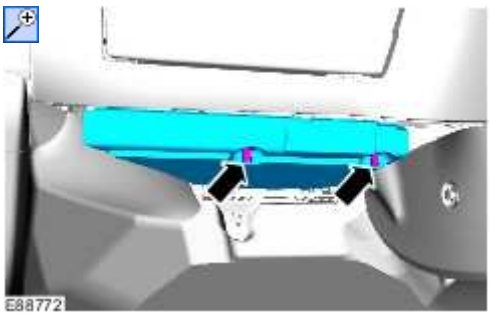
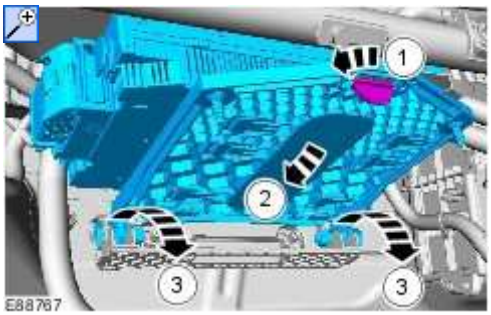
Removal and Installation

Removal



1.



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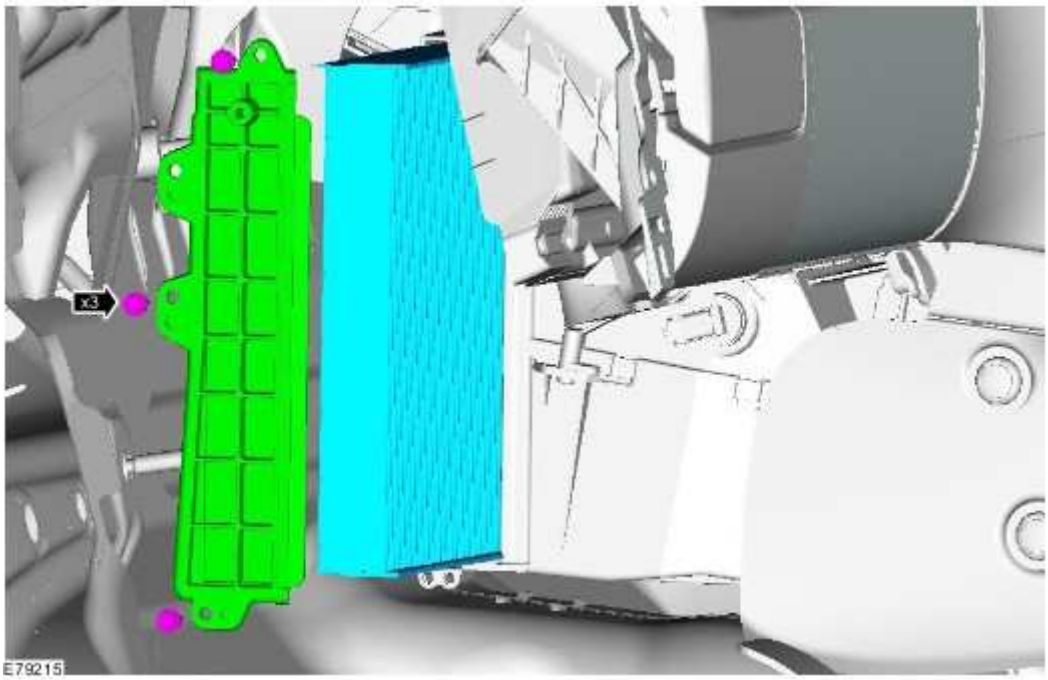

3.

Installation

1. To install, reverse the removal procedure.

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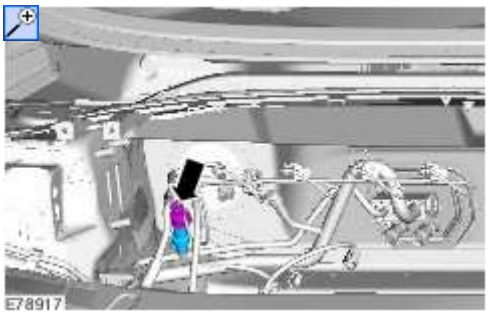
Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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



1. Refer to: Air Conditioning (A/C) System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. *Torque:* 8 Nm

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)
2. To install, reverse removal procedure

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Evacuate the air conditioning (A/C) system.

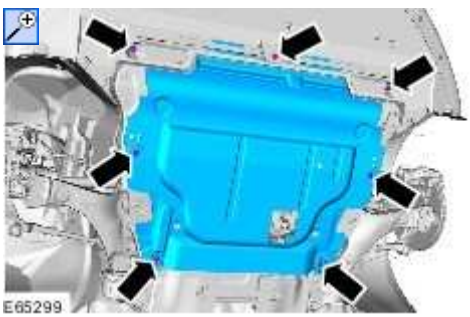
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Vehicles with 1.8L diesel engine

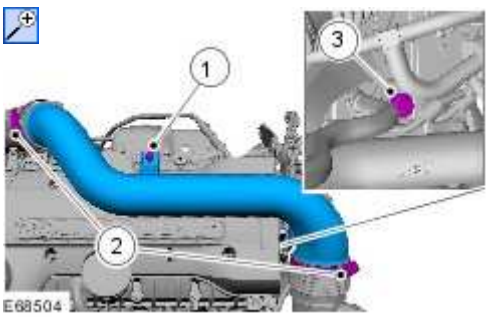
2. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

3.

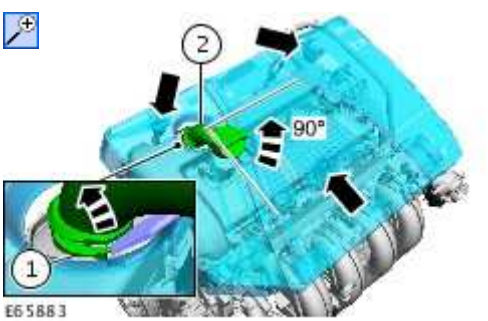


Vehicles with 2.5L engine



4. CAUTION: The inside surfaces of the ends of the pipe must be clean and free from oil residues.
   Torque: 10 Nm

Vehicles with 2.0L engine



5.

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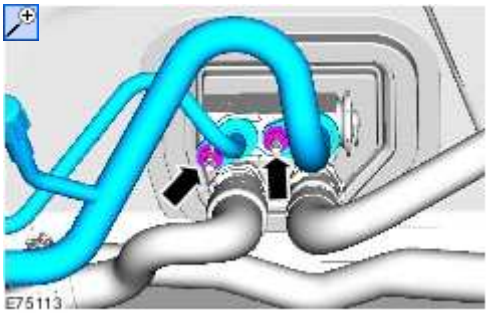
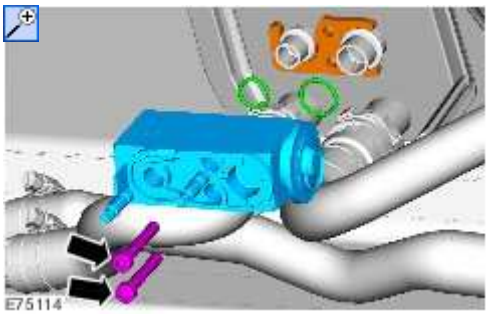
Vehicles with 2.0L diesel engine

6.

All vehicles



7. *Torque:* 8 Nm



8. *Torque:* 4 Nm

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. Install the components in reverse order.

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Removal and Installation

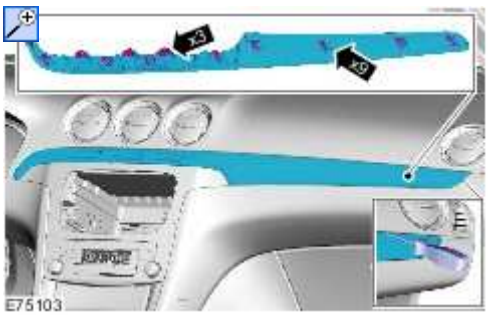
General Equipment

Schlitzschraubendreher

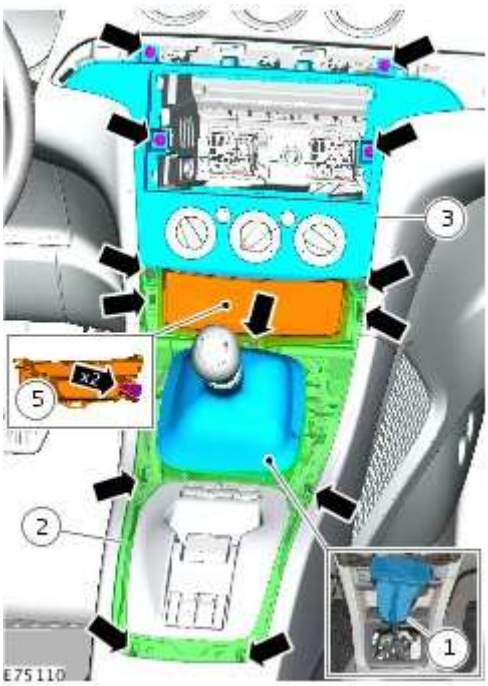
Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).



2. CAUTION: Use suitable packing material to avoid damage to the component.
   General Equipment: Schlitzschraubendreher



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4.

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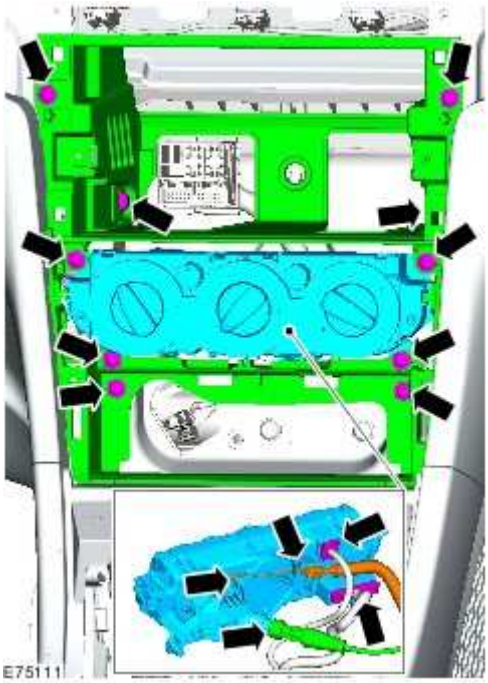

Installation

1. Install the components in reverse order.

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Climate Control - Climate Control Assembly—Vehicles Built From: 05/2007, Vehicles With: Manual Temperature Control	S-MAX/Galaxy 2006.5 (02/2006-)

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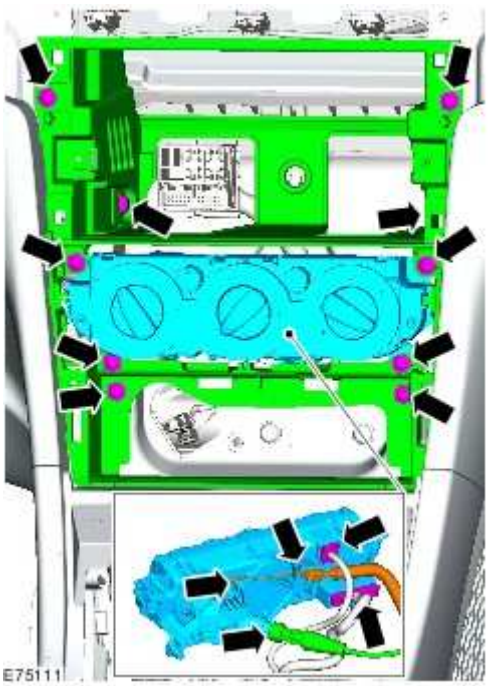
Removal and Installation

Removal



1. Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
2.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

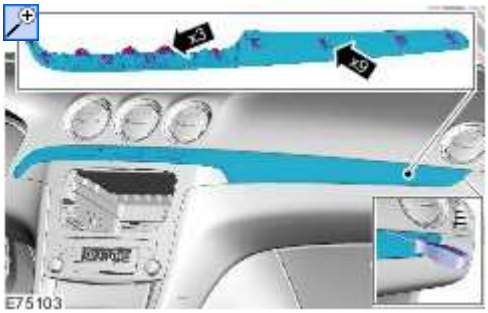
General Equipment

Schlitzschraubendreher

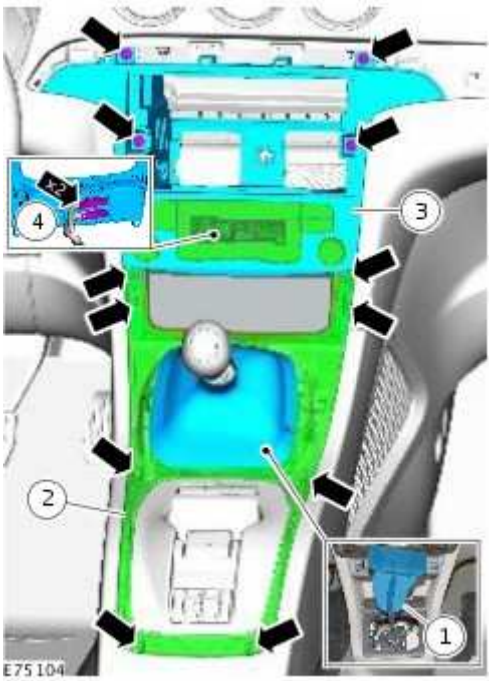
Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Modul - Navigationssystembildschirm - Fahrzeuge ausgestattet mit Travel Pilot EX (415-01 Informations- und Unterhaltungssystem, Removal and Installation).



2. CAUTION: Use suitable packing material to avoid damage to the component.
   General Equipment: Schlitzschraubendreher



3.

4.

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E75105

Installation

1. Install the components in reverse order.

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Removal and Installation

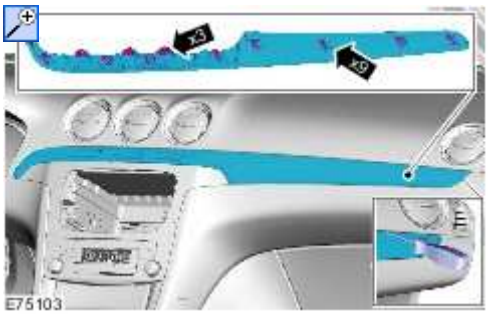
General Equipment

Schlitzschraubendreher

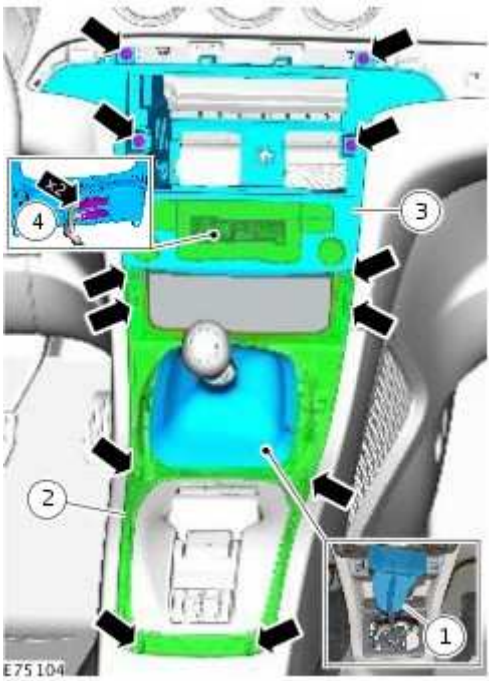
Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Modul - Navigationssystembildschirm - Fahrzeuge ausgestattet mit Travel Pilot EX (415-01 Informations- und Unterhaltungssystem, Removal and Installation).



2. CAUTION: Use suitable packing material to avoid damage to the component.
   General Equipment: Schlitzschraubendreher



3.

4.

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E75105

Installation

1. Install the components in reverse order.

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Removal and Installation

Removal

1. Remove the navigation screen module.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Hose clamp remover/installer

Removal

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

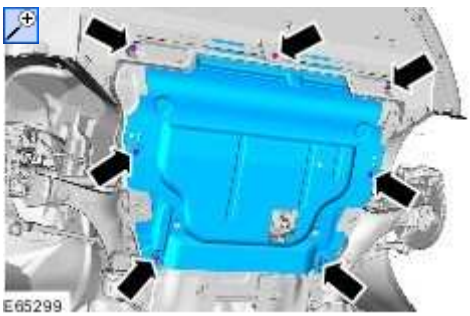
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Descriptio and Operation).

Vehicles with 1.8L diesel engine

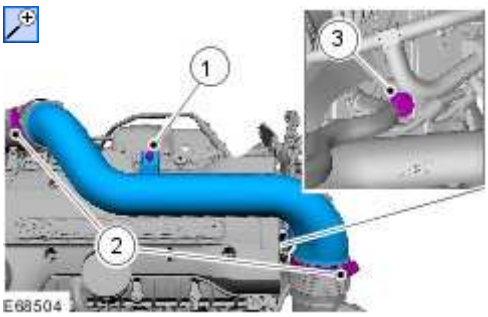
2. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

3.

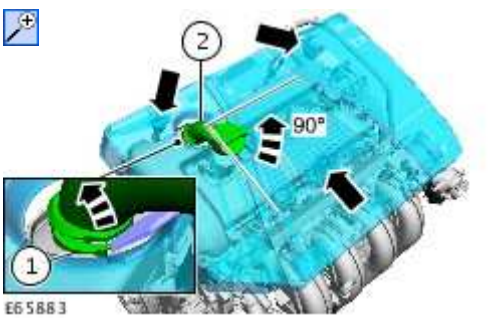


Vehicles with 2.5L engine



4. CAUTION: The inside surfaces of the ends of the pipe must be clean and free from oil residues.
   Torque: 10 Nm

Vehicles with 2.0L engine



5.

Vehicles with 2.0L diesel engine

6.

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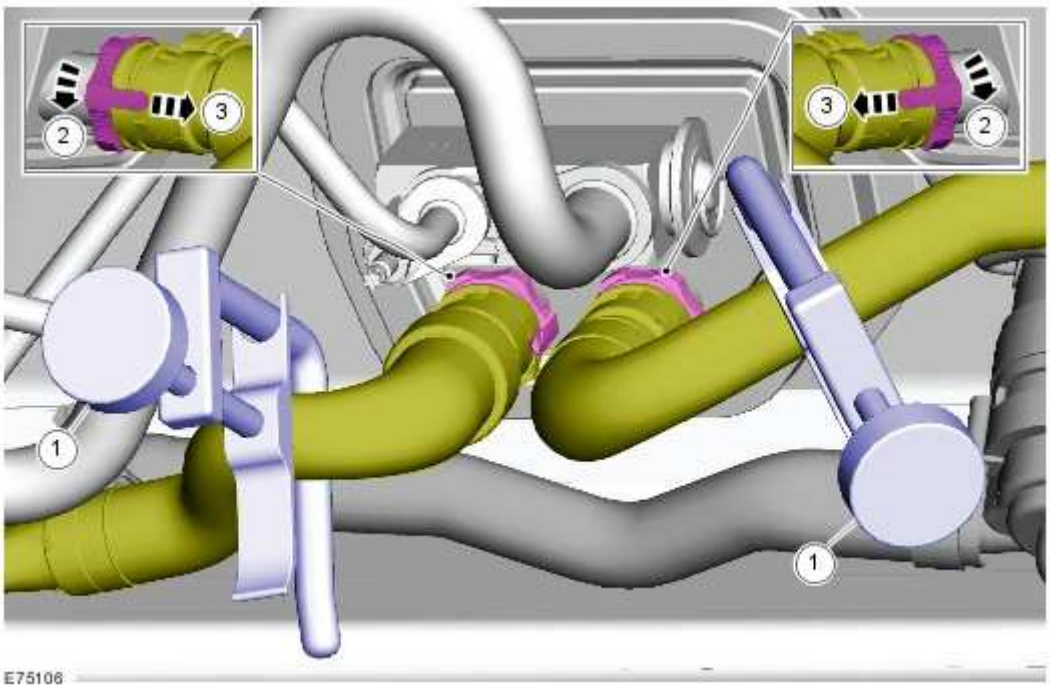
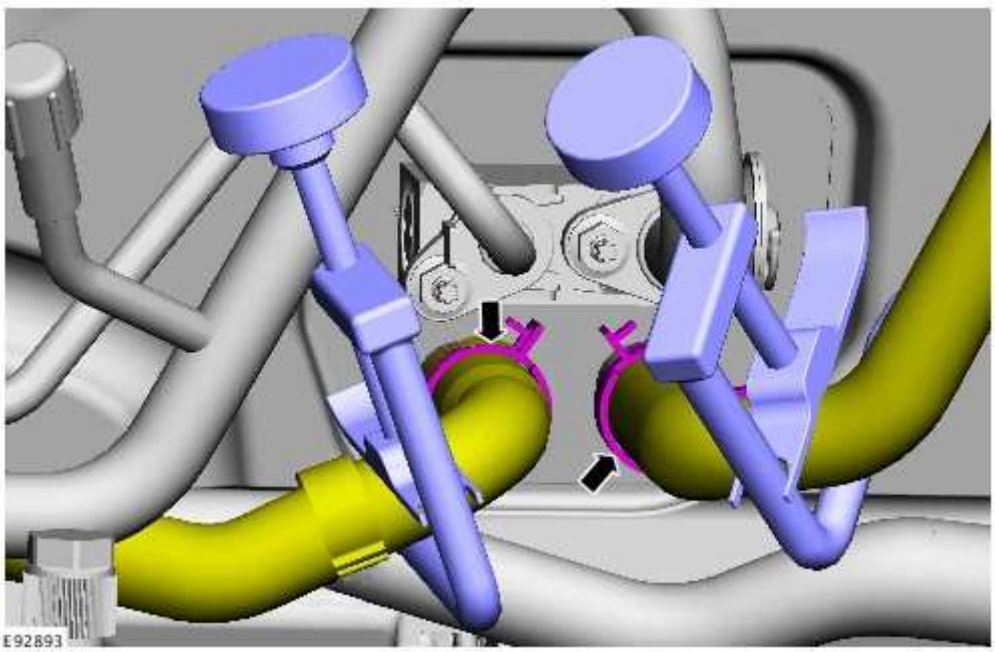
Vehicles built up to 04/2006

7.



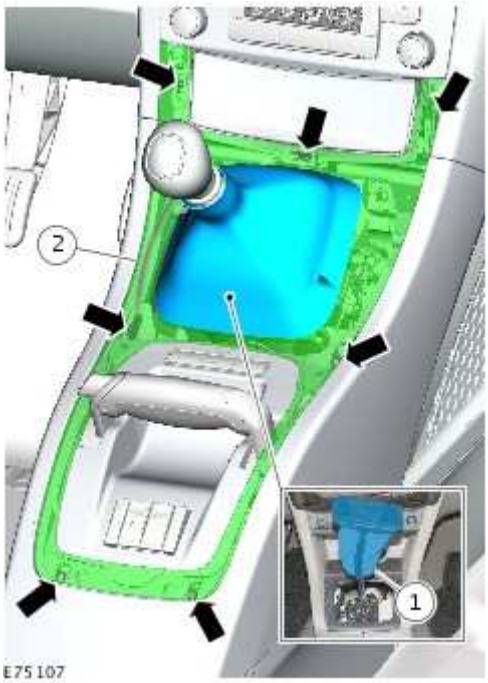
Vehicles built from 04/2006

8. *General Equipment:* H clamp remover/inst



All vehicles

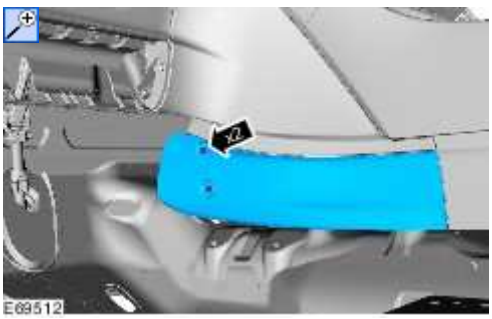
http://vnx.su



9.

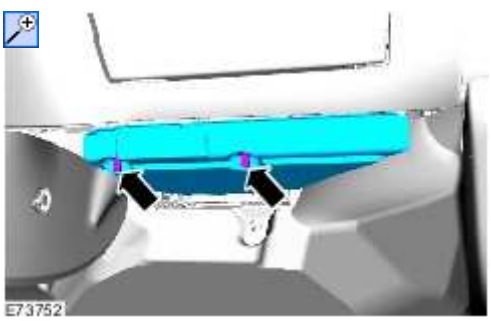
10. Remove the audio unit.

    Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
    Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
    Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigatio System (415-01 Information and Entertainment System, Removal and Installation).



11.

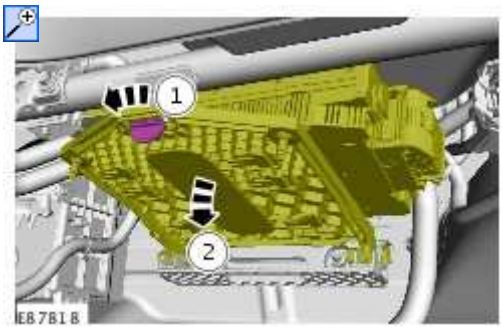
Vehicles with glove compartment cooling



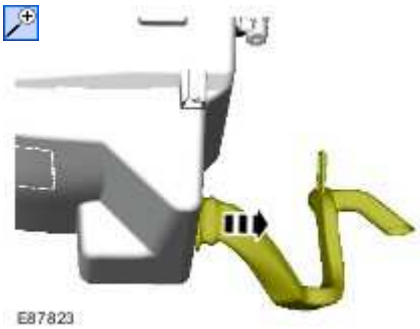
12.

13.

http://vnx.su

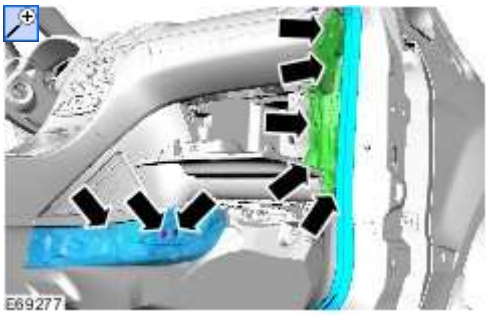


14.



Left-hand drive vehicles

15.



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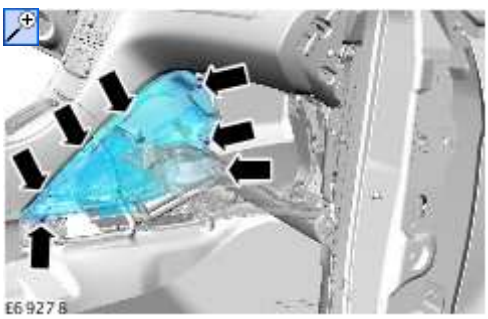
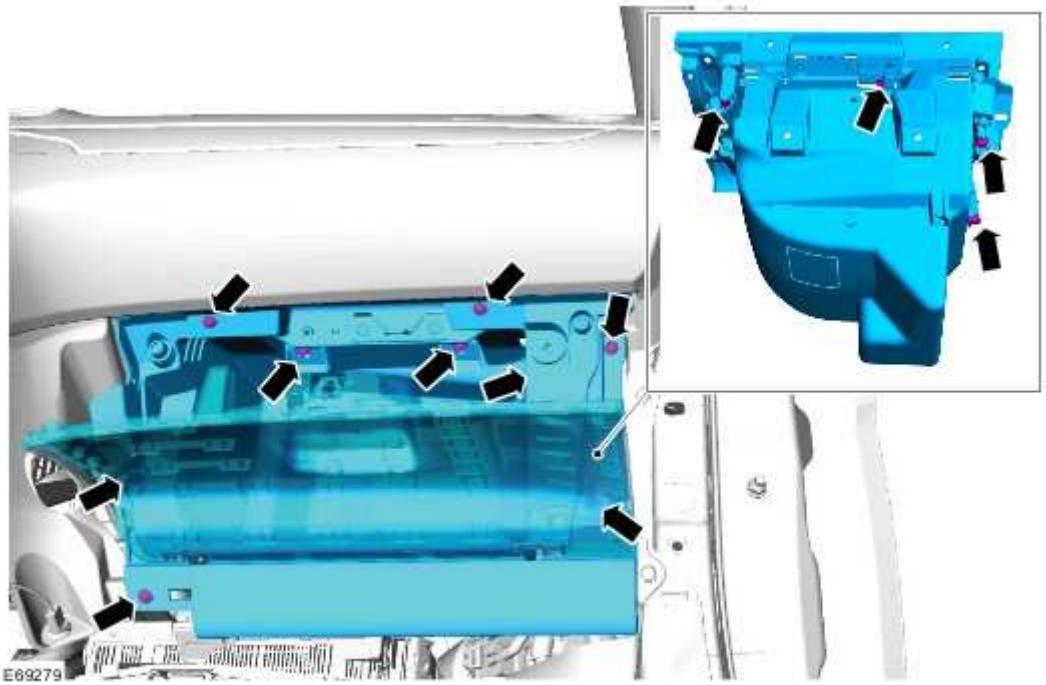
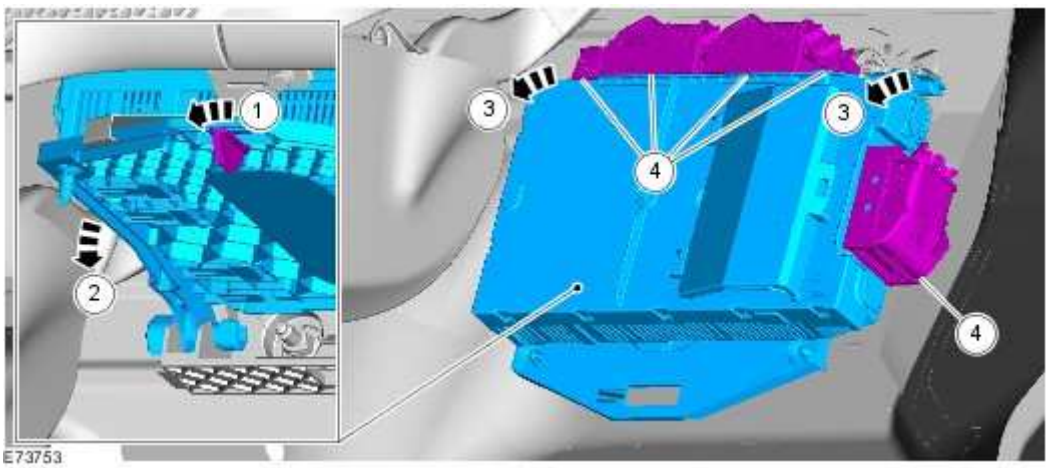


17.

http://vnx.su





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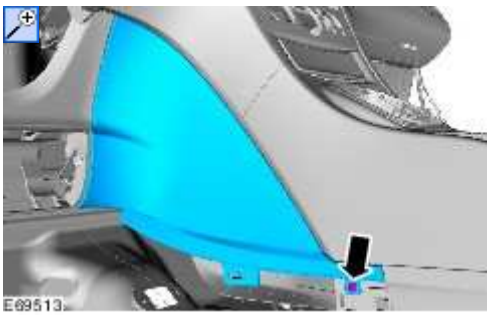

19.

RHD vehicles

20. Remove the clutch master cylinder.

    Refer to: Clutch Master Cylinder (308-02A Clutch Controls - Vehicles With: 5-Speed Manual Transaxle MTX75, Removal and Installation).
    Refer to: Clutch Master Cylinder (308-02C Clutch Controls - Vehicles With: 6-Speed Manual Transaxle M66, Removal and Installation).

21.

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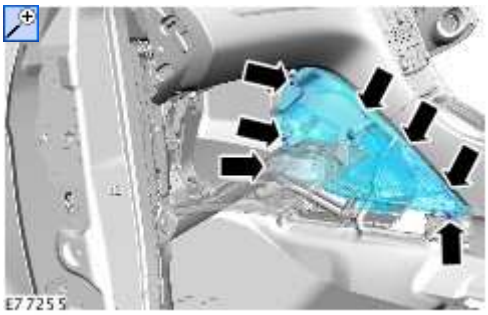
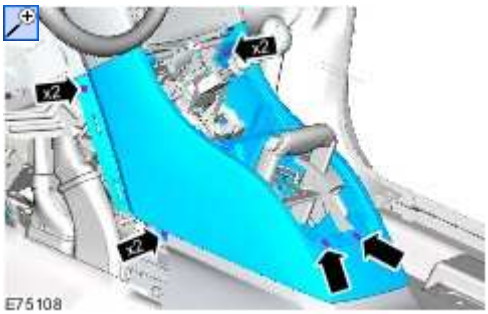


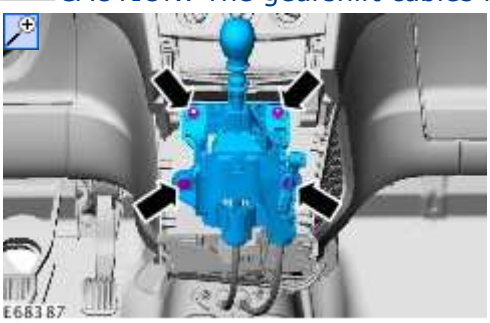
All vehicles

22.



CAUTION: The gearshift cables must not be kinked or twisted.

23. *Torque:* 9 Nm



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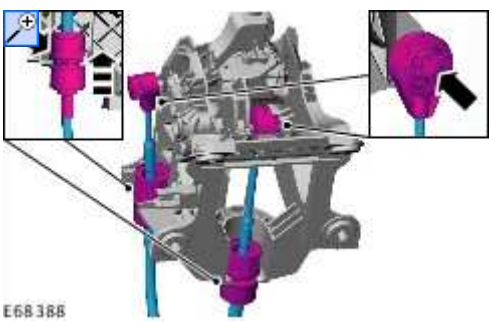
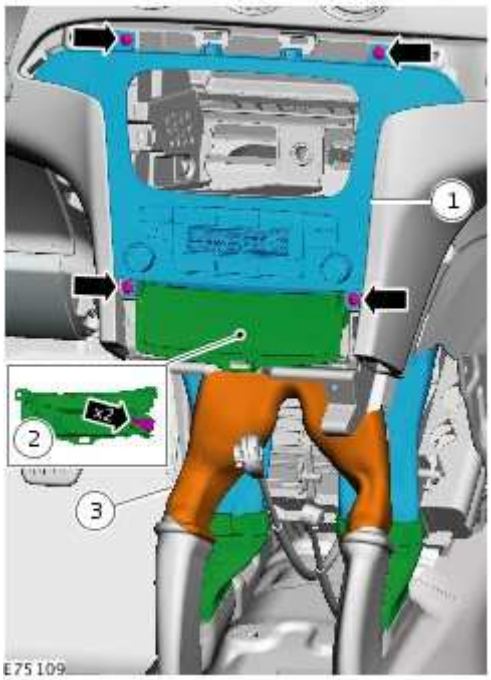


25.

http://vnx.su



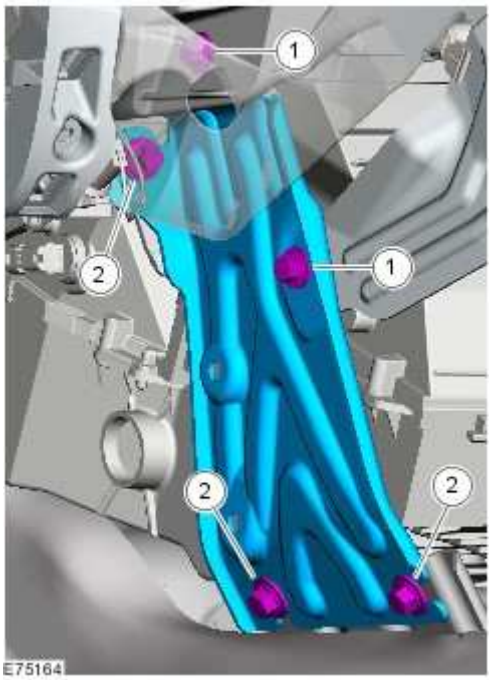
26.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

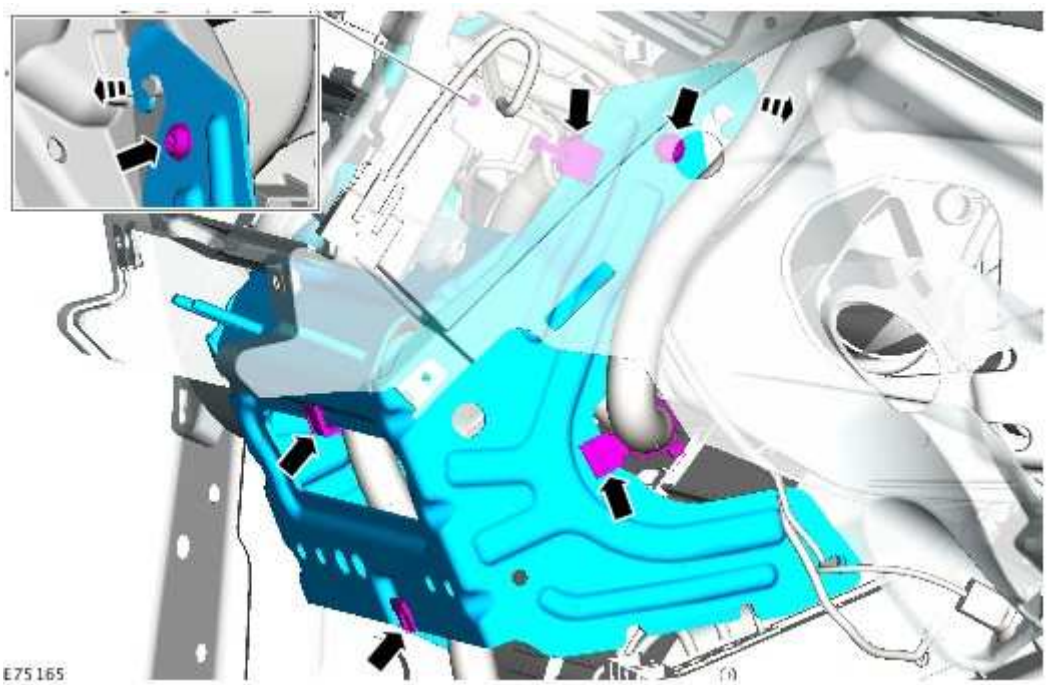
27.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

http://vnx.su

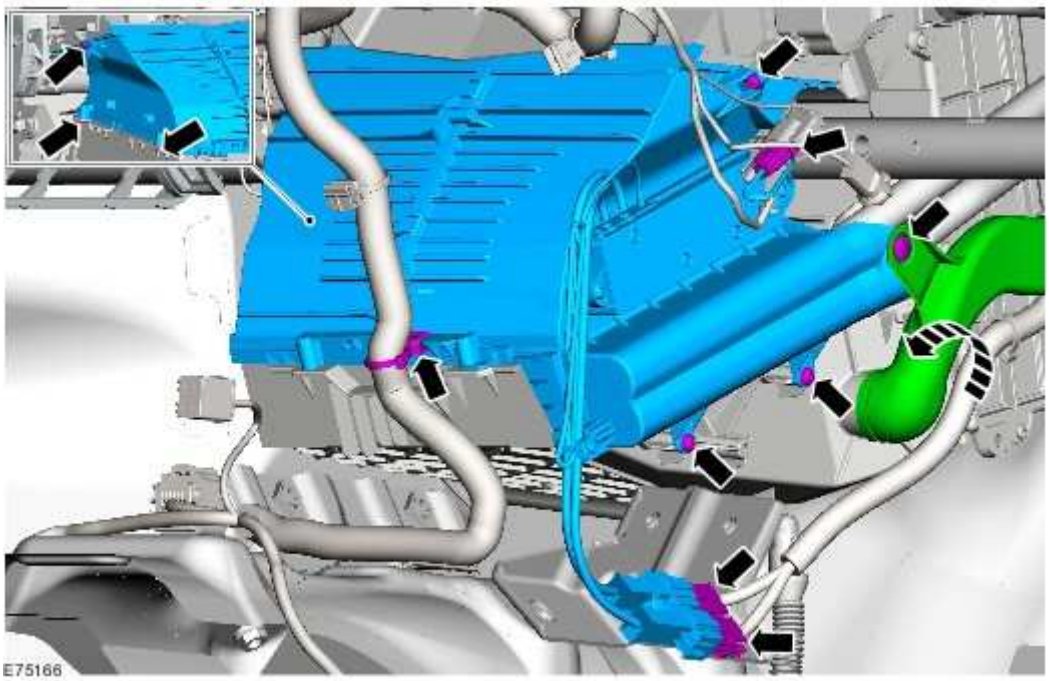


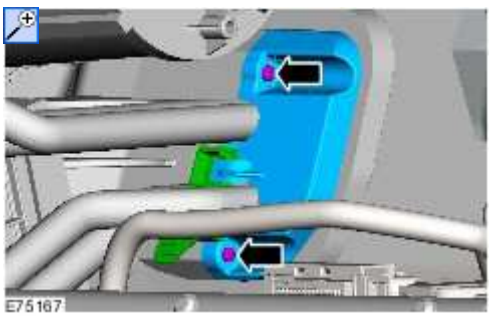
28. *Torque:* 9



29.

http://vnx.su





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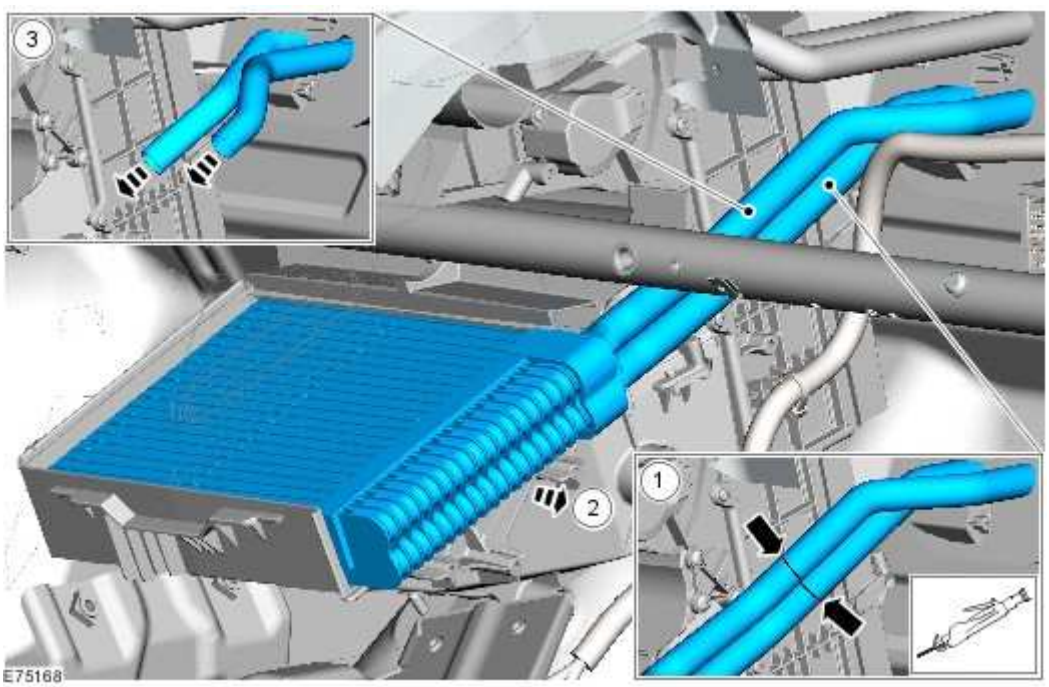


31.

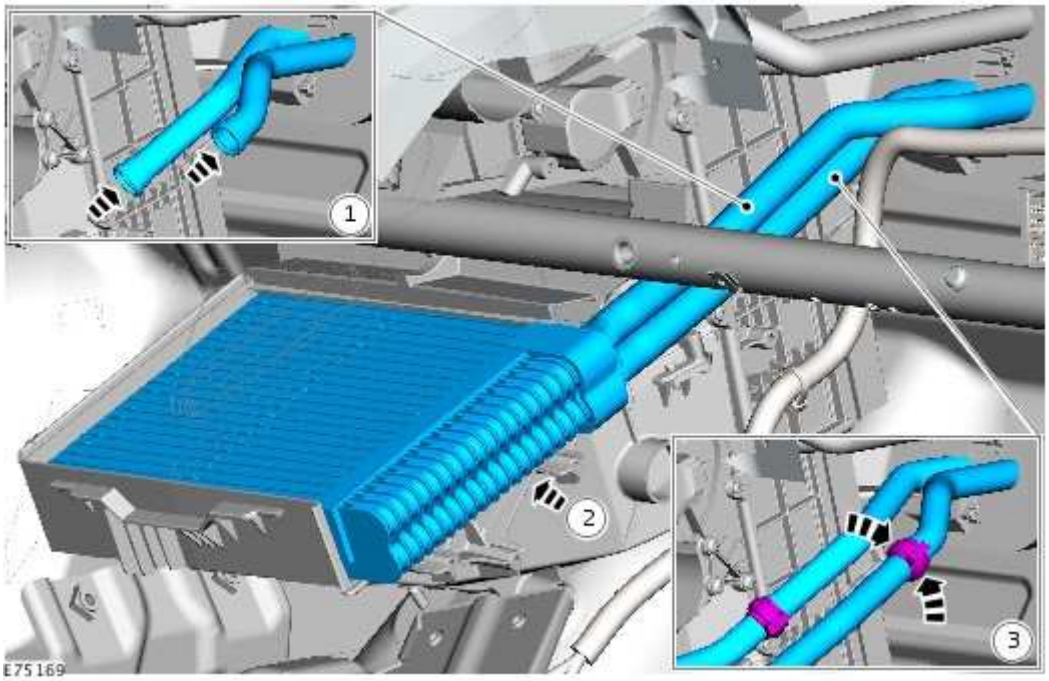
1. Saw
thro
the
cool
lines

Installation

1. Install the
componen
in reverse

http://vnx.su

order.



2. Check the coolant level.

   Refer to: Cooling System Draining, Filling and Bleedi (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160 - MI4, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleedi (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

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Removal and Installation

General Equipment

Hose clamp remover/installer

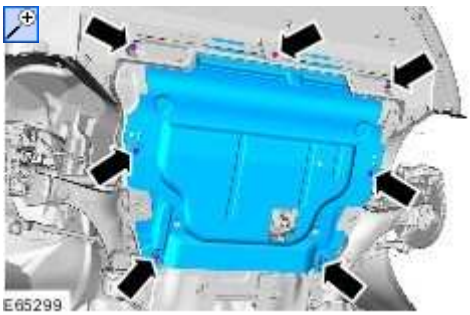
Removal

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

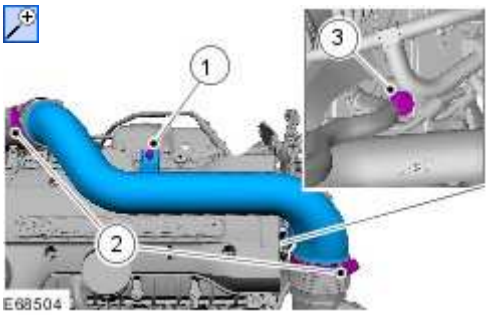
1. Refer to: Engine Cooling System Health and Safety Precautions (100-00 General Information, Descriptio and Operation).

Vehicles with 1.8L diesel engine

2. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).
3.

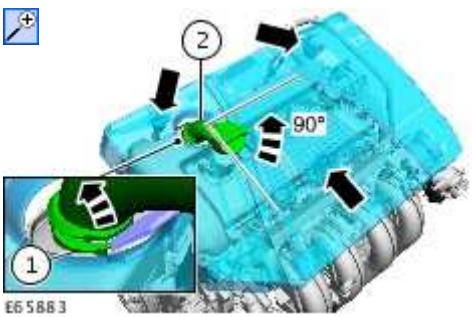


Vehicles with 2.5L engine



4. CAUTION: Make sure that the inside of the pip ends are clean and free of oil residue.
Torque: 10 Nm

Vehicles with 2.0L engine



5.

Vehicles with 2.0L diesel engine

6.

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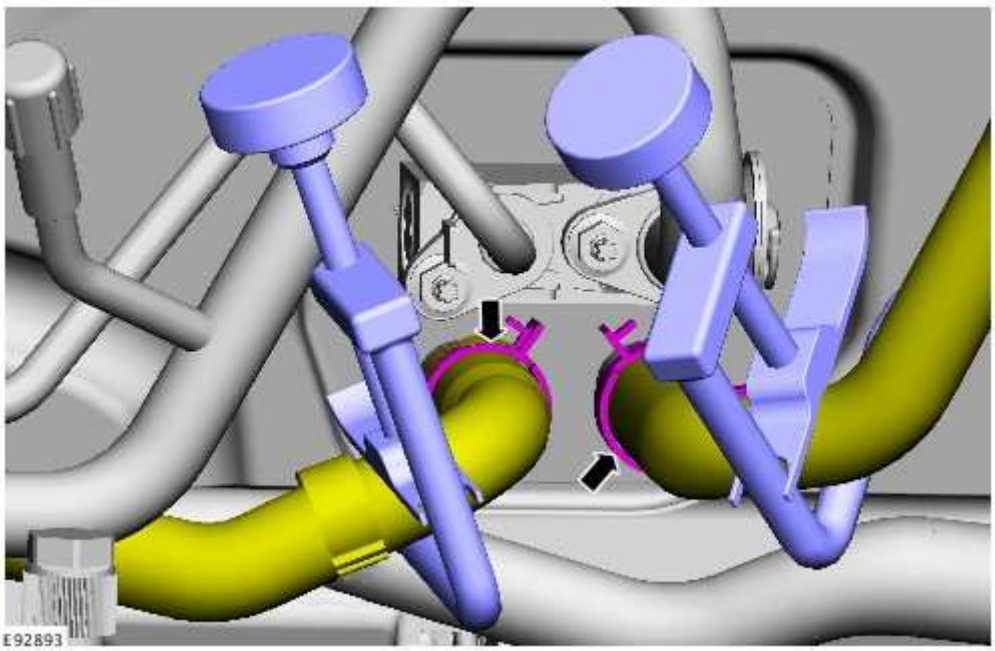
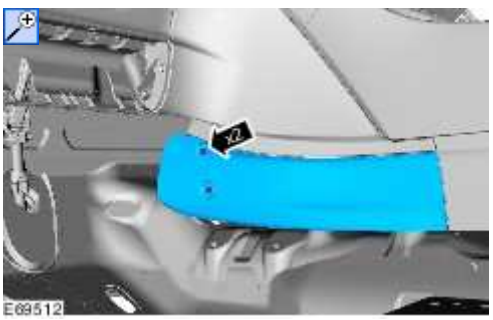
All vehicles



7. *General Equipment:* H clamp remover/inst

8. Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigatio System (415-01 Information and Entertainment System, Removal and Installation).

9.



Vehicles with glove compartment cooling

10.

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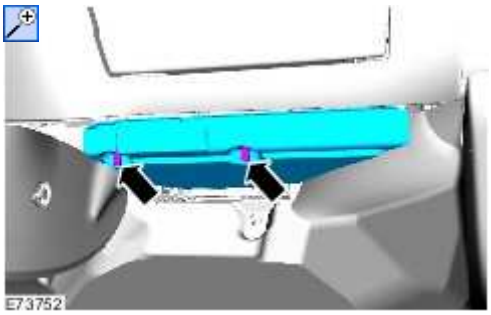
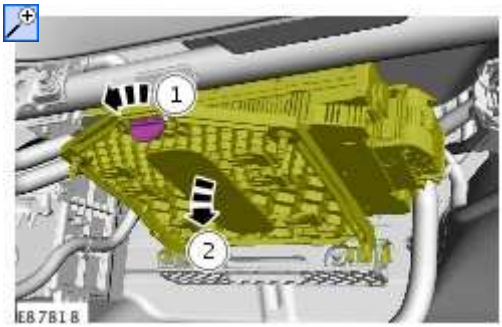


11.



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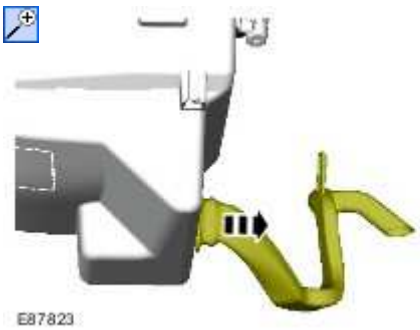
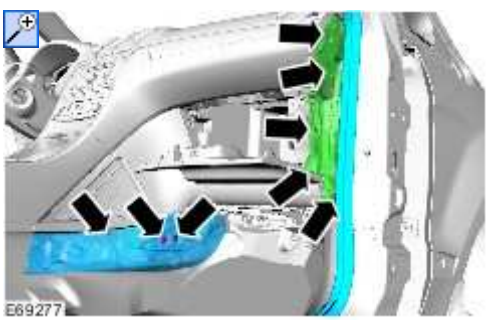


Left-hand drive vehicles



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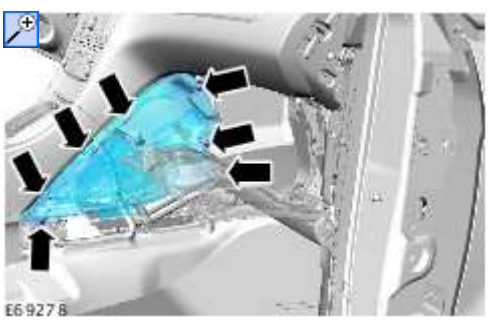

14.

15.

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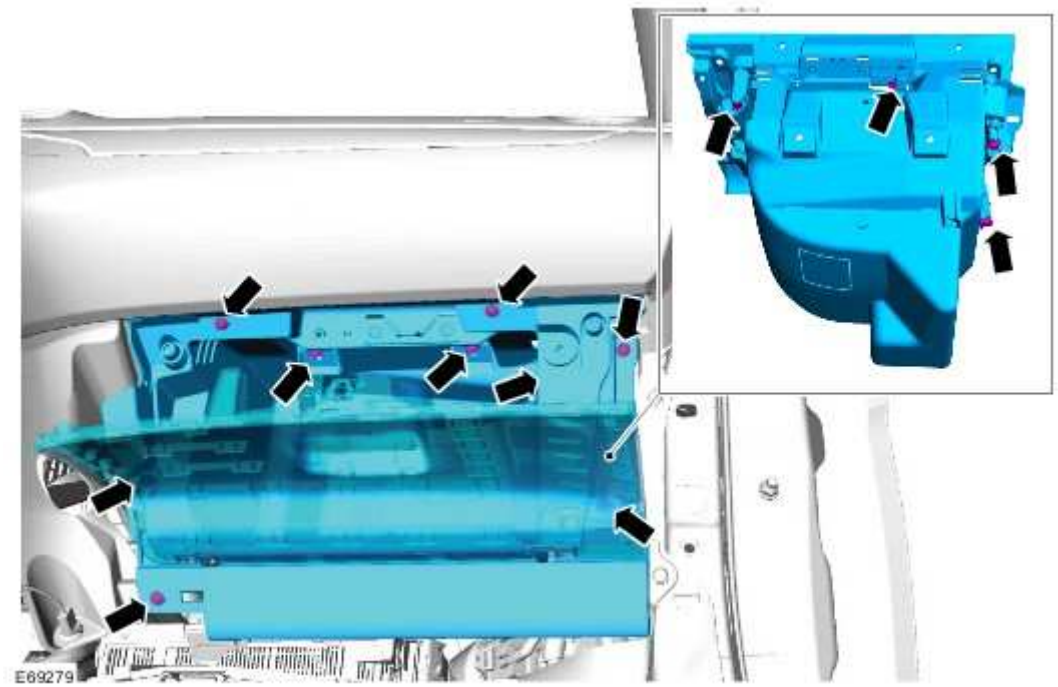

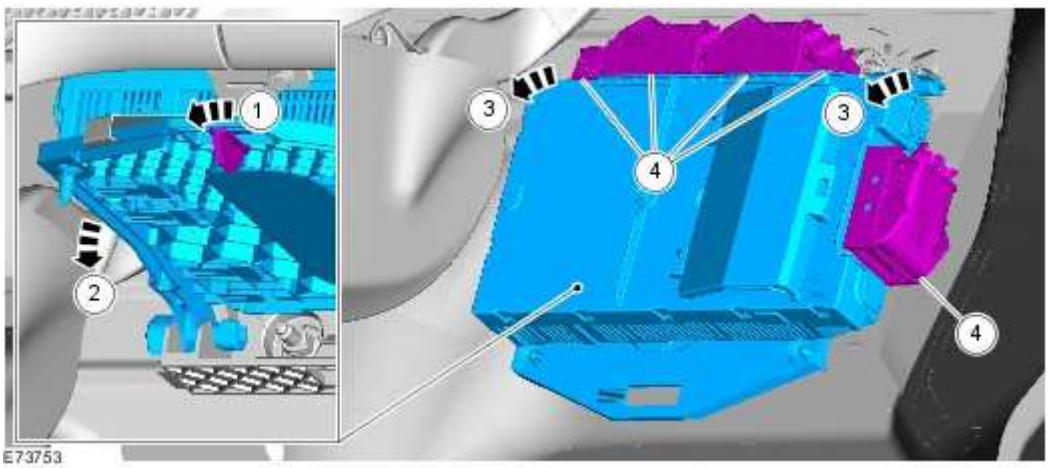

16.

17.

Right-hand drive vehicles

18. Refer to: Clutch Master Cylinder (308-02A Clutch Controls - Vehicles With: 5-Speed Manual Transaxle MTX75, Removal and Installation).
Refer to: Clutch Master Cylinder (308-02C Clutch Controls - Vehicles With: 6-Speed Manual Transaxle M66, Removal and Installation).

19.

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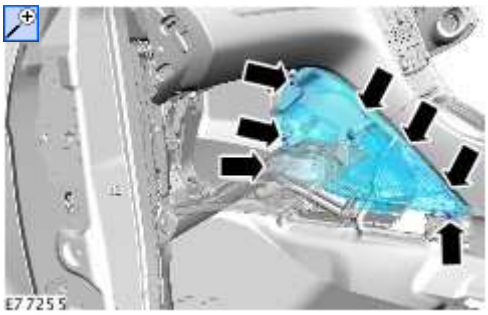
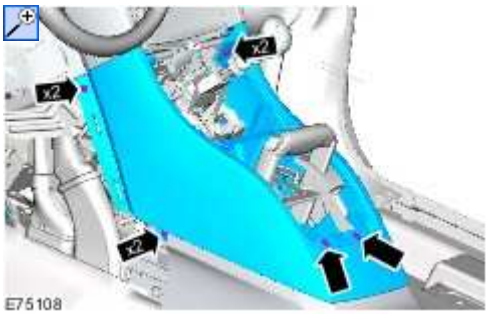
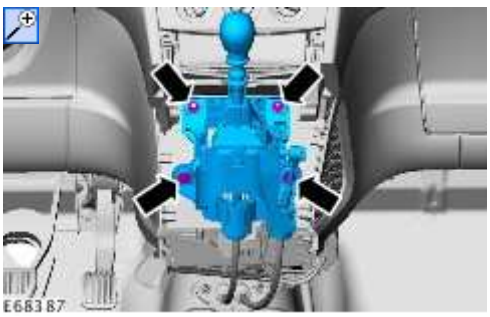


All vehicles

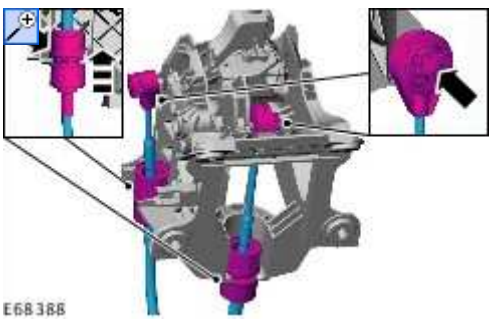


20.

CAUTION: Gearshift cables must not be kinked or bent.



21. *Torque:* 9 Nm



22.

23.

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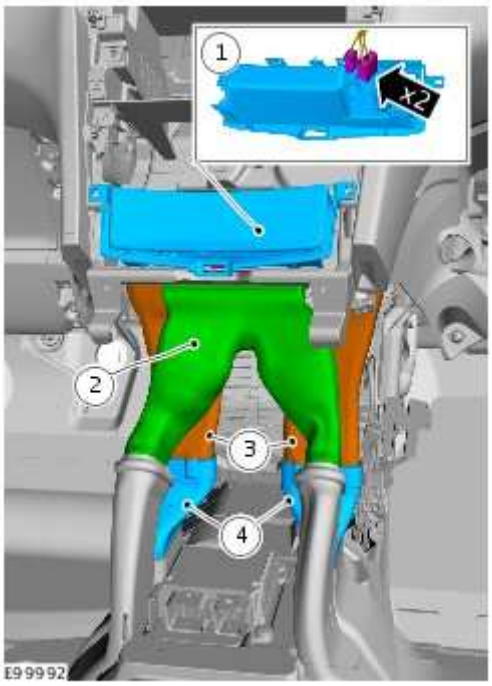


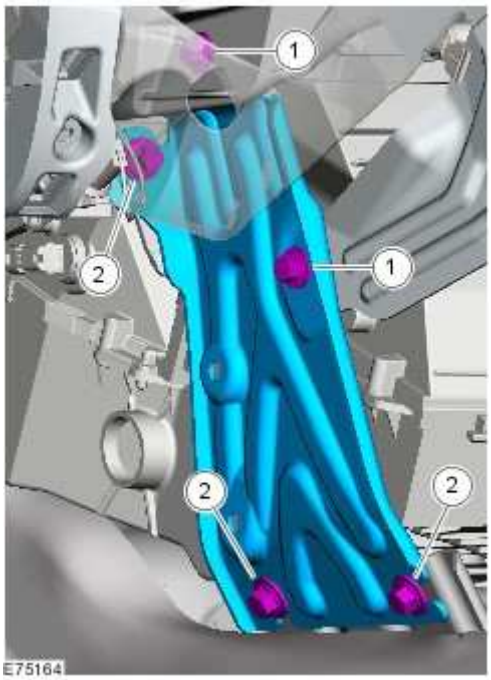
24.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

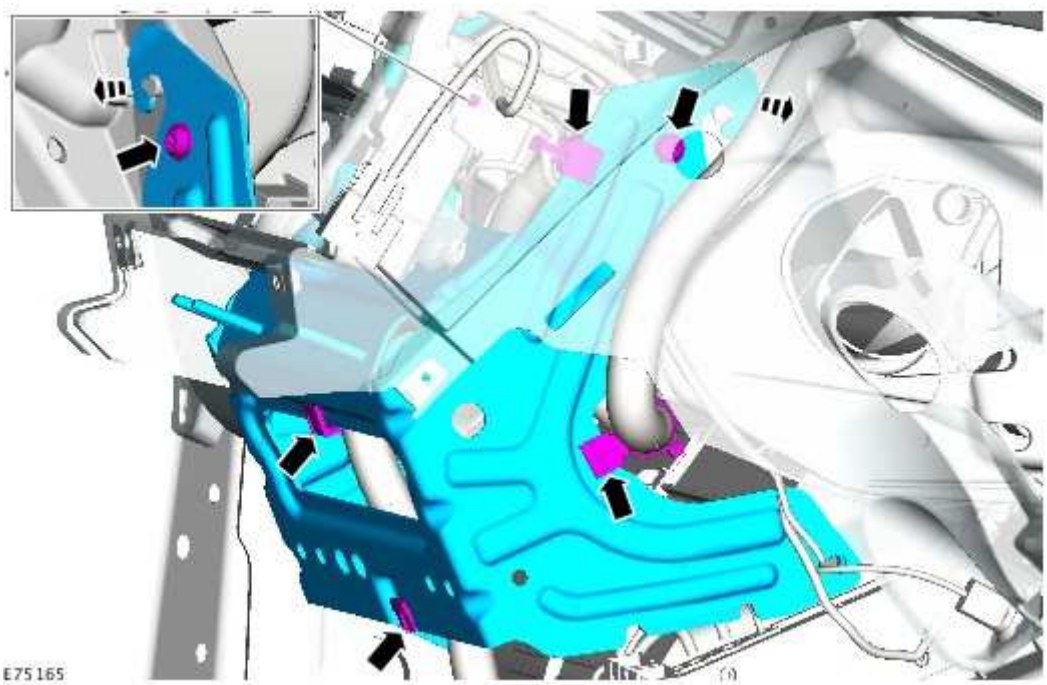
25.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

http://vnx.su

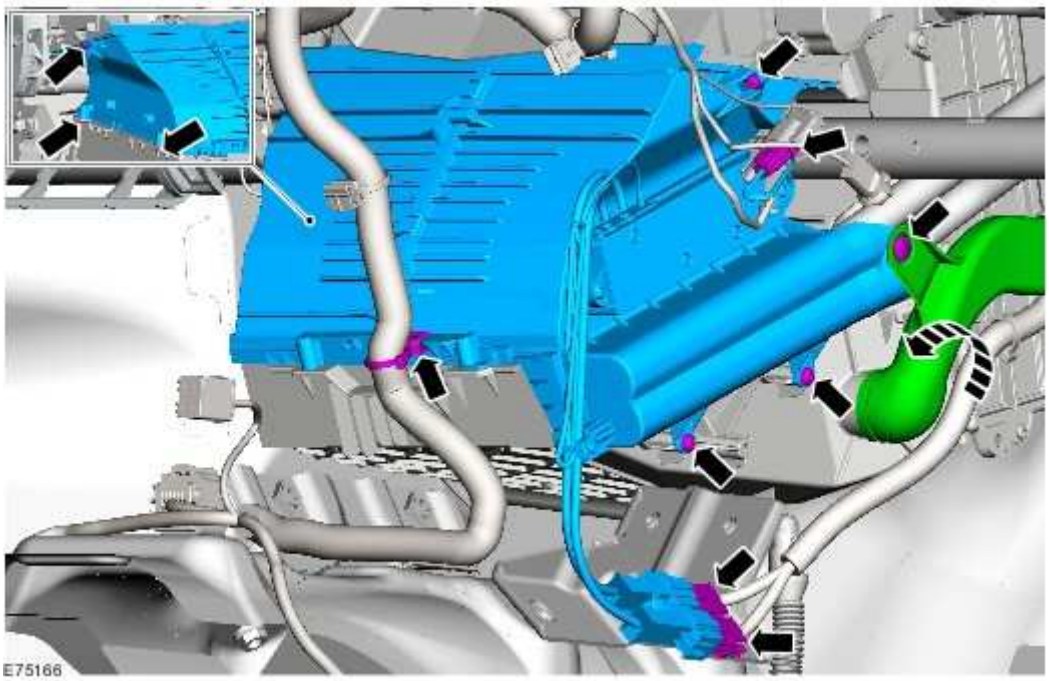


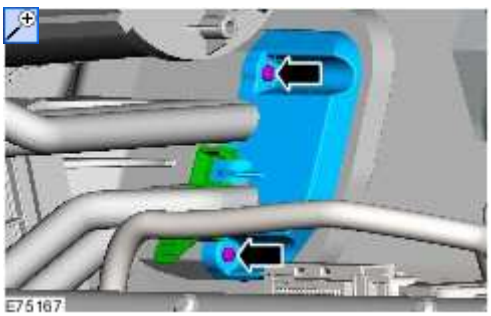
26. *Torque:* 9



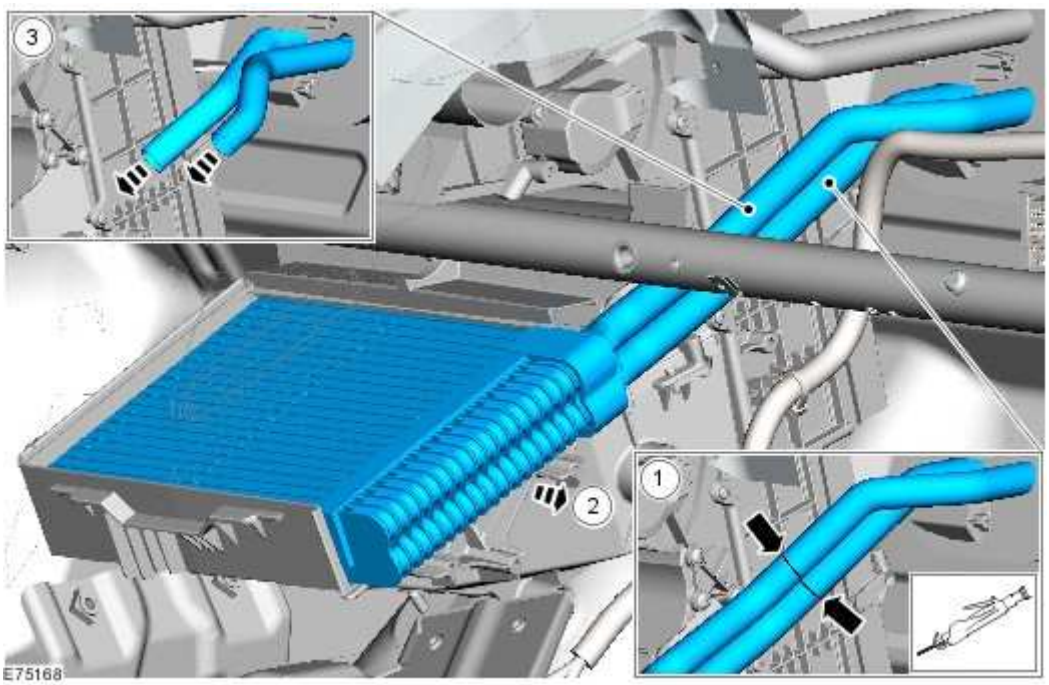
27.

http://vnx.su





28.



29.

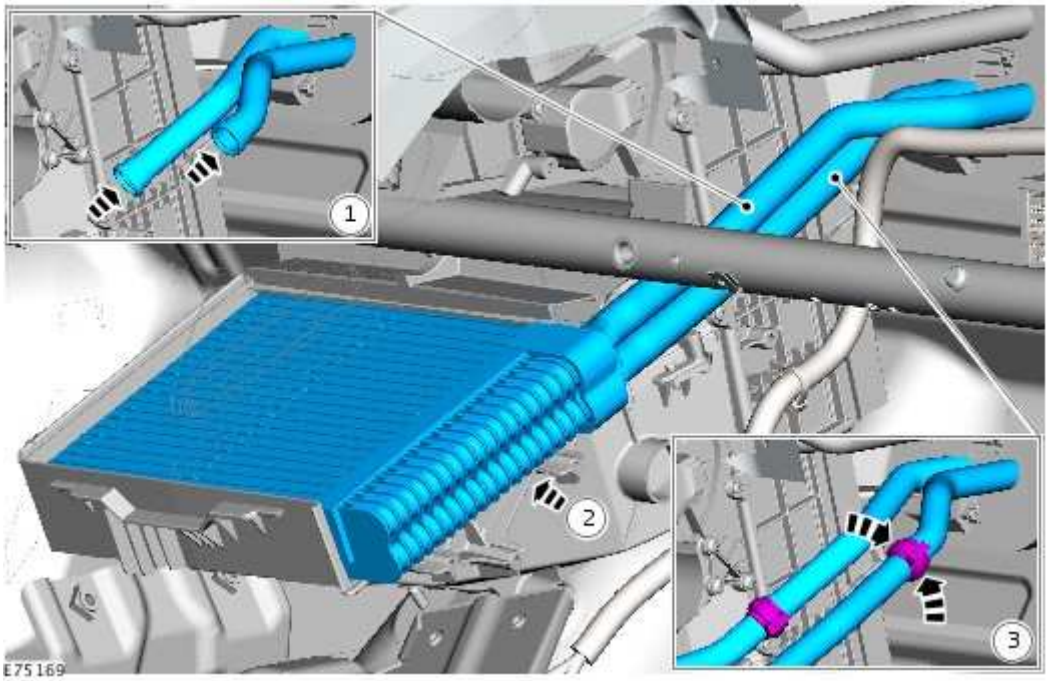
1. Saw
thro
the
cool
lines

Installation

1. To install,
reverse th
removal

http://vnx.su

procedure.



2. Check the coolant level.

   Refer to: Cooling System Draining, Filling and Bleedi (303-03A Engine Cooling - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160 - MI4, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleedi (303-03C Engine Cooling - 2.5L Duratec (162kW/220PS) - VI5, General Procedures).
   Refer to: Cooling System Draining, Filling and Bleedi (303-03D Engine Cooling - 1.8L Duratorq-TDCi (74kW/100PS) - Lynx/1.8L Duratorq-TDCi (92kW/125PS) - Lynx, General Procedures).

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

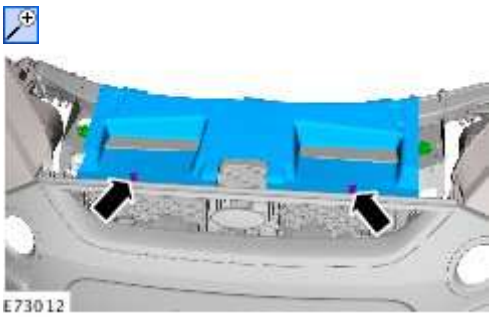
NOTE: Removal steps in this procedure may contain installation details.

1. Evacuate the air conditioning (A/C) system.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the right-hand headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

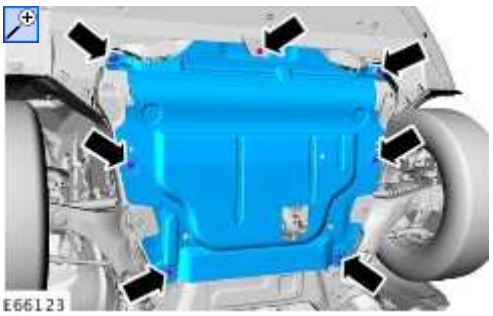
3. *Torque:* 5 Nm



4.

5. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



6.

7.

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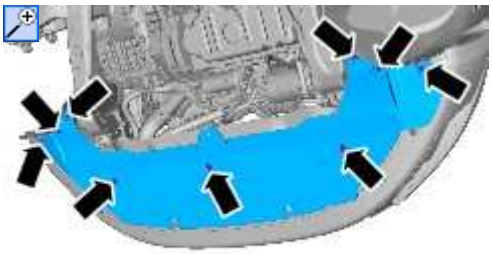


E68962

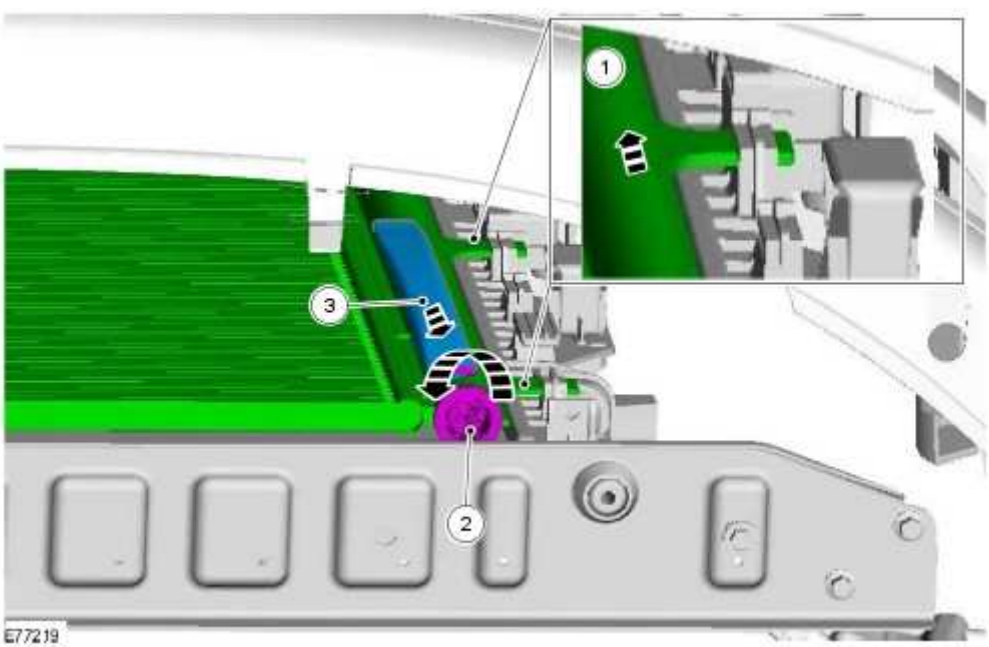
Vehicles with intercooler

8. Remove the intercooler.

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).

All vehicles

9.



E77219

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. Install the components in reverse order.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

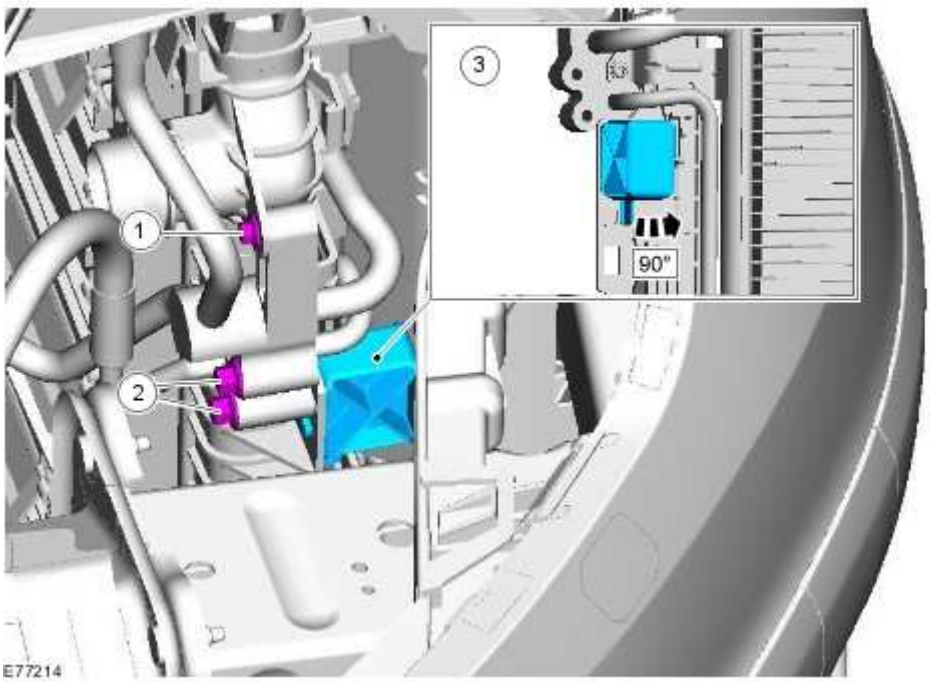
NOTE: Removal steps in this procedure may contain installation details.

1. Evacuate the air conditioning (A/C) system.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

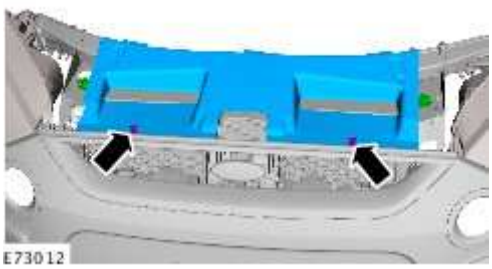
2. Remove the right-hand headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



3.
   1. *Torq*
      5 Nr
   2. *Torq*
      24 N

4.



5. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

6.

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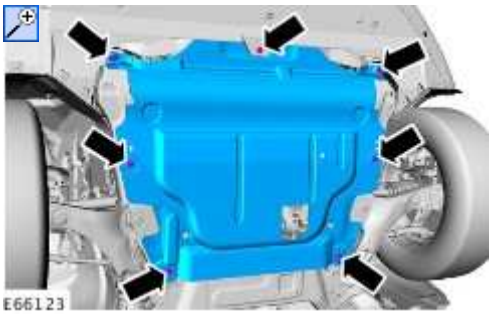
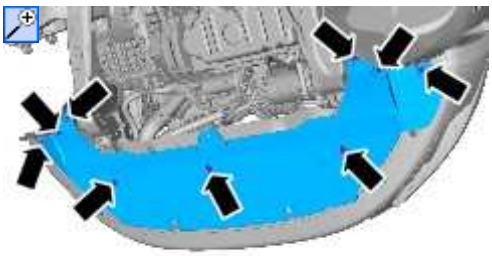

E66123


E68962

7.

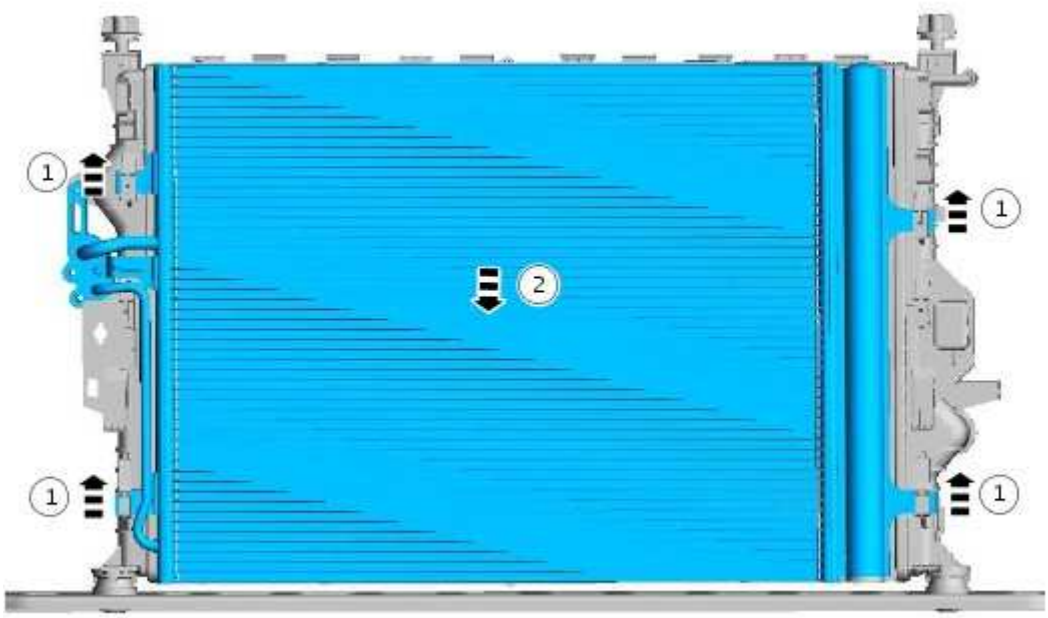
Vehicles with intercooler

8. Remove the intercooler.

   Refer to: Charge Air Cooler (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stag IV/Stage V, Removal and Installation).

All vehicles

9.



E77215

Installation

1. Coat the O-rings on the refrigerant lines.

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Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. Install the components in reverse order.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

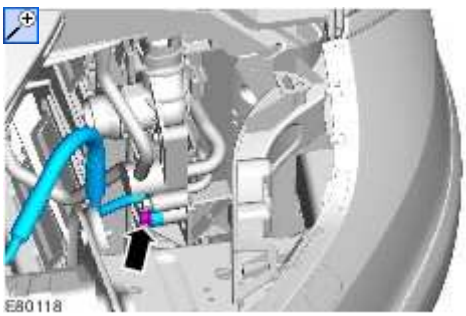
Removal

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

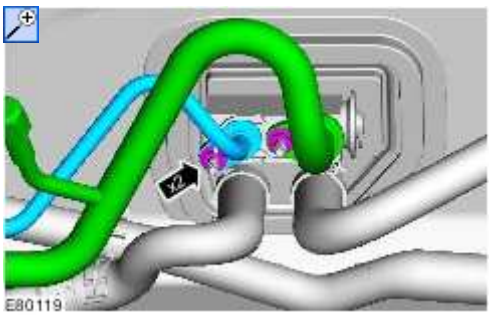
1. Carry out the air conditioning (A/C) system recovery procedure.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the right-hand head lamp unit.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



3. *Torque:* 24 Nm



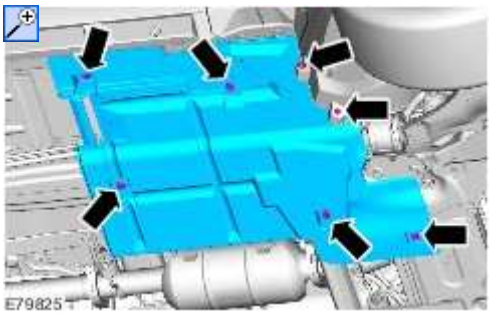
4. *Torque:* 8 Nm

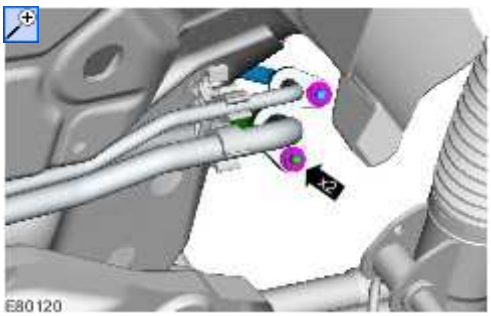
Vehicles with additional air conditioning system

5. Raise vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.

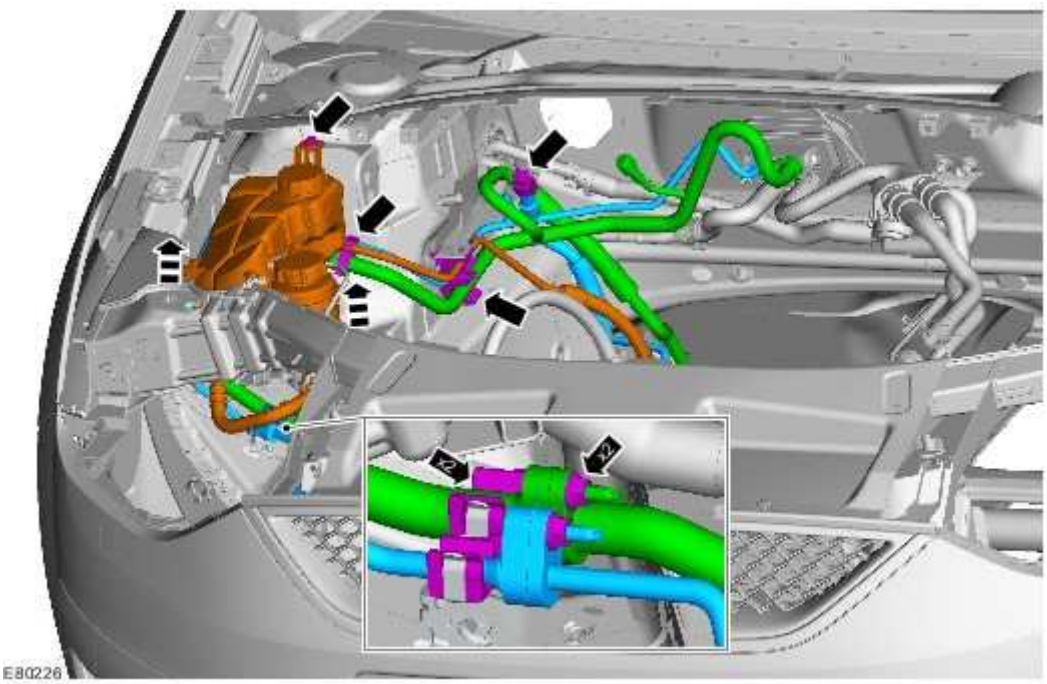
http://vnx.su





7. *Torque:* 8 Nm

All vehicles



8. *Torque:* 8 Nm

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)
2. To install, reverse the removal procedure.

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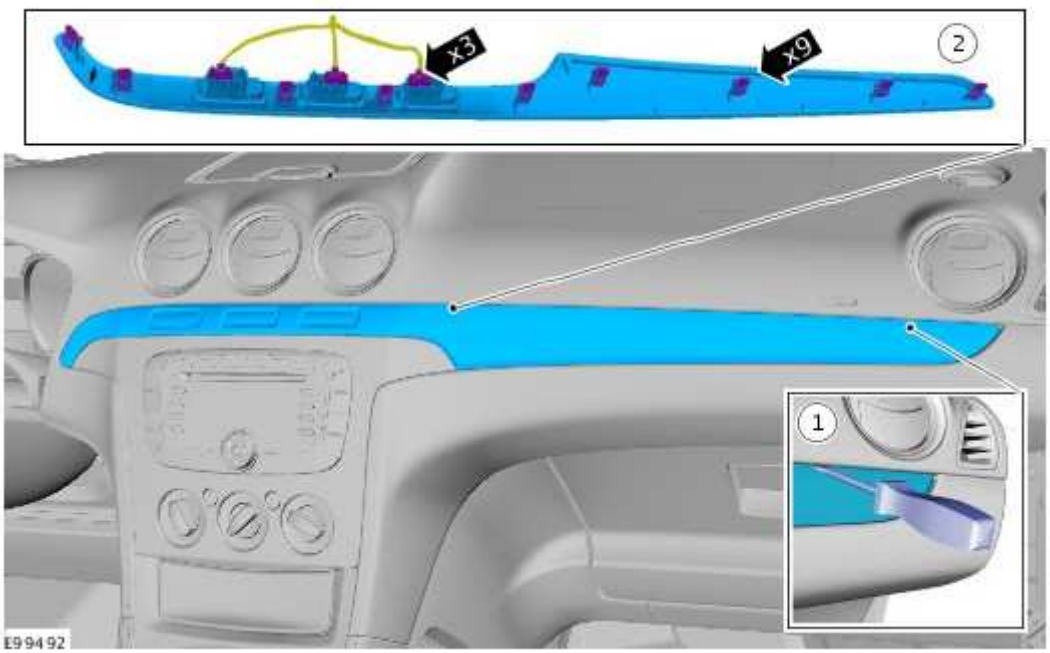
Removal and Installation

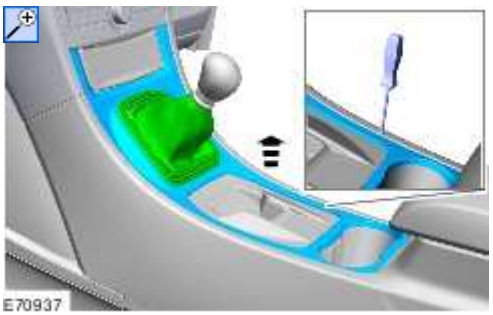
General Equipment

Audio unit removal tools (GV3301)
Ford diagnostic equipment
Schlitzschraubendreher

Removal



1. CAU
suitable
material
damage
compone
General
Schlitzsc

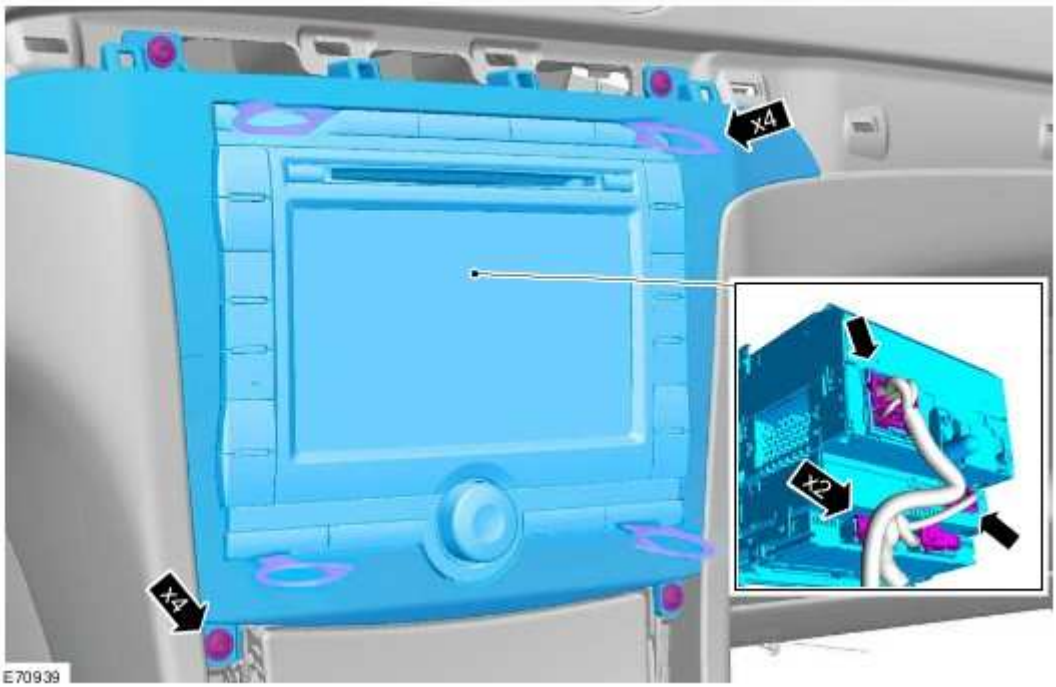


2. CAUTION: Use suitable packing material to av
to the component.
General Equipment: Schlitzschraubendreher

Vehicles built up to 05/2007

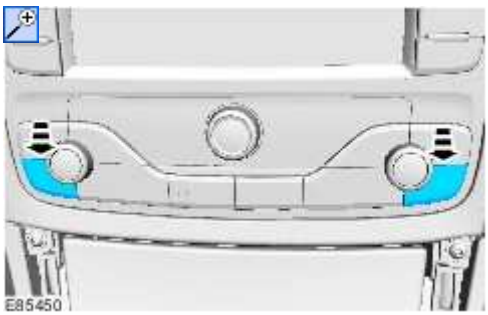
3. *General*
Audio un
tools (GV

http://vnx.su

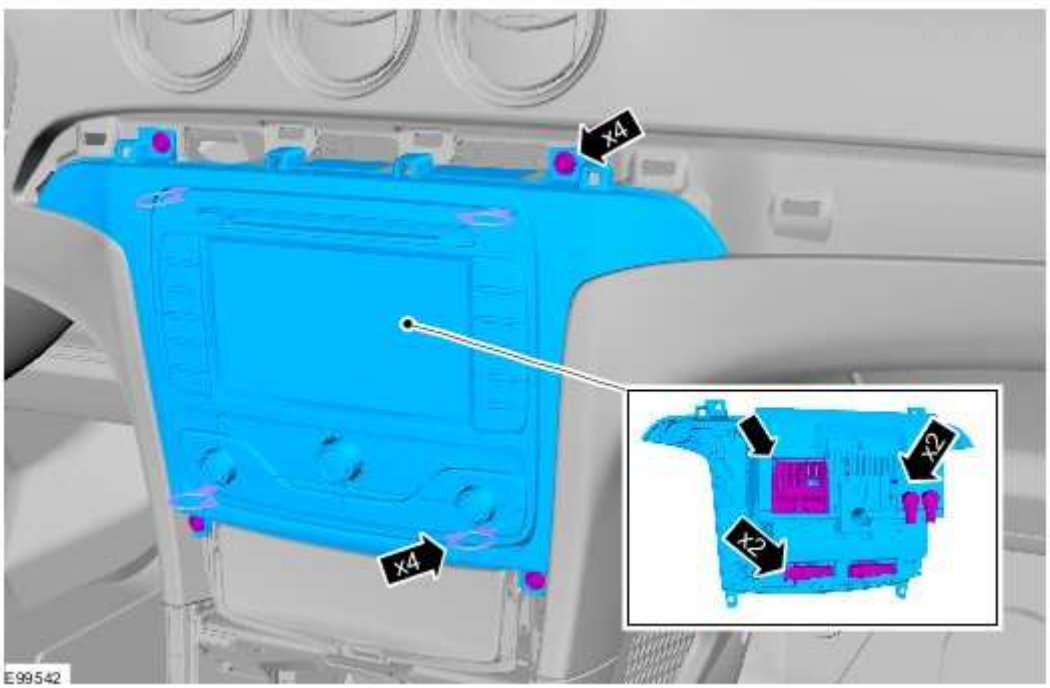


Vehicles built from 05/2007

4.



5. *General*
Audio un
tools (G\



All vehicles

6.

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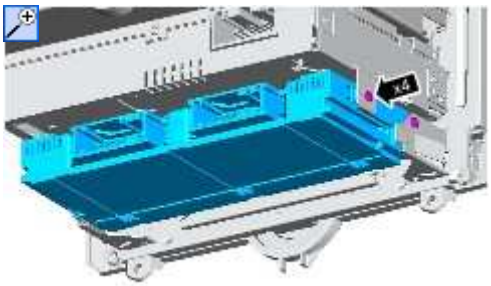

E75133

Installation

1. NOTE: New units must be configured using the Pro
   Module Installation Routine in the diagnostic tool.
   Install the components in reverse order.

   General Equipment: Ford diagnostic equipment

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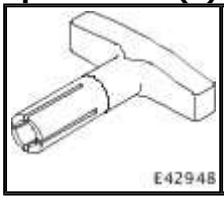
Disassembly and Assembly

Special Tool(s)

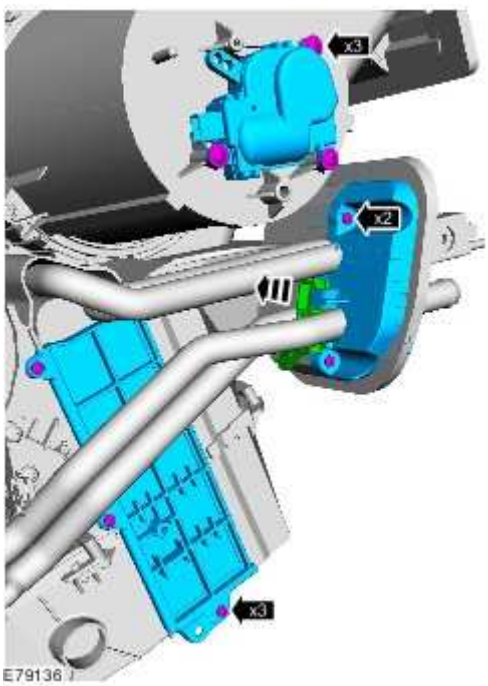
 E42948	412-131 Remover/Installer, Blower Engine

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Disassembly

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

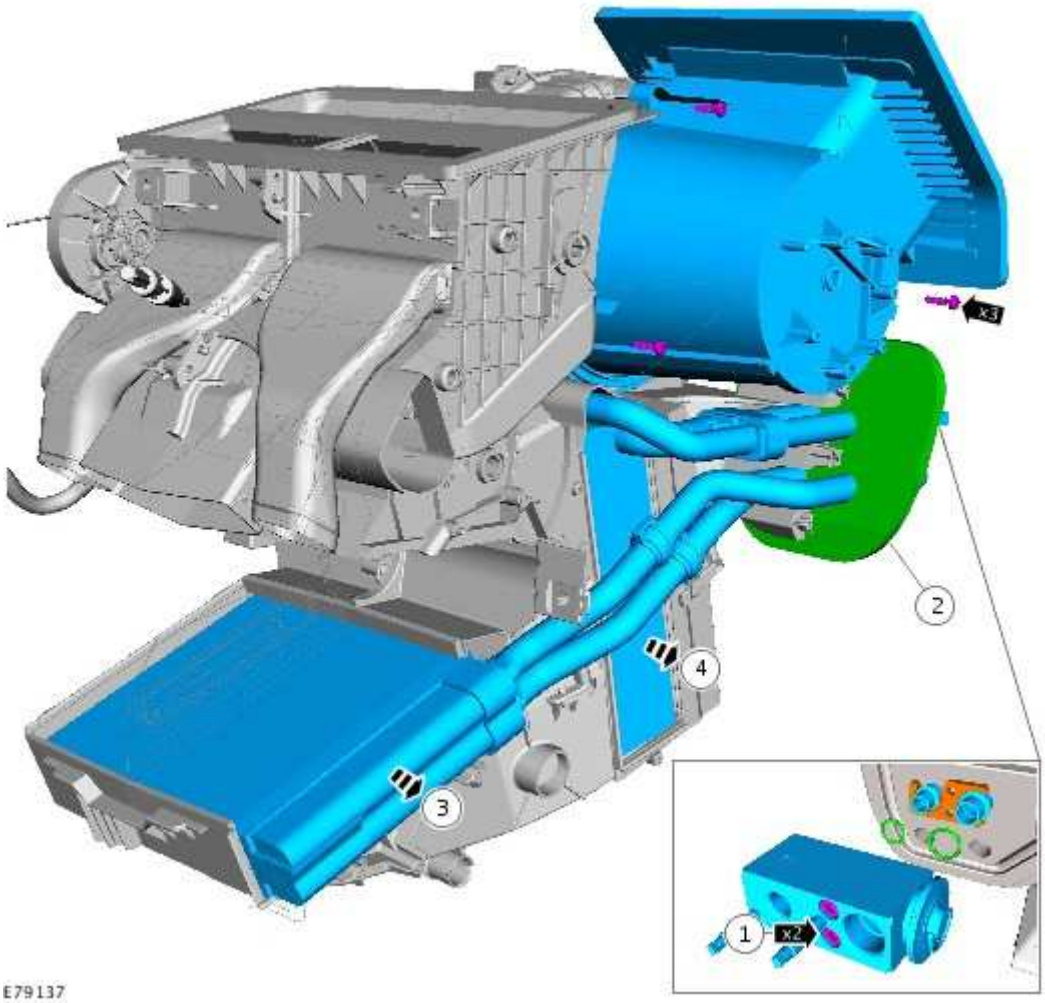


1.

2.

1. *Torq*
   4 Nr

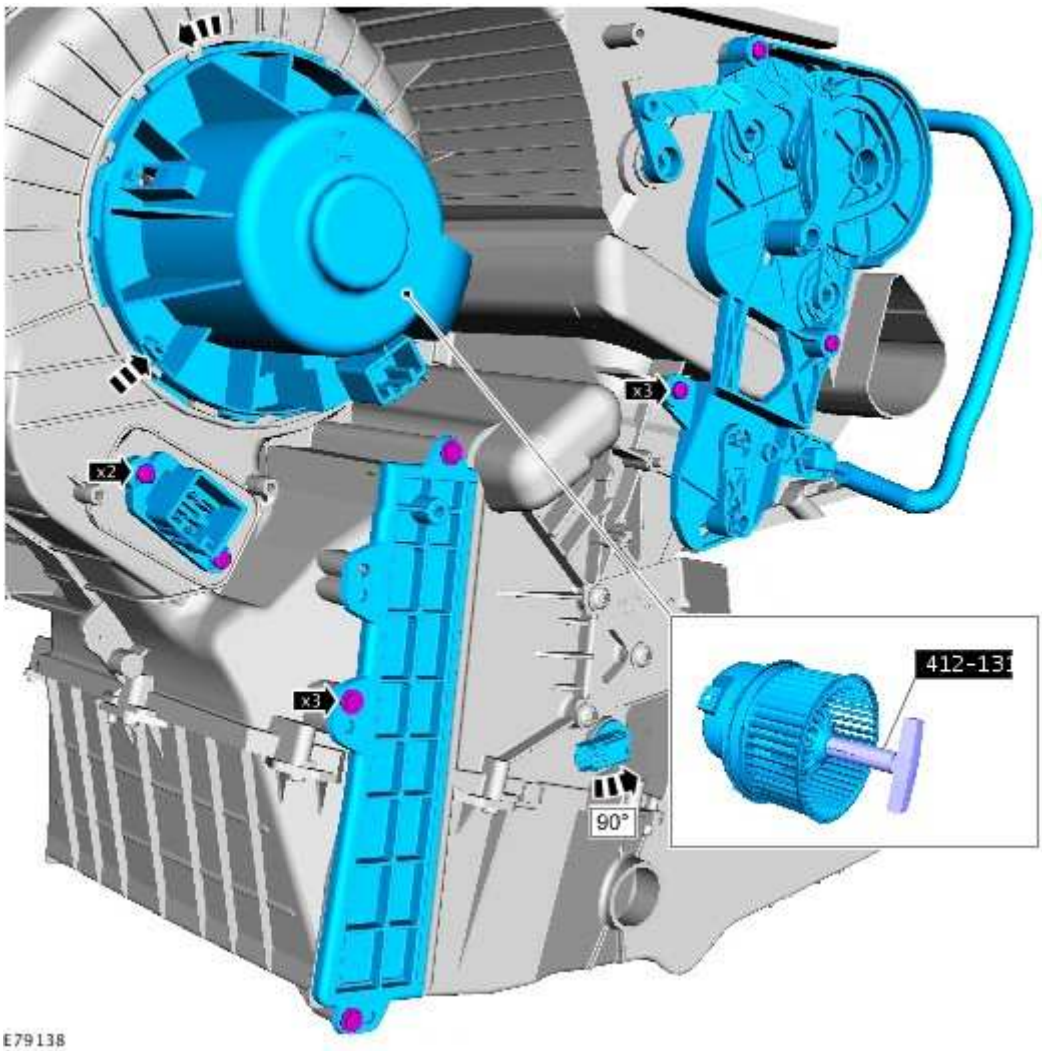
http://vnx.su



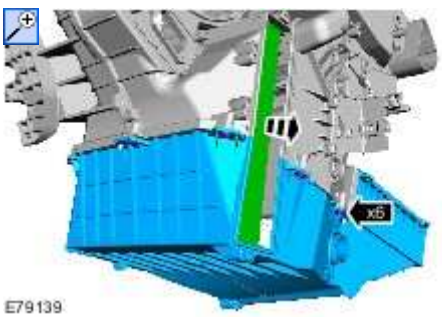
E79137

3. *Special To*
(s): 412-1

http://vnx.su



E79138



E79139

4.

Assembly

5. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

6. To install, reverse the removal procedure.

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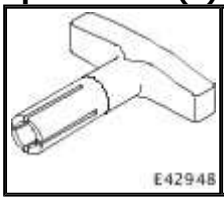
Disassembly and Assembly

Special Tool(s)

 E42948	412-131 Remover/Installer, Blower Engine

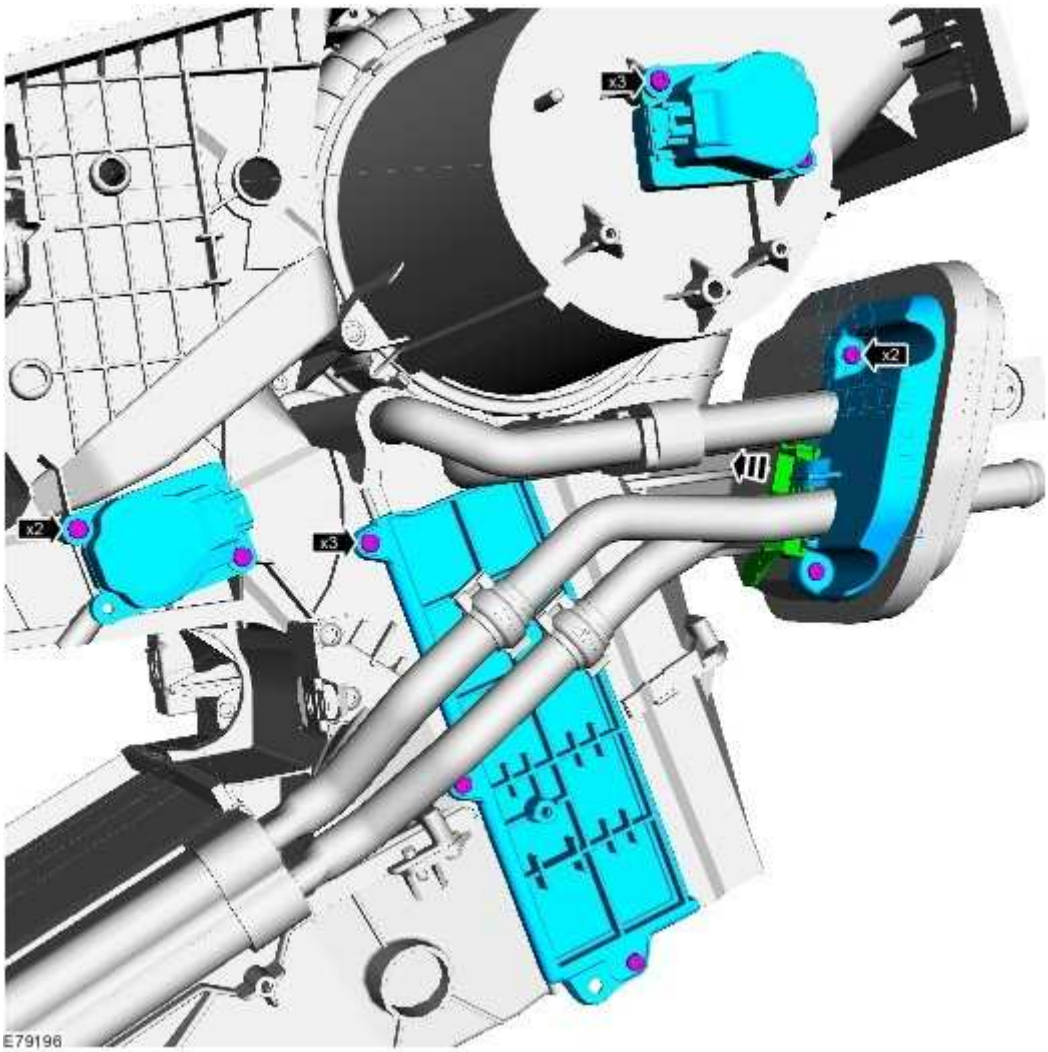
Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Disassembly

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

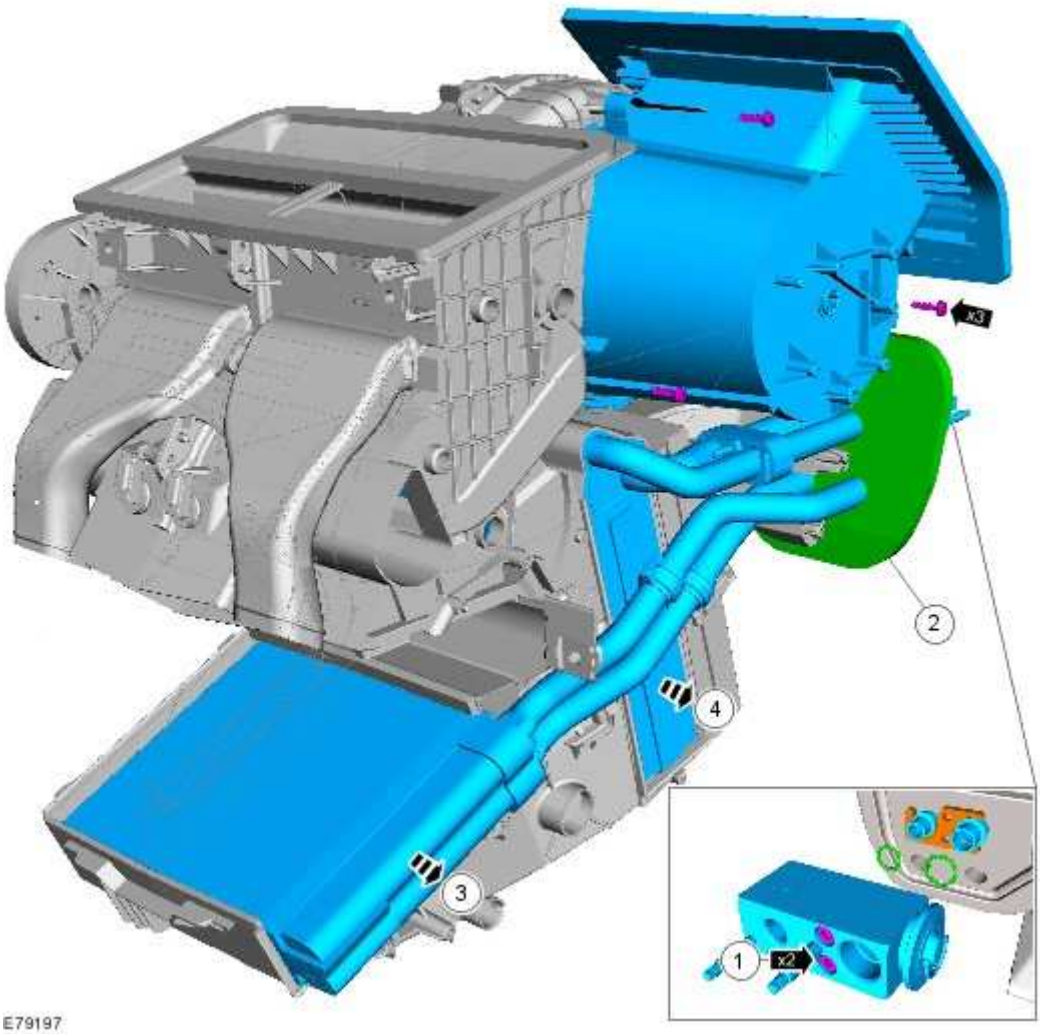
1.



2.

1. *Torq*
   4 Nr

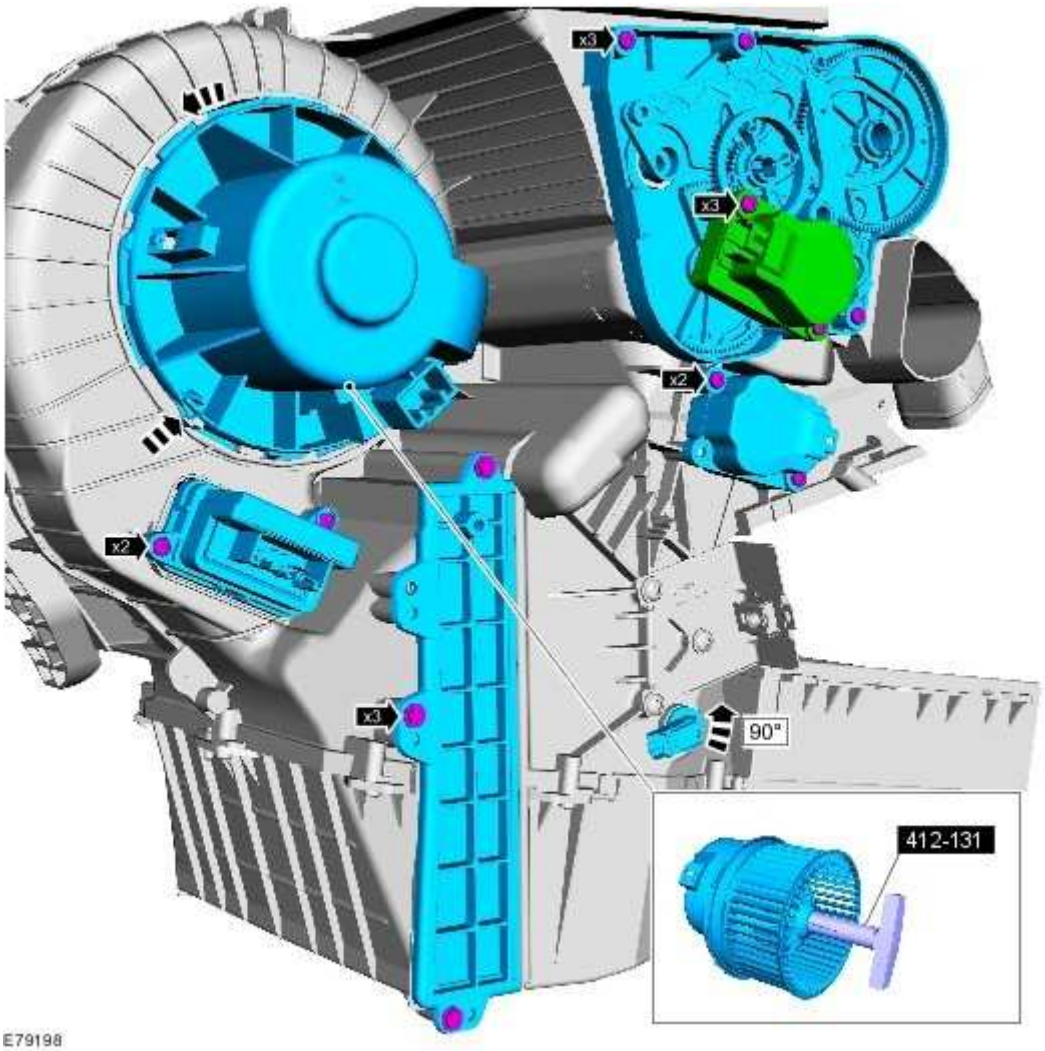
http://vnx.su



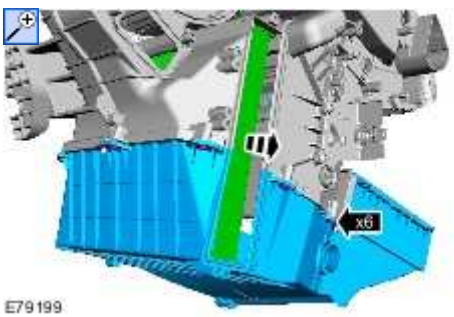
E79197

3. *Special To*
(s): 412-1

http://vnx.su



E79198



E79199

4.

Assembly

5. To install, reverse the removal procedure.
6. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

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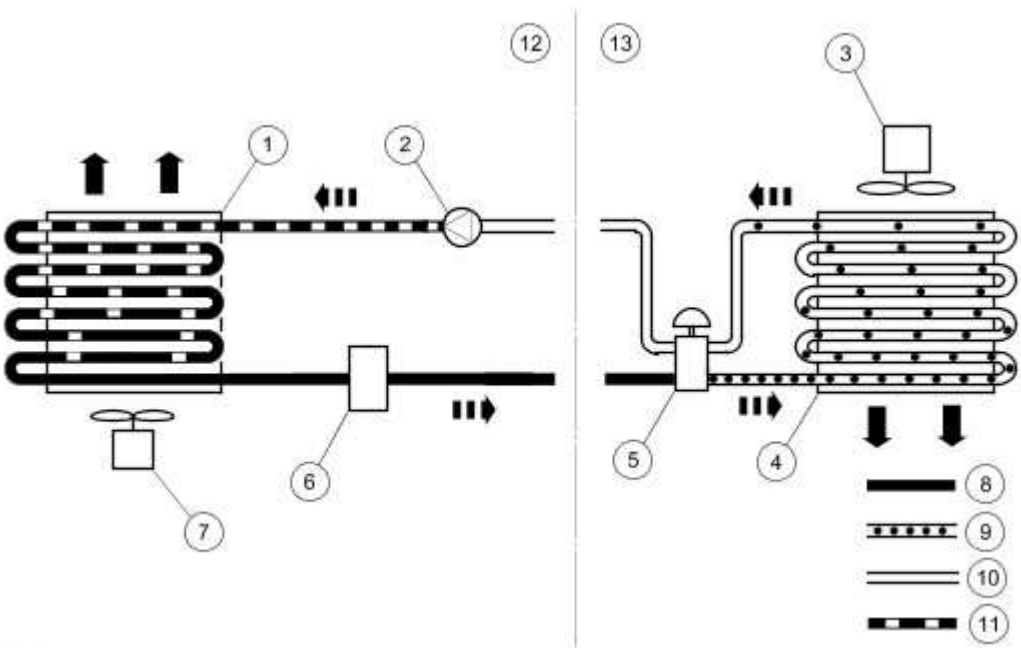
Description and Operation

Refrigerant circuit



E69433

Item	Description
1	Condenser
2	A/C compressor
3	Blower motor
4	Evaporator
5	Expansion valve with electric shut-off valve
6	Refrigerant drier
7	Cooling fans.
8	High - pressure (liquid and warm)
9	Low - pressure (liquid and cool)
10	Low-pressure (gaseous and cool)
11	High pressure (gaseous and hot)
12	Front air conditioning system
13	Additional air conditioning system

Overview - refrigerant lines - additional air conditioning system

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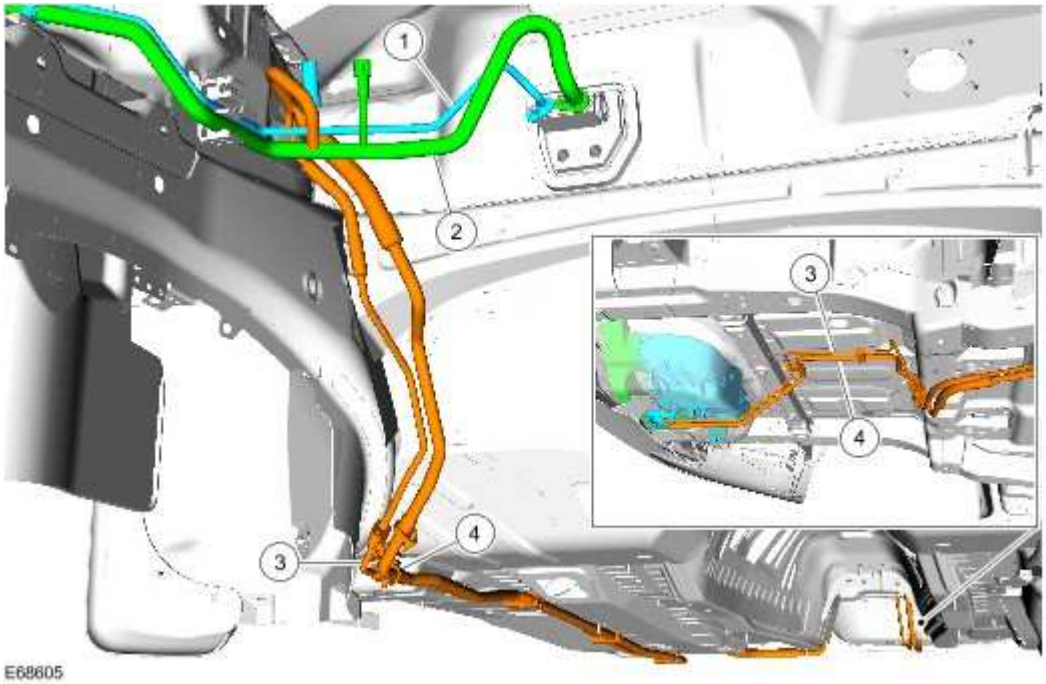
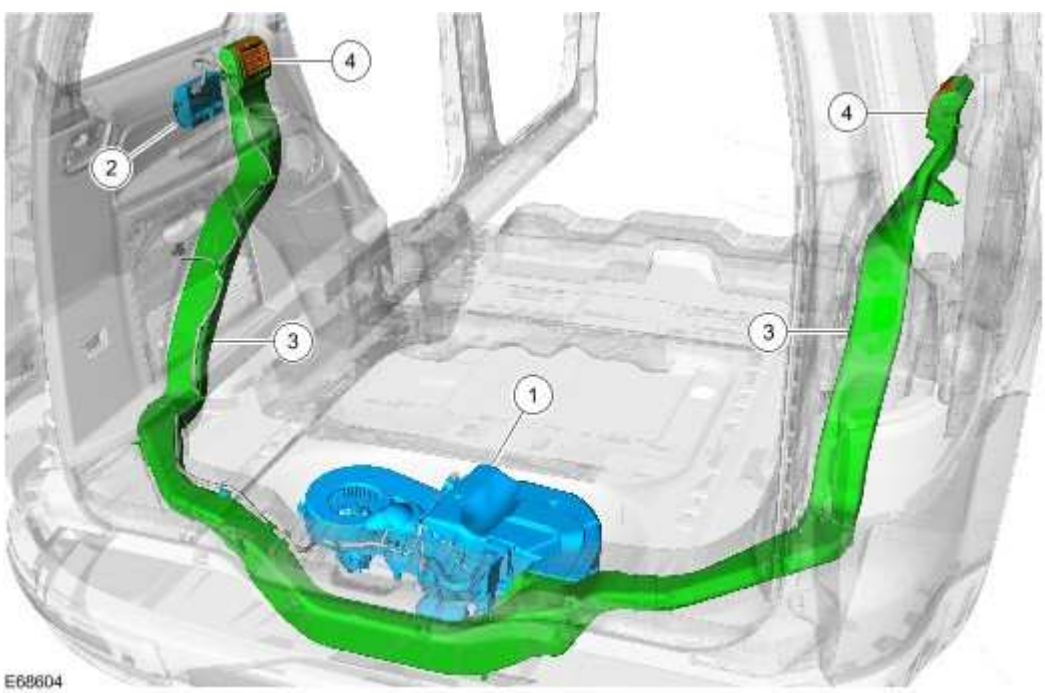


Item	Part Number	Description
1	-	Evaporator inlet line - front air conditioning system
2	-	Evaporator inlet line - front air conditioning system
3	-	Evaporator inlet line - additional air conditioning system
4	-	Evaporator outlet line - additional air conditioning system

Air distribution - additional air conditioning system



Item	Part Number	Description
1	-	Housing - additional air conditioning system
2	-	Auxiliary climate control module
3	-	Air ducts.
	-	

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4		Air outlet vents

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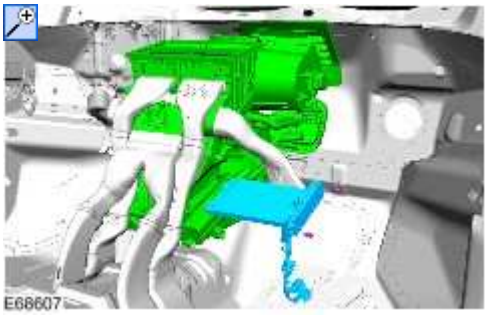
Description and Operation

Electric booster heater



In diesel vehicles which give off little residual heat, a booster heater is used to heat the passenger compartment rapidly in the case of low ambient temperatures.

If the interior temperature is set to "HI" on the control assembly of the climate control or the heater controls are set to their highest setting then the DEATC (electronic temperature control) module sends an "electric booster heater ON" request signal via the MS CAN bus to the generic electronic module (GEM). If a manual air conditioning system is installed, the signal is transmitted via a conventional cable connection.

The GEM switches the electric booster heater according to the available alternator capacity.

The electric booster heater consists of three individual heating elements, which are incorporated into a single housing.

The electric booster heater electronics activates three output stages depending on a pulse width modulated signal (PWM) generated by the GEM. The output stages switch the three heating elements of the electric booster heater ON or OFF individually, whereby the heating periods of the individual elements can overlap. Due to the variable switch-on duration, continuously variable temperature control is possible. The overall heating power of the three heating elements is linearly proportional to the PWM signal. If the PWM signal is below 10% or above 95%, the electric booster heater is not activated.

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Description and Operation

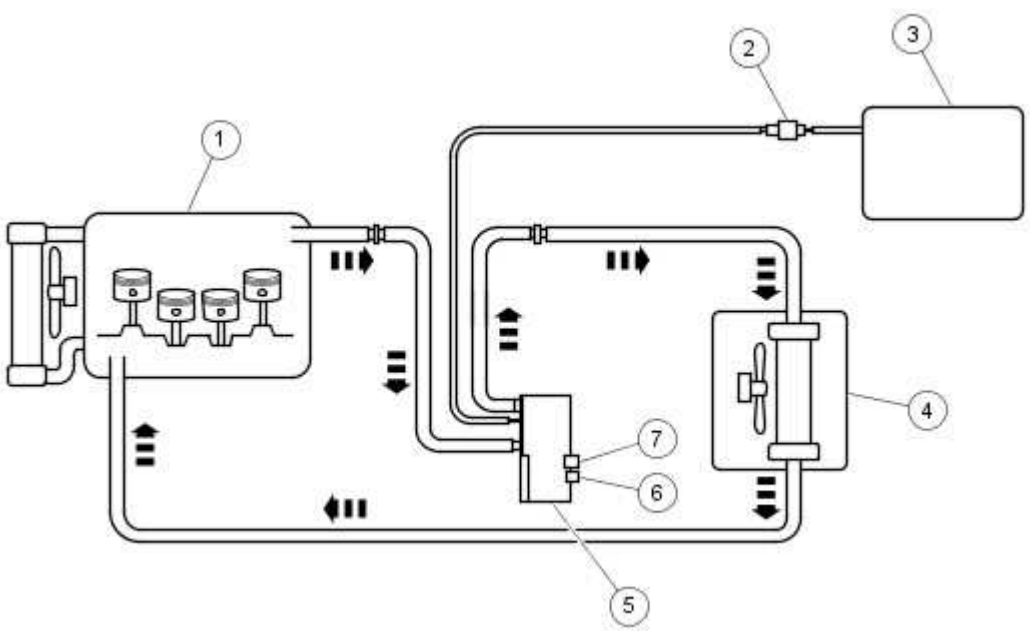
Principles of Operation

The fuel-fired additional heater provides extra heat to the passenger compartment if the heat emitted by the engine is not sufficient (boost heater function).

By burning fuel, the fuel-fired additional heater generates heat which is conveyed via the coolant circuit to the engine and the passenger compartment.

If a fuel-fired booster heater is fitted, there is no electric booster heater

Schematic representation - vehicles with non-programmable additional heater



E69468

Item	Part Number	Description
1	-	Vehicle engine
2	-	Fuel pump module
3	-	Fuel tank
4	-	Heat exchanger with blower motor
5	-	Auxiliary Heaters
6	-	Exhaust pipe
7	-	Air inlet

Schematic representation - vehicles with programmable additional heater

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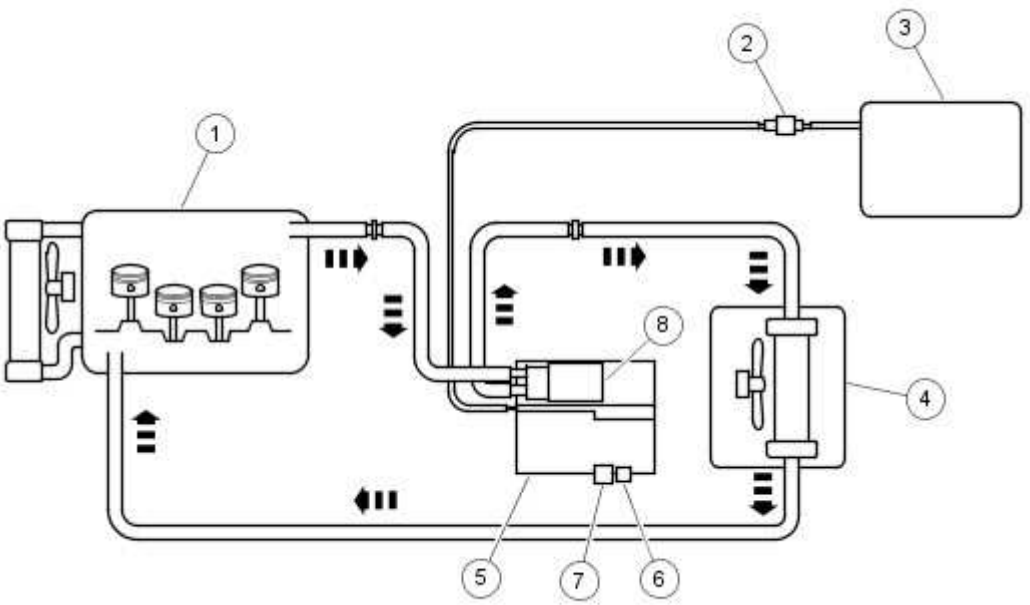

E69469

Item	Part Number	Description
1	-	Vehicle engine
2	-	Fuel pump module
3	-	Fuel tank
4	-	Heat exchanger with blower motor
5	-	Fuel fired booster heater
6	-	Air inlet
7	-	Exhaust pipe
8	-	Wate pump

Overview - Fuel-fired additional heater

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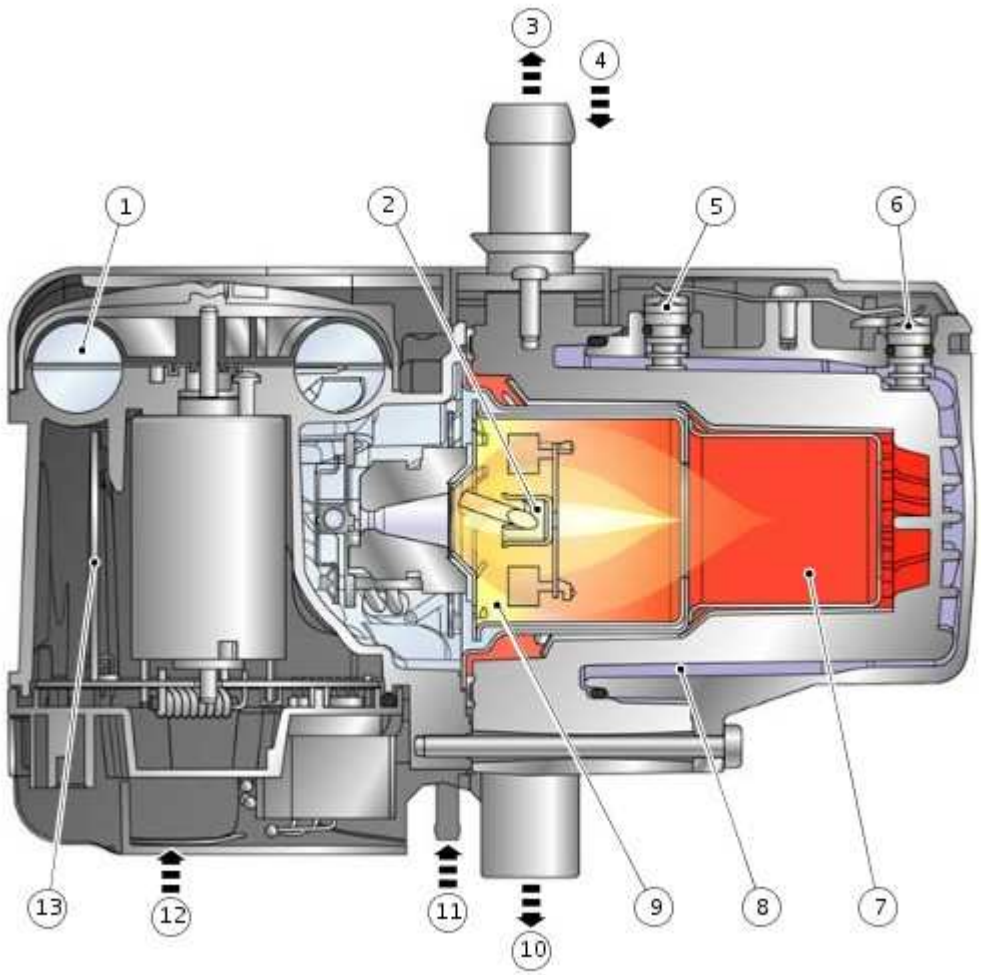

E122703

Item	Part Number	Description
1	-	Combustion air blower
2	-	Glow plug
3	-	Water outlet
4	-	Water ingress
5	-	Temperature sensor
6	-	Overheat Sensor
7	-	Burner
8	-	Heater core.
9	-	Venturi burner
10	-	Exhaust gas leakage.
11	-	Fuel entry
12	-	Combustion air entry
13	-	Electronic Control Unit

Additional heater operation (diesel vehicles only)

When the engine is running, the fuel-fired additional heater assists the engine in heating up the passenger compartment at low ambient temperatures, if the vehicle has an engine that gives off only a small amount of heat.

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When the coolant temperature reaches a minimum value, the control unit transmits a switch-on signal for the passenger compartment blower via the CAN bus in vehicles with automatic air conditioning. When the coolant temperature drops, the blower remains on until the temperature reaches around 20 °C whereupon it is deactivated. On vehicles with manual air conditioning, the driver must switch the blower on.

The fuel tank must be filled to at least 14% for the system to be switched on. If the fuel level drops below 8% then the system is switched off.

In boost mode, the fuel-fired additional heater is only switched on if all of the following criteria are met:

- Engine speed above 500 rpm The fuel-fired additional heater is not allowed to start up while the engine is being cranked; this prevents a shut-down due to low voltage if the battery charge is low.
- Ambient temperature below 5 °C
- Fuel level above 14% of total capacity.
- Switch is at "on" position on the trip computer menu.

One of the following conditions is sufficient to switch off the additional heater in boost heat mode:

- Engine speed below 500 rpm.
- Ambient temperature above 11 °C.
- Switch is at "off" position on the trip computer menu.
- Fuel level below 8% of total capacity.

Fuel powered booster heater with additional parking heater function

The fuel powered booster heater with additional parking heater function has two modes of operation: immediate start-up and programmed start-up.

The heater status is displayed on the instrument cluster display. The parking heater mode is controlled via a menu on the driver information system. The fuel-fired additional heater can be activated and deactivated via the driver information system. (If set to '"Auto" the system is activated, if set to "Off" the system is completely deactivated.) The system is operated from a control menu on the steering wheel.

Immediate start-up of the fuel powered booster heater

This function enables the fuel-fired additional heater to be switched on manually when the engine is not running. The function is activated using the steering wheel control menu in the driver information system.

The ignition key must be in the "II" position before this menu can be used. The timer function for the fuel powered booster heater remains active when the ignition key is in position "0".

After an immediate start-up of the fuel powered booster heater it is switched off again after 30 minutes (or if the fuel level in the fuel tank drops below 8%). The fuel powered booster heater stops within 2 minutes of the engine starting. This leaves enough time to check whether the switch-on conditions for boost heat mode have been met, thus preventing the fuel powered booster heater from having to switch off and switch back on again. The heater can be switched off manually at any time from the menu.

Programmed start-up of the fuel powered booster heater

The driver can use a menu to adjust the time at which the vehicle is to be pre-heated. The following options are available:

- Time setting. One or two times can be programmed for each day of the week. It is possible to program days either individually or together in groups (Mon-Sun/Mon-Sat/Mon-Fri).

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- Time and date setting

With the first option, the fuel-fired additional heater will start repeatedly without needing to be reprogrammed. However, if the engine has not been running since the last programmed start, the fuel powered booster heater will not start up a second time to prevent the battery from being discharged.

The length of time required to pre-heat the vehicle is calculated in the control unit of the fuel-fired additional heater and is based on two temperature values:

- Ambient air temperature: this message is taken from the Generic Electronic Module (GEM) via the CAN bus.
- Coolant temperature: this is determined via an internal sensor in the fuel-fired additional heater.

The maximum heating time is 30 minutes at an outside air temperature of -10°C or lower. The heating time decreases proportionally as the ambient temperature increases until the ambient temperature is +15°C. Then the minimum heating time is 10 minutes. The parking heater is deactivated at temperatures above +15°C.

The sequence for a programmed start of the fuel powered booster heater is as follows:

- Two minutes before the start of the maximum heating time the driver information system/instrument cluster sends an activation message to the fuel-fired additional heater via the CAN bus.
- The fuel-fired additional heater calculates the required heating time and, if necessary, sends a delay request on the CAN bus.
- At the calculated time, the fuel-fired additional heater starts up. The conditions for start-up are: engine not running and fuel level above 14% of total capacity.
- When the coolant temperature reaches around +30°C , the fuel-fired additional heater sends a request to switch on the passenger compartment blower.
- Eight minutes after the programmed switch-off time, the fuel powered booster heater stops heating mode and starts a run-on operation to clean the system's spark plugs.
- Ten minutes after the switch-off time, the post-cleaning operation is complete. The additional ten minutes run-on time provides some leeway in case the driver is late arriving.

After a programmed start-up of the fuel powered booster heater, it is switched off again after the heating time has elapsed (or if the fuel level in the fuel tank drops below 8%). The fuel powered booster heater stops within 2 minutes of the engine starting. This leaves enough time to check whether the switch-on conditions for boost heat mode have been met, thus preventing the fuel powered booster heater from having to switch off and switch back on again. The heater can be switched off manually at any time from the menu.

Whilst the fuel-fired additional heater is in additional heating mode and/or parking heating mode, the instrument cluster receives a fuel consumption signal; this is used to re-calculate the vehicle's remaining range and fuel consumption data.

Emergency shutoff

In the event of an accident in which the airbags are deployed, the fuel powered booster heater module receives a message on the CAN bus from the restraints control module (RCM). When this signal is received, the fuel powered booster heater system is immediately deactivated .

The fuel powered booster heater module deactivates the system and does not respond to further messages on the CAN bus. The fuel powered booster heater module needs to be activated with the diagnostic unit.

Initial operation

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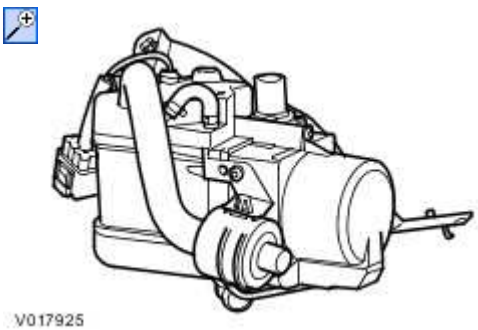
The fuel powered booster heater needs to be filled before being operated for the first time. Activation of the fuel pump for the fuel powered booster heater is controlled by the diagnostic unit.

Fuel fired booster heater



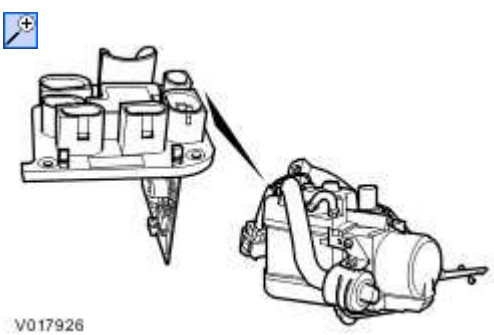
The fuel powered booster heater has the following internal electrical components:

- Fuel-fired additional heater control module
- Combustion Air Blower
- Glow Plug
- Water temperature sender unit
- Overheating sensor
- Fuel preheater (diesel vehicles only)

The fuel powered booster heater has the following external electrical components:

- Wate pump
- Fuel pump module
- Remote start equipment (special accessory)

Fuel-fired additional heater control module



The fuel powered booster heater module is fitted with an external central connector for connecting it to the vehicle, a coolant pump and a fuel pump. The other 3 connectors are covered by a plastic cover and are used for the internal electrical components. The blower motor is connected directly to the fuel powered booster heater module board from underneath with 2 pins. The fuel powered booster heater module receives signals from the individual temperature sensors and other components. Based on this data, the fuel powered booster heater module controls its start-up, power and switch off. The fuel powered booster heater module constantly monitors whether faults occur in the system during operation and saves these as fault codes.

Wate pump

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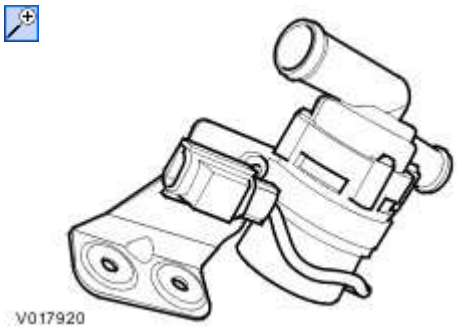
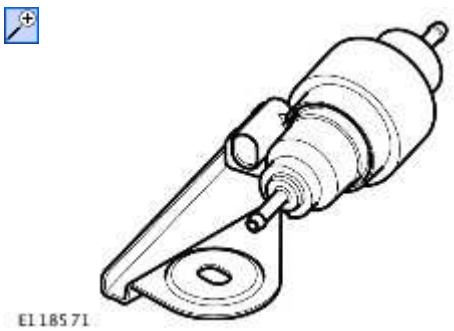


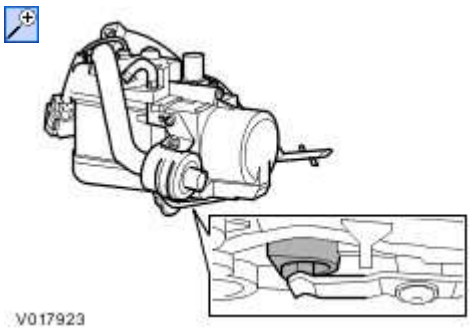
The coolant pump is located to the rear of the engine compartment near the bulkhead. The coolant pump is powered by a built-in electric motor and circulates the cooling fluid in the engine cooling system.

Fuel pump module



The fuel pump is an electric reciprocating pump that meters the correct quantity of fuel for the fuel powered booster heater. The power supply for the fuel pump is connected to the fuel powered booster heater module. By pulsing the voltage supply at a varying frequency, the fuel powered booster heater module can regulate the quantity of fuel supplied for combustion. The fuel pump is located close to the fuel tank and is connected to the fuel tank by a separate tank connection without a filter.

ECT sensor



The fuel powered booster heater module uses the coolant temperature sensor to determine the coolant temperature, which it then uses to set the starting and stopping time. The coolant temperature sensor is installed next to the overheating sensor below a cover on the underside of the fuel powered booster heater.

Overheating sensor

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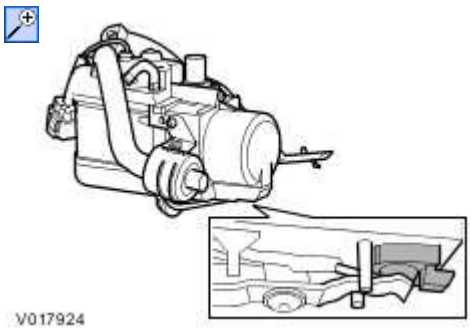
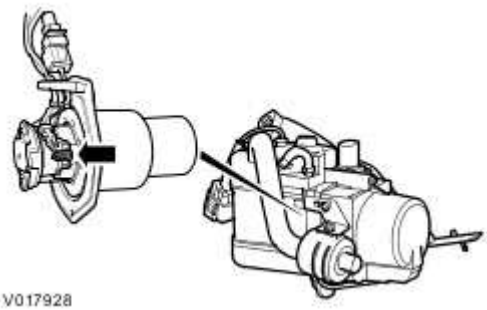


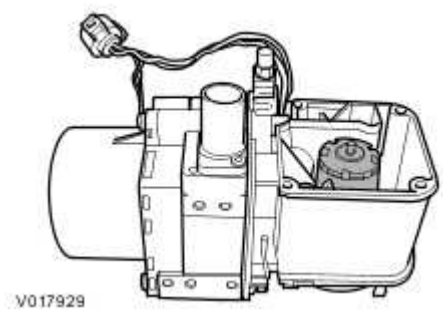
The overheating sensor enables the fuel powered booster heater module to determine the coolant temperature, protecting the heater from overheating. The overheating sensor is installed next to the coolant temperature sensor below a cover on the underside of the fuel powered booster heater.

Glow Plug



The glow plug is positioned in such a way that one section protrudes into the combustion chamber. It has a wire that starts to glow when it draws current from the fuel powered booster heater module. The flow plug is activated by the fuel powered booster heater module and ignites the fuel/air mixture in the combustion chamber. The fuel powred booster heater module also uses the glow plug to detect combustion in the combustion chamber. The signal from the glow plug is also used to switch off the fuel powered booster heater.

Combustion Air Blower



The combustion air blower draws in air from the air intake and forces it into the combustion chamber during combustion. The combustion air blower is built into the heater and is positioned below the fuel powered booster heater module.

Fuel preheater (diesel vehicles only)

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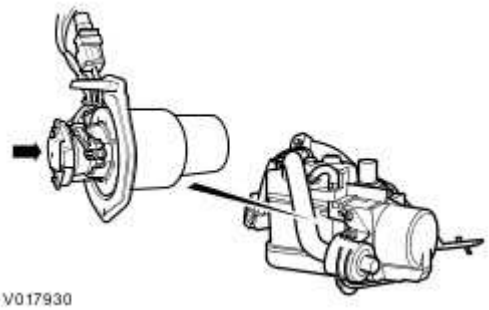

The fuel preheater is used to preheat the fuel in diesel vehicles to make it thinner in cold weather conditions. The heating coil in the fuel preheater is built into the heater next to the glow plug and is controlled by a pulse width modulated (PWM) signal.

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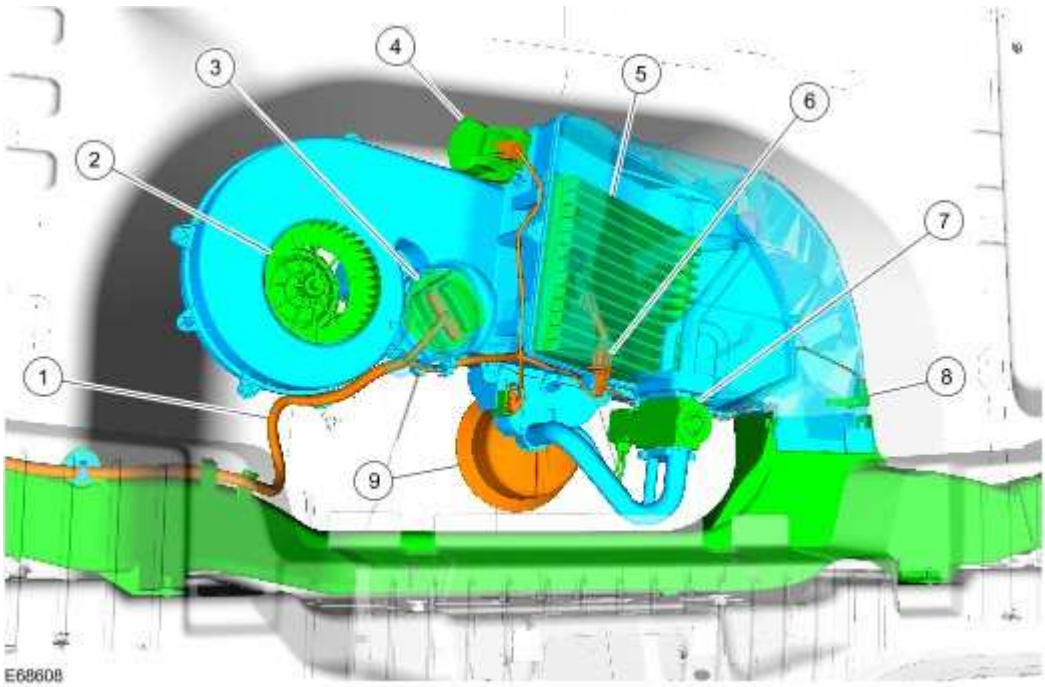
Description and Operation

Overview of the additional air conditioning system



Item	Description
1	Wiring harness - additional air conditioning system
2	Blower motor
3	Blower control module
4	Temperature control flap actuator
5	Evaporator
6	De-icing switch.
7	Expansion valve with electric shut-off valve
8	Air outlet temperature sensor
9	Refrigerant line conduit

Control assembly, climate control - vehicles with additional air conditioning system

The additional air conditioning system is only available on vehicles which are equipped with automatic temperature control

On vehicles with additional air conditioning the top right button on the control assembly for the climate control is used to switch on the additional air conditioning.

The additional air conditioning is controlled via the control assembly for climate control.

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Vehicles with additional air conditioning and automatic temperature control have a control assembly for climate control with the following button operated functions:

- Switching the additional air conditioning on/off
- Switching the air conditioning system on and off
- Temperature adjustment for the driver's side / front passenger's side
- Switching the windshield defrost function on and off
- Switching the electronic automatic climate control and the dual mode on and off
- Air distribution
- Blower control
- Switching off the dual automatic climate control
- Recirculated air control

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Removal and Installation

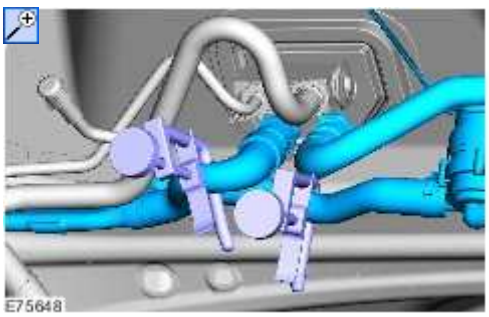
General Equipment

Hose clamp remover/installer

Removal

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

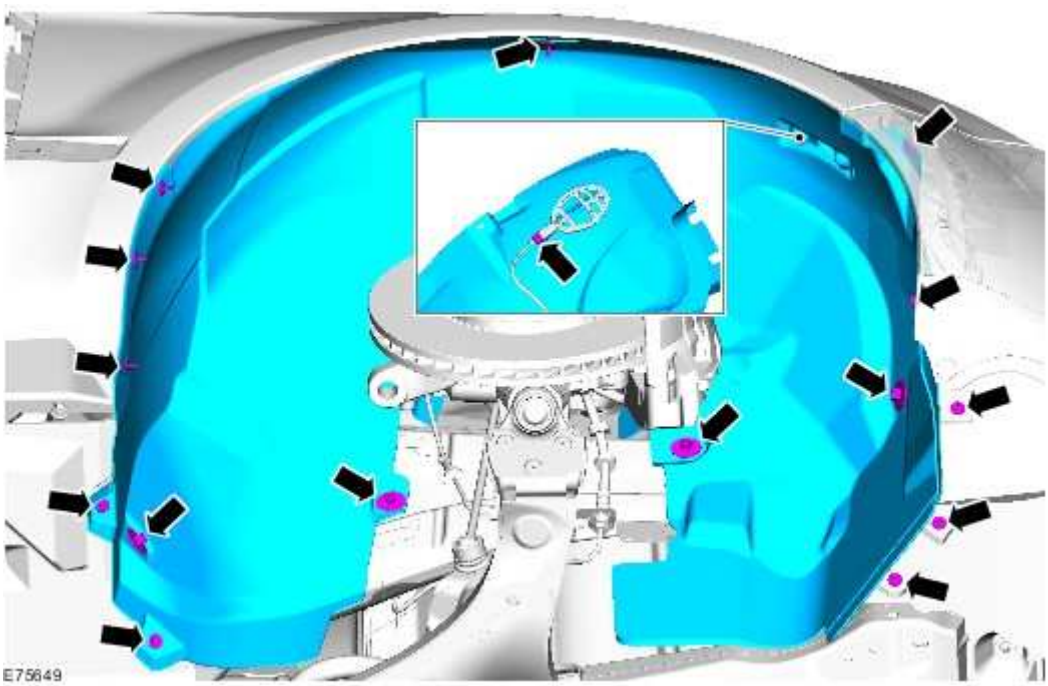
1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Hea and Safety Precautions (100-00 General Information Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Descriptio Operation).



2. CAUTION: Make sure that all openings are sea
   General Equipment: Hose clamp remover/installer

3. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

4.



5. CAUTION: Make sure that all openings are sea
   Refer to: Spring Lock Couplings (310-00 Fuel Systen General Information, General Procedures).
   Torque: 8 Nm

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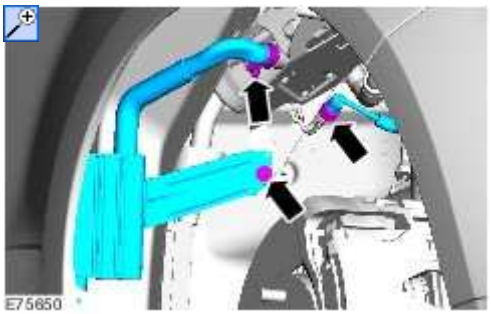

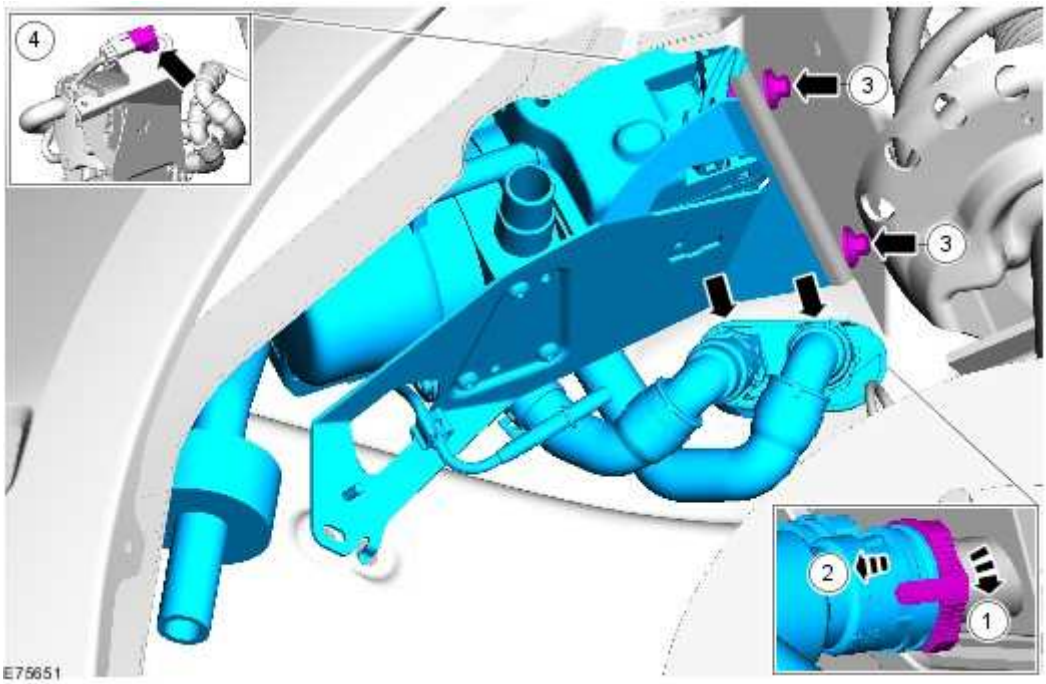

6. CAUT
Make sure
that all
openings
sealed.
Torque: 8

Installation

1. Install the components in reverse order.

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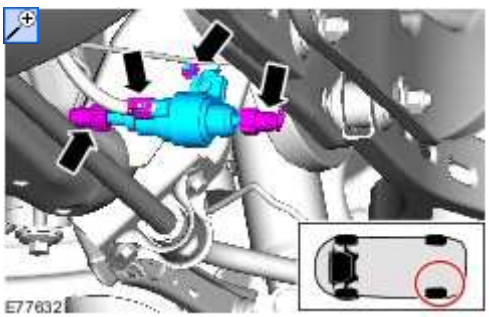
Removal and Installation

Removal

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



1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00 General Information, Description and Operation).
   Refer to: Diesel Fuel System Health and Safety Precautions (100-00 General Information, Description and Operation).
2. CAUTION: All openings must be closed. Use new blanking caps.
   Refer to: Spring Lock Couplings (310-00 Fuel System - General Information, General Procedures).
   Torque: 8 Nm

Installation

1. Install the components in reverse order.

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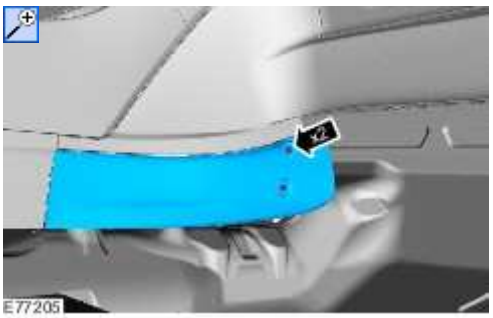
Removal and Installation

Removal

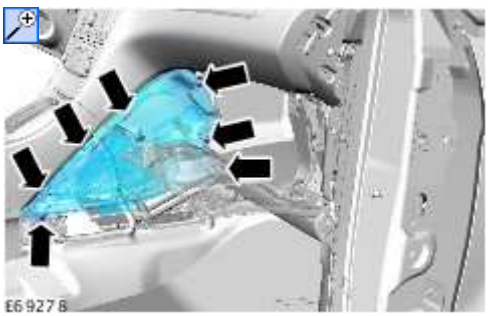
NOTE: Removal steps in this procedure may contain installation details.

All vehicles



1.

Left-hand drive vehicles



2.

RHD vehicles

3.

All vehicles

4.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

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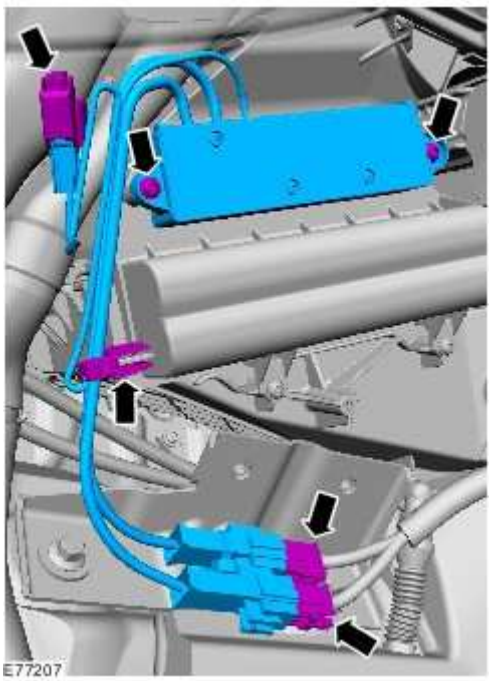

5.

Installation

1. Install the components in reverse order.

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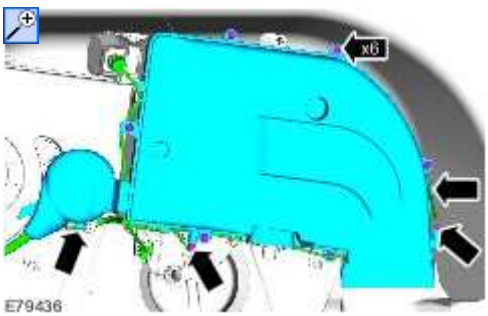
Removal and Installation

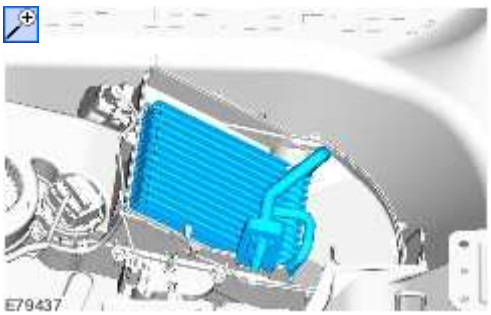
Removal

1. Remove the additional expansion valve.

   Refer to: Zusatzexpansionsventil (412-02 Zusatz-Innenraumklimatisierung, Removal and Installation).



2.



3.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

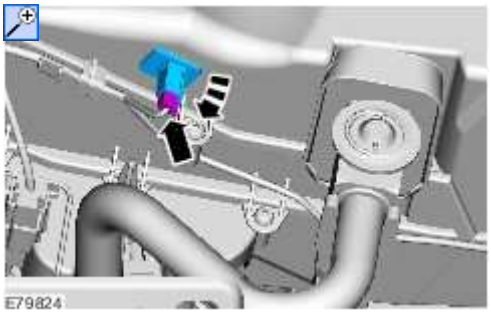
Removal

1. Remove the luggage compartment trim on the left and right-hand sides.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.

3.



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

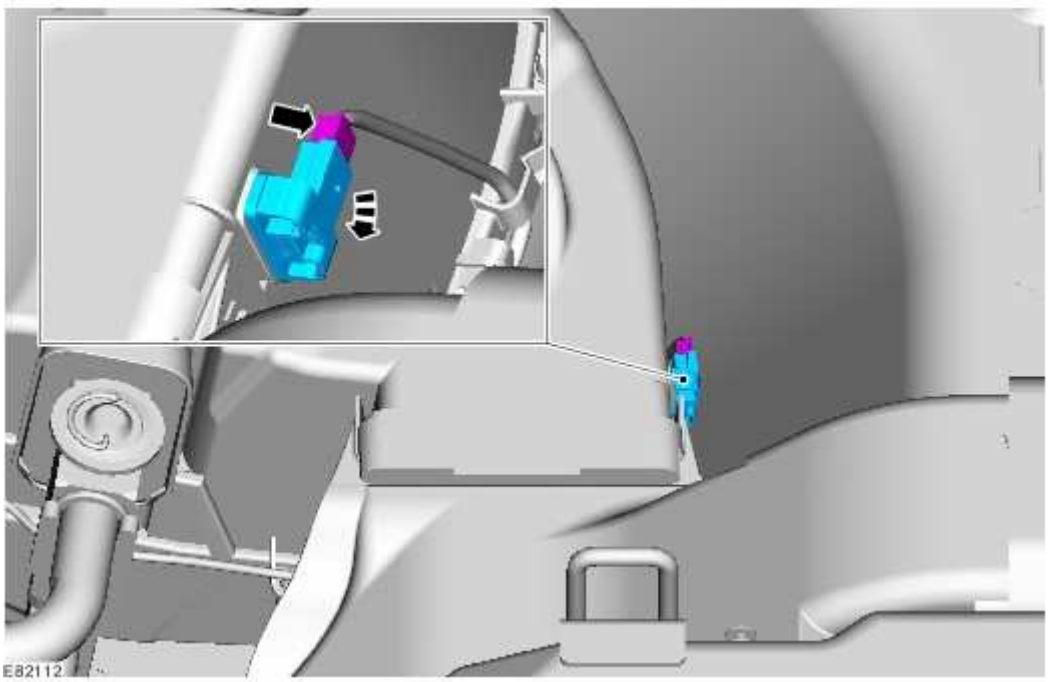
Removal

1. Remove the luggage compartment trim on the left and right-hand sides.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.

3.



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

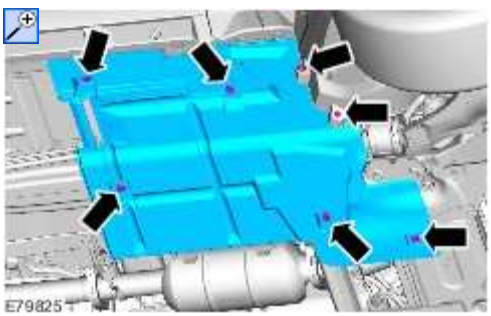
1. Carry out the air conditioning (A/C) system recovery procedure.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control Sy - General Information, General Procedures).

2. Raise the vehicle.

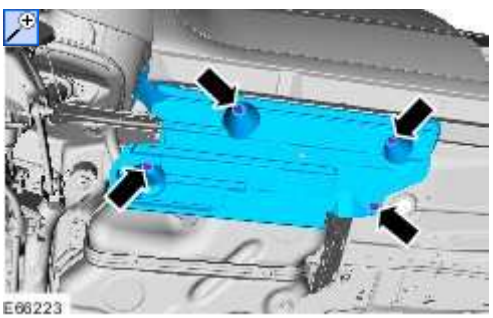
   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

Vehicles with diesel engine



3.

All vehicles



4.

5. CAUT
   Make sure that all openings a sealed.
   1. *Torq* Nm
   2. *Torq* Nm

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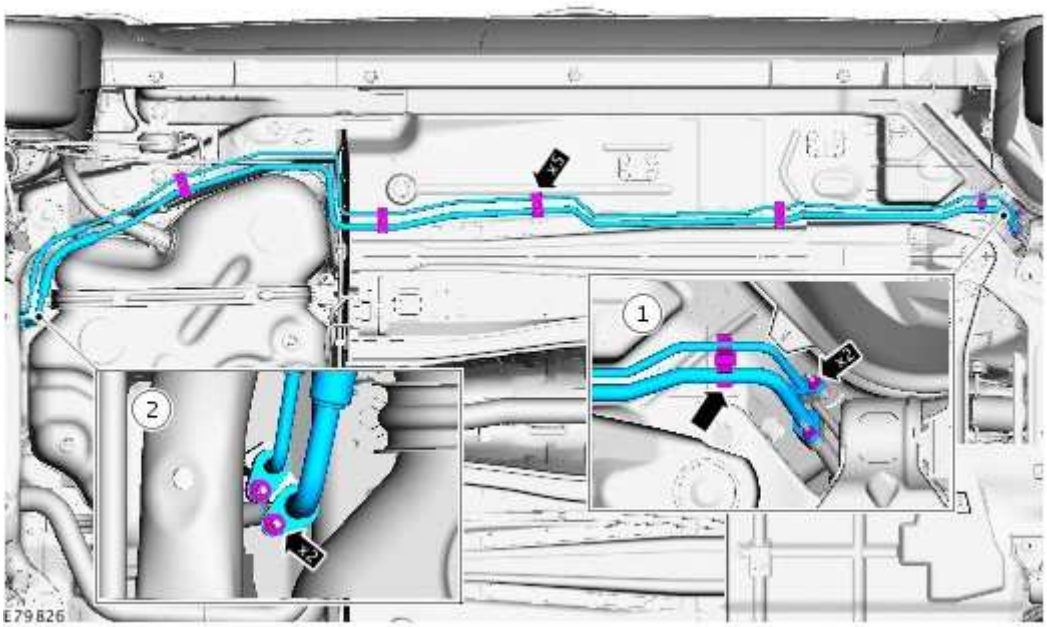

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

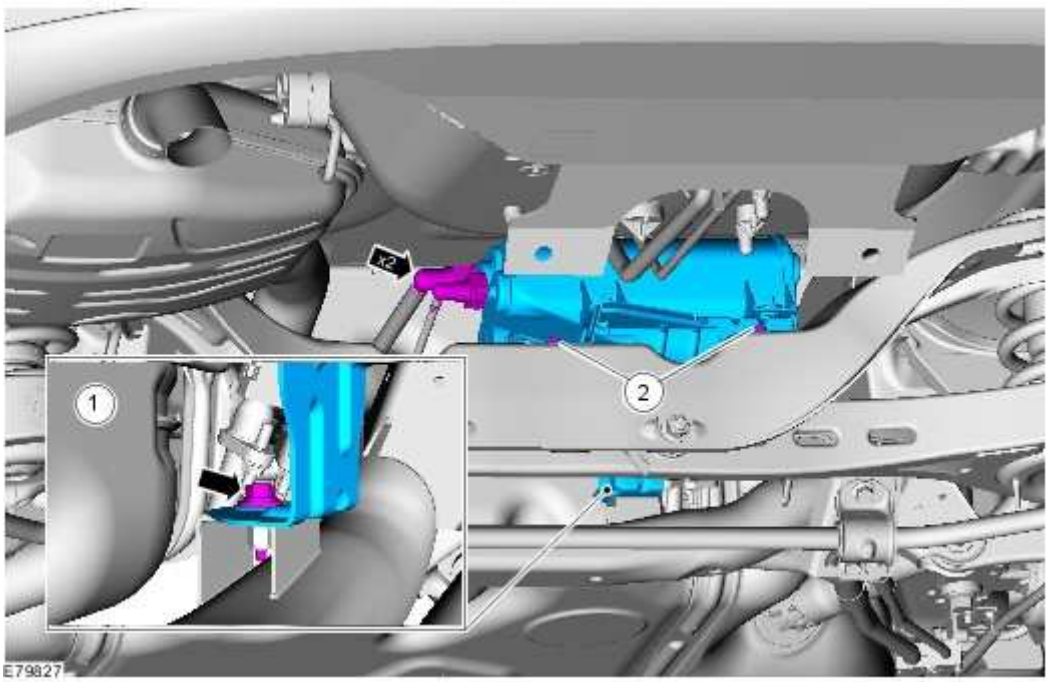
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control Sy - General Information, General Procedures).

2. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).

All except vehicles with diesel engine

3. Refer to: Petrol and Petrol-Ethanol Fuel Systems Hea and Safety Precautions (100-00 General Information Description and Operation).



All vehicles

4. CAUT
   Make sure that all openings a sealed. Us new blank caps.
   1. *Torq* Nm
   2. *Torq* Nm

5. CAUT
   Make sure that all openings a sealed.
   1. *Torq*

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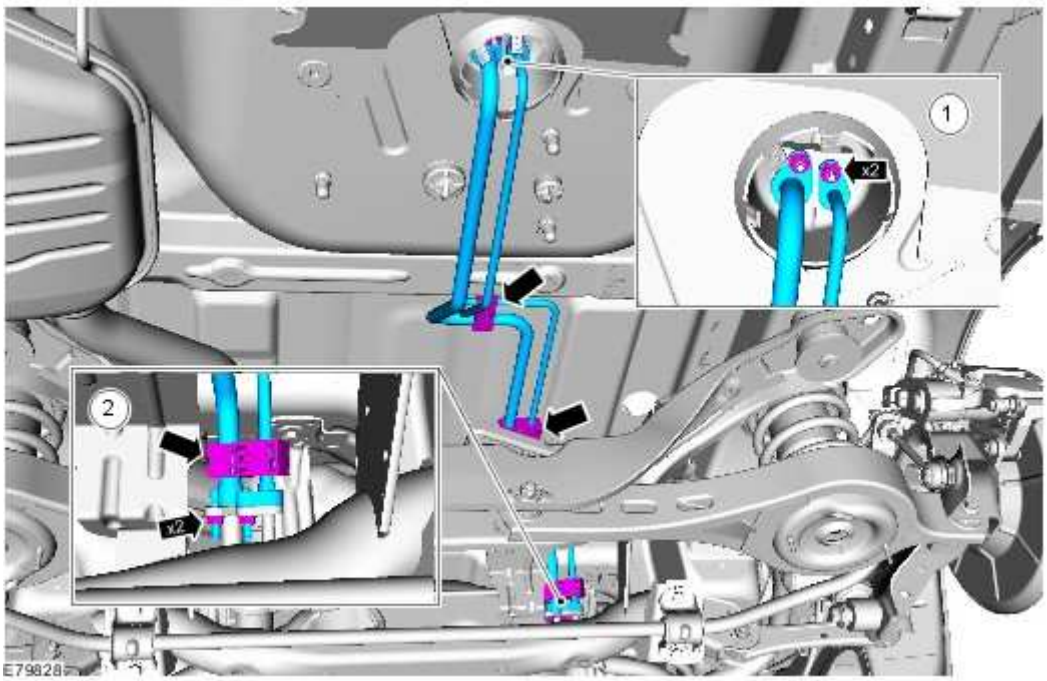

Nm
2. *Torq*
Nm

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Hose clamp remover/installer

Removal

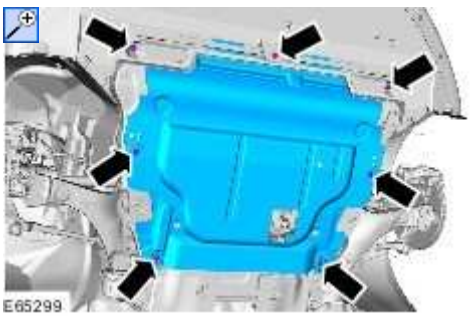
NOTE: Removal steps in this procedure may contain installation details.

Vehicles with 1.8L diesel engine

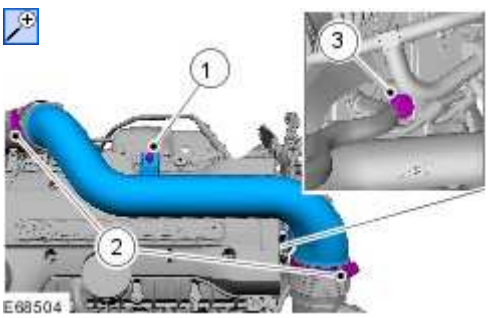
1. Raise and support the vehicle.

   Refer to: Anheben mit Hebebühne (100-02, Description and Operation).

2.



Vehicles with 2.5L engine



3. CAUTION: The inside surfaces of the ends of the pipe must be clean and free from oil residues.
   Torque: 10 Nm

Vehicles with 2.0L engine

4.

All vehicles

5.

2. *General Equipment:* Hose clamp remover/installer

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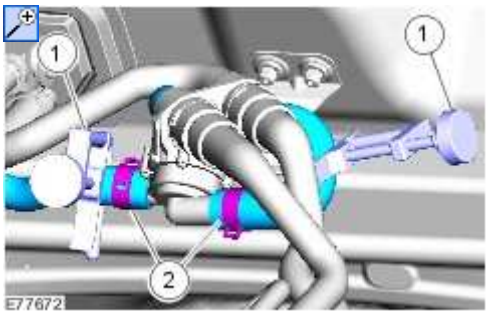

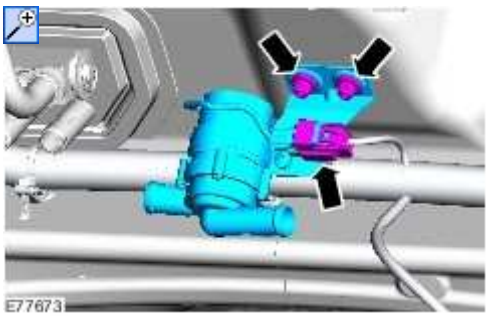

6. *Torque:* 8 Nm

Installation

1. Install the components in reverse order.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

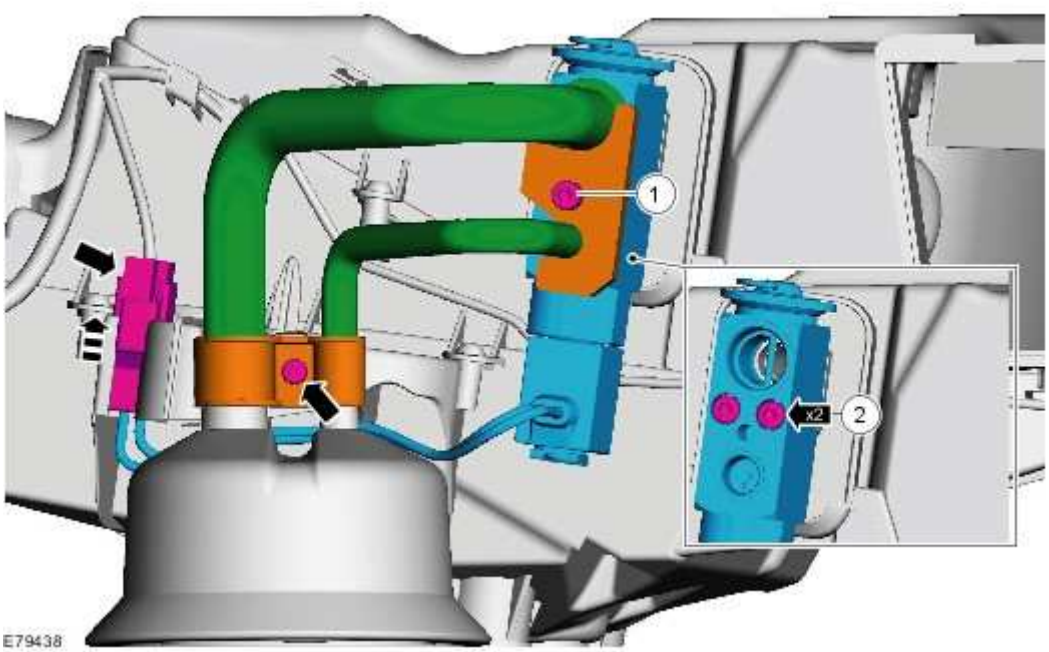
   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

2. Remove the luggage compartment trim on the left a right-hand sides.

   Refer to: Loadspace Trim Panel - VIN Plate Body Sty Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.

4.



1. *Torq* 9 Nr
2. *Torq* 6 Nr

Installation

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1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

Removal

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

1. Carry out the air conditioning (A/C) system recovery procedure.

   Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

2. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

3.
   1. *Torque:* 8 Nm
   2. *Torque:* 5 Nm

4. Remove the luggage compartment trim on the left and right-hand sides.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

5.

6.

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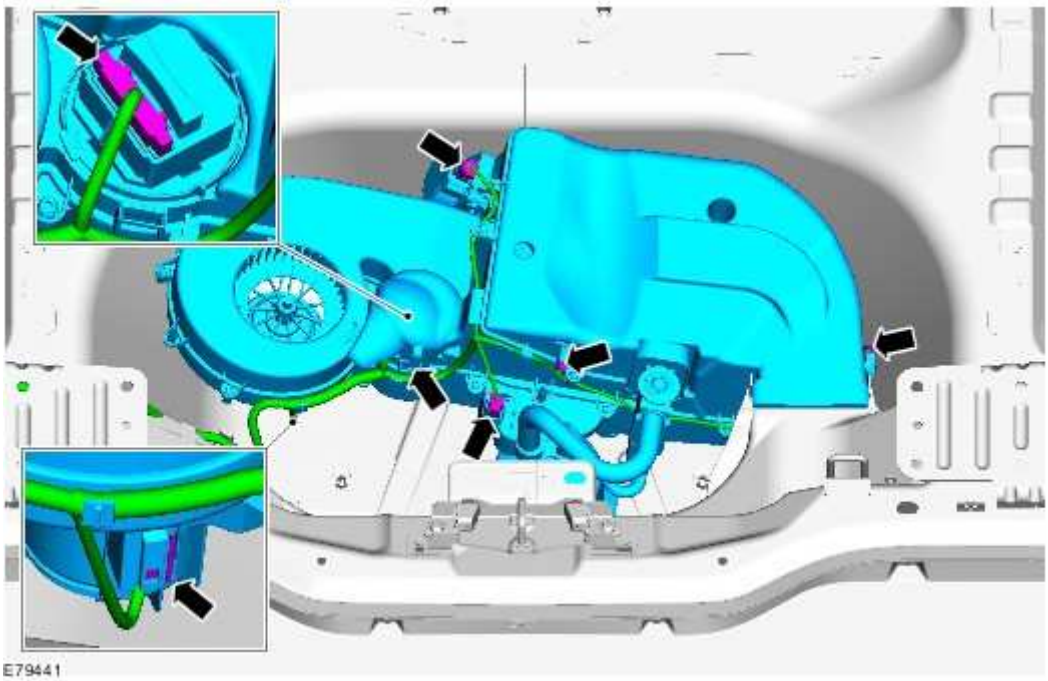
E79441

Installation

1. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

2. To install, reverse the removal procedure.

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Removal and Installation

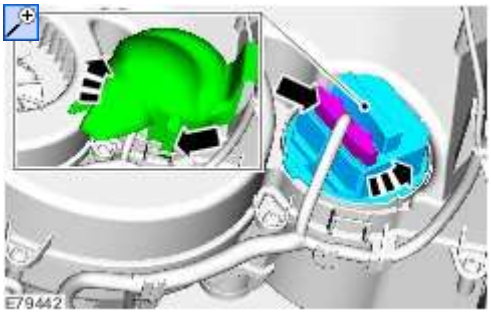
Removal

1. Remove the luggage compartment trim on the left and right-hand sides.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.

3.



Installation

1. To install, reverse the removal procedure.

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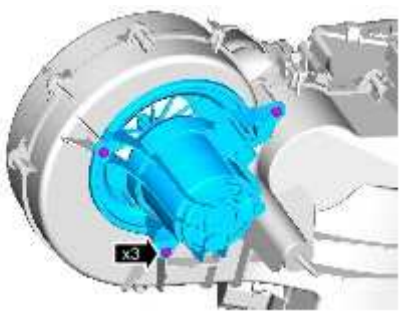
Removal and Installation

Removal

1. Remove the housing of the additional air conditioning system.

   Refer to: Zusatzklimaanlagengehäuse (412-02, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

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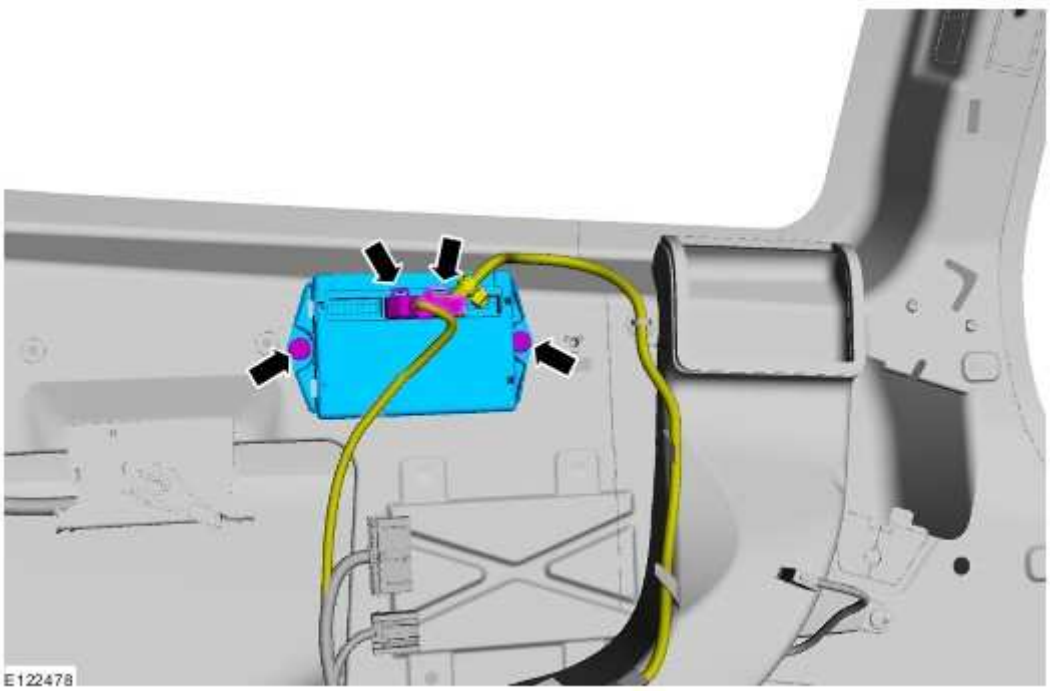
Removal and Installation

Removal

1. Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
2.



Installation

1. To install, reverse the removal procedure.

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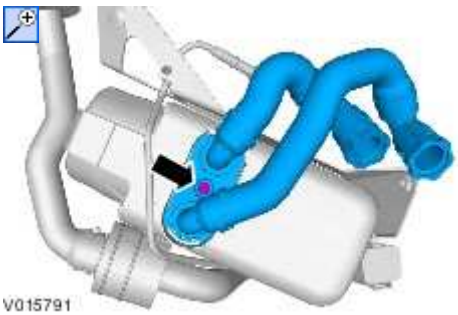
Disassembly and Assembly

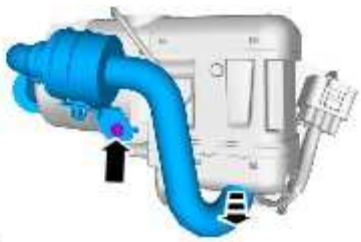
Disassembly

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

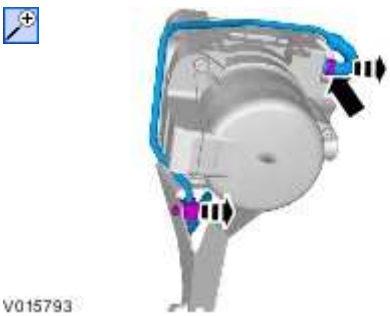
1. Refer to: Benzin-Kraftstoffsystem - Gesundheits- und Sicherheitshinweise (100-00, Description and Operation).


V015791

2. CAUTION: Make sure that all openings are sealed.
Torque: 6 Nm


V015792

3. CAUTION: Make sure that all openings are sealed.
Torque: 5 Nm


V015793

4.

V015794

5.

6. CAUTION: Take extra care not to damage the edges of the component.

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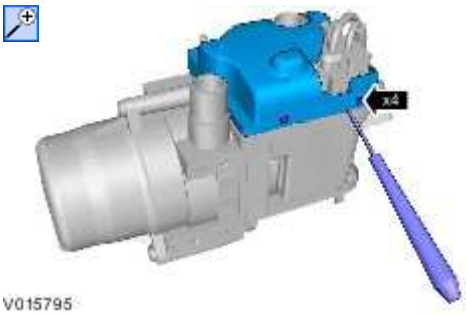
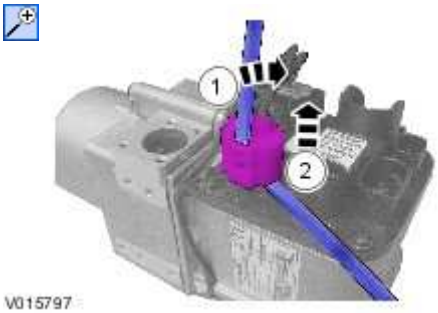


V015795

7.

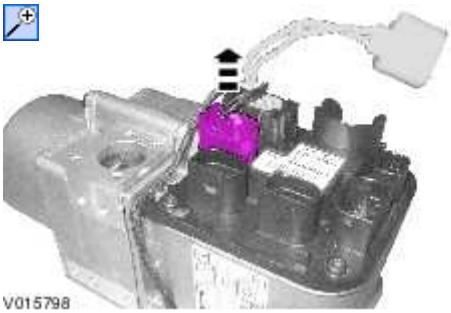
V015796

8.

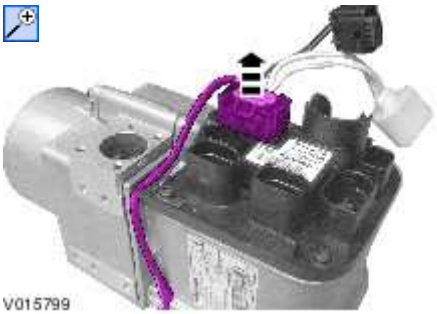


V015797

9.


V015798

10.


V015799

11.

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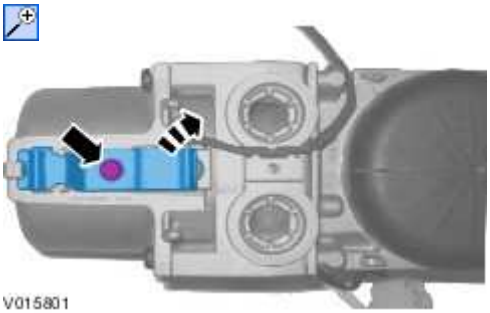
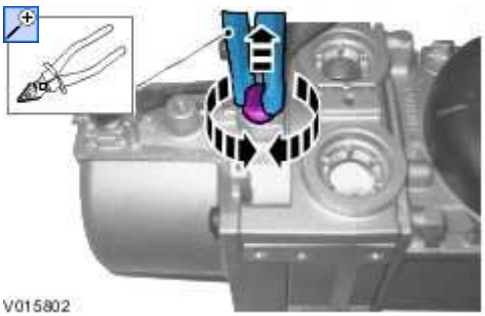


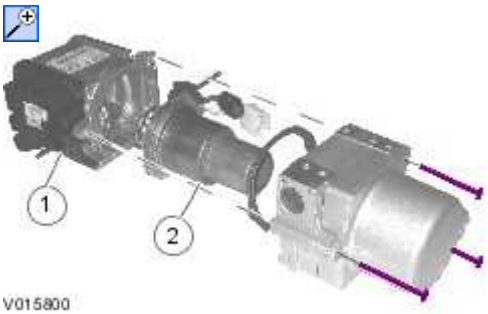
V015801

12.



V015802

13. *Torque:* 7 Nm



V015800

Assembly

14. To install reverse the removal procedure.

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Disassembly and Assembly

Materials

Name	Specification
Compressor Oil - Air Conditioning	WSH-M1C231-B / 6U7J-M1C231-AA

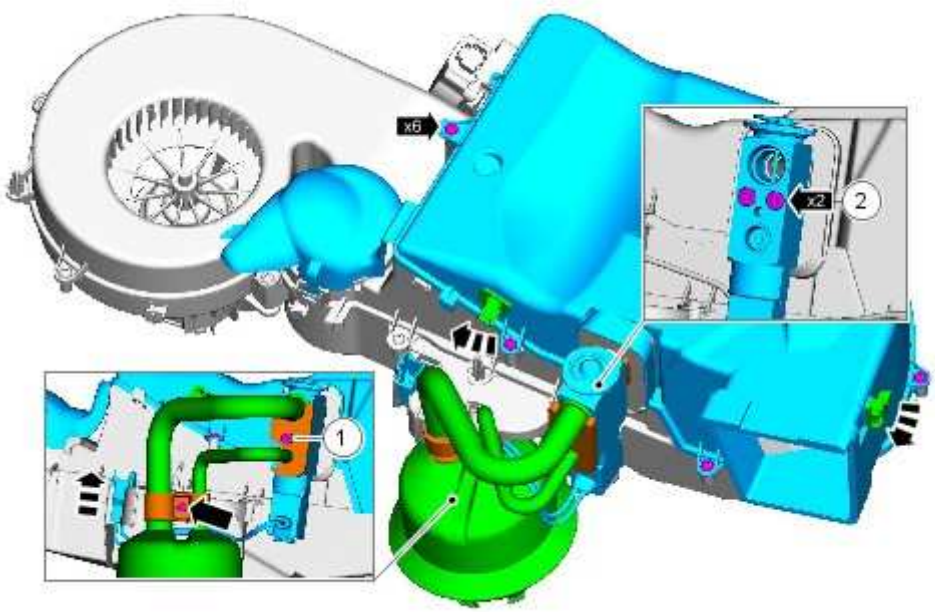
Disassembly

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

1. Remove the additional climate control housing.

   Refer to: Zusatzklimaanlagengehäuse (412-02, Removal and Installation).

2.
   1. *Torq*
      9 Nr
   2. *Torq*
      6 Nr



E82116

3.

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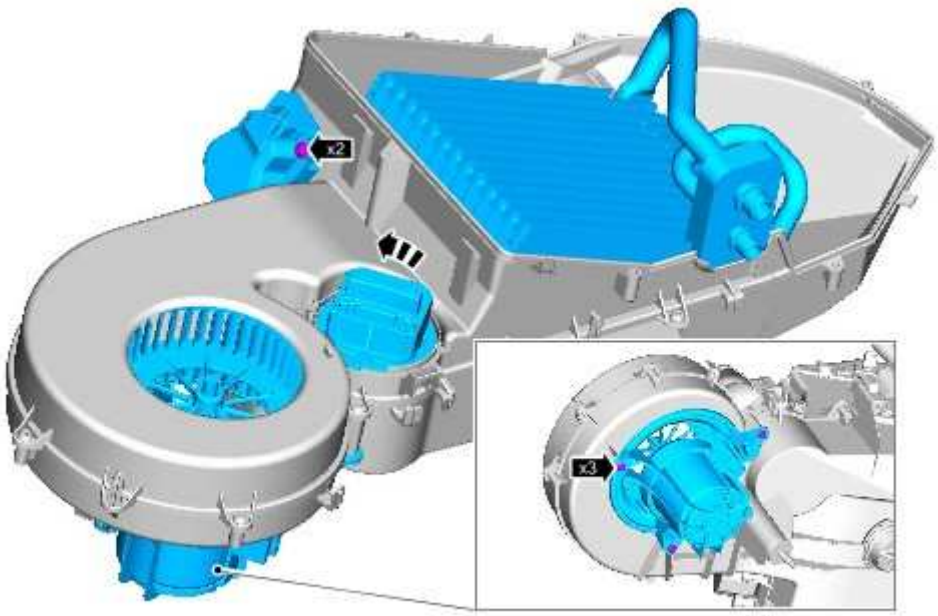
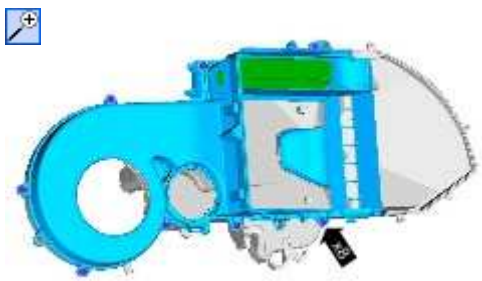


E82117



E82177

4.

Assembly

5. Coat the O-rings on the refrigerant lines.

   Material: Compressor Oil - Air Conditioning (WSH-M1C231-B / 6U7J-M1C231-AA)

6. To install, reverse the removal procedure.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 413-00, for schematic and connector information.

General Equipment

Worldwide diagnostic system (WDS)

Instrument Cluster and Dimmable Backlighting

The dimmable illumination utilizes light emitting diodes (LEDs) and bulb(s).

The following dimmable components are backlit using LEDs only:

- transmission control lever
- heater control panel
- audio unit
- navigation system display module
- instrument cluster
- climate control module
- hazard switch
- traction control system disable switch
- right-hand and left-hand heated front seat switch(es)

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine/engine compartment or underbody components • Fluid levels • Accessory installation	• Fuse(s) • Loose or corroded connector (s) • Instrument cluster • Switch(es) • Wiring Harness • Circuit(s) • LED(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The control illumination is inoperative	* Fuse. * Headlamp switch. * Circuit.	* REFER to the WDS.
The instrument panel illumination does not dim	* Dimmer switch.	* INSTALL a new headlamp/dimmer switch

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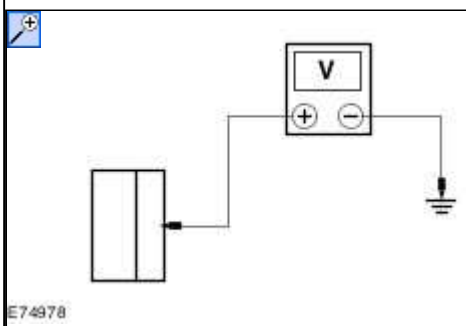
		unit.
The Instrument cluster illumination is inoperative	* Circuit(s). * Instrument cluster.	* REFER to the WDS.
The climate control illumination is inoperative	* Circuit(s). * Climate control assembly.	* REFER to the WDS.
The audio system illumination is inoperative	* Circuit(s). * Audio unit.	* REFER to the WDS.
The navigation system display module illumination (vehicles with Travel Pilot EX) is inoperative	* Circuit(s). * Navigation system display module.	* REFER to the WDS.
The navigation system display module illumination (vehicles with DVD Navigation System with Touchscreen) is inoperative	* Circuit(s). * Navigation system display module.	* REFER to the WDS.
The cigar lighter illumination is inoperative	* Circuit(s). * Cigar lighter.	* GO to Pinpoint Test A.
The hazard switch illumination is inoperative	* Circuit(s). * Hazard switch.	* GO to Pinpoint Test B.
The front seat heater switch(es) illumination is inoperative	* Circuit(s). * Front seat heater switch(es).	* GO to Pinpoint Test C.
The front and rear window defrost switch illumination is inoperative	* Circuit(s). * Rear window defrost switch.	* GO to Pinpoint Test D.
The parking aid switch illumination is inoperative	* Circuit(s). * parking aid switch.	* GO to Pinpoint Test E.
The electronic parking brake switch illumination is inoperative	* Circuit(s). * Electronic parking brake switch.	* GO to Pinpoint Test F.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE CIGAR LIGHTER ILLUMINATION IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK CIRCUIT CLN17S (BN) FOR VOLTAGE	
	1 Disconnect Cigar Lighter C2DC07-B.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
	5 Measure the voltage between the cigar lighter C2DC07-B pin 1, circuit CLN17S (BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A2.

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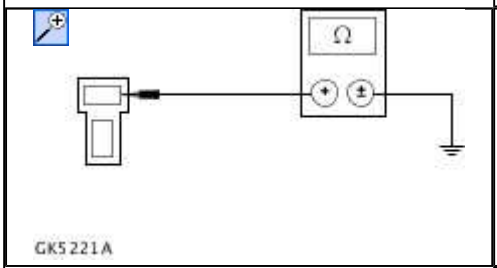
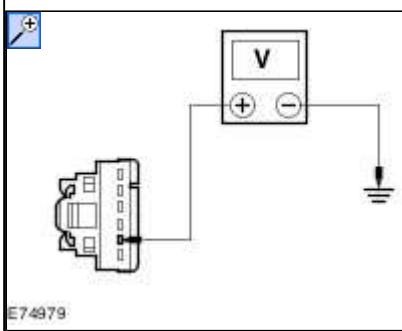
	No REPAIR the circuit CLN17S (BN) or circuit CLN17G (BN) as necessary. TEST the system for normal operation.
A2: CHECK CIRCUIT GD138AZ (BK/WH) FOR OPEN	
	1 Connect Cigar Lighter C2DC07-B.
	2 Disconnect Cigar Lighter C2DC07-A.
	3 Measure the resistance between the cigar lighter C2DC07-A pin 1, circuit GD138AZ (BK/WH), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new cigar lighter. TEST the system for normal operation. **No** REPAIR circuit GD138AZ (BK/WH) or circuit GD138AL (BN/WH) as necessary. TEST the system for normal operation.

PINPOINT TEST B : THE HAZARD SWITCH ILLUMINATION IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT CLS38A (VT/WH) FOR VOLTAGE	
	1 Disconnect Hazard Switch C2LS32.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
	5 Measure the voltage between the hazard switch C2LS32 pin 5, circuit CLS38A (VT/WH), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** REPAIR the circuit. TEST the system for normal operation.
B2: CHECK CIRCUIT GD133CF (BK) FOR OPEN	
	1 Ignition switch in position 0.
	2 Measure the resistance between hazard switch C2LS32 pin 4, circuit GD133CF (BK), harness side and ground.

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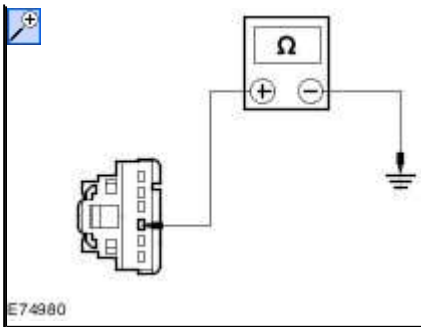
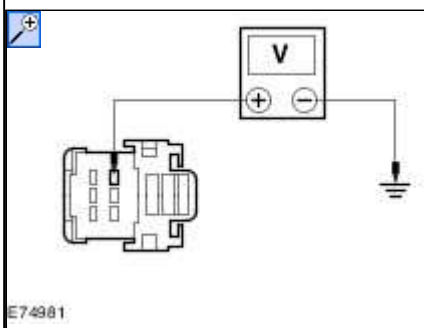
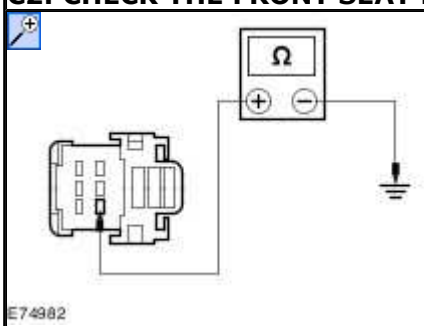
	
	Is the resistance less than 5 ohms? **Yes** INSTALL a new hazard switch. TEST the system for normal operation. **No** REPAIR the circuit GD133CF (BK) or circuit GD133AW (BK) as necessary. TEST the system for normal operation.

PINPOINT TEST C : THE FRONT SEAT HEATER SWITCH ILLUMINATION IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK INOPERATIVE FRONT SEAT HEATER SWITCH FOR VOLTAGE	
	1 Disconnect Front Seat Heater Switch - C3HS29.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
	5 Measure the voltage between the front seat heater switch C3HS29 pin 3, circuit CLN17H (BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to C2. **No** REPAIR circuit CLN17H (BN), circuit CLN17J (BN) or circuit CLN17G (BN) as necessary. TEST the system for normal operation.
C2: CHECK THE FRONT SEAT HEATER SWITCH FOR OPEN	
	1 Measure the resistance between the front seat heater switch C3HS29 pin 1, circuit GD138AP (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes**

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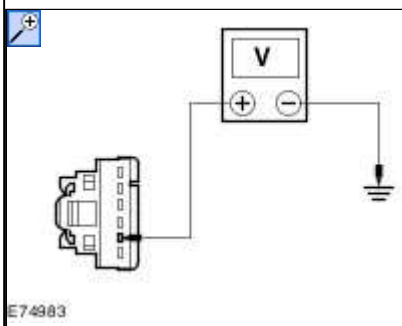
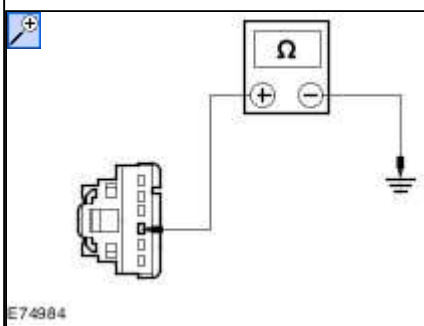
	INSTALL a new front seat heater switch. TEST the system for normal operation. **No** REPAIR circuit GD138AP (BK), circuit GD133AR (BK), circuit GD133CE (BK) or circuit GD133AW (BK) as necessary. TEST the system for normal operation.

PINPOINT TEST D : THE FRONT AND REAR WINDOW DEFROST SWITCH ILLUMINATION IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE FRONT AND REAR WINDOW DEFROST SWITCH FOR VOLTAGE	
	1 Disconnect Rear Window Defrost Switch C2RD09.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
 E74983	5 Measure the voltage between the rear window defrost switch C2RD09 pin 5, circuit CLN17H (BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D2. **No** REPAIR the circuit CLN17T (BN) or circuit CLN17G (BN) as necessary. TEST the system for normal operation.
D2: CHECK CIRCUIT GD133BN (BK) FOR OPEN	
	1 Ignition switch in position 0.
 E74984	2 Measure the resistance between the rear window defrost switch C2RD09 pin 4, circuit GD133BN (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new rear window defrost switch. TEST the system for normal operation. **No** REPAIR circuit GD133BN (BK), circuit GD133CH (BK) or circuit GD133AW (BK) as necessary. TEST the system for normal operation.

PINPOINT TEST E : THE PARKING AID SWITCH ILLUMINATION IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE PARKING AID SWITCH FOR VOLTAGE	

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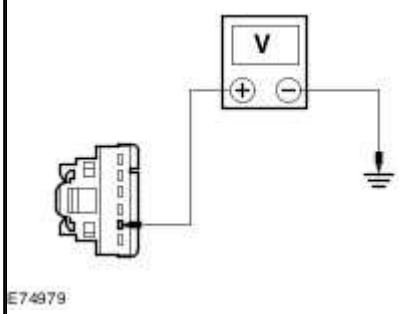
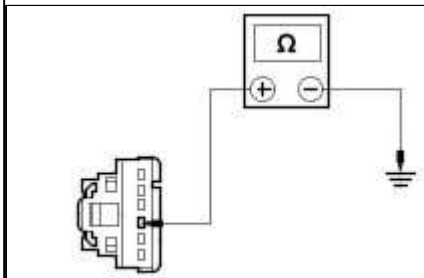
	1 Disconnect Parking Aid Switch C2CA15.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
 E74979	5 Measure the voltage between the parking aid switch C2CA15 pin 5, circuit CLN17U (BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to E2. **No** REPAIR the circuit CLN17U (BN) or circuit CLN17G (BN) as necessary. TEST the system for normal operation.
E2: CHECK CIRCUIT GD133BR (BK) FOR OPEN	
	1 Ignition switch in position 0.
 E74984	2 Measure the resistance between the parking aid switch C2CA15 pin 4, circuit GD133BR (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new parking aid switch. TEST the system for normal operation. **No** REPAIR circuit GD133BR (BK), circuit GD133CH (BK) or circuit GD133AW (BK) as necessary. TEST the system for normal operation.

PINPOINT TEST F : THE ELECTRONIC PARKING BRAKE SWITCH ILLUMINATION IS INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: CHECK THE ELECTRONIC PARKING BRAKE SWITCH FOR VOLTAGE	
	1 Disconnect Electronic Parking Brake Switch C3CB09.
	2 Ignition switch in position II.
	3 Make sure that the illumination dimmer switch is in the full illumination position.
	4 Place the headlamp switch in the ON position.
	5 Measure the voltage between the electronic parking brake switch C3CB09 pin 1, circuit CLN17N (BN), harness side and ground.

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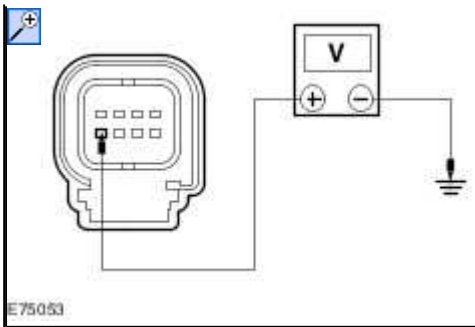
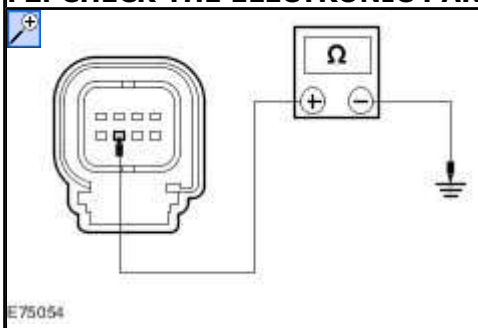
	
	Is the voltage greater than 10 volts? **Yes** GO to F2. **No** REPAIR circuit CLN17N (BN), circuit CLN17J (BN) or circuit CLN17G (BN) as necessary. TEST the system for normal operation.
F2: CHECK THE ELECTRONIC PARKING BRAKE SWITCH FOR OPEN	
	1 Measure the resistance between the electronic parking brake switch C3CB09 pin 2, circuit GD138AL (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new electronic parking brake switch. TEST the system for normal operation. **No** REPAIR circuit GD138AL (BK), circuit GD133AR (BK), circuit GD133CE (BK) or circuit GD133AW (BK) as necessary. TEST the system for normal operation.

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Description and Operation

The instrument cluster is part of the central vehicle configuration and saves a copy of the configuration data stored in the GEM. It acts as a back-up copy in the event that the GEM must be renewed.

After changing the instrument cluster, the current mileage of the vehicle must be entered using the Ford diagnostic unit.

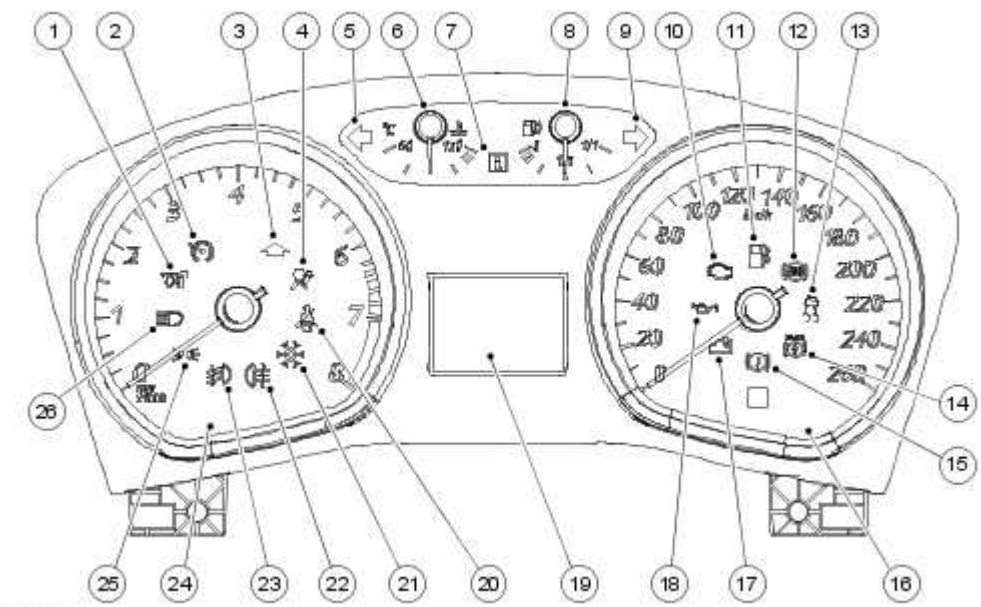
Is it possible to reset the mileage to zero on new vehicles. The following conditions apply:

- the 20 kilometer (mile) limit must not be exceeded,
- under 20 kilometers (miles), the mileage can be reset to zero a maximum of three times. However, resetting is only possible up to a total of 50 kilometers.

For this purpose, the confirmation button on the steering wheel must be pressed for longer than 7 seconds.

The instrument cluster can be diagnosed using IDS.

Vehicles with low series instrument cluster



E94365

Item	Part Number	Description
1	-	Glow plug indicator
2	-	Speed control indicator
3	-	Gear change indicator (gear change recommendation)
4	-	Air bag warning indicator
5	-	Left-hand turn signal indicator
6	-	Coolant temperature gauge
7	-	Information and message center display / alarm system enabled (when ignition off)
8	-	Fuel Level Gauge
9	-	Right-hand turn signal indicator
	-	

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10		Malfunction Indicator Lamp (MIL)
	11 -	Low fuel level indicator (at about 8L tank contents)
12	-	Anti-lock Braking system (ABS) Warning Indicator
13	-	Stability assist indicator
14	-	Parking brake warning indicator
15	-	Braking system indicator (handbrake, brake fault, brake fluid)
16	-	Speedometer
17	-	Charging system warning indicator
18	-	Low oil pressure warning indicator
19	-	Message center
20	-	Seat belt indicator
21	-	Ice warning indicator
22	-	Rear Fog Lamp Indicator
23	-	Front fog lamp indicator
24	-	Tachometer
25	-	Headlamp indicator
26	-	High beam indicator

The information and message center indicator illuminates if a new message is stored in the information display. Depending on the importance of the message, the display lights up red or yellow and remains lit until the cause of the fault is rectified. When the ignition is switched off, flashing of the display shows the status of the alarm system, however, all other warnings take precedence and can interrupt the flashing.

The instrument cluster is used as a gateway for the following systems:

- Audio unit
- Compact disc (CD) changer
- Video system
- Navigation system (high and low level)
- Cellular phone system

The instrument cluster gateway allows data from the modules and systems to communicate through the mid-series controller area network (CAN) bus to the modules, systems and data link connector (DLC).

Message center

The information and message center is a monochrome display and indicates to the driver the following information and messages in a text or graphical display:

- Odometer
- Low oil warning indicator
- Change oil indicator
- Brake pad wear warning indicator
- High coolant temperature warning indicator
- Powertrain warning indicator
- Low brake fluid warning indicator
- Electronic parking brake warning indicator
- Low washer fluid warning indicator
- Low tire pressure warning indicator
- Door(s) ajar indicators
- Hood ajar indicator
- Liftgate ajar indicator

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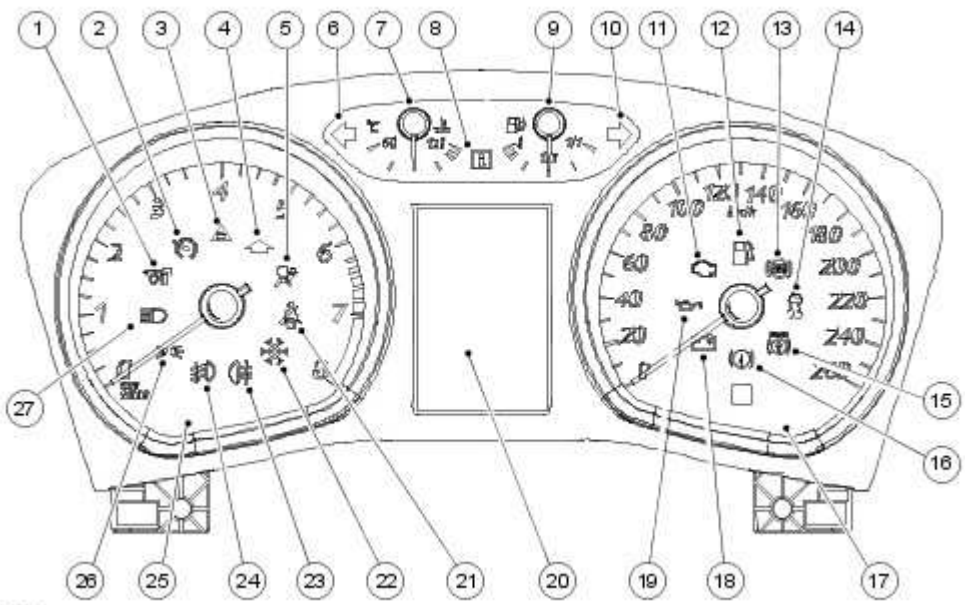
- Ambient air temperature indicator
- Electro-hydraulic power steering (EHPS) warning indicator
- EHPS select indicator
- Clock/date
- Average fuel economy indicator
- Average speed indicator
- Distance to empty indicator
- Integrated driver information
- Fuel fired booster heater (if equipped) set up information
- Vehicle locking indicator
- Vehicle setting - self-test mode
- Water-in-fuel warning indicator
- Transaxle selector indicator
- Voice recognition status indicator
- Power mode status indicator
- Charging system status indicator
- Battery warning(s) indicator

Vehicles with mid series instrument cluster



Item	Part Number	Description
1	-	Glow plug indicator
2	-	Speed control indicator
3	-	Active speed control indicator
4	-	Gear change indicator (gear change recommendation)
5	-	Air bag warning indicator
6	-	Left-hand turn signal indicator
7	-	Coolant temperature gauge
8	-	Information and message center display / alarm system enabled (when ignition off)
9	-	Fuel Level Gauge
10	-	Right-hand turn signal indicator
11	-	Malfunction Indicator Lamp (MIL)
12	-	Low fuel level indicator (at about 8L tank contents)

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13	-	Anti-lock Braking system (ABS) Warning Indicator
14	-	Stability assist indicator
15	-	Parking brake warning indicator
16	-	Braking system indicator (handbrake, brake fault, brake fluid)
17	-	Speedometer
18	-	Charging system warning indicator
19	-	Low oil pressure warning indicator
20	-	Message center
21	-	Seat belt indicator
22	-	Ice warning indicator
23	-	Rear Fog Lamp Indicator
24	-	Front fog lamp indicator
25	-	Tachometer
26	-	Headlamp indicator
27	-	High beam indicator

The information and message center indicator illuminates if a new message is stored in the information display. Depending on the importance of the message, the display lights up red or yellow and remains lit until the cause of the fault is rectified. When the ignition is switched off, flashing of the display shows the status of the alarm system, however, all other warnings take precedence and can interrupt the flashing.

The instrument cluster is used as a gateway for the following systems:

- Audio unit
- Compact disc (CD) changer
- Video system
- Navigation system (high and low level)
- Cellular phone system

The instrument cluster gateway allows data from the modules and systems to communicate through the mid-series controller area network (CAN) bus to the modules, systems and data link connector (DLC).

Message center

The information and message center is a large monochrome display and indicates to the driver the following information and messages in a text or graphical display:

- Odometer
- Low oil warning indicator
- Change oil indicator
- Brake pad wear warning indicator
- High coolant temperature warning indicator
- Powertrain warning indicator
- Low brake fluid warning indicator
- Electronic parking brake warning indicator
- Low washer fluid warning indicator
- Low tire pressure warning indicator
- Door(s) ajar indicators
- Hood ajar indicator
- Liftgate ajar indicator
- Ambient air temperature indicator
- Electro-hydraulic power steering (EHPS) warning indicator
- EHPS select indicator

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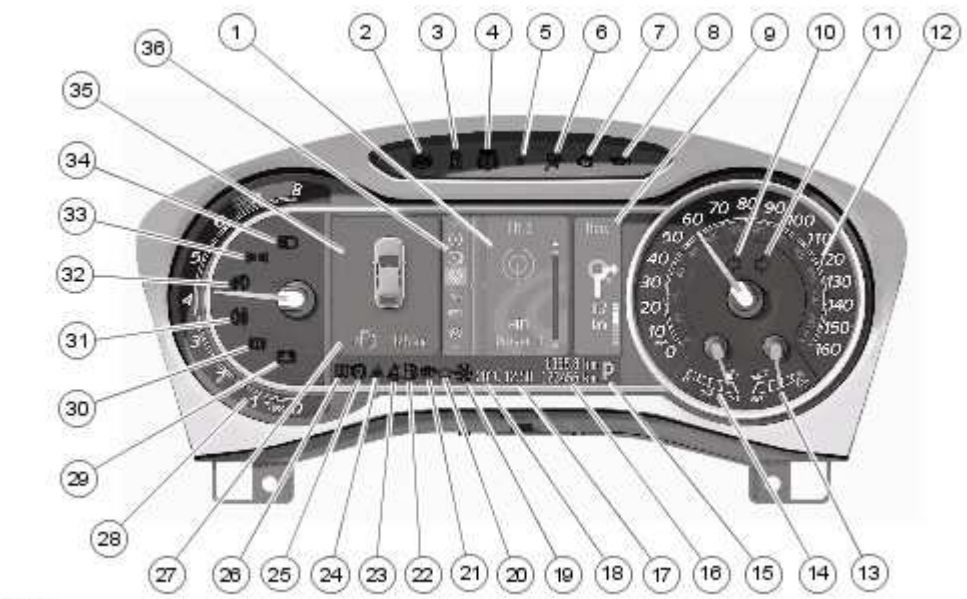
- Clock/date
- Average fuel economy indicator
- Average speed indicator
- Distance to empty indicator
- Integrated driver information
- Fuel fired booster heater (if equipped) set up information
- Vehicle locking indicator
- Vehicle setting - self-test mode
- Water-in-fuel warning indicator
- Transaxle selector indicator
- Voice recognition status indicator
- Power mode status indicator
- Charging system status indicator
- Battery warning(s) indicator
- Radio station indicator
- Cellular phone indicator
- Navigation system information
- Adaptive Speed Control Indicator
- Tire pressure monitoring system indicator

Vehicles with high series instrument cluster



E94367

Item	Part Number	Description
1	-	Display for selected functions (e.g. audio system and telephone)
2	-	Anti-lock Braking system (ABS) Warning Indicator
3	-	Stability assist indicator
4	-	Parking brake warning indicator
5	-	Alarm system enabled (when ignition off)
6	-	Air bag warning indicator
7	-	Malfunction Indicator Lamp (MIL)
8	-	Low oil pressure warning indicator
9	-	Navigation display
10	-	Left-hand turn signal indicator
11	-	Right-hand turn signal indicator
	-	

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12		Speedometer
	13 -	Coolant temperature gauge
14	-	Fuel Level Gauge
15	-	Selected transmission range (vehicles with automatic transaxle)
16	-	Mileage readings (trip and total)
17	-	Clock
18	-	Ambient temperature
19	-	Ice warning indicator
20	-	Gear change indicator (gear change recommendation)
21	-	Glow plug indicator
22	-	Low fuel level indicator (at about 8L tank contents)
23	-	Seat belt indicator
24	-	Forward Alert (adaptive speed control system)
25	-	Speed control indicator
26	-	Information and message center indicator
27	-	Trip computer
28	-	Tachometer
29	-	Charging system warning indicator
30	-	Braking system indicator (handbrake, brake fault, brake fluid)
31	-	Rear Fog Lamp Indicator
32	-	Front fog lamp indicator
33	-	Headlamp indicator
34	-	High beam indicator
35	-	Display for "door ajar" warning, tire pressure monitoring, adaptive speed control and fault messages
36	-	Display for selectable functions

The information and message center indicator illuminates if a new message is stored in the information display. Depending on the importance of the message, the display lights up red or yellow and remains lit until the cause of the fault is rectified. When the ignition is switched off, flashing of the display shows the status of the alarm system, however, all other warnings take precedence and can interrupt the flashing.

The high-series instrument cluster has a colored TFT display with enhanced display and operating functions for the following systems:

- Navigation
- In-car entertainment
- Telephone system
- Trip computer

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Engine oil filter • Engine oil level • Engine coolant temperature (ECT) sensor • Engine coolant level • Thermostat • Collapsed or damaged fuel tank • Door adjustment	• Fuse(s) • Wiring harness • Electrical connector(s) • Instrument cluster • Light emitting diode(s) (LED)(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and enter the instrument cluster Self-Diagnostic Mode.

Self-Diagnostic Mode

NOTE: The OK button is located on the steering wheel right-hand side switch.

1. **1.** To enter the instrument cluster Self-Diagnostic Mode. Simultaneously press and hold the OK button and turn the ignition switch from position 0, to position II.
2. **2.** Entry to the Self-Diagnostic Mode is confirmed when 'TEST' is displayed in the information and message center display. The set button must be released within three seconds of 'TEST' being displayed or the instrument cluster will exit the Self-Diagnostic Mode.
3. **3.** To navigate through or skip any of the instrument cluster Self-Diagnostic Mode tests, press the OK button. If the OK button is pressed for more than 3 seconds between tests, the instrument cluster will exit the Self-Diagnostic Mode.
4. **4.** The Self-Diagnostic Mode is deactivated when the ignition switch is turned to the OFF position or low battery voltage is detected.
5. **5.** If input data to the instrument cluster is missing or invalid, the information and message center will display '----'
6. **6.** If the Self-Diagnostic Mode cannot be accessed, use the Ford approved diagnostic tool to diagnose the instrument cluster.

NOTE: Additional tests are available after the following Self-Diagnostic Mode tests, but are not applicable for this diagnostic.

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Self-Diagnostic Mode

Test	Odometer Display	Gauge/Indicator/Display Tested	Description
1. Self-Diagnostic entry	• TEST • no display	Instrument cluster	Establishes Self-Diagnostic Mode.
2. Gauge sweep	• GAUGE SWEEP • no display	Tachometer, speedometer, temperature and fuel	All gauges go through a minimum to maximum pointer sweep smoothness check. The pointers should take 3 seconds to achieve full sweep and 3 seconds to return to the rest position.
3. Information and Message Center	Filled in black	Information and Message Center	Fills in the LCD of the information and message center display.
4. Indicator LED (s)	• LED TEST • no display	Indicators and warning indicators	Illuminates all the LED warning indicators that are controlled by the instrument cluster.
5. ROM level	• ROM LEVEL • XXXX / FAIL	Instrument cluster read only memory (ROM)	Displays the instrument cluster ROM level and type.
6. NVM ROM level	• NVM TARGET ROM • XXXX	Instrument cluster	Displays the NVM target ROM level.
7. NVM EEPROM level	• NVM EEPROM LVL • XXXX / FAIL	Instrument cluster	Displays the NVM EEPROM level.
8. Manufacturing start date	• MANUFACTURE • HOURS XXXX	Instrument cluster manufacturing date	Displays the instrument cluster start date of manufacture.
9. Manufacturing date	• MANUFACTURE • HOURS XXXX	Instrument cluster manufacturing date	Displays the instrument cluster date of manufacture.
10. Diagnostic trouble code (DTC)	• DTC #NN • XXXX	DTCs	Display the individual DTCs at 1 second intervals. REFER to the Ford approved diagnostic tool to diagnose the instrument cluster.
11. Vehicle speed m.p.h.	• ROAD SPEED • XXX.X MPH	Speedometer	Displays the speed signal input in miles per hour.
12. Vehicle speed km/h	• ROAD SPEED • XXX.X KM/H	Speedometer	Displays the speed signal input in kilometres per hour.
13. Speedometer gauge output	• SPEEDO • XXXX	Speedometer	Displays the speedometer output.
14. Engine speed	• ENGINE SPEED • XXXX	Tachometer	Displays the engine speed input signal (RPM)
15. Tachometer gauge output	• TACHO GAUGE • XXXX	Tachometer	Displays the tachometer output.
15. Odometer count	• ODO ROLL COUNT • XXX	Odometer	Displays the odometer rolling count
16. Odometer value	• ODOMETER COUNT	Odometer	Displays the odometer value

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	• XXXXXX.XX KM		
17. Fuel volume	• FUEL A/D INPUT • XXX	Fuel sender system	Displays the fuel volume signal input. Range 0 to 1023
18. Fuel gauge output	• FUEL GAUGE • XXXX	Fuel gauge	Displays the fuel gauge output.
18. Fuel flow rolling count	• FUEL FLOW • XXXX	Fuel gauge	Displays the fuel flow rolling count
19. Fuel level percentage	• FUEL PERCENT • XXXX	Fuel gauge	Displays the fuel average percentage level: Range of display 00 to 64 (64 being 100% full). FF will be displayed for invalid data.
20. Engine coolant temperature (ECT)	• ENGINE TEMP • XXX C	ECT	Displays the engine coolant temperature as a decimal: Range -60 to +195. +196 would indicate invalid data.
21. Temperature gauge output	• TEMP GAUGE • XXXX	Temperature gauge	Displays the temperature gauge output.
22. Battery voltage	• BATTERY • XX.X	Battery voltage	Displays battery voltage input.
23. Distance to empty	• DIST. TO EMPTY • XXX MILES	Information and message center	Displays the distance to fuel tank empty.
24. Fuel economy	• RAFE • XXX MPG	Information and message center	Displays the rolling average fuel economy in miles per UK gallon.
25. Not required	• A/D INPUT 00 to A/D INPUT 05 • XX	-	Not required.
26. Not required - low series instrument cluster	• PORT A to PORT N • XX	-	Not required.
27. Not required - mid series instrument cluster	• PORT A to PORT N • XX	-	Not required.

7. **7.** The above self-test function is to act as a guide to establish if the concern is instrument cluster related. Before any other action is taken REFER to the Ford approved diagnostic tool to continue diagnostics.

Configuration of Instrument Cluster

The central car configuration data must be manually uploaded after the installation of a new instrument cluster. This is carried out by selecting the **Toolbox/Module Programming/Programmable Parameters/Car Configuration Parameters** options within the menus of the Ford approved diagnostic tool and following the on screen instructions as required.

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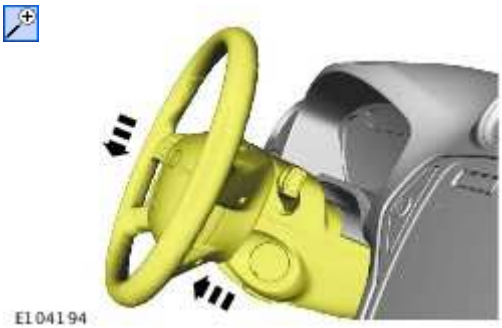
Removal and Installation

General Equipment

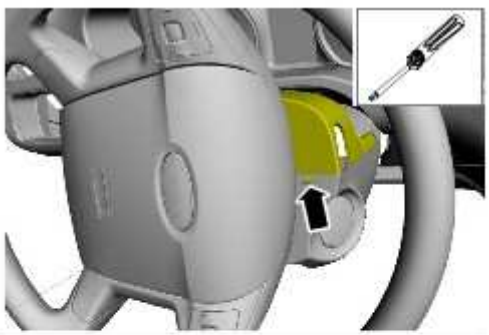
Cable ties
Flat-bladed screwdriver
Ford diagnostic equipment
Round-ended steel rule

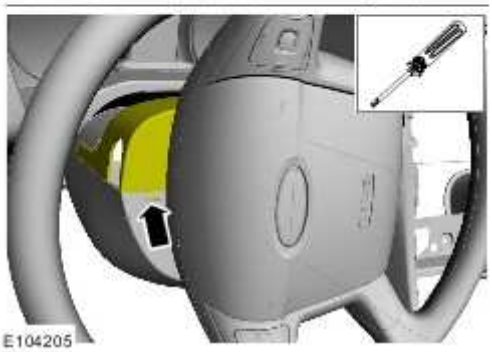
Removal

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

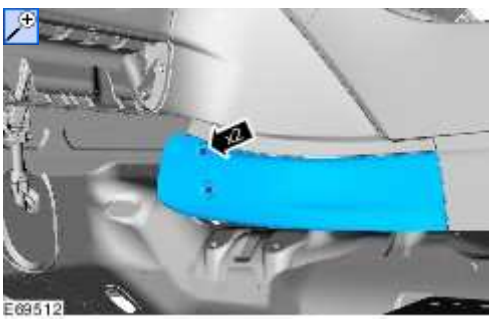


1.





2. *General Equipment:* Flat-bladed screwdriver



3.

4.

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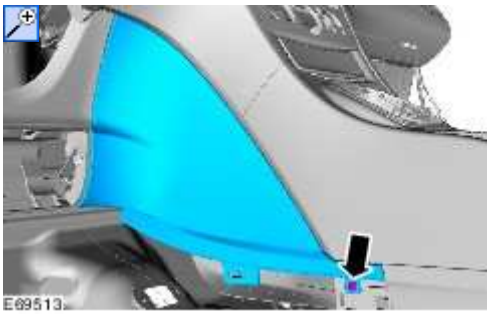
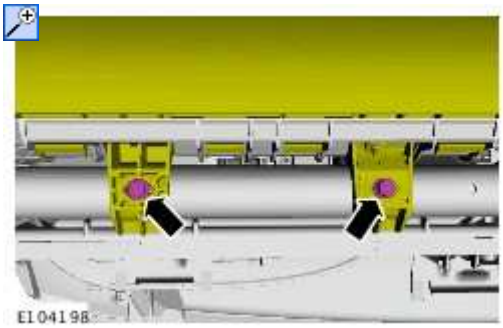


5.

6. *Torque:* 8 Nm



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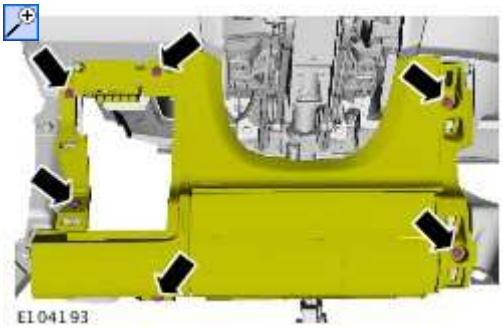
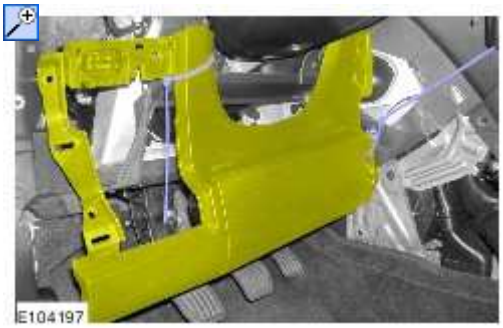


8. CAUTION: Make sure that no strain is placed on the wiring harnesses.
General Equipment: Cable ties



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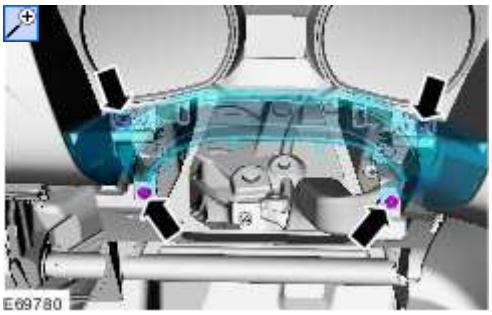

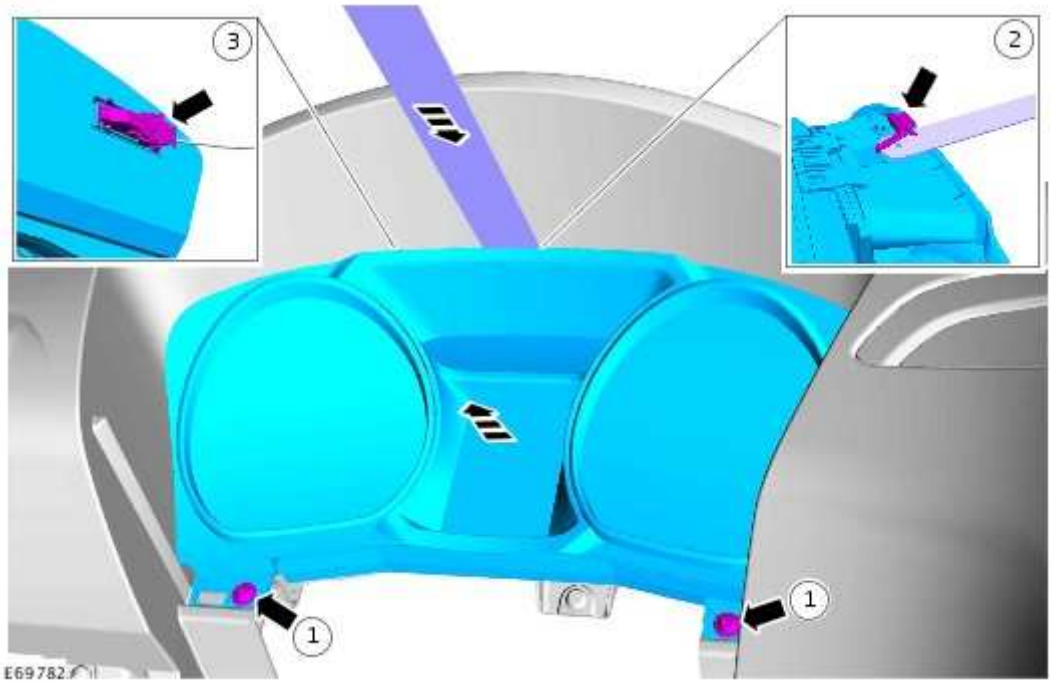

10. *General Equipme*
Round-ended st
rule

Installation

1. To install, reverse the removal procedure.
2. NOTE: The central car configuration data must be manually uploaded after the installation of a new instrument cluster.
For additional information due to module configurati
see TSB 73/2006.

General Equipment: Ford diagnostic equipment

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Diagnosis and Testing

Principles of Operation

The horn system consists of a relay, a steering wheel switch and either one or two horns. The horn(s) receives voltage from the switched side of the relay, and the relay switch is controlled on its ground side by the steering wheel switch.

The horn relay, is located in the battery junction box (BJB) and is supplied with a permanent voltage from the battery.

The steering wheel horn switch shares the steering wheel clockspring circuit with the air-bag circuit. Each of these systems work completely independent of each other.

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Wiring harness • Electrical connector(s) • Horn switch • Horn • Clockspring • Horn relay • BJB

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** Retrieve the Diagnostic Trouble Code (DTC)s and refer to the DTC Index Chart.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description/Condition	Possible Source	Action
9C5512	Horn relay- circuit short to battery	BJB	REFER to Ford diagnostic equipment.
9C5514	Horn relay - circuit short to ground or open	BJB	REFER to Ford diagnostic equipment.

1. **1.** If the cause is still evident, refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The horn is inoperative	* Circuit(s). * Horn. * Horn relay. * Clockspring. * Horn switch. * BJB.	* GO to Pinpoint Test A.

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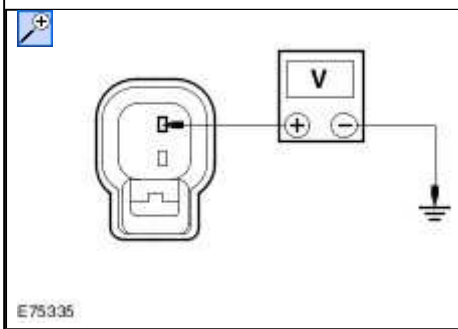
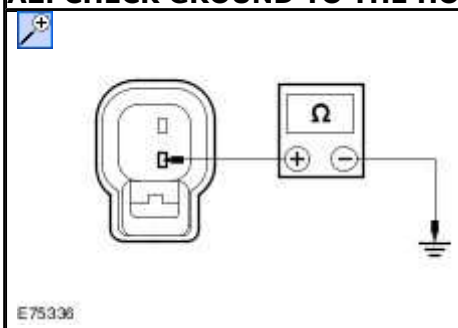
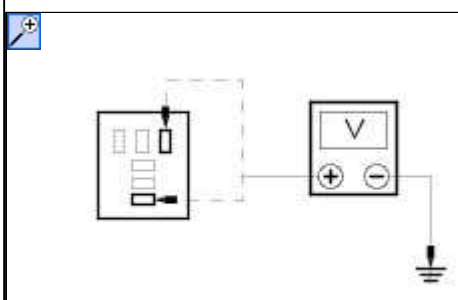
The horn is always on	* Horn relay. * BJB. * Horn switch. * Circuit(s). * Clockspring.	* REFER to the Ford diagnostic equipment.

Pinpoint Tests

PINPOINT TEST A : THE HORN IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK POWER TO THE HORN	
	1 Disconnect Horn C1RH02.
 E75335	2 Measure the voltage between the horn C1RH02 pin 2, circuit GBB31B (BU/OG), harness side and ground while pressing the horn switch.
	Is the voltage greater than 10 volts? **Yes** GO to A2. **No** GO to A3.
A2: CHECK GROUND TO THE HORN	
 E75336	1 Measure the resistance between the horn C1RH02 pin 1, circuit GD312G (BK/VT), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new horn. TEST the system for normal operation. **No** REPAIR circuit GD312G (BK/VT). TEST the system for normal operation.
A3: CHECK POWER TO THE HORN RELAY	
	1 Disconnect Horn Relay R9.
 VUE0031984	2 Measure the voltage between the horn relay R9 pin 1, harness side and ground; and horn relay R9 pin 3, harness side and ground.
	Are the voltages greater than 10 volts?

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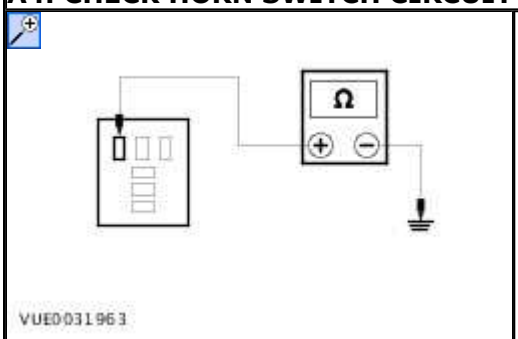
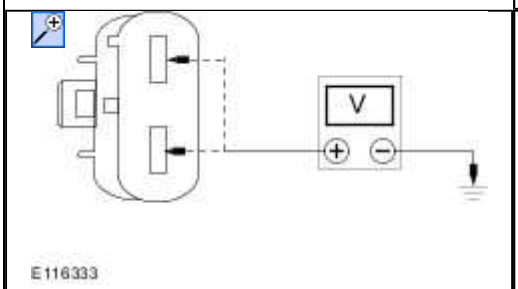
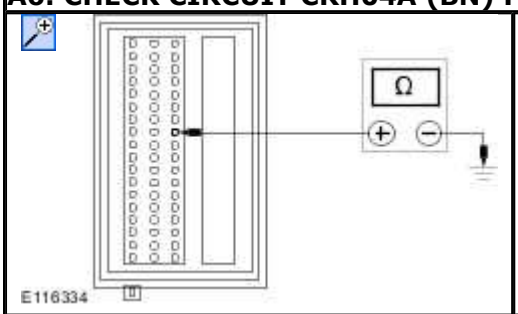
	Yes GO to A4. **No** INSTALL a new BJB. TEST the system for normal operation.
A4: CHECK HORN SWITCH CIRCUIT FOR OPEN	
	1 Measure the resistance between the horn relay R9 pin 2, circuit CRH04A (VT/GN), harness side and ground while pressing the horn switch.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new horn Relay R9. Test the system for normal operation. **No** GO to A5.
A5: CHECK SUPPLY TO THE CJB	
	1 Disconnect CJB 1BB01.
	2 Measure the voltage between the CJB 1BB01 pin 1, harness side and ground and between the CJB 1BB01 pin 2, harness side and ground.
	Are the voltages greater than 10 volts? **Yes** REPAIR the circuit SBB17. TEST the system for normal operation. **No** GO to A6.
A6: CHECK CIRCUIT CRH04A (BN) FOR OPEN	
	1 Measure the resistance between the CJB 1BB01 pin 46 component side and ground while pressing the horn switch.
	Is the resistance less than 5 ohms? **Yes** REPAIR the circuit CRH04A. TEST the system for normal operation. **No** GO to A7.
A7: CHECK CJB 1BB01 FOR OPEN	
	1 Measure the resistance between the CJB 1BB01 pin 13, harness side and ground while pressing the

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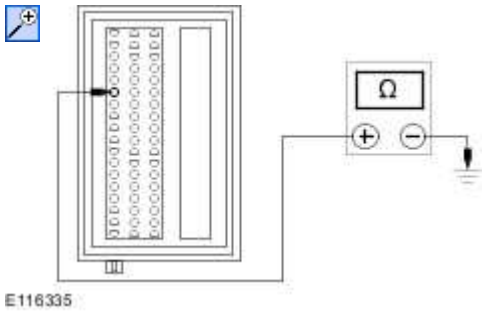
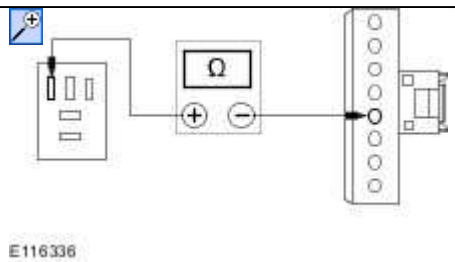
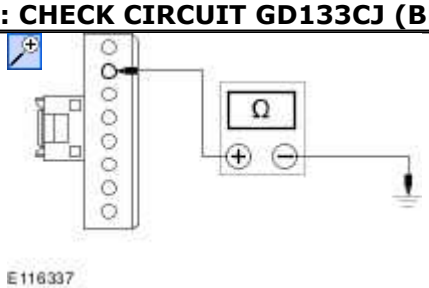
	horn switch.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new CJB 1BB01. Test the system for normal operation. **No** GO to A8.
A8: CHECK CIRCUIT CRH03A (BN) FOR OPEN	
WARNING: To deactivate the driver air bag, refer to the procedure in section 501-20B. Failure to follow this instruction, may result in personal injury.	
	1 Disconnect steering wheel module 2R115.
	2 Measure the resistance between the steering wheel module 2R115 pin 4, circuit CRH03-A (BN), harness side and horn relay R9 pin 2, CRH03-A (BN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to A9. **No** REPAIR the circuit CRH03-A. TEST the system for normal operation.
A9: CHECK CIRCUIT GD133CJ (BK) FOR OPEN	
	1 Measure the resistance between the steering wheel module 2R115 pin 7, circuit GD133CJ (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to A10. **No** REPAIR the circuit GD133CJ. TEST the system for normal operation.
A10: CHECK CIRCUIT C2RH02AB FOR OPEN	
	1 Disconnect horn switch 2RH03.
	2 Measure the resistance between the steering wheel module 2R115 pin 7, circuit CRH02AB, harness side and horn switch 2RH03 pin 1, circuit C2RH02B, harness side.

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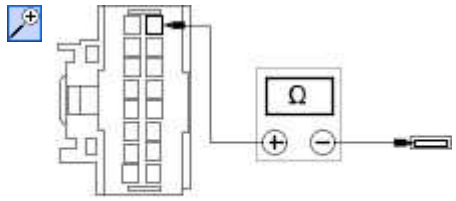


Is the resistance less than 5 ohms?

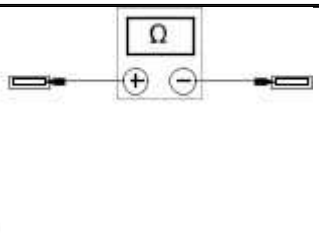
Yes

GO to A11.

No

REPAIR the circuit C2RH02AB. TEST the system for normal operation.

A11: CHECK THE HORN SWITCH



1 Measure the resistance between the horn switch 2RH03 pin 1, component side and horn switch 2RH03 pin 2, component side while pressing the horn switch.

Is the resistance less than 5 ohms?

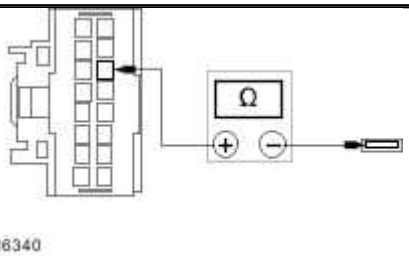
Yes

GO to A12.

No

INSTALL a new horn switch 2RH03. TEST the system for normal operation.

A12: CHECK CIRCUIT C2RH03AB FOR OPEN



1 Measure the resistance between the steering wheel module pin 4, circuit CRH03AB, harness side and horn switch C2RH03 pin 2, circuit C2RH03AB, harness side.

Is the resistance less than 5 ohms?

Yes

INSTALL a new steering wheel module. TEST the system for normal operation.

No

REPAIR the circuit C2RH03AB. TEST the system for normal operation.

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Diagnosis and Testing

The clock is an integral part of the instrument cluster.
REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).

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Description and Operation

The information and message center is an integral part of the instrument cluster. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

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Diagnosis and Testing

The information and message center is an integral part of the instrument cluster.
REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing).

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Removal and Installation

Removal

1. The information and message center is an intergral part of the instrument cluster.

   Refer to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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Description and Operation

Tire Pressure Monitoring System

For additional information, refer to: Tire Pressure Monitoring System (TPMS) (204-04 Wheels and Tires, Description and Operation).

Proximity Warning System

For additional information, refer to: Proximity Warning System (413-09 Warning Devices, Description and Operation).

Safety Belt Minder System

For additional information, refer to: Safety Belt System (501-20A Safety Belt System, Description and Operation).

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Description and Operation

System Operation - Speed Control

The speed control system is integrated within the engine management system and uses fueling intervention to automatically maintain a set vehicle speed. Once engaged, the speed control system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- On/Off/Cancel switch
- + and – (set/accelerate and decelerate)
- Resume switch
- Clockspring
- Speed control display (in the instrument cluster)

The speed control system uses various inputs from the following:

- brake pedal switch
- clutch pedal switch
- accelerator pedal position (APP) sensor
- park brake signal
- powertrain control module (PCM)
- stability assist module
- transmission control module (if equipped)

The speed control is operated by the driver using the steering wheel switches. When the speed control is active (by pressing ACC switch on and after pressing set + or -), the PCM regulates the vehicle speed so that it is equal to or less than that of the set speed depending upon the traffic situations.

System Operation - Adaptive Speed Control

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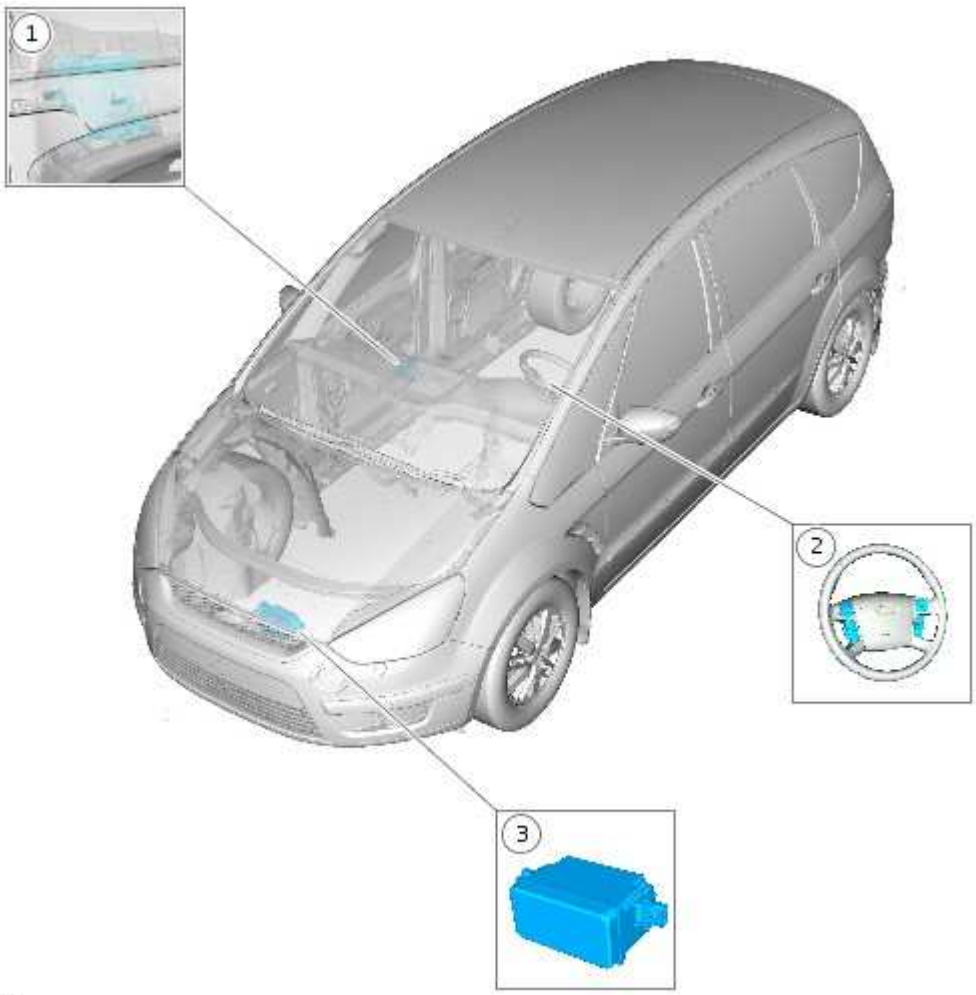

E72684

Item	Part Number	Description
1	—	Proximity warning module
2	—	Adaptive speed control steering wheel switches
3	—	Proximity warning radar unit

In addition to the standard speed control system, the adaptive speed control system uses the proximity warning radar unit to detect the speed, distance and range rate of vehicles ahead of it.

The adaptive speed control system is similar to conventional speed control in that it maintains the vehicle's pre-set speed. However, unlike conventional speed control, the adaptive speed control system can automatically adjust speed in order to maintain a suitable distance between vehicles in the same lane. This is achieved through the proximity warning radar unit, proximity warning module and is controlled by the adaptive speed control steering wheel switches. If the vehicle in front slows down, or if another object is detected, the adaptive speed control system sends a signal to the engine and braking system to decelerate. Then when the road is clear, the adaptive speed control system will accelerate the vehicle back to the set speed.

The adaptive speed control system is also capable of assisting the driver when the brakes need to be applied in an emergency situation.

When the forward alert system detects that a collision with an object in front of the vehicle may occur, an audible and visual warning is displayed in the instrument cluster. The warning level can be adjusted to suit the driver. In addition to the driver warning, the forward alert system calculates the need of assisting the driver in a braking situation by a

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possible precharge of the brake pressure by raising the emergency brake assist (EBA) level.

In general, the system is only reacting on movable (non-stationary) targets and has a requirement of minimum speed to be activated.

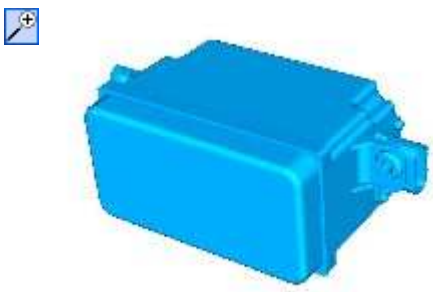
Adaptive speed control and forward alert are not available on vehicles with a standard anti-lock braking system (ABS) or standard stability assist module. Adaptive speed control works only in combination with an enhanced stability assist module or an anti-lock brake system/traction control module which is standard on vehicles that are equipped with continuous damping control (CDC).

Speed Control Steering Wheel Switches

E72685

The driver is able to switch the adaptive speed control system on or off through the steering wheel switches (ACC on & Set+/-), as well as being able to change the various settings. The time gap between the vehicle, and the vehicle in front can be set in 5 steps through the rocker buttons behind the cancel buttons the left side. In addition the forward alert system can be switched on or off with the button on the left lower side of the steering wheel.

Proximity Warning Radar Unit



E72686

The proximity warning radar unit is installed behind the adaptive speed control front bumper grill of the vehicle

The proximity warning radar unit continuously calculates the distance between itself and any objects in its path and relays this information to the proximity warning module. **If the proximity warning radar unit becomes damaged due to an accident it is important to install a new component. A bracket twisted during any accident repair operation at the front of the vehicle requires a new proximity warning radar unit to be installed, as the proximity warning radar unit must look accurately in the straight forward position at all times.**

Proximity Warning Module

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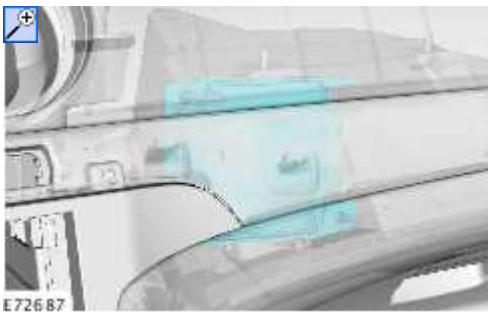

The proximity warning module is located behind the passenger side of the instrument panel.

The proximity warning module receives information from the proximity warning radar unit and adjusts the speed of the vehicle using the engine and the brakes to maintain a constant time gap to the vehicle in front. The proximity warning module also relays information to the instrument cluster to provide the driver with feedback about the system's settings. Instrument cluster equipment Level 2 or 3 is required.

Instrument Cluster

Information about the adaptive speed control system is displayed to the driver in the instrument cluster. Details of the speed and the distance in time are shown. When the adaptive speed control system detects that a collision is imminent, the instrument cluster will also display an audible and visual warning alerting the driver.

Service Alignment Procedure

This procedure is required if:

- **A new proximity warning radar unit and, or proximity warning module are installed**
- **The proximity warning radar unit needed to be removed or is misaligned in its position due to another repair operation.**

Install new components to the vehicle. Make sure that the vehicle is on level ground.

If the radar assembly was the only new component to be installed, the adaptive speed control system will automatically enter 'Service Alignment Mode'.

The **follow** indicator will now be flashing, this indicates that the vehicle is in "service alignment" and now requires driving.

The service alignment process measures the path of stationary targets such as streetlights, railings, road signs, parked vehicles etc., and uses this data to correct for radar misalignment. Alignment will complete more quickly if more suitable targets are seen. The following recommendations will help:

- The vehicle speed must be above 30 mph (48 kph).
- Choose a road with plenty of road furniture. Use an inside or outside lane.
- Following vehicles too closely will obscure the stationary targets from the radar, a time

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gap of 2 seconds is recommended.
- A straight road will produce a quicker and better result, although the process will still operate on a curved road.
- The time the adaptive speed control module takes to align will vary, depending on the route, speed, number of targets, and individual module.
- When the flashing **follow** indicator light extinguishes, the adaptive speed control system is now functional, and a required vehicle speed can now be set by the driver and the adaptive speed control system will operate as normal.

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Diagnosis and Testing

General Equipment

Ford Diagnostic Equipment

Inspection and Verification

NOTE: The safety belt minder can be accidentally activated if items are placed on the passenger seat.

1. **1.** Verify the customer concern.
2. **2.** Check the system to make sure that the safety belt minder has not been deactivated.
   REFER to: Safety Belt Minder Deactivating/Activating (413-09 Warning Devices, General Procedures).
3. **3.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Safety belt buckle	• Wiring harness • Electrical connector(s) • Safety belt buckle switch • Passenger seat mat minder • Restraints control module (RCM)

4. **4.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
5. **5.** If the cause is not visually evident, retrieve the Diagnostic Trouble Codes (DTCs) using the Ford diagnostic equipment.
6. **6.** If no DTCs are displayed relating to the symptom, refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The safety belt indicator does not illuminate	* Driver safety belt buckle switch. * Passenger safety belt buckle switch. * Passenger seat mat minder. * Circuit(s). * RCM. * Instrument cluster.	* GO to Pinpoint Test A.
The safety belt indicator is illuminated continuously	* Driver safety belt buckle switch. * Passenger safety belt buckle switch. * Passenger seat mat minder. * Circuit(s). * RCM. * Instrument cluster.	* GO to Pinpoint Test B.

PINPOINT TEST A : THE SAFETY BELT INDICATOR DOES NOT ILLUMINATE

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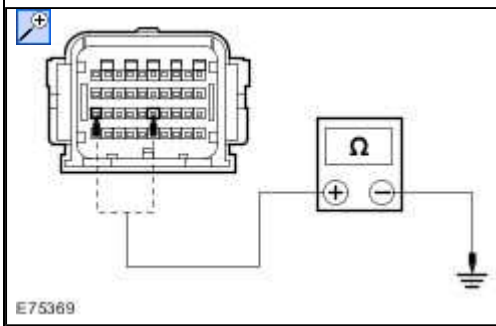
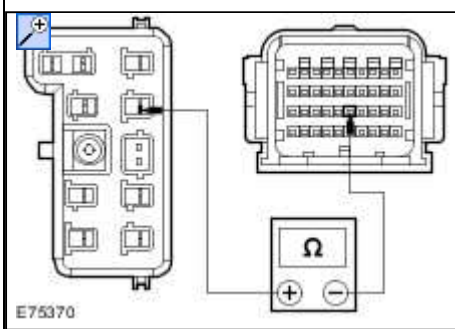
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK CIRCUITS CR201A (BU/OG) AND CR203A (GY/VT) FOR SHORT TO GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: The following tests are to be carried out with the safety belt unbuckled.	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Measure the resistance between the RCM C3R114 (driver side) pin 25, circuit CR201A (BU/OG), harness side and ground; and between the RCM C3R114 (passenger side) pin 30, circuit CR203A (GY/VT), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). TEST the system for normal operation. **No** Driver side. GO to A2. Passenger side. GO to A4.
A2: CHECK CIRCUIT CR201A (BU/OG) FOR OPEN CIRCUIT	
	1 Disconnect Driver Side Underseat Connector C3HS03.
	2 Measure the resistance between the driver side underseat connector C3HS03 pin 14, circuit CR201A (BU/OG), harness side and the RCM C3R114 pin 25, circuit CR201A (BU/OG), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to A3. **No** REPAIR circuit CR201A (BU/OG). TEST the system for normal operation.
A3: CHECK CIRCUIT RR155E (GY) FOR GROUND	
	1 Measure the resistance between the driver side underseat connector C3HS03 pin 13, circuit RR155E (GY), harness side and ground.

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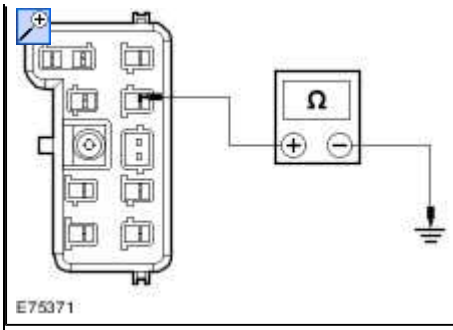
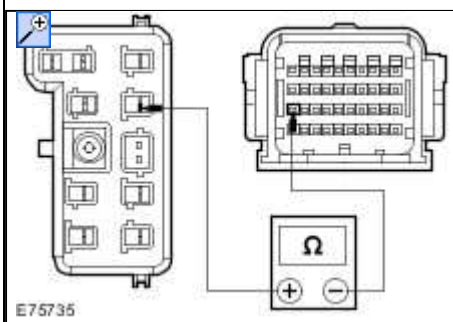
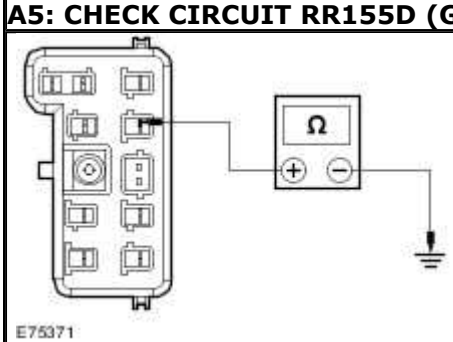
	
	Is the resistance greater than 10000 ohms? **Yes** INSTALL a new driver safety belt buckle. TEST the system for normal operation. If the concern persists, INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit RR155E (GY). TEST the system for normal operation.
A4: CHECK CIRCUIT CR203A (GY/VT) FOR OPEN	
	1 Disconnect Passenger Side Underseat Connector C3HS08.
	2 Measure the resistance between the passenger side underseat connector C3HS08 pin 14, circuit CR203A (GY/VT), harness side and the RCM C3R114 pin 30, circuit CR203A (GY/VT), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to A5. **No** REPAIR circuit CR203A (GY/VT). TEST the system for normal operation.
A5: CHECK CIRCUIT RR155D (GY) FOR GROUND	
	1 Measure the resistance between the passenger side underseat connector C3HS08 pin 13, circuit RR155D (GY), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to A6. **No** REPAIR circuit RR155D (GY). TEST the system for normal operation.
A6: CHECK THE PASSENGER SEAT MAT MINDER FOR OPEN CIRCUIT	
NOTE: This step requires the aid of another technician.	

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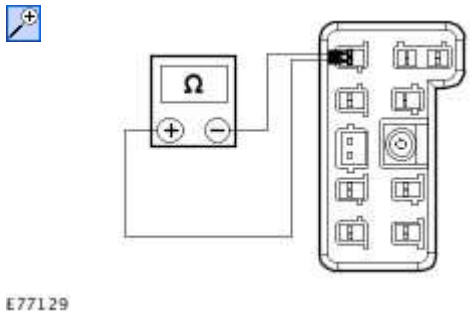


1 Measure the resistance between the passenger side underseat connector C3HS08 pin 11, component side and the passenger side underseat connector C3HS08 pin 12, component side with the seat occupied and not occupied.

Are the resistances between 0 and 400 ohms with the seat occupied and between 400 and 10,000 ohms with the seat not occupied?

Yes

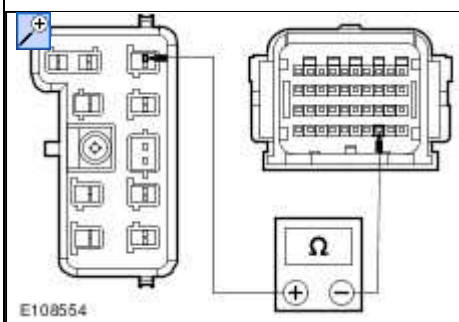
GO to A7.

No

INSTALL a new mat minder. Test the system for normal operation. If the concern persists, INSTALL a new instrument cluster.
REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).
TEST the system for normal operation.

A7: CHECK CIRCUIT VR212A (YE/GN) FOR OPEN CIRCUIT

1 Disconnect Passenger Side Underseat Connector C3HS08.



2 Measure the resistance between the passenger side underseat connector C3HS08 pin 11, circuit VR212A (YE/GN), harness side and the RCM C3R114 pin 33, circuit VR212A (YE/GN) harness side.

Are the resistances less than 5 ohms?

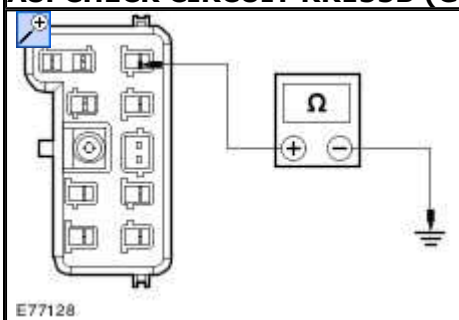
Yes

GO to A8.

No

REPAIR circuit VR212A (YE/GN). TEST the system for normal operation.

A8: CHECK CIRCUIT RR155B (GY) FOR GROUND



1 Measure the resistance between the passenger side underseat connector C3HS08 pin 12, circuit RR155B (GY), harness side and ground.

Is the resistance less than 5 ohms?

Yes

INSTALL a new passenger safety belt buckle. TEST the system for normal operation. If the concern persists, INSTALL a new instrument cluster.
REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation).
TEST the system for normal operation.

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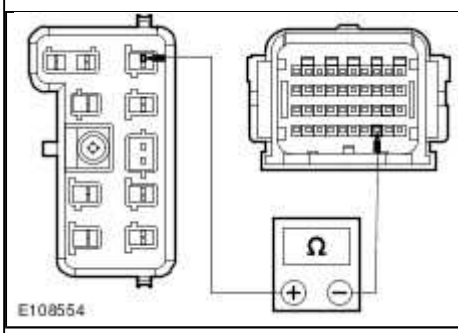
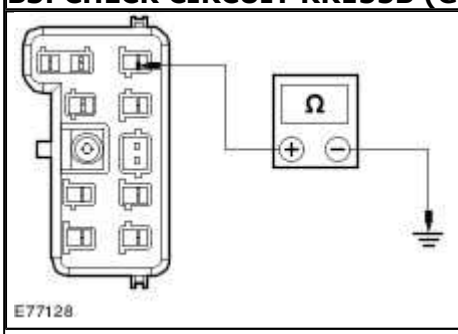
	No REPAIR circuit RR155B (GY). TEST the system for normal operation.

PINPOINT TEST B : THE SAFETY BELT INDICATOR IS ILLUMINATED CONTINUOUSLY.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE DRIVER/PASSENGER SAFETY BELT SWITCH(ES)	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: The following tests are to be carried out with the safety belt unbuckled.	
	1 Deactivate the SRS.
	2 Ignition switch in position 0.
	3 Disconnect Driver Side Underseat Connector C3HS03, Passenger Side Underseat Connector C3HS08.
	4 Ignition switch in position II.
	Is the safety belt indicator illuminated? **Yes** For passenger side, GO to B2. For driver side, GO to B5. **No** INSTALL a new safety belt buckle(s) as required. TEST the system for normal operation.
B2: CHECK CIRCUIT VR212A (YE/GN) FOR OPEN	
	1 Disconnect RCM C3R114.
	2 Measure the resistance between the RCM C3R114 pin 33, circuit VR212A (YE/GN), harness side and the passenger side underseat connector C3HS08 pin 11, circuit VR212A (YE/GN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B3. **No** REPAIR the circuit. TEST the system for normal operation.
B3: CHECK CIRCUIT RR155B (GY) FOR GROUND	
	1 Measure the resistance between the passenger side underseat connector C3HS08 pin 12, circuit RR155B (GY), harness side and ground.
	Is the resistance less than 5 ohms? **Yes**

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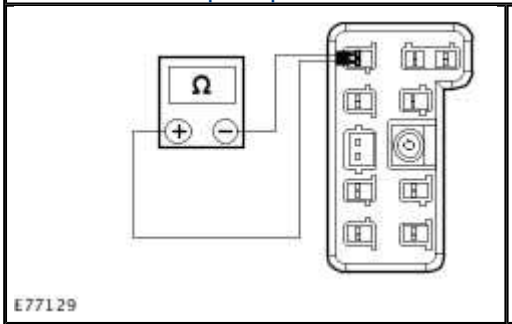
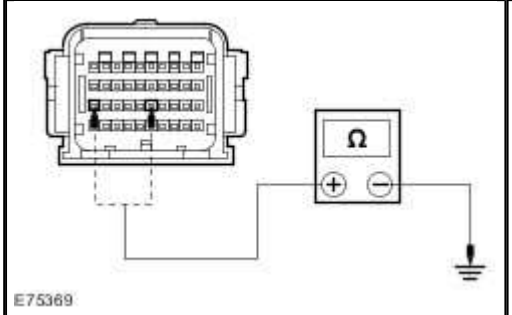
	GO to B4. **No** REPAIR the circuit. TEST the system for normal operation.
B4: CHECK THE PASSENGER SEAT MAT MINDER FOR OPEN CIRCUIT	
NOTE: This step requires the aid of another technician.	
	1 Measure the resistance between the passenger side underseat connector C3HS08 pin 11, component side and the passenger side underseat connector C3HS08 pin 12, component side with the seat occupied and not occupied.
	Are the resistances between 0 and 400 ohms with the seat occupied and between 400 and 10,000 ohms with the seat not occupied? **Yes** GO to B5. **No** INSTALL a new mat minder. Test the system for normal operation. If the concern persists, INSTALL a new instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Removal and Installation). TEST the system for normal operation.
B5: CHECK CIRCUITS CR201A (BU/OG) AND CR203A (GY/VT) FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Measure the resistance between the RCM C3R114 (driver side) pin 25, circuit CR201A (BU/OG), harness side and ground; and between the RCM C3R114 (passenger side) pin 30, circuit CR203A (GY/VT), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit CR201A (BU/OG) or CR203A (GY/VT) as required. TEST the system for normal operation.

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General Procedures

Preparation

1. Apply the parking brake.
2. Place the transmission selector lever in P (Park) - vehicles with automatic transmission or the neutral position - vehicles with manual transmission.
3. Turn the ignition switch to the 0 position.
4. Close all the vehicle doors from the inside of the vehicle.

Deactivating/Activating

NOTE: Deactivation of the belt minder may also be carried out using IDS. Follow the instructions on the screen.

1. **Unbuckle** the drivers safety belt.
2. Turn the ignition switch to position II. (Do not start the engine).
3. **Wait at least 15 seconds.**
4. NOTE: This step must be completed within 60 seconds or the procedure must be repeated.
   Buckle then unbuckle the safety belt nine times, ending with the safety belt unbuckled. Release the red unbuckle switch **completely** every cycle.
5. The safety belt warning indicator flashes three times to confirm the belt minder status change.
6. Turn the ignition switch to position 0. The deactivation/activation procedure is now complete.

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General Procedures

1. This procedure is required if a new proximity warning radar unit and, or proximity warning module are installed or if the proximity warning radar unit needed to be removed or is misaligned in its position due to another repair operation.
2. Make sure that the vehicle is on level ground.
3. Activate the adaptive speed control system and the system will automatically enter service alignment mode.
4. The FOLLOW indicator on the information and message center will now be flashing, this indicates that the vehicle is in service alignment mode and requires driving.
5. Carry out a road test to set the alignment of the adaptive speed control system. The following recommendations will assist in completion of the alignment process.
6.
   - The vehicle speed must be above 30 mph (48 kph).
   - Choose a road with plenty of road furniture and use an inside or outside line.
   - Following vehicles too closely will obscure the stationary targets from the radar, a time gap of 2 seconds is recommended.
   - A straight road will produce a quicker and better result, although the process will still operate on a curved road.
   - The time the adaptive speed control module takes to align will vary depending on the route, speed, number of targets and individual module.
   - When the flashing FOLLOW indicator light extinguishes the adaptive speed control system is now functional and a required vehicle speed can now be set by the driver. The speed control system will operate as normal.
7. In general the procedure can be manually triggered by the WDS tester systems. If the WDS is connected and the procedure is selected in the WDS the procedure will be started and the telltale will start flashing like described above. An advantage of this manually triggered procedure is the presence of a bar on the WDS screen that is indicating the progress of the adjustment procedure while driving.

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General Procedures

1. Close all doors.
2. Turn the ignition key to position II.
3. Simultaneously press the accelerator pedal and the brake pedal and hold for a minimum of 15 seconds.
4. Press the "OK" button of the multifuctional switch and the oil change reminder indicator will turn off. This confirms that the reset procedure has been correctly completed.

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Removal and Installation

Removal

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

Left-hand drive vehicles

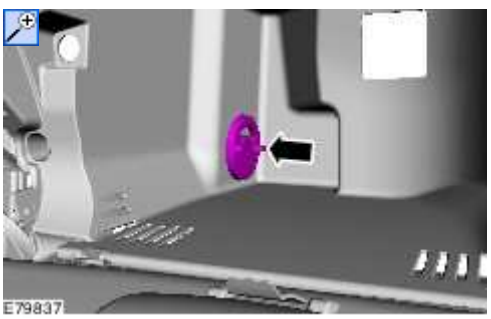
E79836

1.

E75091

2.

Vehicles with air conditioning


E79837

3.

Left-hand drive vehicles

E79838

4.

Right-hand drive vehicles

5.

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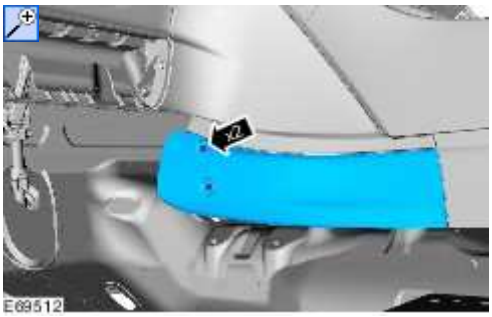

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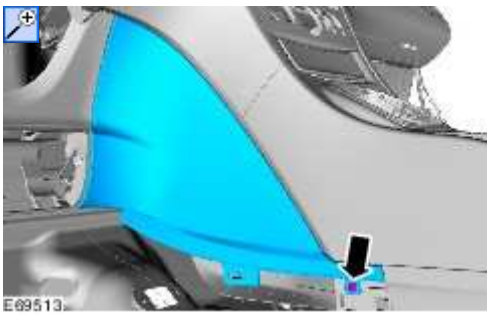

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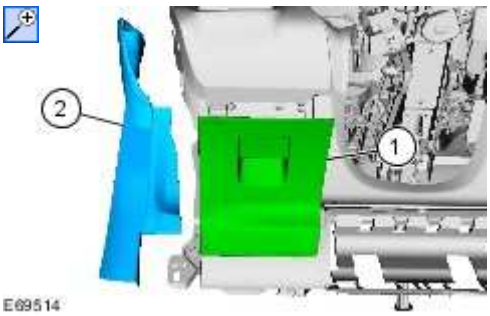

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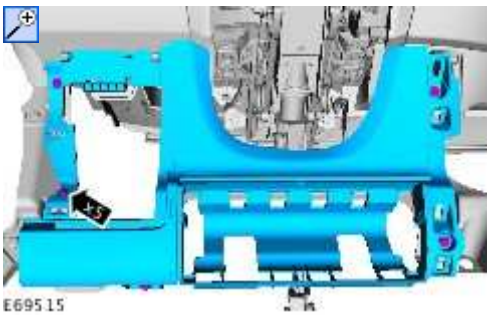
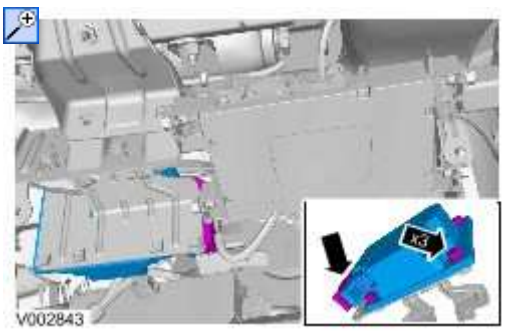


All vehicles



9. NOTE: Make sure that the component terminals are not bent or damaged.
Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Carry out the proximity warning radar unit adjustment.

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Refer to: Proximity Warning Radar Unit Adjustment (413-09 Warning Devices, General Procedures).

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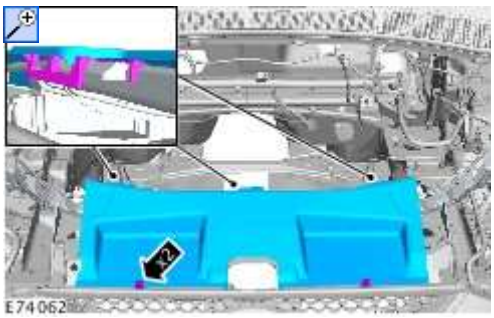
Removal and Installation

Removal

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

1. Remove the left headlamp.

   Refer to: Headlamp Assembly (417-01 Exterior Light Removal and Installation).



2.

3.

4.

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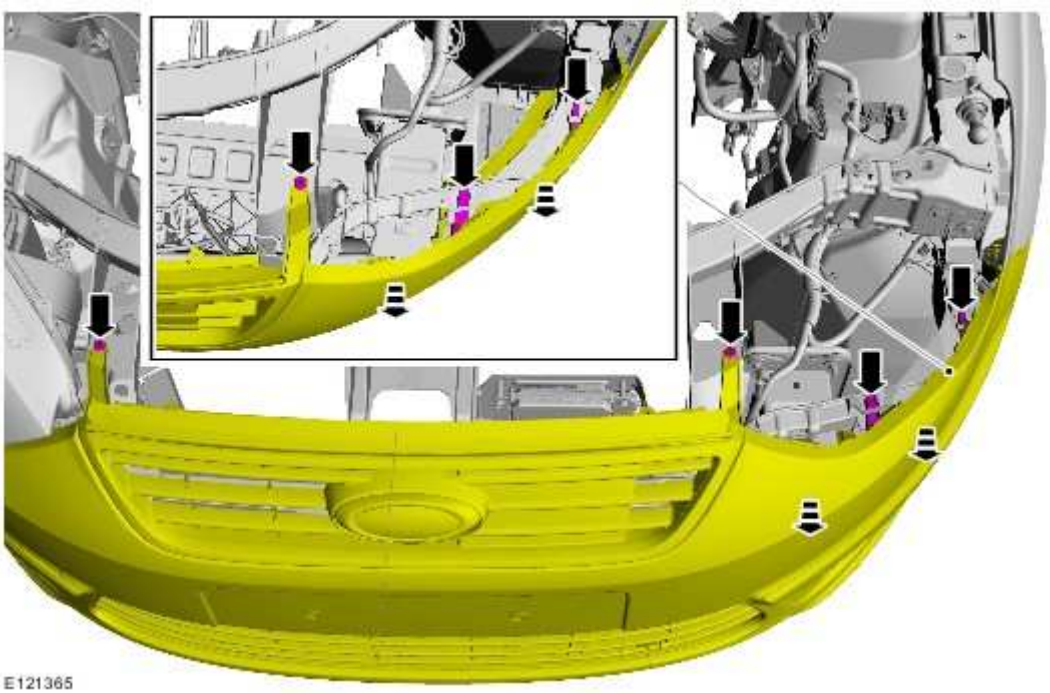
E121364



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5.

6. CAUTIOI

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If
accident
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install a
sensor.
Torque:

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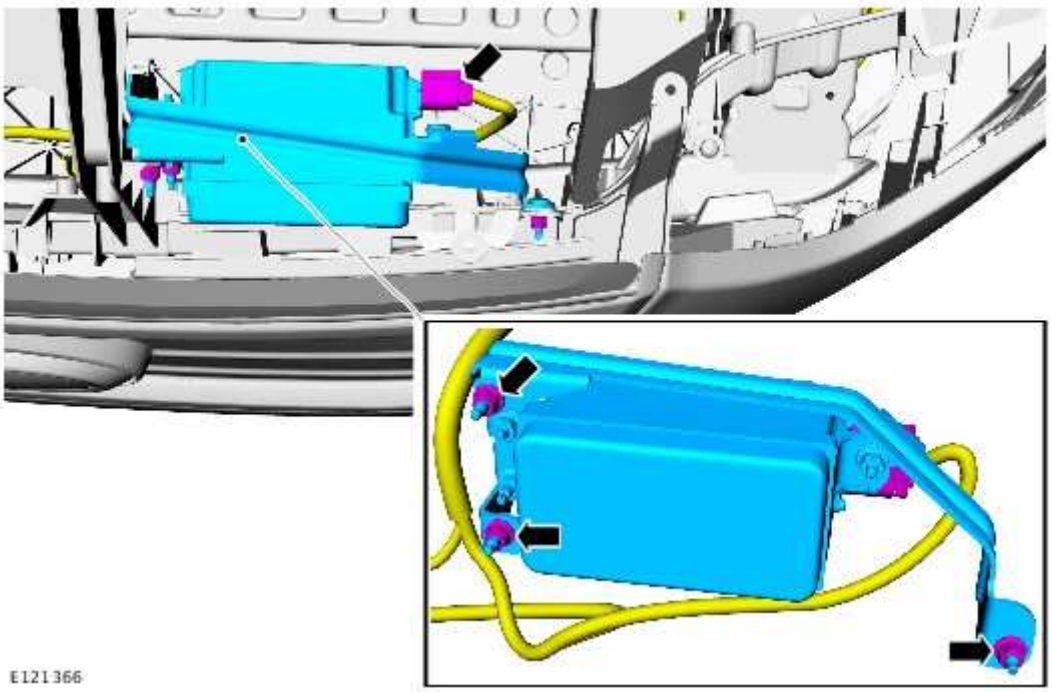

Installation

1. To install, reverse the removal procedure.
2. Refer to: Proximity Warning Radar Unit Adjustment (Warning Devices, General Procedures).

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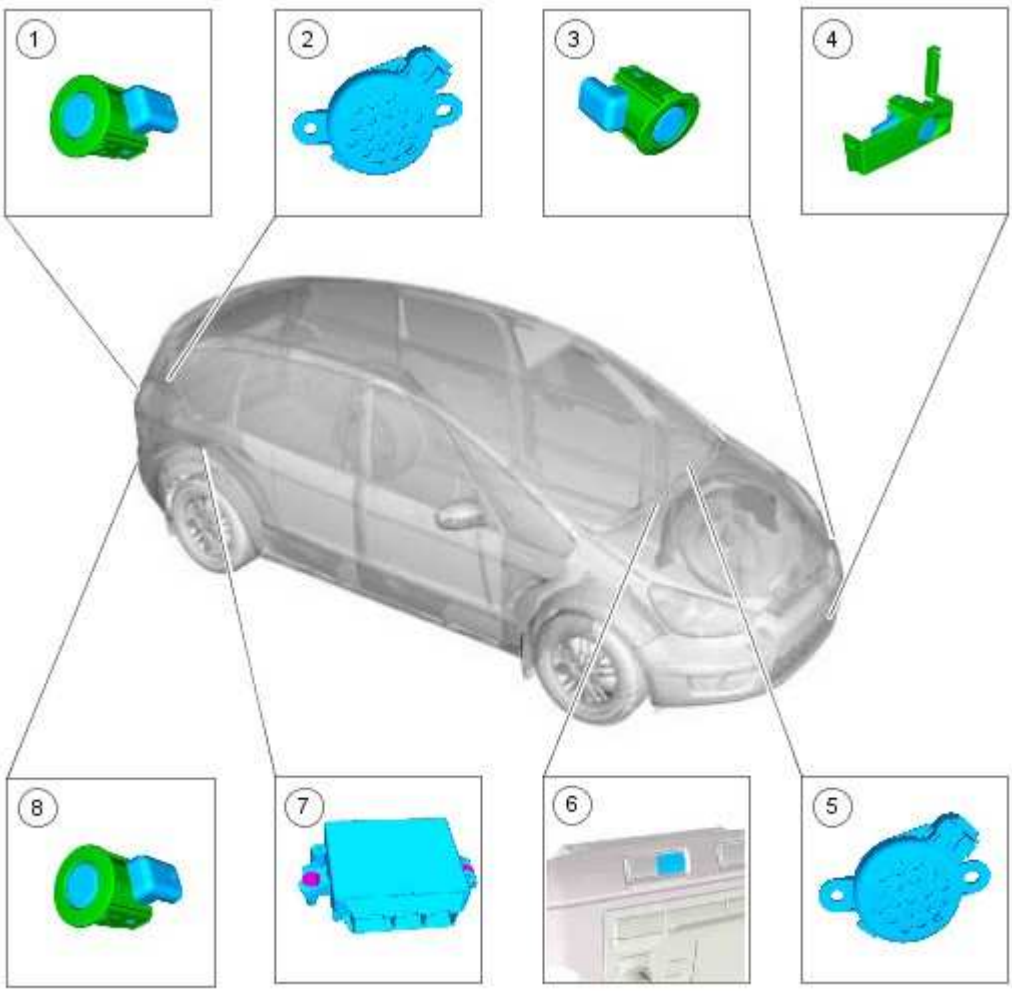
Description and Operation

Component location



E71782

Item	Part Number	Description
1	-	Rear outer parking aid sensor
2	-	Rear outer parking aid sensor holder
3	-	Front parking aid speaker
4	-	Front inner parking aid sensor holder
5	-	Front inner parking aid sensor
6	-	Front outer parking aid sensor holder
7	-	Front outer parking aid sensor
8	-	Parking aid switch (with light emitting diode (LED))
9	-	Parking aid module (with rear parking aid speaker)
10	-	Rear inner parking aid sensor
11	-	Rear inner parking aid sensor holder

Description and operation

Only one level of parking aid system is installed to the vehicle, a front and rear system.

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The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during forward or reverse parking manoeuvres. The system consists of four ultrasonic parking aid sensors in each bumper, a parking aid module, parking aid speaker(s) and a parking aid switch.

At low speeds, the parking aid module uses the parking aid sensors to monitor the area around the front and rear bumpers. If an object is detected within a monitored area, the parking aid module outputs a warning tone using the parking aid speakers. Objects very close to the ground may not be detected, but because of their low height will not cause damage to the vehicle.

The parking aid module communicates through discrete signals with the parking aid speakers. The parking aid speakers output the applicable warning tones when an object is detected. The medium speed controller area network (CAN) bus is used to collect vehicle data from other vehicle systems.

When the parking aid module activates the system, the parking aid switch LED is illuminated. The parking aid module processes signals received from the sensors to determine if there is an object within the detection range of the parking aid sensors.

In the combined mode, the parking aid sensor(s) emit a series of ultrasonic impulses and switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the parking aid module and compared with pre-programmed data stored in an EEPROM within the parking aid module. The parking aid module receives this data through the signal line from the parking aid sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse. The duration of the impulse duration is determined by the parking aid module, with the parking aid sensor controlling the frequency of the impulse output.

In receiver mode, the parking aid sensor receives impulses that were emitted by adjacent parking aid sensors. The parking aid module uses this information to determine the distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either parking aid speaker(s) as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until at approximately 250 mm (10 inches), the audible tone becomes continuous.

If, after the initial detection of an object, there is no decrease in distance between the object and the vehicle, the audible warning tones remain constant if the object is detected by a central parking aid sensor or stops after 3 seconds if the object is detected by a corner parking aid sensor.

The parking aid module continues to monitor the distance and will resume the warning tones if a decrease in distance is detected.

The parking aid system is activated when the driver presses the parking aid switch (vehicle speed below 16 km/h (10 mph) and the parking aid system not active) or selects reverse gear.

Front and rear parking aid sensors are activated and deactived together.

The parking aid system operation is disabled when the parking aid switch is pressed while the parking aid system is active or the ignition is switched off. The parking aid system operation is also disabled if the vehicle forward speed exceeds 16 km/h (10 mph).

The parking aid system can detect when a trailer is connected to the vehicle by a message output on the medium speed CAN bus from the trailer. When the parking aid module detects that a trailer is connected to the vehicle, the rear parking aid sensors are disabled to prevent constant warnings due to the close proximity of the trailer.

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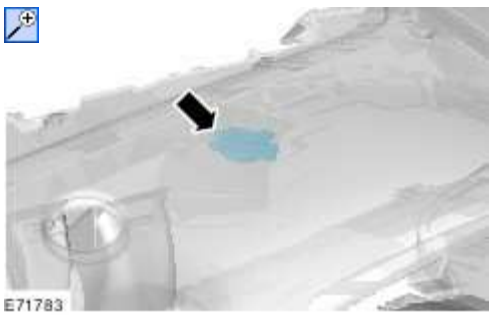
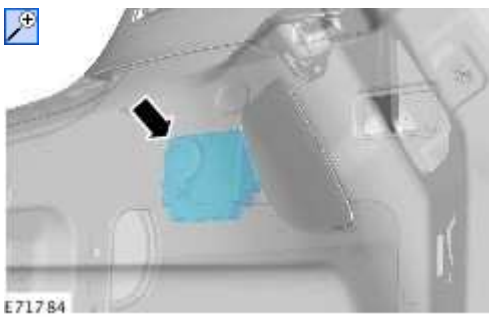
Front parking aid speaker



The front parking aid speaker is located behind the instrument panel close to the instrument cluster.

Parking aid module



The parking aid module has three connectors which provide for power, ground and CAN bus connections, front and rear parking aid sensors, parking aid switch, LED and parking aid speakers.

The medium speed CAN bus connections provide for the receipt of the following information from other systems:

- ABS (anti-lock brake system) module - Road speed signal
- Central junction box (CJB) - Reverse gear engaged signal, vehicle configuration parameters, carmode and powermode
- Powertrain control module (PCM) - Vehicle speed signal
- Transmission control unit - Gear lever position (automatic transmission)
- Trailer module - Trailer connection status

The parking aid module carrys out self-check routines and when the parking aid system is active, checks the parking aid sensor wiring for short or open circuits. If a concern is detected, a diagnostic trouble code (DTC) is stored in a memory in the parking aid module and the front and rear parking aid sensors will be disabled until the DTC is cleared and the ignition cycled. The driver is made aware of any concern condition by the parking aid switch LED flashing and a continuous warning tone being emitted for 3 seconds at the start of ignition cycle, in place of the normal short tones when the parking aid system is functioning normally. DTCs can be read using the worldwide diagnosis system (WDS) through the data link connector (DLC).

In addition, the rear parking aid speaker is integrated to the parking aid module housing.

Rear parking aid sensor

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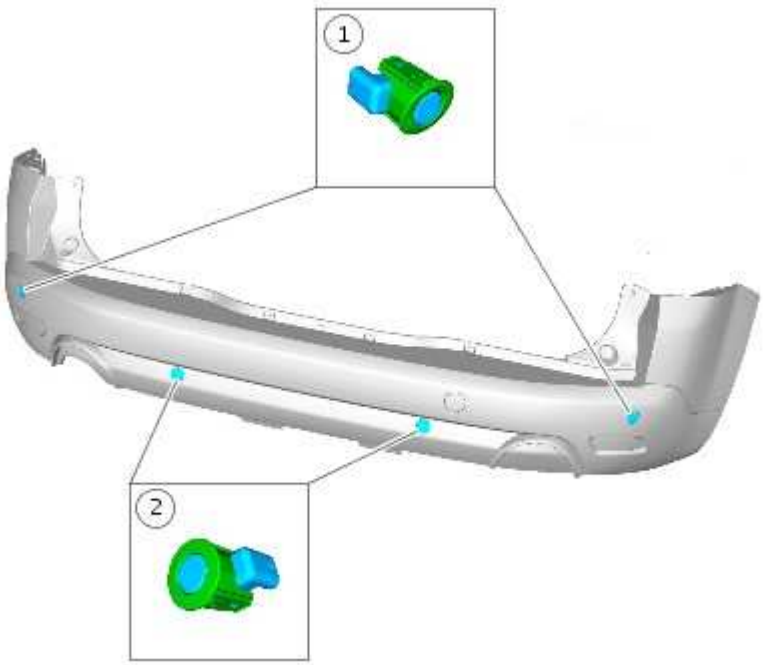

E71785

Item	Part Number	Description
1	-	Rear outer parking aid sensor(s)
2	-	Rear inner parking aid sensor(s)

The parking aid sensor comprises of a sensor and a holder. The holder makes sure that each parking aid sensor is correctly orientated in relation to its location in the rear bumper.

Each parking aid sensor has a three pin connector which connects with the rear bumper wiring harness, which in turn is connected to the main body wiring harness. Three pins provide for power supply, ground and signal lines to and from the parking aid module.

Each parking aid sensor comprises of the following:

- a plastic housing
- an aluminium membrane which contains a piezo electric disc
- a decoupling ring which may be a separate component from the sensor or overmoulded to the sensor membrane

The disc resonates at a frequency of ca. 50kHz, producing the ultrasonic output. The disc also receives the reflected echo signal from any objects within range.

The parking aid module controls the operation of each parking aid sensor using a digital output on the signal line. The parking aid module controls the parking aid sensor in one of two modes; combined transmitter and receiver mode or receiver mode only.

Parking aid switch

E71786

The parking aid switch is located in the instrument panel, above the audio unit or

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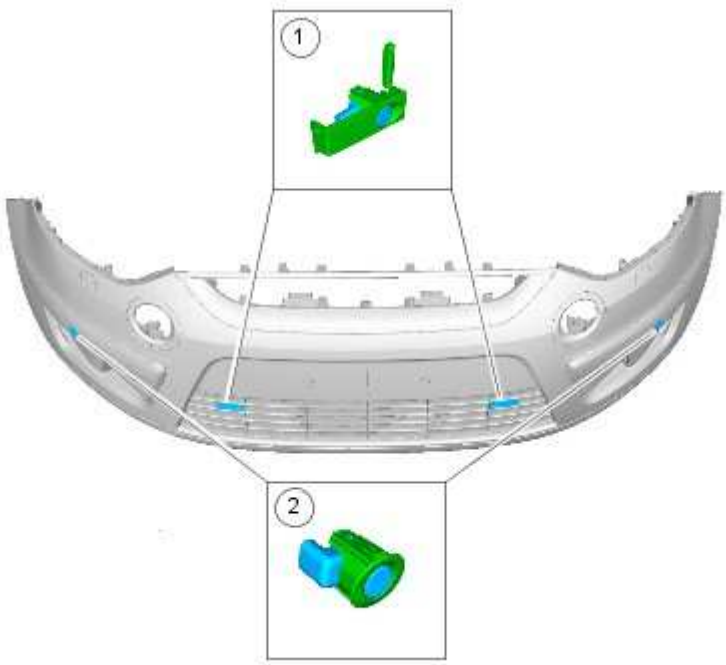
navigation system display module. The parking aid switch is the left-hand side switch with an integral LED.

The parking aid switch is a non-latching push switch which allows the driver to select the parking aid system on or off. When pressed, the parking aid switch momentarily connects a ground to the parking aid module. The LED indicates when the parking aid system is active. The LED is controlled by the parking aid module.

The parking aid switch allows the driver to disable the parking aid system when reverse gear is selected or to activate the parking aid sensors when not in reverse gear.

If a concern exists in the parking aid system, the LED flashes for 3 seconds when the reverse gear is selected or the driver selects the parking aid sensors on, using the parking aid switch.

Front parking aid sensor



E71787

Item	Part Number	Description
1	-	Front inner parking aid sensor(s)
2	-	Front outer parking aid sensor(s)

The parking aid sensor comprises of a sensor and a holder. The holder makes sure that each parking aid sensor is correctly orientated in relation to its location in the front bumper.

Each parking aid sensor has a three pin connector which connects with the front bumper wiring harness, which in turn is connected to the main body wiring harness. Three pins provide for power supply, ground and signal lines to and from the parking aid module.

Each parking aid sensor comprises of the following:

- a plastic housing
- an aluminium membrane which contains a piezo electric disc
- a decoupling ring which may be a separate component from the sensor or overmoulded to the sensor membrane

The disc resonates at a frequency of ca. 50kHz, producing the ultrasonic output. The disc also receives the reflected echo signal from any objects within range.

The parking aid module controls the operation of each parking aid sensor using a digital output on the signal line. The parking aid module controls the parking aid sensor in one of

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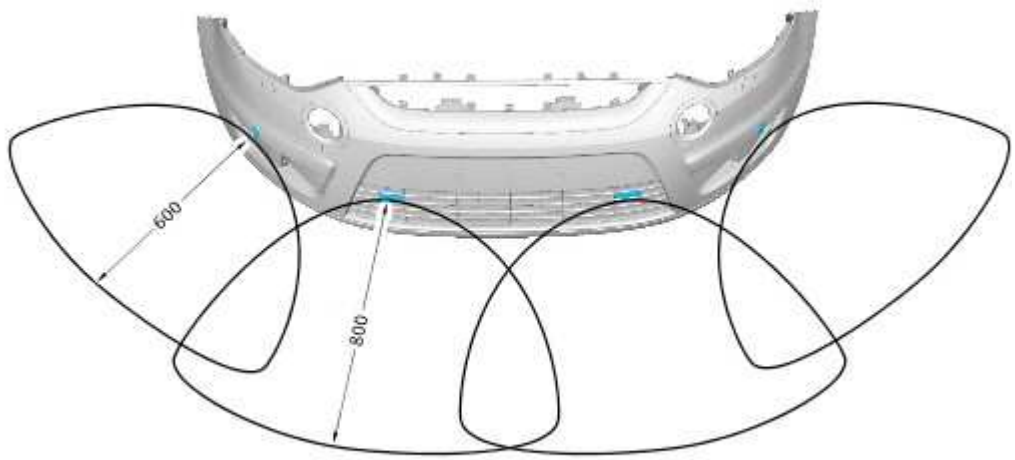
two modes; combined transmitter and receiver mode or receiver mode only.

Distance calculation

Front parking aid sensors

mm

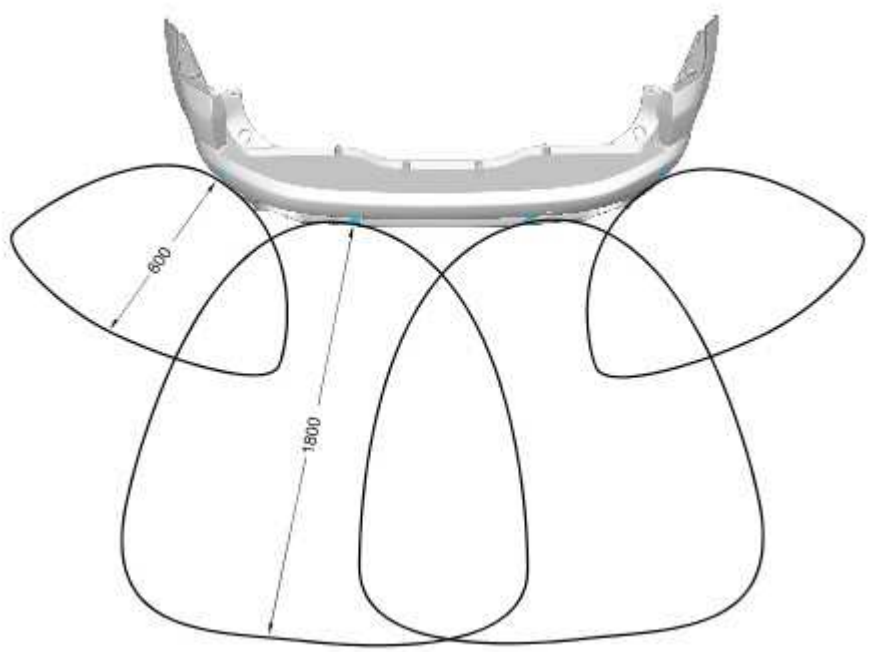


E71788

The maximum detection range for the front parking aid sensors is 800 mm (31 inches) for the central parking aid sensors and 600 mm (23.5 inches) for the corner parking aid sensors.

Rear parking aid sensors

mm



E71709

The maximum detection range for the rear parking aid sensors is 1800 mm (70 inches) for the central parking aid sensors and 600 mm (23.5 inches) for the corner parking aid sensors.

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Diagnosis and Testing

Principle of Operation

For a detailed description of the parking aid system,
REFER to: Parking Aid (413-13 Parking Aid, Description and Operation).

Inspection and Verification

CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

NOTE: Particular attention should be paid to the following items where Diagnostic Trouble Codes (DTCs) may not be logged:

- Check for contamination (e.g. foreign matter, grime, frosting, ice) around the parking aid sensors, if so clean as necessary.
- Check for the correct installation and alignment of the sensors to the bumper cover.
- Spurious detection of the ground may occur during front system operation on an up-slope.

Visual Inspection

Electrical
• Fuse(s) • Relay(s) • Wiring Harness • Electrical connector(s) • Front parking aid sensor(s) and retainers • Rear parking aid sensor(s) and retainers • Front parking aid speaker • Rear parking aid speaker • Parking aid switch and LED • Reversing lamp switch • Parking aid module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, check for DTCs and refer to the DTC Index Chart.

DTC Index Chart

NOTE: Generic scan tools may not read the DTCs listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the concern (the last two digits give additional information read by the manufacturer approved diagnostic system).
NOTE: When carrying out voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.
NOTE: Check and rectify basic concerns before beginning diagnostic routines involving

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pinpoint tests.
NOTE: Inspect electrical connectors for signs of water ingress, and pins for damage and/or corrosion.
NOTE: If DTCs are recorded and, after carrying out the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose electrical connectors and corroded pins.

DTC	Description	Possible Cause	Action
B1B3601	Front outer right sensor	• Front outer right parking aid sensor signal circuit - short to ground, open circuit • Front outer right parking aid sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B3612	Front outer right sensor	• Front outer right parking aid sensor signal circuit - short to power	GO to Pinpoint Test A.
B1B3696	Front outer right sensor	• Front outer right parking aid sensor ground circuit open circuit • Front outer right parking aid sensor internal failure	GO to Pinpoint Test B.
B1B3801	Front inner right sensor	• Front inner right parking aid sensor signal circuit short to ground or open circuit • Front inner right parking aid sensor power supply circuit open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B3812	Front inner right sensor	• Front inner right parking aid sensor signal circuit - short to power	GO to Pinpoint Test C.
B1B3896	Front inner right sensor	• Front inner right parking aid sensor ground circuit - open circuit • Front inner right parking aid sensor internal failure	GO to Pinpoint Test D.
B1B4001	Front outer left sensor	• Front outer left parking aid sensor signal circuit - short to ground, open circuit • Front outer left parking aid sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B4012	Front outer left sensor	• Front outer left parking aid sensor signal circuit - short to power	GO to Pinpoint Test E.
B1B4096	Front outer left sensor	• Front outer left parking aid sensor ground circuit - open circuit • Front outer left parking aid sensor internal failure	GO to Pinpoint Test F.
B1B4201	Front inner left sensor	• Front inner left parking aid sensor signal circuit - short to ground, open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.

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		• Front inner left parking aid sensor power supply circuit - open circuit	
B1B4212	Front inner left sensor	• Front inner left parking aid sensor signal circuit - short to power	GO to Pinpoint Test G.
B1B4296	Front inner left sensor	• Front inner left parking aid sensor ground circuit - open circuit • Front inner left parking aid sensor internal failure	GO to Pinpoint Test H.
B1B4401	Rear outer right sensor	• Rear outer right parking aid sensor signal circuit - short to ground, open circuit • Rear outer right parking aid sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B4412	Rear outer right sensor	• Rear outer right parking aid sensor signal circuit - short to power	GO to Pinpoint Test I.
B1B4496	Rear outer right sensor	• Rear outer right parking aid sensor ground circuit - open circuit • Rear outer right parking aid sensor internal failure	GO to Pinpoint Test J.
B1B4601	Rear inner right sensor	• Rear inner right parking aid sensor signal circuit - short to ground, open circuit • Rear inner right parking aid sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B4612	Rear inner right sensor	• Rear inner right parking aid sensor signal circuit - short to power	GO to Pinpoint Test K.
B1B4696	Rear inner right sensor	• Rear inner right parking aid sensor ground circuit - open circuit • Rear inner right parking aid sensor internal failure	GO to Pinpoint Test L.
B1B4801	Rear outer left sensor	• Rear outer left parking aid sensor signal circuit - short to ground, open circuit • Rear outer left parking aid sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B4812	Rear outer left sensor	• Rear outer left parking aid sensor signal circuit - short to power	GO to Pinpoint Test M.
B1B4896	Rear outer left sensor	• Rear outer left parking aid sensor ground circuit - open circuit • Rear outer left parking aid sensor internal failure	GO to Pinpoint Test N.

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B1B5001	Rear inner left sensor	• Rear inner left parking aid sensor signal circuit - short to ground, open circuit • Rear inner left sensor power supply circuit - open circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
B1B5012	Rear inner left sensor	• Rear inner left parking aid sensor signal circuit - short to power	GO to Pinpoint Test O.
B1B5096	Rear inner left sensor	• Rear inner left parking aid sensor ground circuit - open circuit • Rear inner left parking aid sensor internal failure	GO to Pinpoint Test P.
B1B5201	Rear parking aid speaker	• Rear parking aid speaker - internal fault • Rear parking aid speaker circuit short to ground or open circuit	GO to Pinpoint Test Q.
B1B5212	Rear parking aid speaker	• Rear parking aid speaker - short to power (detected if driven only)	GO to Pinpoint Test R.
B1B5301	Front parking aid speaker	• Front parking aid speaker - internal fault • Front parking aid speaker circuit short to ground or open circuit	GO to Pinpoint Test S.
B1B5312	Front parking aid speaker	• Front parking aid speaker - short to power (detected if driven only)	GO to Pinpoint Test T.
B1B5411	Parking aid status LED	• Parking aid status LED - short to ground (detected if driven only)	GO to Pinpoint Test U.
B1B5412	Parking aid status LED	• Parking aid status LED - short to power (detected if not driven only)	GO to Pinpoint Test V.
B1B5711	Front parking aid sensors power supply circuit	• Front parking aid sensors power supply circuit - short to ground	GO to Pinpoint Test W.
B1B5811	Rear parking aid sensors power supply circuit	• Rear parking aid sensors power supply circuit - short to ground	GO to Pinpoint Test X.
B1C3073	Parking aid switch	• Parking aid switch stuck closed • Parking aid switch circuit - short circuit	Refer to the Ford diagnostic equipment to access pinpoint tests for this DTC.
U001000	Medium speed CAN bus	• Medium speed CAN bus	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U007300	Parking aid module bus "A" Off	• Parking aid module communication bus "A" Off	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U014000	Communication lost with the CJB	• Logged when subscribed CAN message missing from the CJB	REFER to: Communications Network (418-00 Module Communications Network,

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			Diagnosis and Testing).
U025200	Communication lost with the lighting control module - rear "B"	CAN message missing from trailer module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U030000	Internal parking aid module software incompatibility	• CJB car configuration data is not compatible with the parking aid module	Re-configure the CJB using the Ford diagnostic equipment. Clear the DTC(s) and re-test. If DTC(s) still logged, install a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation).
U042200	Invalid data received from the CJB	• Logged when subscribed CAN message invalid from the CJB	Check the CJB for DTC(s) and refer to the DTC Index. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U048400	Invalid data received from the lighting control module - rear "B"	CAN message invalid from trailer module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U210000	Initial configuration not complete	• No configuration has been previously set	Re-configure the CJB using the Ford diagnostic equipment. Clear the DTC(s) and re-test. If DTC(s) still logged, check the CAN network. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U210100	Parking aid module configuration incompatible	• Data sent from the CJB is invalid	Re-configure the CJB using the Ford diagnostic equipment. Clear the DTC(s) and re-test. If DTC(s) still logged, check the CAN network. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U300049	Parking aid module	• Internal parking aid module failure	Install a new parking aid control module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation).
U300316	Battery voltage	• Circuit voltage below threshold	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
U300317	Battery voltage	• Circuit voltage above threshold	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
U300362	Battery voltage	• Mis-match in battery voltage, of 2 volts or lower, between the parking aid module and the CJB	GO to Pinpoint Test Y.

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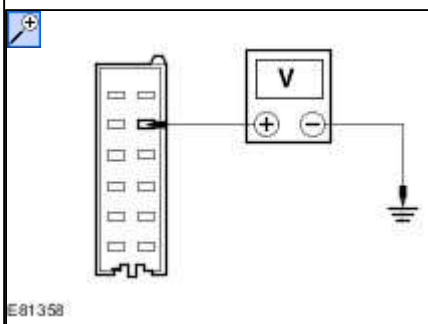
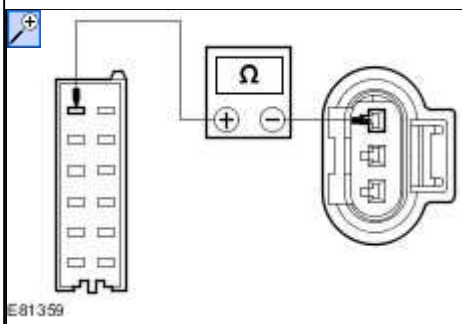
Pinpoint Tests

PINPOINT TEST A : DTC B1B3612 - FRONT OUTER RIGHT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK CIRCUIT VMP13 (BU/OG) FOR SHORT TO POWER	
	1 Disconnect Front outer right parking aid sensor C1MP13.
	2 Disconnect Parking aid module C4MP01B.
	3 Ignition switch in position II.
 E81358	4 Measure the voltage between the parking aid module C4MP01B pin 8, circuit VMP13A (BU/OG), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new front outer right parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST B : DTC B1B3696 - FRONT OUTER RIGHT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK CIRCUIT RMP06 (YE/OG) FOR OPEN	
	1 Disconnect Front outer right parking aid sensor C1MP13.
	2 Disconnect Parking aid module C4MP01B.
 E81359	3 Measure the resistance between the parking aid module C4MP01B pin 1, circuit RMP06A (YE/OG), harness side and the front outer right parking aid sensor C1MP13 pin 3, circuit RMP06C (YE/OG), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new front outer right parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern

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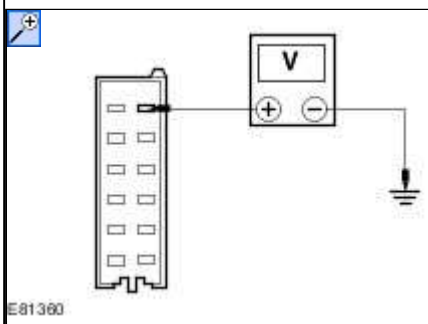
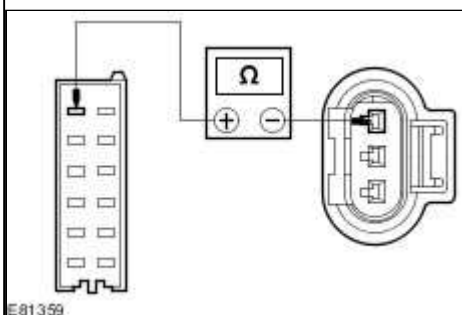
	persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST C : DTC B1B3812 - FRONT INNER RIGHT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK CIRCUIT VMP12 (BU/GY) FOR SHORT TO POWER	
	1 Disconnect Front inner right parking aid sensor C1MP12.
	2 Disconnect Parking aid module C4MP01B.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01B pin 7, circuit VMP12A (BU/GY), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new front inner right parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST D : DTC B1B3896 - FRONT INNER RIGHT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK CIRCUIT RMP06 (YE/OG) FOR OPEN	
	1 Disconnect Front inner right parking aid sensor C1MP12.
	2 Disconnect Parking aid module C4MP01B.
	3 Measure the resistance between the parking aid module C4MP01B pin 1, circuit RMP06A (YE/OG), harness side and the front inner right parking aid sensor C1MP12 pin 3, circuit RMP06E (YE/OG), harness side.

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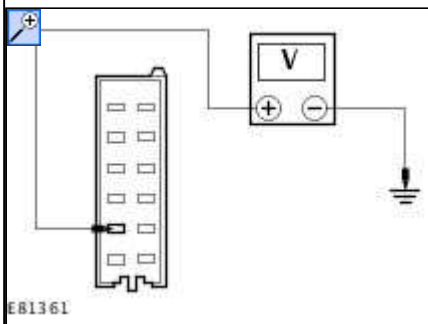
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new front inner right parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST E : DTC B1B4012 - FRONT OUTER LEFT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK CIRCUIT VMP11 (BU/GN) FOR SHORT TO POWER	
	1 Disconnect Front outer left parking aid sensor C1MP11.
	2 Disconnect Parking aid module C4MP01B.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01B pin 7, circuit VMP11A (BU/GN), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new front outer left parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST F : DTC B1B4096 - FRONT OUTER LEFT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK CIRCUIT RMP06 (YE/OG) FOR OPEN	
	1 Disconnect Front outer left parking aid sensor C1MP11.
	2 Disconnect Parking aid module C4MP01B.
	3 Measure the resistance between the parking aid module C4MP01B pin 1, circuit RMP06A (YE/OG), harness side and the front outer left parking aid sensor C1MP11 pin 3, circuit RMP06F (YE/OG),

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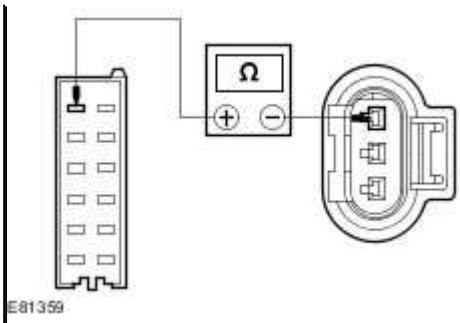
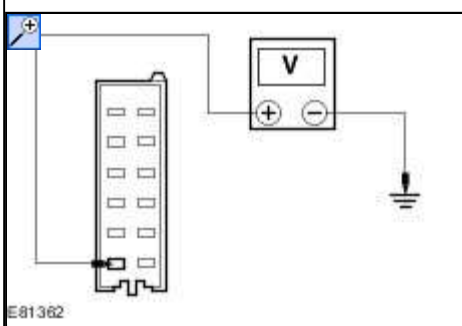
	harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new front outer left parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST G : DTC B1B4212 - FRONT INNER LEFT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK CIRCUIT VMP10 (WH/BU) FOR SHORT TO POWER	
	1 Disconnect Front inner left parking aid sensor C1MP10.
	2 Disconnect Parking aid module C4MP01B.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01B pin 6, circuit VMP10A (WH/BU), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new front inner left parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST H : DTC B1B4296 - FRONT INNER LEFT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE	

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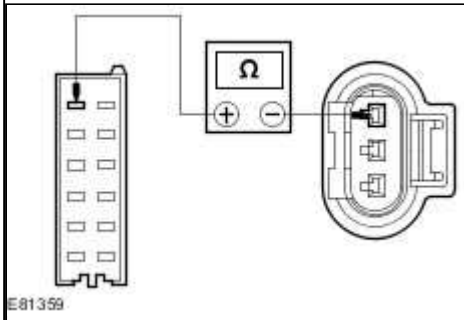
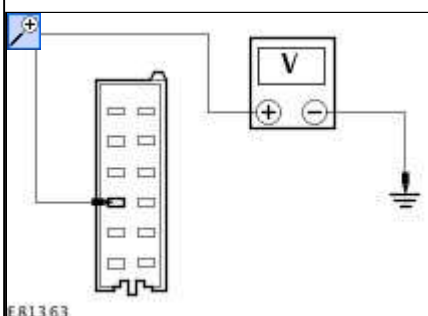
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK CIRCUIT RMP06 (YE/OG) FOR OPEN	
	1 Disconnect Front inner left parking aid sensor C1MP10.
	2 Disconnect Parking aid module C4MP01B.
	3 Measure the resistance between the parking aid module C4MP01B pin 1, circuit RMP06A (YE/OG), harness side and the front inner left parking aid sensor C1MP10 pin 3, circuit RMP06G (YE/OG), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new front inner left parking aid sensor. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST I : DTC B1B4412 - REAR OUTER RIGHT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK CIRCUIT VMP17 (YE/OG) FOR SHORT TO POWER	
	1 Disconnect Rear outer right parking aid sensor C4MP17.
	2 Disconnect Parking aid module C4MP01C.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01C pin 4, circuit VMP17A (YE/OG), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new rear outer right parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid,

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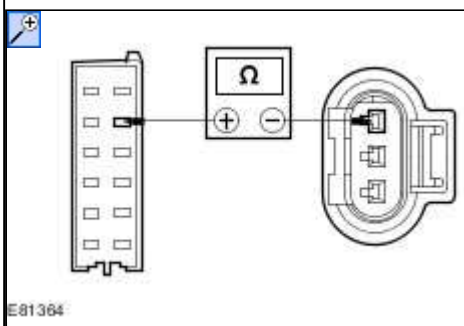
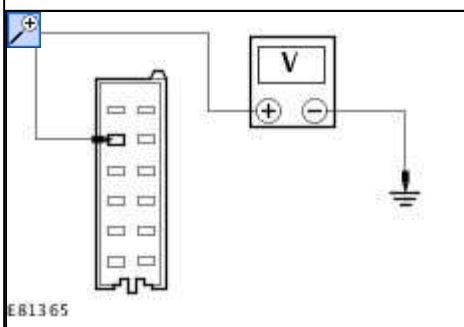
	Removal and Installation). TEST the system for normal operation.

PINPOINT TEST J : DTC B1B4496 - REAR OUTER RIGHT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK CIRCUIT RMP07 (GN/WH) FOR OPEN	
	1 Disconnect Rear outer right parking aid sensor C4MP17.
	2 Disconnect Parking aid module C4MP01C.
	3 Measure the resistance between the parking aid module C4MP01C pin 8, circuit RMP07A (GN/WH), harness side and the rear outer right parking aid sensor C4MP17 pin 3, circuit RMP07E (GN/WH), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new rear outer right parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST K : DTC B1B4612 - REAR INNER RIGHT PARKING AID SENSOR SIGNAL - SHORT TO POWER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK CIRCUIT VMP16 (YE/GY) FOR SHORT TO POWER	
	1 Disconnect Rear inner right parking aid sensor C4MP16.
	2 Disconnect Parking aid module C4MP01C.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01C pin 2, circuit VMP16A (YE/GY), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No**

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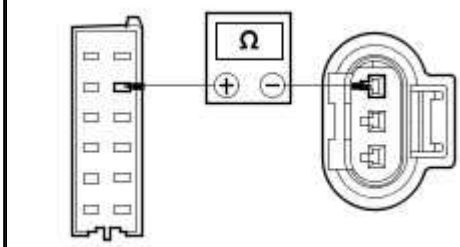
	INSTALL a new rear inner right parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST L : DTC B1B4696 - REAR INNER RIGHT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK CIRCUIT RMP07 (GN/WH) FOR OPEN	
	1 Disconnect Rear inner right parking aid sensor C4MP16.
	2 Disconnect Parking aid module C4MP01C.
	3 Measure the resistance between the parking aid module C4MP01C pin 8, circuit RMP07A (GN/WH), harness side and the rear inner right parking aid sensor C4MP16 pin 3, circuit RMP07D (GN/WH), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new rear inner right parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST M : DTC B1B4812 - REAR OUTER LEFT PARKING AID SENSOR SIGNAL - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK CIRCUIT VMP15 (YE/GN) FOR SHORT TO POWER	
	1 Disconnect Rear outer left parking aid sensor C4MP15.
	2 Disconnect Parking aid module C4MP01C.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01C pin 5, circuit VMP15A (YE/GN), harness side and ground.

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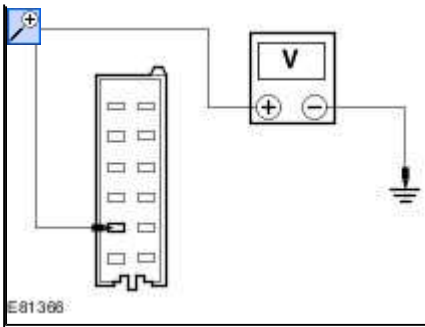


Is a voltage present?

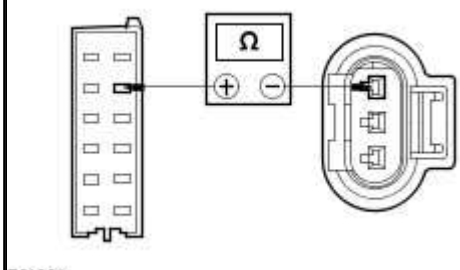
Yes

REPAIR the circuit. TEST the system for normal operation.

No

INSTALL a new rear outer left parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation).
TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation).
TEST the system for normal operation.

PINPOINT TEST N : DTC B1B4896 - REAR OUTER LEFT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
N1: CHECK CIRCUIT RMP07 (GN/WH) FOR OPEN	
	1 Disconnect Rear outer left parking aid sensor C4MP15.
	2 Disconnect Parking aid module C4MP01C.
	3 Measure the resistance between the parking aid module C4MP01C pin 8, circuit RMP07A (GN/WH), harness side and the rear outer left parking aid sensor C4MP15 pin 3, circuit RMP07B (GN/WH), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new rear outer left parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST O : DTC B1B5012 - REAR INNER LEFT PARKING AID SENSOR SIGNAL - SHORT TO POWER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

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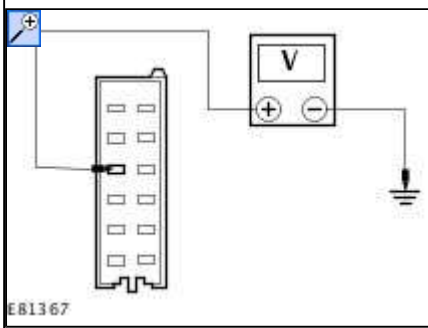
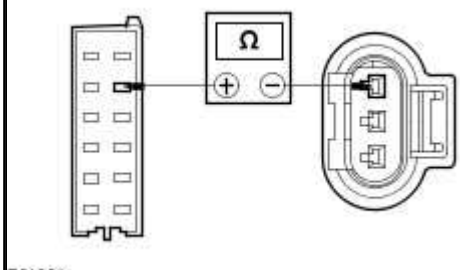
O1: CHECK CIRCUIT VMP14 (WH/OG) FOR SHORT TO POWER

	1 Disconnect Rear inner left parking aid sensor C4MP14.
	2 Disconnect Parking aid module C4MP01C.
	3 Ignition switch in position II.
 E81367	4 Measure the voltage between the parking aid module C4MP01C pin 3, circuit VMP14A (WH/OG), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new rear inner left parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST P : DTC B1B5096 - REAR INNER LEFT PARKING AID SENSOR - GROUND CIRCUIT OPEN OR PARKING AID SENSOR INTERNAL FAILURE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
P1: CHECK CIRCUIT RMP07 (GN/WH) FOR OPEN	
	1 Disconnect Rear inner left parking aid sensor C4MP14.
	2 Disconnect Parking aid module C4MP01C.
 E81364	3 Measure the resistance between the parking aid module C4MP01C pin 8, circuit RMP07A (GN/WH), harness side and the rear inner left parking aid sensor C4MP14 pin 3, circuit RMP07F (GN/WH), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new rear inner left parking aid sensor. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No**

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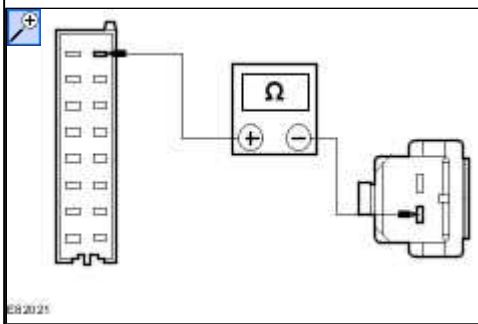
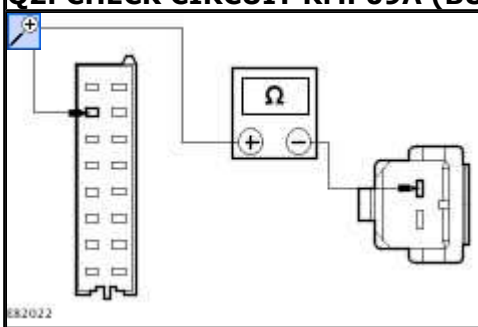
	REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST Q : DTC B1B5201 - REAR PARKING AID SPEAKER - INTERNAL FAULT, SHORT TO GROUND OR OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK CIRCUIT CMP09A (BN/BU) FOR OPEN	
	1 Disconnect Parking aid module C4MP01A.
	2 Disconnect Rear parking aid speaker C4MP09.
	3 Measure the resistance between the parking aid module C4MP01A pin 10, circuit CMP09A (BN/BU), harness side and the rear parking aid speaker C4MP09 pin 1, circuit CMP09A (BN/BU), harness side.
	Is the resistance less than 1 Ohm? **Yes** GO to Q2. **No** REPAIR the circuit. TEST the system for normal operation.
Q2: CHECK CIRCUIT RMP09A (BU/GN) FOR OPEN	
	1 Measure the resistance between the parking aid module C4MP01A pin 2, circuit RMP09A (BU/GN), harness side and the rear parking aid speaker C4MP09 pin 2, circuit RMP09A (BU/GN), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new rear parking aid speaker. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST R : DTC B1B5212 - REAR PARKING AID SPEAKER - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK CIRCUIT CMP09A (BN/BU) FOR SHORT TO POWER	
	1 Disconnect Parking aid module C4MP01A.
	2 Disconnect Rear parking aid speaker C4MP09.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01A pin 10, circuit CMP09A (BN/BU), harness side and ground.

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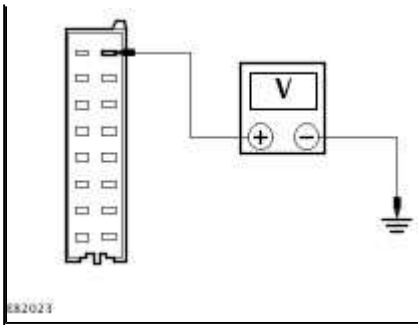


Is a voltage present?

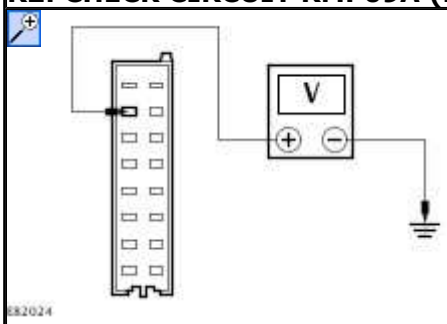
Yes

REPAIR the circuit. TEST the system for normal operation.

No

GO to R2.

R2: CHECK CIRCUIT RMP09A (BU/GN) FOR SHORT TO POWER



1 Measure the voltage between the parking aid module C4MP01A pin 2, circuit RMP09A (BU/GN), harness side and ground.

Is a voltage present?

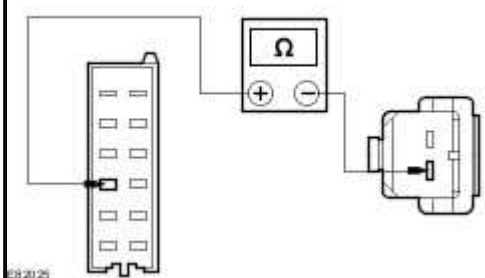
Yes

REPAIR the circuit. TEST the system for normal operation.

No

INSTALL a new rear parking aid speaker. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module.
REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation).
TEST the system for normal operation.

PINPOINT TEST S : DTC B1B5301 - FRONT PARKING AID SPEAKER - INTERNAL FAULT, SHORT TO GROUND OR OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: CHECK CIRCUIT CMP08 (GY/BN) FOR OPEN	
	1 Disconnect Parking aid module C4MP01B.
	2 Disconnect Front parking aid speaker C2MP08.
	3 Measure the resistance between the parking aid module C4MP01B pin 4, circuit CMP08A (GY/BN), harness side and the front parking aid speaker C2MP08 pin 1, circuit CMP08B (GY/BN), harness side.
	Is the resistance less than 1 Ohm? **Yes** GO to S2. **No**

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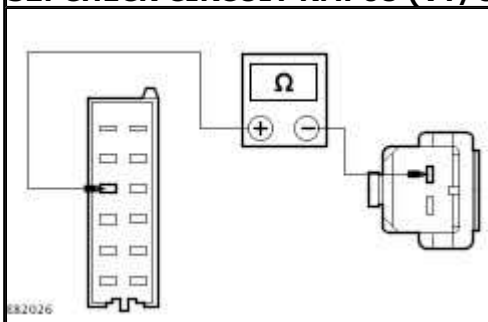
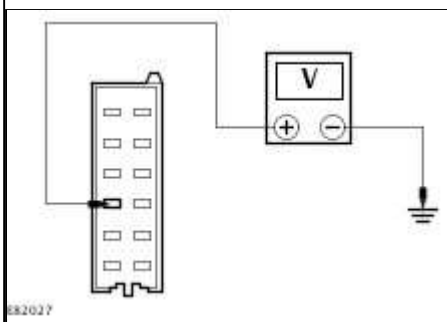
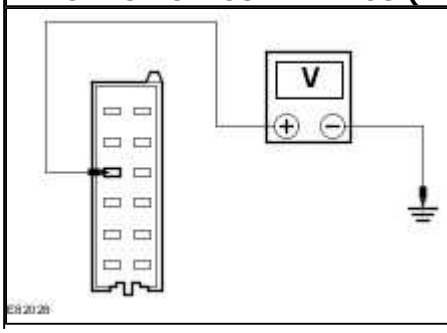
	REPAIR the circuit. TEST the system for normal operation.
S2: CHECK CIRCUIT RMP08 (VT/OG) FOR OPEN	
	1 Measure the resistance between the parking aid module C4MP01B pin 3, circuit RMP08A (VT/OG), harness side and the front parking aid speaker C2MP08 pin 2, circuit RMP08B (VT/OG), harness side.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new front parking aid speaker. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST T : DTC B1B5312 - FRONT PARKING AID SPEAKER - SHORT TO POWER	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK CIRCUIT CMP08 (GY/BN) FOR SHORT TO POWER	
	1 Disconnect Parking aid module C4MP01B.
	2 Disconnect Front parking aid speaker C2MP08.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01B pin 4, circuit CMP08B (GY/BN), harness side and ground.
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** GO to T2.
T2: CHECK CIRCUIT RMP08 (VT/OG) FOR SHORT TO POWER	
	1 Measure the voltage between the parking aid module C4MP01B pin 3, circuit RMP08A (VT/OG), harness side and ground.

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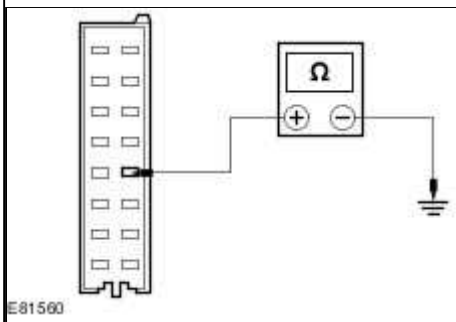
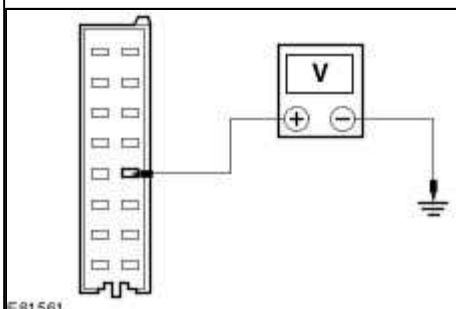
	Is a voltage present? **Yes** REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new front parking aid speaker. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST U : DTC B1B5411 - PARKING AID STATUS LED - SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
U1: CHECK CIRCUIT CMP02 (GN/BU) FOR OPEN	
	1 Disconnect Parking aid module C4MP01A.
	2 Disconnect Parking aid switch C2CA1S.
	3 Measure the resistance between the parking aid module C4MP01A pin 13, circuit CMP02A (GN/BU), harness side and ground.
	Is the resistance greater than 10,000 Ohms? **Yes** INSTALL a new parking aid switch. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST V : B1B5412 - PARKING AID STATUS LED - SHORT TO POWER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
V1: CHECK CIRCUIT CMP02 (GN/BU) FOR SHORT TO POWER	
	1 Disconnect Parking aid module C4MP01A.
	2 Disconnect Parking aid switch C2CA1S.
	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module C4MP01A pin 13, circuit CMP02A (GN/BU), harness side and ground.
	Is a voltage present?

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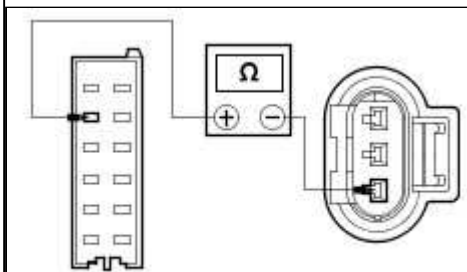
	Yes REPAIR the circuit. TEST the system for normal operation. **No** INSTALL a new parking aid switch. TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST W : DTC B1B5711 - FRONT PARKING AID SENSORS - POWER SUPPLY CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
W1: CHECK CIRCUIT LMP06 (VT/GY) FOR OPEN	
	1 Disconnect Front outer right parking aid sensor C1MP13.
	2 Disconnect Front inner right parking aid sensor C1MP12.
	3 Disconnect Front outer left parking aid sensor C1MP11.
	4 Disconnect Front inner left parking aid sensor C1MP10.
	5 Disconnect Parking aid module C4MP01B.
 E81368	6 Measure the resistance between the parking aid module C4MP01B pin 2, circuit LMP06A (VT/GY), harness side and the following electrical connectors. • Front outer right parking aid sensor C1MP13 pin 1, circuit LMP06C (VT/GY), harness side. • Front inner right parking aid sensor C1MP12 pin 1, circuit LMP06F (VT/GY), harness side. • Front outer left parking aid sensor C1MP11 pin 1, circuit LMP06E (VT/GY), harness side. • Front inner left parking aid sensor C1MP10 pin 1, circuit LMP06G (VT/GY), harness side.
	Are the resistances less than 1 Ohm? **Yes** INSTALL a new parking aid sensor(s) as required. REFER to: Front Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST X : DTC B1B5811 - REAR PARKING AID SENSORS - POWER SUPPLY CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK CIRCUIT LMP07 (BU/WH) FOR OPEN	
	1 Disconnect Rear outer right parking aid sensor

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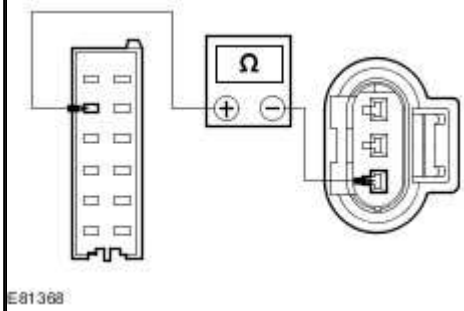
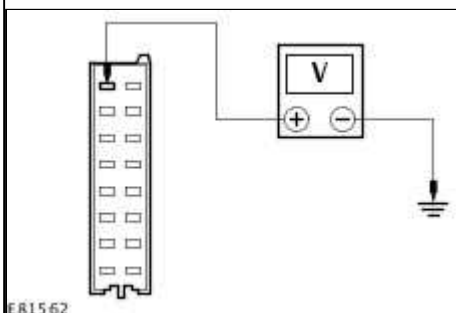
	C1MP17.
	2 Disconnect Rear inner right parking aid sensor C1MP16.
	3 Disconnect Rear outer left parking aid sensor C1MP15.
	4 Disconnect Rear inner left parking aid sensor C1MP14.
	5 Disconnect Parking aid module C4MP01C.
 E81368	6 Measure the resistance between the parking aid module C4MP01C pin 11, circuit LMP07A (BU/WH), harness side and the following electrical connectors. • Rear outer right parking aid sensor C1MP17 pin 1, circuit LMP07F (BU/WH), harness side. • Rear inner right parking aid sensor C1MP16 pin 1, circuit LMP07E (BU/WH), harness side. • Rear outer left parking aid sensor C1MP15 pin 1, circuit LMP07B (BU/WH), harness side. • Rear inner left parking aid sensor C1MP14 pin 1, circuit LMP07D (BU/WH), harness side.
	Are the resistances less than 1 Ohm? **Yes** INSTALL a new parking aid sensor(s) as required. REFER to: Rear Parking Aid Sensor (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. If the concern persists, INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit(s). TEST the system for normal operation.

PINPOINT TEST Y : DTC U300362 - MIS-MATCH IN BATTERY VOLTAGE BETWEEN THE PARKING AID MODULE AND THE CJB	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK CIRCUIT CBR01AWA (BU) FOR POWER	
	1 Disconnect Parking aid module C4MP01A.
	2 Ignition switch in position II.
 E81562	3 Measure the voltage between the parking aid module C4MP01A pin 1, circuit CBR01AWA (BU), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to Y2. **No** REPAIR the circuit. TEST the system for normal

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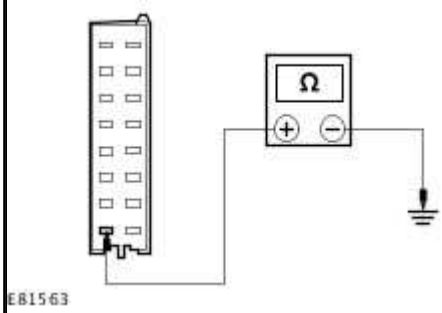
	operation. If the concern persists, REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Y2: CHECK CIRCUIT GD152 (BK/BU) FOR OPEN	
	1 Ignition switch in position 0.
	**2** Measure the resistance between the parking aid module C4MP01A pin 8, circuit GD152 (BK/BU), harness side and ground.
	Is the resistance less than 1 Ohm? **Yes** INSTALL a new parking aid module. REFER to: Parking Aid Module (413-13 Parking Aid, Removal and Installation). TEST the system for normal operation. **No** CLEAN and TIGHTEN the ground connection. TEST the system for normal operation. If the concern persists, REPAIR the circuit. TEST the system for normal operation.

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Removal and Installation

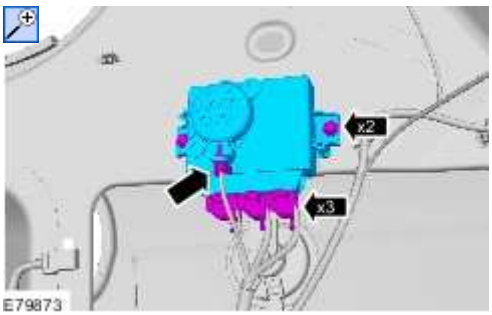
Removal

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

1. Remove the right-hand load space trim panel.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.

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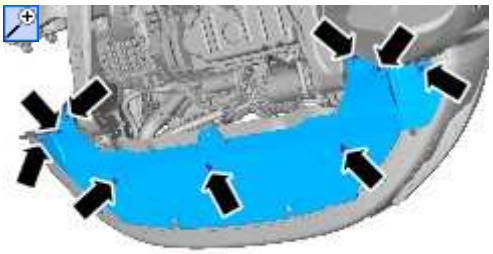
Removal and Installation

Removal

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

1. Raise and support the vehicle.

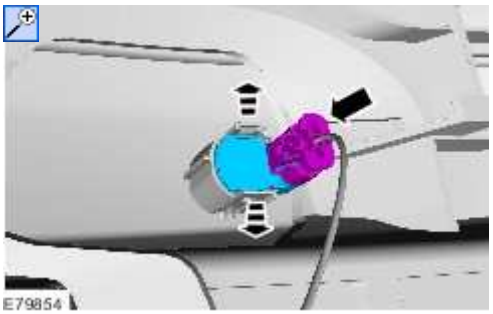
   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



E68962

2.

3. NOTE: If necessary remove bumper cover.



E79854

4.

Installation

1. To install, reverse the removal procedure.

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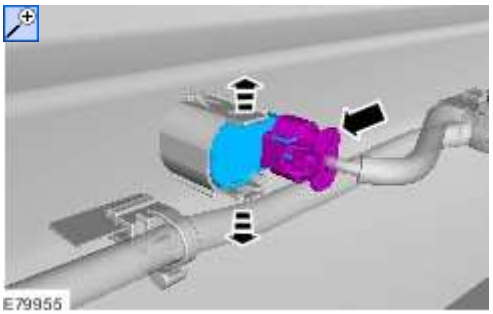
Removal and Installation

Removal

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

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2.

Installation

1. To install, reverse the removal procedure.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 414-02, for schematic and connector information.

General Equipment

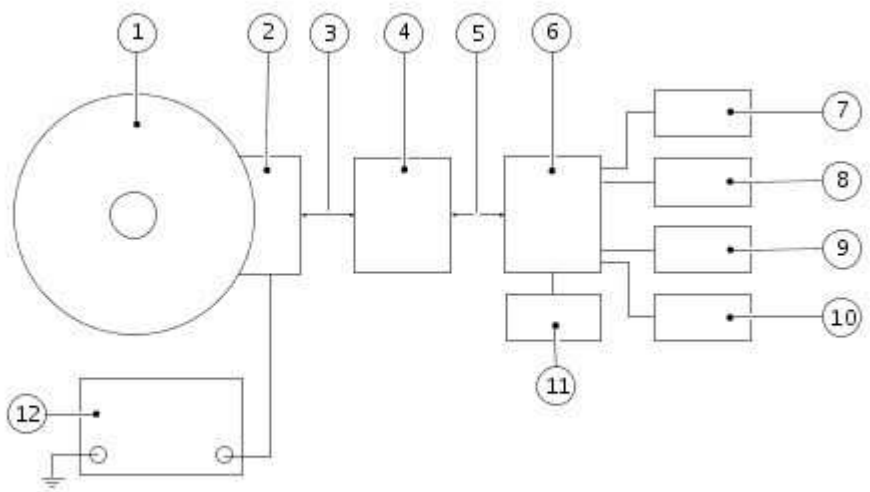
Ford approved diagnostic tool
Surface charge dissipation unit (SCD²)
Micro390 battery tester

Principles of Operation

The charging system for this vehicle is composed of a generator combined with a generator control module.

The generators for some variants are equipped with pulleys with built in reverse rotation clutches. These pulleys allow the generator armature to free-wheel during sudden engine deceleration so smoothing the reduction in charge rate output. This also reduces the load changes on the accessory drive belt.

Charging Control



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Item	Part Number	Description
1	-	Generator
2	-	Generator control module
3	-	Local interconnect network (LIN) communication
4	-	Powertrain control module (PCM)
5	-	Control area network (CAN) communication
6	-	General electronic module (GEM)
7	-	Heated front screen
8	-	Heated rear screen
9	-	Heated mirrors
	-	

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10			Supplementary heater
	11	-	Instrument cluster
12		-	Battery

Charging is controlled by the PCM and the GEM. The PCM communicates with the generator control module using a LIN connection. The PCM will instruct the generator to increase or decrease charging voltages in accordance with the requirements of the power supply systems. In turn the generator control module will inform the PCM of the current output of the generator.

The generator control module monitors the generator output. If a fault develops in the generator control module, control circuits or the generator, the PCM will be informed and a diagnostic trouble code (DTC) will be set.

Using the information received by the PCM from the generator control module, the PCM can calculate the generator load. The generator load information is transferred to the GEM using CAN communication. The GEM uses the load information to calculate maximum allowable current consumption of the climate related systems. The GEM also controls the initiation of fault warnings to the display information module. The battery charge warning indicator is turned off by means of an instruction from the GEM using CAN communication.

To reduce the load on the generator to within its working limits and assist with battery recovery after start up, the GEM will switch non critical systems off and on.

The systems that are controlled by the GEM have typical loads of:

- Heated windshield
  - 70 amps
- Heated rear screen
  - 25 amps
- Heated mirrors
  - 4 amps
- Supplementary heating
  - 80 amps

The climate systems have been chosen because they can be switched off for short periods of time with barely detectable changes in their ultimate function. During this control period, the function indicators for the system being controlled will remain illuminated. The total load reduction if all controlled components where switched off would be in the region of 180 amps.

Conversely, the GEM can switch the same components on at any time thereby increasing engine load. This function is used to assist with the engine warm up process.

Inspection and Verification

WARNINGS:

Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near batteries to protect against possible splashing of the acid solution. In case of acid contact with skin or eyes, flush immediately with water for a minimum of 15 minutes and get prompt medical attention. If acid is swallowed, call a physician immediately. Failure to follow these instructions may result in personal injury.

Batteries normally produce explosive gases which can cause personal injury. Therefore, do not allow flames, sparks or lighted substances to come near the battery. When charging or working near a battery, always shield your face and protect your eyes. Always provide ventilation. Failure to follow these instructions may result in personal injury.

1. **1.** Verify the customer concern.

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2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Accessory drive belt • Generator • Generator decoupler (if equipped)	• Fuse(s) • Wiring harness • Electrical connector(s) • Battery junction box (BJB) • Battery • Battery cables • Charging system warning indicator • PCM • GEM

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** Check the operation of the charging system warning indicator lamp, located in the instrument cluster. Normal operation is as follows:

   Normal Charging System Voltages

Ignition Switch Position	I Circuit	Generator B+ Circuit	Battery	Engine to battery ground	Charging System Warning Indicator Operation
Position 0	0V	10-12V	10-12V	0V	OFF
Position II	0V	10-12V	10-12V	0V	Illuminated
Position II with the engine running	13-15V	13-15V	13-15V	0V	OFF

5. **5.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The charging system warning indicator is on with the engine running and the battery does not increase voltage.	* Accessory drive belt.	* CHECK the condition and installation of the accessory drive belt. INSTALL a new accessory drive belt or tensioner as required. CHECK the system for normal operation.
	* Generator. * Generator control module. * Generator LIN communication system. * PCM. * GEM.	* Using the Ford approved diagnostic tool, RETRIEVE and RECTIFY the charging related DTCs from the PCM and the GEM. TEST the system for normal operation.
The charging system warning indicator is on with the engine running and the battery increases voltage.	* GEM. * PCM. * Instrument cluster. * Instrument cluster CAN bus system. * Generator. * Generator control module.	* Using the Ford approved diagnostic tool, RETRIEVE and RECTIFY the charging system indicator related DTCs from the GEM and the PCM. TEST the system for normal operation.

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	* Generator LIN communication system.	
The charging system warning indicator is off with ignition switch in the RUN position and the engine off.	* GEM. * Instrument cluster. * Instrument cluster CAN bus system.	* Using the Ford approved diagnostic tool, RETRIEVE and RECTIFY the charging system indicator related DTCs from the GEM. TEST the system for normal operation.
Vehicle electrical systems inoperative	* Battery.	* CARRY OUT the battery test, REFER to the Battery Test in Component Tests in this section.
The engine cranks slowly	* Battery.	* CARRY OUT the battery test, REFER to the Battery Test in Component Tests in this section.
	* Battery cable(s). * Starter motor.	* REFER to: Starting System (303-06A Starting System - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Diagnosis and Testing).

Component Tests

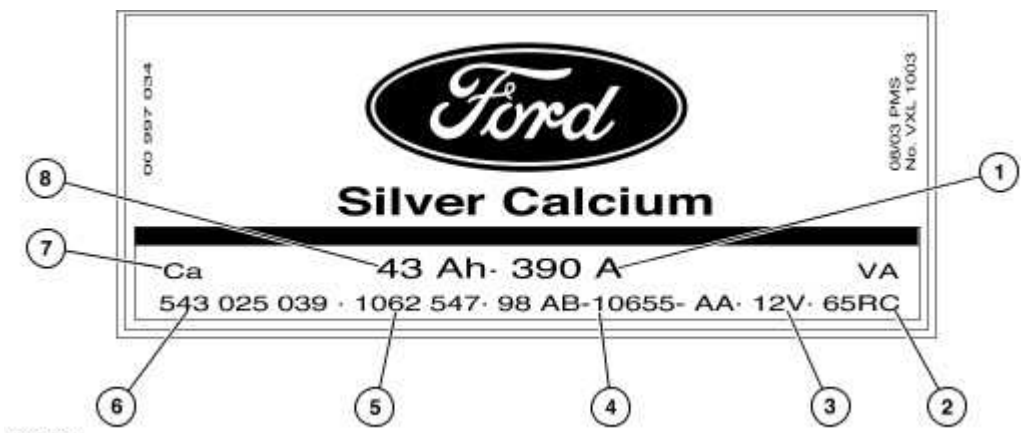
Generator On-Vehicle Tests - No-Load Test

1. **1.** REFER to the Ford approved diagnostic tool

Generator On-Vehicle Tests - Load Test

1. **1.** REFER to the Ford approved diagnostic tool

Battery Identification



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Item	Part Number	Description
1	-	Cold crank amp (CCA) rating
2	-	Reserve capacity (RC) rating (minutes)
3	-	Battery voltage
4	-	Ford part number
5	-	FINIS code
6	-	EN number (European Norm)
7	-	Battery type: Ca = Silver/Calcium; Sb = Lead/Antimony
	-	

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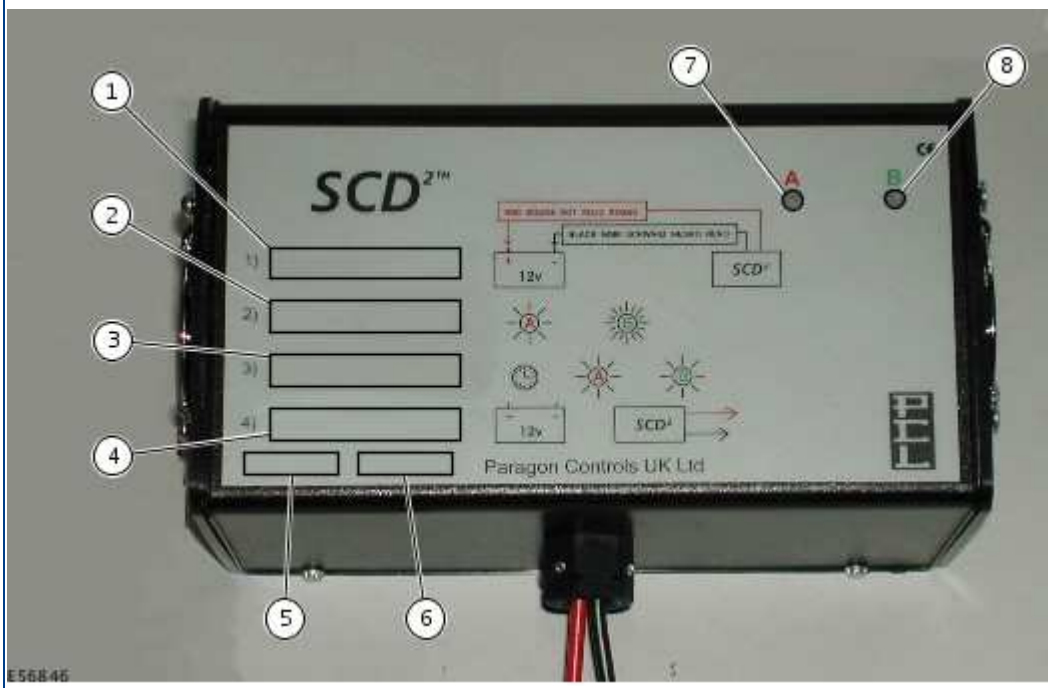
8		Amp hour rating

Battery Surface Charge Removal

Surface charge dissipation unit (SCD²)



Item	Part Number	Description
1	-	Connect black lead to battery - Connect red lead to battery +
2	-	Red A indicator illuminates and green B indicator flashes
3	-	Wait until green B indicator illuminates
4	-	Disconnect from battery
5	-	Max 18v
6	-	-20°C to +55°C
7	-	Red indicator (A)
8	-	Green indicator (B)

CAUTION: Prior to testing any battery, the surface discharge must be dissipated. This includes batteries that are returned disconnected from the vehicle. If the battery is holding a surface charge, the battery tester will give false readings.
NOTE: The SCD² tool eliminates the need to dissipate the battery's surface charge via the manual process of loading the battery via the operation of the vehicles electrical systems. It also removes the variability in the process and makes sure that the actual dissipation of the surface charge is qualified prior to testing.

1. **1.** Remove the battery.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2. **2.** Connect the black lead to the battery negative terminal and the red lead to the battery positive terminal.
3. **3.** The red indicator (A) illuminates and the green indicator (B) flashes.
4. **4.** Wait until the green indicator (B) fully illuminates, then disconnect from the battery.

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Alternative Method To Dissipate The Battery Surface Charge

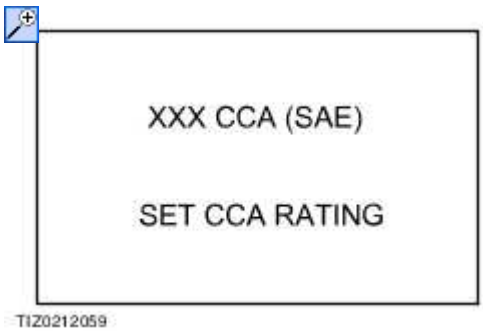
1. **1.** Leave the battery to stand for a minimum of six hours without charging or discharging or remove the surface charge through partial loading as follows:
    - Turn the ignition key to position II and switch on the headlamps (main beam), heated windshield (if equipped), heated rear window (if equipped) and the heater blower motor (position II). Leave the vehicle in this condition for a minimum of 60 seconds to dissipate the battery surface charge.
    - Turn the ignition key to position 0 and switch off the headlamps, heated windshield (if equipped), heated rear window (if equipped) and the heater blower motor. Leave the vehicle in this condition for a minimum of five minutes before testing battery condition.

Battery Test

NOTE: Using the Micro390 Battery Tester: To fully determine battery condition once the surface charge has been dissipated, the Micro390 battery tester must be used. For the Micro390 battery tester to operate, it requires a minimum of 5.5 volts charge to be present on the test battery. Therefore, if the Micro390 does not operate when connected to a test battery, then a charge of less than 5.5 volts is present. In this instance, the battery must be charged in line with the battery charging instructions prior to testing. In the event of a conflict of results between the charge eye indicator and the battery tester, the battery tester result must always be used. The charge eye indicator is for guidance only.

1. **1.** Remove the battery.
   REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

2. **2.** Connect the battery tester to the battery.
    - Connect the red clip to the battery positive (+) terminal and the black clip to the battery negative (–) terminal.



3. NOTE: The label affixed to the top of batteries progressively from 06/1998 identifies the battery CCA rating. Remove the battery if the label is obscured.

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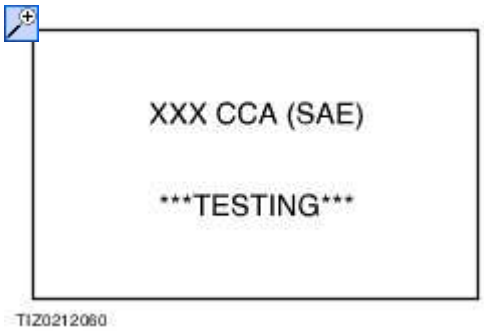
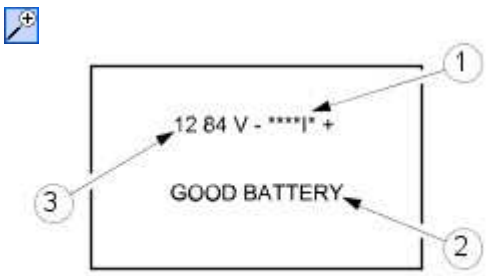
3. Use the ”Arrow” buttons on the battery tester to scroll to the battery’s labelled CCA rating.



TIZ0212060

4. **4.** Press the ”Test” button that corresponds to the correct battery temperature.
    - If the battery temperature is above zero degrees centigrade: press the ”sun” button. If the battery temperature is below zero degrees centigrade: press the ”Ice-crystal” button.



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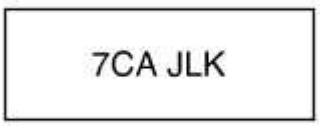
5. **5.** Carry out the action based upon the test result displayed and the following table.
    1. Charge level bar graph.
    2. Test result.
    3. Battery voltage.



TIZ0212062

6. **6.** Press the "information" button and carefully note the six-digit "Test Code" on the job card for claim submission and audit purposes (graphic shows an example of the code only).

Battery tester results and required actions

Tester Reading	Action
GOOD BATTERY	Return to service
GOOD RECHARGE	Fully charge the battery and return to service*
CHARGE & RETEST	Fully charge the battery and retest

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REPLACE BATTERY or BAD CELL BATTERY	WARNING: Do not recharge the battery. Make sure that the surface charge was removed. If so, disconnect the battery from the vehicle and retest. If the result remains after surface charge removal, install a new battery. REFER to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
UNABLE TO TEST	Retest the battery.

*In addition, it is advisable to check the vehicle electrical system. Check that the generator is functioning correctly and that all key-off loads (luggage compartment lamps, glove compartment lamp and interior lamps) are not staying on.

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General Procedures

General Equipment

Midtronics GR-590 Battery Management Center
Battery Charger

WARNINGS:

Always observe the battery charger equipment manufacturer’s instructions.

Do not jump/slave start using a battery charging system from another vehicle.

Do not overfill a battery as this can cause acid leakage that will result in damage to the vehicle and possible personal injury.

CAUTIONS:

Do not rely on the generator to recharge a discharged battery. It would take in excess of eight hours of continuous driving with no additional loads placed on the charging system.

Make sure that the battery electrolyte reaches the indicated maximum mark.

Connect the battery charger cables to the battery before switching the battery charger on.

Switch the battery charger off before disconnecting the battery charger cables from the battery.

NOTE: Ford batteries generally require no maintenance however, in certain conditions, it is possible for the electrolyte in a battery to fall below the minimum level.

NOTE: The use of the Midtronics GR-590 Battery Management Center, which has been specifically designed for use on silver calcium type batteries is recommended. Once connected to the battery, the battery charger detects the state of battery charge and then applies the appropriate charge rate and duration. When the battery is fully charged, the battery charger switches to stand-by, keeping the battery in a fully charged state preventing excessive gassing and overcharging. The Midtronics GR-590 Battery Management Center also incorporates a software program that has the capability to assist in the recovery of deeply discharged (sulphated) batteries.

NOTE: Charging methods and types of battery chargers vary widely. Whichever method is utilized it must be carried out carefully to avoid damage to the battery and possible personal injury. Specific instructions accompanying each battery charger and must be followed exactly. Safeguards provided by the equipment manufacturer should not be disregarded by the operator.

NOTE: A battery which has been stored in a highly discharged state may be slow to accept a charge at first. In such cases the initial charging rate may be so low that the ammeter on some battery testers will not show any indication of charge for 5 to 10 minutes.

NOTE: Automatic battery chargers are also protected against reverse polarity connection and require no adjustment or monitoring.

NOTE: Slow-charging will readily restore a battery to a full state of charge and, since the charging current is relatively low, the possibility of overcharging a battery are minimized. The charge rate used should be approximately equal to 5% of the reserve capacity of the battery being charged (approximately three to six Amps depending on battery size). The charging current should be adjusted 10 minutes after initial setting and again after 1 hour before being left to charge the battery for between 8 and 12 hours.

NOTE: A constant voltage battery charger will charge a battery at a set maximum voltage. The voltage used depends upon the design and condition of the battery charger

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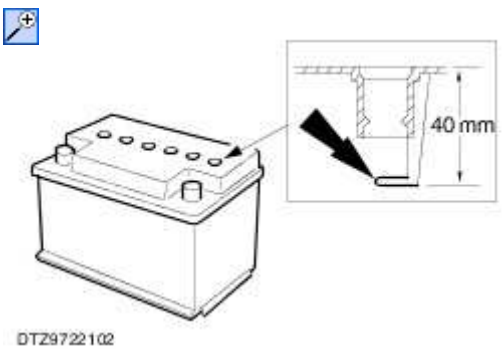
and the age and temperature of the battery. This type of battery charger initially charges at a high rate of current that reduces as battery voltage is restored. When using a constant voltage battery charger, the charging current should be recorded after five minutes and the battery charger switched off when the charging current falls to one–third of the recorded value, or after eight hours whichever occurs first.
NOTE: Multiple battery chargers are designed to charge a number of batteries, simultaneously. Of the two different types of multiple battery chargers available, only those that charge batteries in series should be used and it is important that batteries are of the same or very similar ratings and voltages. Multiple battery chargers that charge batteries in parallel are not recommended.
NOTE: The use of a fast (boost) battery charger is not recommended as it can cause damage to a battery. Fast charging will only restore a battery to a state of charge that will enable it to carry out it's critical function of cranking the engine. Fast charging will not restore a battery to a full state of charge and must therefore be followed by a period of slow charging. Excessively fast charging can cause damage to a battery. For this reason, charging times must be carefully controlled. Fast battery chargers vary widely in design so it is very important to strictly adhere to the equipment manufacturer's instructions. A charge of 30 amps for up to 30 minutes is the most common fast charging application. If the battery is very discharged and requires additional restoration, an additional charge of 20 amps for a period up to one and a half hours should be applied. Fast charging for a period in excess of two hours significantly increases the risk of causing damage to the battery.
NOTE: When connecting and disconnecting the battery from the vehicle, make sure that the battery ground cable is disconnected first and connected last and that all electrical items are switched off. Record the audio unit keycode and preset radio frequencies before disconnecting the battery.

1. Remove the battery (Focus C-MAX 2003.75, Focus 2004.75, S-MAX/Galaxy 2006.50, Mondeo 2007.50 only).
2. Disconnect the battery ground cable (All, except the vehicles mentioned in the previous step).



3. NOTE: The maximum battery electrolyte level is approximately 40 mm below the very top of the battery casing. This corresponds to a point just below the lower rim of the battery casing.
   Check that the battery electrolyte reaches the indicated maximum level. Top up with distilled/de-ionized water, as necessary.
4. Connect the positive red clamp from the battery charger to the positive battery terminal.
5. Connect the negative black clamp from the battery charger to the negative battery terminal.
6. Connect the AC power cable to the mains outlet and switch on.
7. Follow the instructions supplied with the battery charger to charge the battery.
8. To disconnect the battery charger, reverse the connection procedure.

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Battery Specifications

Ah Rating	Battery Type	Build date that Ca battery can be installed from
50	Silver Calcium (Ca)	09/1999
60	Silver Calcium (Ca)	09/1999
70	Silver Calcium (Ca)	09/1999
80	Silver Calcium (Ca)	09/1999

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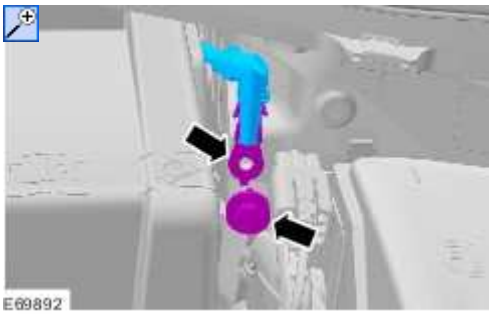
General Procedures

Disconnect

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



1. Obtain and record the audio unit keycode and preset radio frequencies.
2. *Torque:* 24 Nm

Connect

1. Enter the audio unit keycode and preset radio frequencies.
2. Reset the clock to the correct time.
3. Start and run the engine at idle for three minutes.
4. When the engine reaches normal operating temperature, increase the engine speed to 1200 rpm and maintain for approximately 2 minutes.
5. Drive the vehicle for approximately five miles/eight kilometers of varied driving.
6. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Removal and Installation

Removal

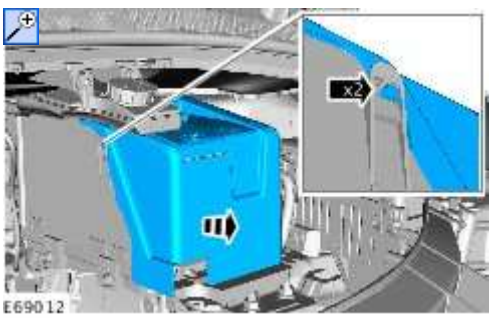
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the air cleaner.

   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
   Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
   Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).
   Refer to: Air Cleaner (303-12E Intake Air Distribution and Filtering - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V, Removal and Installation).



3.

4.
   1. *Torque:* 5 Nm
   2. *Torque:* 10 Nm

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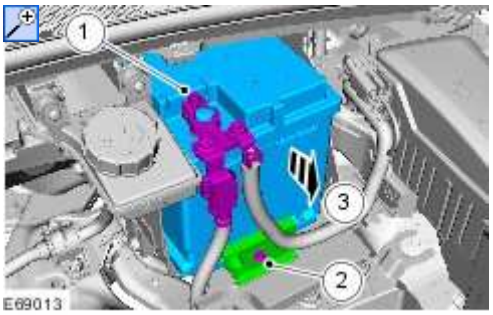

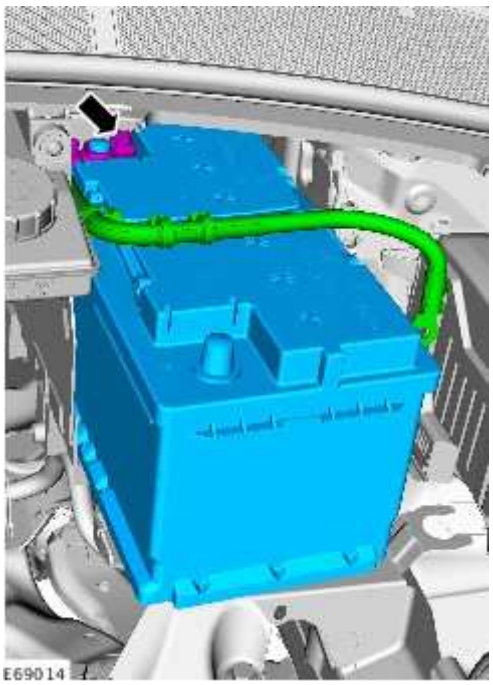

5. *Torque:* 5 Nm

Installation

1. CAUTION: If installing a new battery, only install the specified battery type.
   To install, reverse the removal procedure.

   Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

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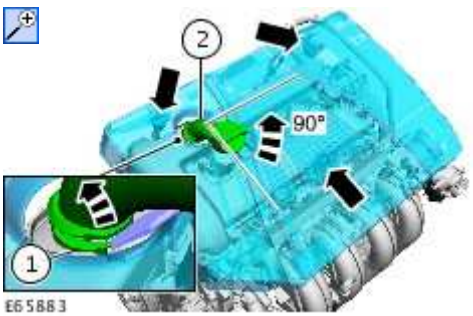
Removal and Installation

Removal

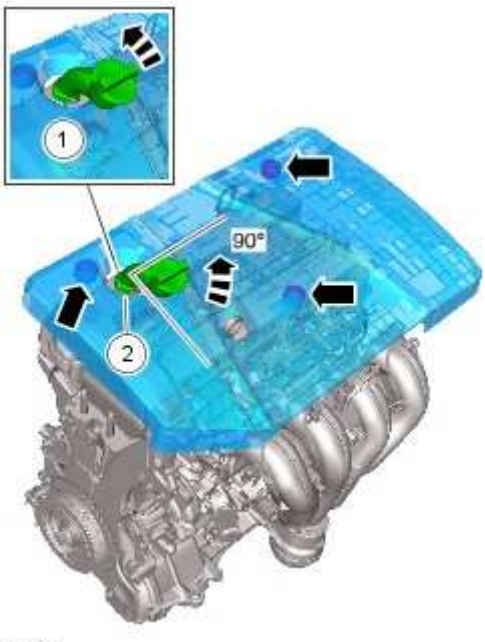
CAUTION: Make sure that the ignition key is removed.
NOTE: Removal steps in this procedure may contain installation details.

Vehicles with 2.0L engine



1.

Vehicles with 2.3L engine



2.

All vehicles

3. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05A, Removal and Installation).

4. CAUTION: Take extra care not to damage the wiring harnesses.
   Torque: 15 Nm

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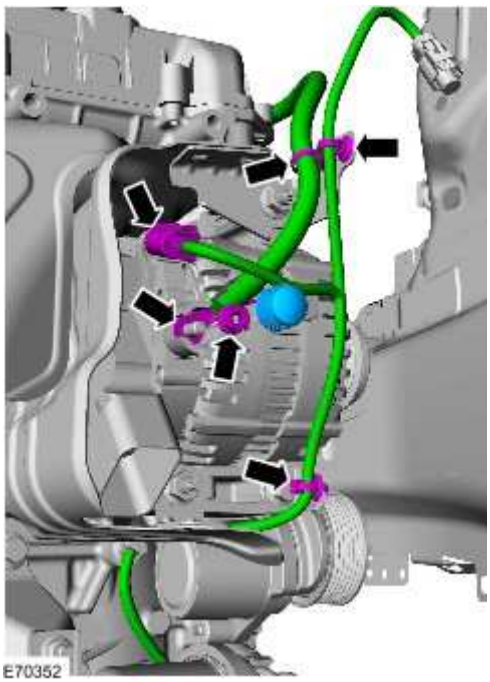
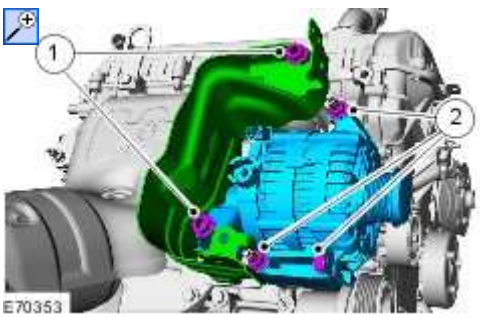
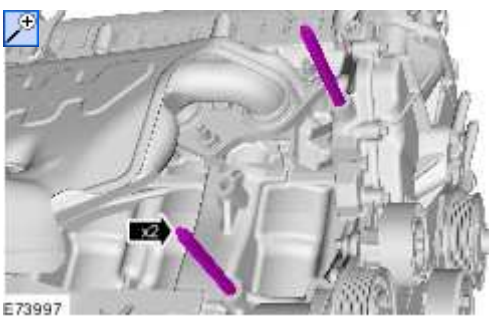




5.
1. *Torque:* 25 Nm
2. *Torque:* 47 Nm



6. NOTE: The following step is only required if a stud is loosened when the nut is removed.
Torque: 47 Nm

Installation

1. To install, reverse the removal procedure.

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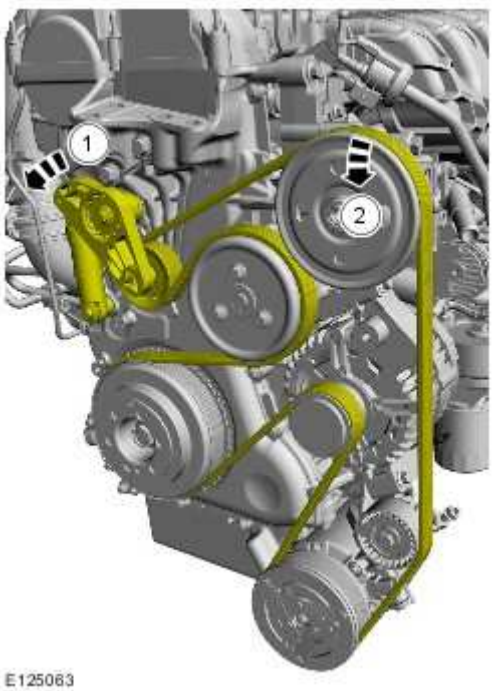
Removal and Installation

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Intake Manifold (303-01B Engine - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
3.



4. WARNING: Take extra care when handling the compressed spring.
5.
   2. *Torque:* 15 Nm
   3. *Torque:* 24 Nm

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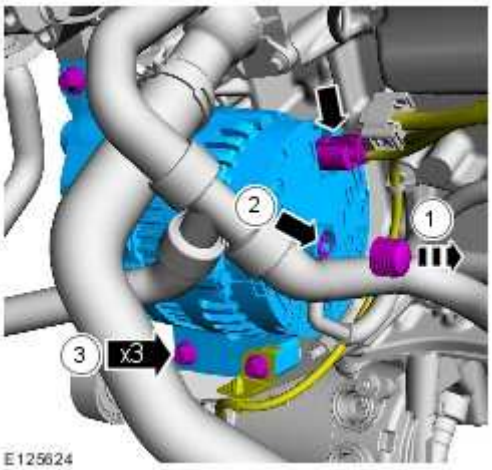
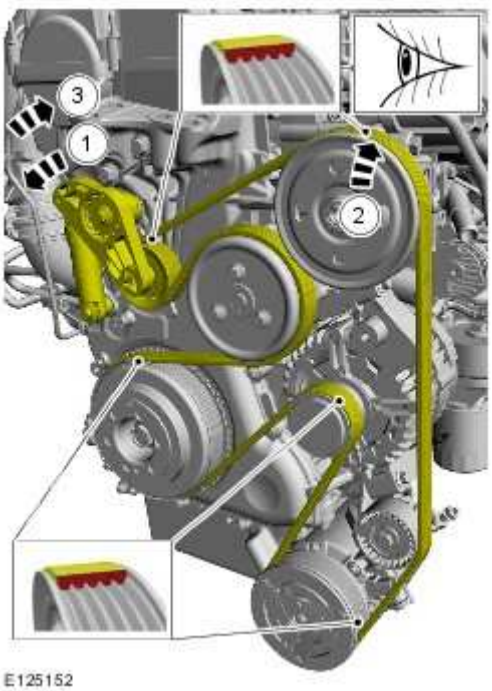


Installation



1. To install, reverse the removal procedure.
2. WARNING: Take extra care when handling the compressed spring.

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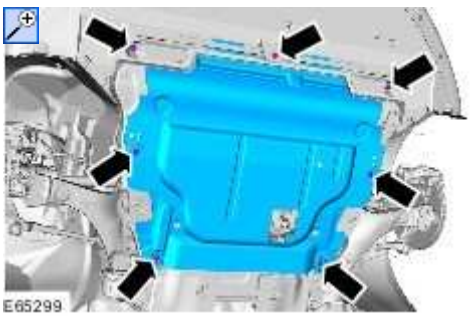
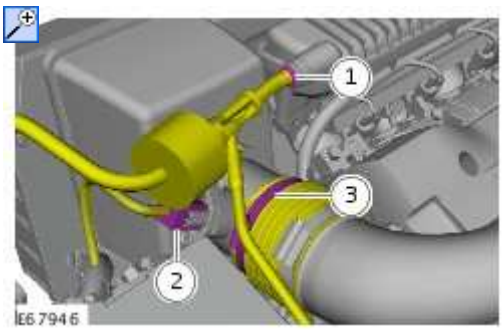
Removal and Installation

Removal

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

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the following items:
   1. Refer to: Throttle Body (303-04 Fuel Charging and Controls - 2.5L Duratec-ST (VI5), Removal and Installation).
   2. Right-hand headlamp.

      Refer to: Headlamp Assembly (417-01A, Removal and Installation).
3. Refer to: Lifting (100-02, Description and Operation).
4. 

5. Refer to: Accessory Drive Belt (303-05 Accessory Drive - 2.5L Duratec-ST (VI5), Removal and Installation).
6. 

CAUTION: Make sure that the inside of the pipe ends are clean and free of oil residue.
7.

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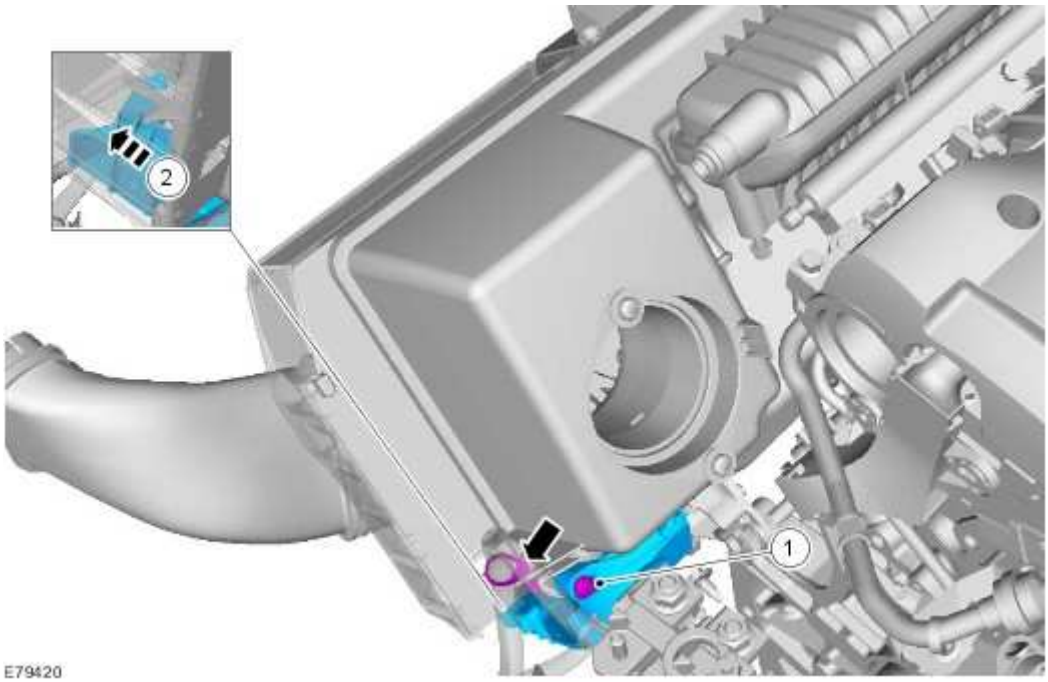

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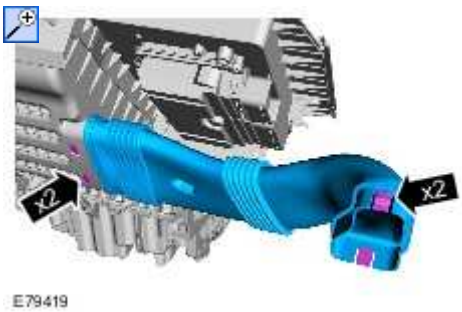

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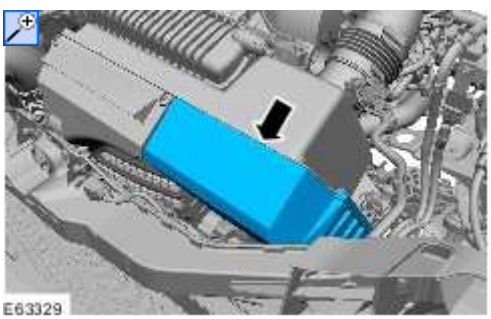
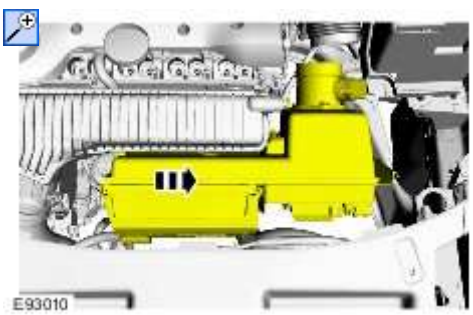


10.



11.

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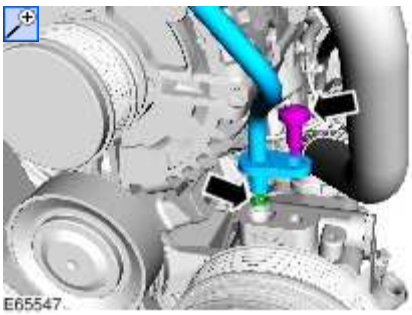
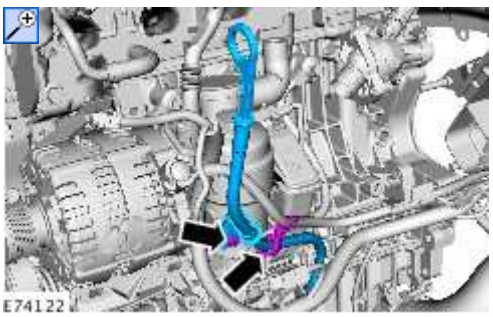
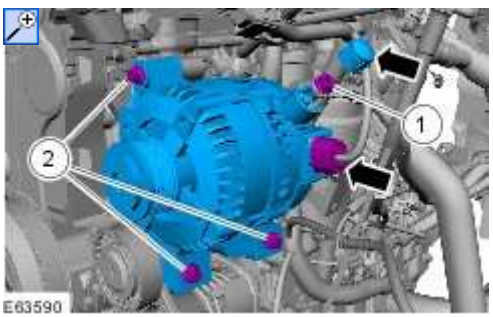


12. WARNING: Be prepared to collect escaping fluid.

    CAUTION: Make sure that all openings are sealed. Use new blanking caps.
    NOTE: The O-ring seal is to be reused unless damaged.
    Torque: 23 Nm



13. *Torque:* 10 Nm



14. NOTE: Install all the bolts finger tight before final tightening.
    1. *Torque:* 15 Nm
    2. *Torque:* 25 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling (211-00 Steering System - General Information, General Procedures).

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Removal and Installation

General Equipment

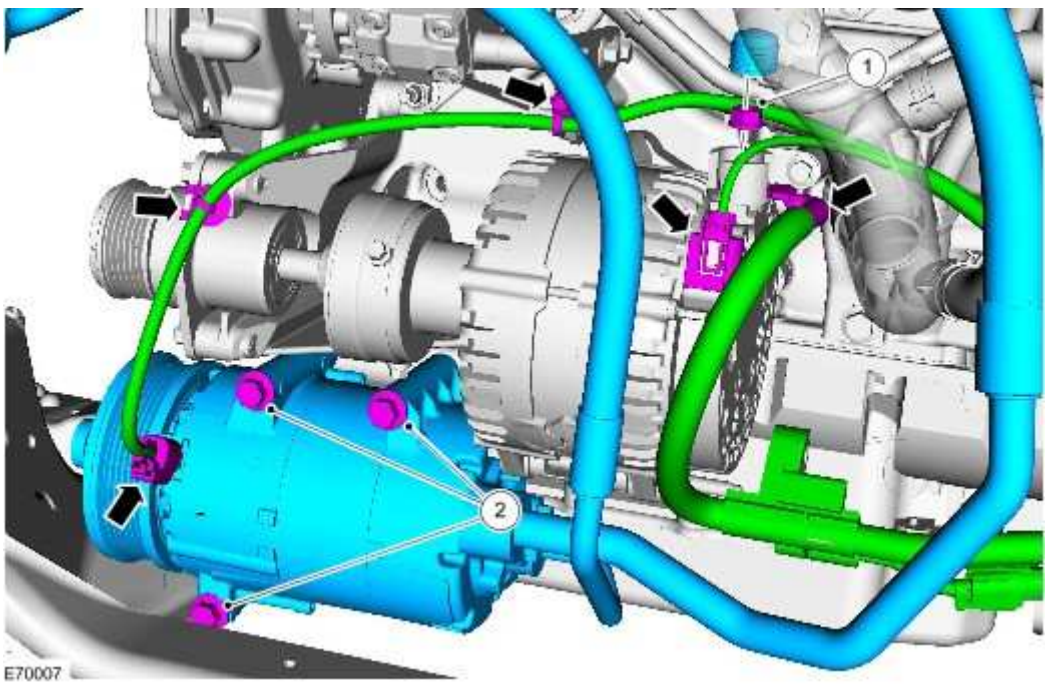
Cable ties

Removal

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

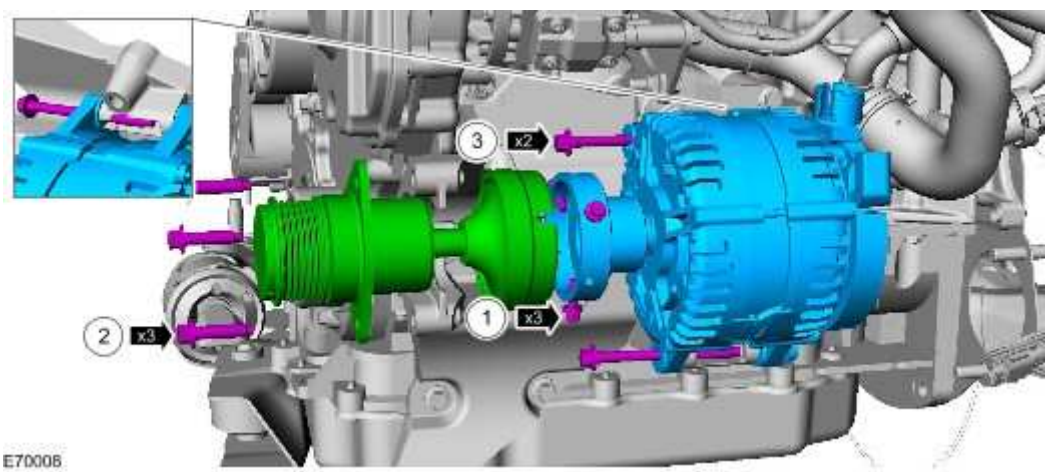
1. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05 Accessory Dr 1.8L Duratorq-TDCi (Lynx) Diesel, Removal and Installation).



2. CAUT
   Make sure no strain i placed on refrigerant lines.
   NOTE: Not the positio the electri connectors
   1. *Torq* Nm
   2. Secu A/C com to th radia supp brac

      Gene Equi Cabl *Torq* Nm



3.
   1. Do n remo gene deco bolts the gene

      Torq Nm
   2. *Torq* Nm
   3. *Torq* Nm

Installation

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1. To install, reverse the removal procedure.

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Generator and Regulator - Generator— 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW/2.0L Duratorq-TDCi (118kW/160PS) - DW, Emission Requirements: Stage IV/Stage V	S-MAX/Galaxy 2006.5 (02/2006-)

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Removal and Installation

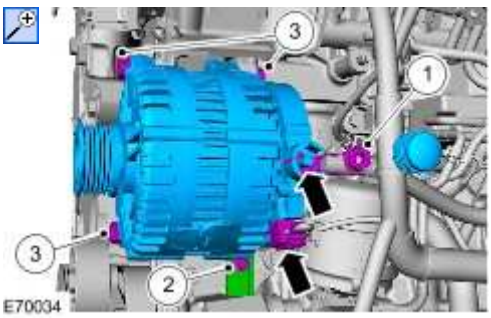
Removal

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

1. Remove the accessory drive belt.

   Refer to: Accessory Drive Belt (303-05E Accessory Drive - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).
2. Remove the fuel filter.

   Refer to: Fuel Filter (310-01C Fuel Tank and Lines - 2.0L Duratorq-TDCi (85kW/115PS) - DW/2.0L Duratorq-TDCi (100kW/136PS) - DW/2.0L Duratorq-TDCi (103kW/140PS) - DW, Emission Requirements: Stage IV, Removal and Installation).



3.
   1. *Torque:* 15 Nm
   2. *Torque:* 10 Nm
   3. *Torque:* 48 Nm

Installation

1. To install, reverse the removal procedure.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 415-00, for schematic and connector information.

General Equipment

Ford approved diagnostic tool

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Audio unit • Antenna • Foreign objects contacting speaker • Trim poorly fitted/resonance • Audio control switch (if equipped) • Digital versatile disc (DVD) player • Compact disc (CD) changer	• Fuse(s) • Wiring harness • Electrical connector(s) • Audio unit • Audio control switch (if equipped) • Central junction box (CJB) • Video display • DVD player • CD changer • Auxiliary input device

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Self-Diagnostic Mode.

Self-Diagnostic Mode - Low Series Audio Unit

NOTE: The audio unit must be in radio mode before entering the Self-Diagnostic Mode.

1. **1.** To enter the audio unit Self-Diagnostic Mode, switch the audio unit ON. Within four seconds press the preset buttons 3 and 5 together.
2. **2.** Release the preset buttons 3 and 5 and the audio unit will enter the Self-Diagnostic Mode.
3. **3.** To exit the Self-Diagnostic Mode, switch the audio unit OFF.

Self-Diagnostic Mode

Message Displayed	Circuit Tested
1. 4CH LF for four channel system 2CH LF for two channel system	Left hand front speaker circuit
2. 4CH RF for four channel system 2CH RF for two channel system	Right hand front speaker circuit
3. 4CH LR for four channel system	Left hand rear speaker circuit
4. 4CH RR for four channel system	Right hand rear speaker circuit

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5. XX.X (frequency) SEEKING	Antenna cable
6. XXXXXXXX (name of radio station)	Active FM frequency radio station found (audible for 2 seconds)

4. **4.** If the cause is not evident after the Self-Diagnostic Mode, connect the Ford approved diagnostic tool to the data link connector (DLC).

5. **5.** Retrieve the Diagnostic Trouble Code (DTC)s and refer to the DTC Index Chart.

Self-Diagnostic Mode - High Series Audio Unit

NOTE: The audio unit must be in radio mode before entering the Self-Diagnostic Mode.

1. **1.** To enter the audio unit Self-Diagnostic Mode, switch the audio unit ON. Within four seconds press the preset buttons 3 and 6 together.

2. **2.** Release the preset buttons 3 and 6 and the audio unit will enter the Self-Diagnostic Mode.

3. **3.** To exit the Self-Diagnostic Mode, switch the audio unit OFF.

Self-Diagnostic Mode

Message Displayed	Circuit Tested
1. 4CH LF for four channel system 2CH LF for two channel system	Left hand front speaker circuit
2. 4CH RF for four channel system 2CH RF for two channel system	Right hand front speaker circuit
3. 4CH LR for four channel system	Left hand rear speaker circuit
4. 4CH RR for four channel system	Right hand rear speaker circuit
5. XX.X (frequency) SEEKING	Antenna cable
6. XXXXXXXX (name of radio station)	Active FM frequency radio station found (audible for 2 seconds)

4. **4.** If the cause is not evident after the Self-Diagnostic Mode, connect the Ford approved diagnostic tool to the data link connector (DLC).

5. **5.** Retrieve the Diagnostic Trouble Code (DTC)s and refer to the DTC Index Chart.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description/Condition	Possible Source	Action
B1342	Audio unit internal failure	Audio unit	INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B2403	CD player internal failure	Audio unit	INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B2404	Audio control switch circuit failure	Audio control switch	GO to Pinpoint Test I.
B2406	CD player internal failure	Audio unit	INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B2408	Speaker line short circuit	Speaker(s)	GO to Pinpoint Test C.

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B2409	AM receiving signal error	Antenna cable	GO to Pinpoint Test B.
B2410	FM receiving signal error	Antenna cable	GO to Pinpoint Test B.
B2477	Module configuration failure	Audio unit and central junction box (CJB)	REFER to the Ford approved diagnostic tool.
P1628	Module ignition supply input	CJB	REFER to the Ford approved diagnostic tool.

1. **1.** If the cause is still evident, refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The audio unit is inoperative/does not operate correctly	* Circuit(s). * Audio unit.	* GO to Pinpoint Test A.
The display is blank - radio and CD player operate	* Audio unit.	* INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
Poor reception	* Antenna. * Antenna cable. * Audio unit.	* GO to Pinpoint Test B.
Poor quality/distorted sound from one or more speakers (not all speakers)	* Speaker(s). * Circuit(s). * Audio unit.	* For concern with the main speakers, GO to Pinpoint Test C. * For concern with the front tweeter speakers, GO to Pinpoint Test D. * For concern with the rear tweeter speakers, GO to Pinpoint Test E.
No sound from all speakers	* Audio unit.	* INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
No sound from one or more of the speakers (not all speakers)	* Speaker(s). * Circuit(s). * Audio unit.	* For concern with the main speakers, GO to Pinpoint Test F. * For concern with the front tweeter speakers, GO to Pinpoint Test G. * For concern with the rear tweeter speakers, GO to Pinpoint Test H.
The auxiliary audio control is inoperative/does not operate correctly.	* Circuit(s). * Auxiliary audio control switch. * Audio unit.	* GO to Pinpoint Test I.
The CD changer is inoperative/does not operate correctly	* Circuit(s). * CD changer.	* GO to Pinpoint Test J.
The audio unit illumination is inoperative	* Circuit(s). * Audio unit. * Genetic electronic module (GEM).	* REFER to: Instrument Cluster and Panel Illumination (413-00 Instrument Cluster and Panel Illumination, Diagnosis and Testing).
The auxiliary input device is inoperative/does not operate correctly	* Auxiliary input device.	* REFER the customer to the auxiliary input source supplier.
	* Circuit(s). * Audio unit.	* GO to Pinpoint Test K.
The DVD player is inoperative/does not operate correctly	* Contaminated DVD disc(s).	* CLEAN the DVD disc(s) using lint free material. TEST the system for normal operation.

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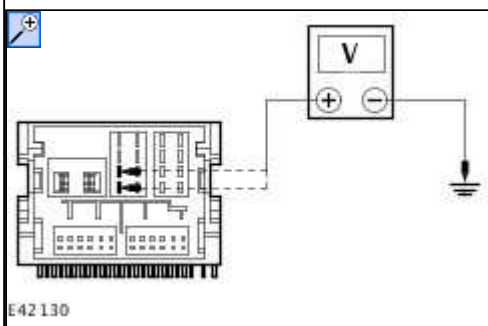
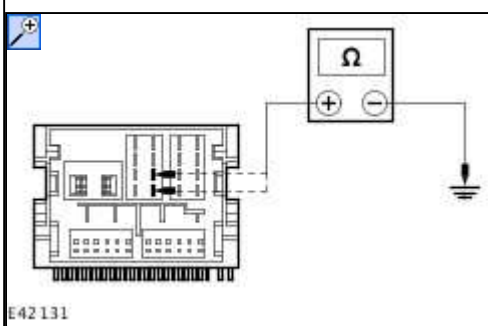
	* Circuit(s). * DVD player.	* GO to Pinpoint Test L.
The video display is inoperative/does not operate correctly	* Contaminated DVD disc(s).	* CLEAN the DVD disc(s) using lint free material. TEST the system for normal operation.
	* Circuit(s). * Video display.	* GO to Pinpoint Test M.
	* DVD player.	* GO to Pinpoint Test L.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE AUDIO UNIT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR POWER TO THE AUDIO UNIT	
	1 Disconnect Audio Unit C2ME03A.
	2 Ignition switch in position I.
	3 Measure the voltage between the audio unit C2ME03A pin 15, circuit SBP06D (BN/RD), harness side and ground, and between the audio unit C2ME03A pin 16, circuit CDC33C (VT/GN), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to A2. **No** REPAIR circuit SBP06D (BN/RD) or circuit CDC33C (VT/GN). TEST the system for normal operation.
A2: CHECK THE AUDIO UNIT GROUND CIRCUITS FOR GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the audio unit C2ME03A pin 11, circuit GD103C (BK/BU), harness side and ground, and between the audio unit C2ME03A pin 12, circuit GD103A (BK/BU), harness side and ground.
	Are the resistances less than 1 ohm? **Yes** INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit GD103C (BK/BU) or circuit GD103A (BK/BU). TEST the system for normal operation.

PINPOINT TEST B : POOR RECEPTION

NOTE: The secondary antenna cable amplifier to left-rear quarter glass wiring harness is

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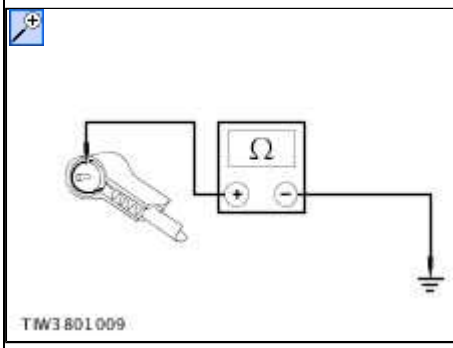
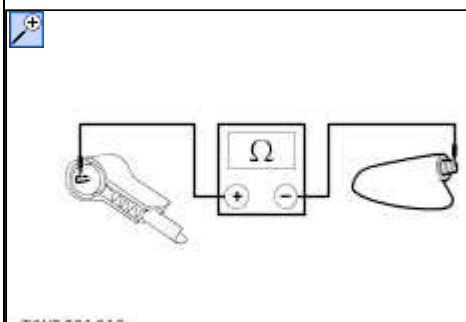
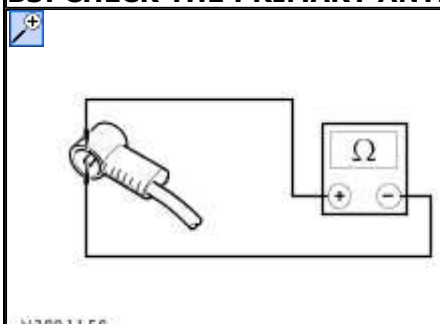
polarised (labelled A and B) at the rear quarter glass end. The polarisation of these connectors should be checked before proceeding as an incorrect connection may cause poor or no reception.

NOTE: The performance of the secondary antenna may be affected if windshield adhesive comes into contact with the antenna connections in the glass. Check the connections are free from windshield adhesive before proceeding.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE PRIMARY ANTENNA CABLE SHIELD	
	1 Ignition switch in position 0.
	2 Disconnect the antenna cable from the audio unit.
 TW3801009	3 Measure the resistance between the antenna cable ground connector (shield), and ground.
	Is the resistance less than 1 ohm? **Yes** GO to B2. **No** CLEAN and TIGHTEN the antenna base connection to the body. If the concern persists, INSTALL a new antenna cable. TEST the system for normal operation.
B2: CHECK THE PRIMARY ANTENNA CENTER CONDUCTOR FOR OPEN CIRCUIT	
	1 Remove the antenna mast.
 TW3801010	2 Measure the resistance of the center conductor between the ends of the antenna cable.
	Is the resistance less than 1 ohm? **Yes** GO to B3. **No** INSTALL a new antenna cable. TEST the system for normal operation.
B3: CHECK THE PRIMARY ANTENNA CABLE FOR SHORT	
 V3801158	1 Measure the resistance between the antenna center conductor and the antenna ground (shield).

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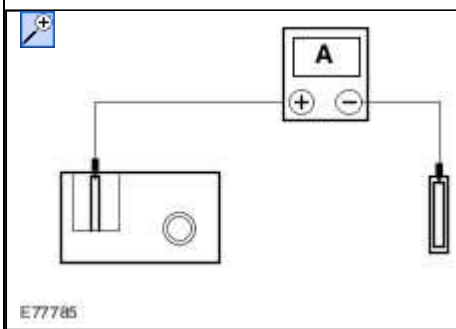
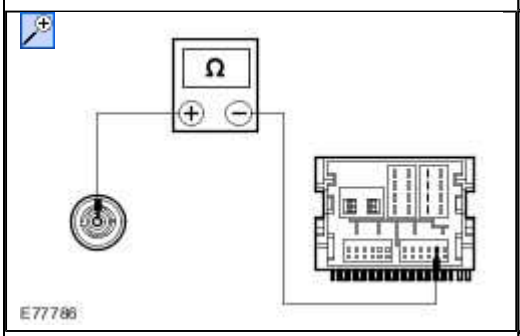
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** CLEAN and TIGHTEN the ground connections at the base of the antenna and battery negative cable to the body. If concern the persists, GO to B4. **No** INSTALL a new antenna cable. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation).
B4: CHECK THE CURRENT DRAW OF THE SECONDARY ANTENNA CABLE AMPLIFIER	
NOTE: The secondary antenna cable amplifier is located under the headliner above the left-rear quarter window glass.	
	1 Disconnect Secondary Antenna Cable Amplifier Power Supply.
	2 Switch the audio unit on.
	3 Measure the amperage between the secondary antenna cable amplifier power supply electrical connector and the power supply connection on the secondary antenna cable amplifier.
	Is the amperage between 20 and 70 milliamps? **Yes** GO to B5. **No** Clean and TIGHTEN the secondary antenna cable amplifier ground connection. TEST the system for normal operation. If the concern persists, INSTALL a new secondary antenna cable amplifier. TEST the system for normal operation.
B5: CHECK THE SECONDARY ANTENNA CABLE FOR OPEN	
	1 Disconnect Audio Unit C2ME03B.
	2 Disconnect Secondary Antenna Cable.
	3 Measure the resistance between the audio unit electrical connector C2ME03B, circuit CME36A (GN/VT), harness side and the secondary antenna cable connector, harness side.
	Is the resistance less than 1 ohm? **Yes** GO to B6. **No** INSTALL a new secondary antenna. TEST the system for normal operation.
B6: CHECK THE SECONDARY ANTENNA CABLE AMPLIFIER TO LEFT-REAR QUARTER GLASS WIRING HARNESS FOR OPEN	

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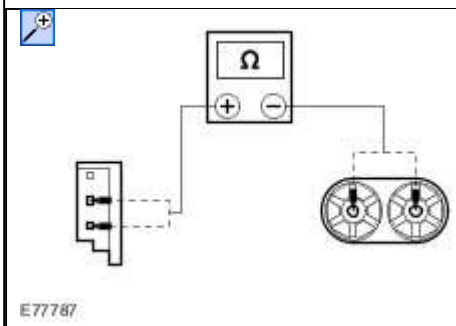
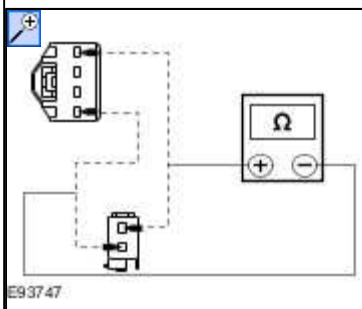
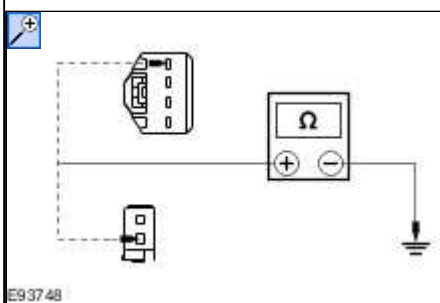
	1 Disconnect Secondary Antenna Cable Amplifier to Left-rear Quarter Glass wiring harness (at both ends).
 E77787	2 Measure the resistances between the following secondary antenna cable amplifier to left-rear quarter glass wiring harness electrical connectors. • Secondary antenna cable amplifier connector pin 1, harness side and left-rear quarter glass connector pin A, harness side. • Secondary antenna cable amplifier connector pin 2, harness side and left-rear quarter glass connector pin B, harness side.
	Are the resistances less than 1 ohm? **Yes** INSTALL a new left-rear quarter window glass. TEST the system for normal operation. **No** INSTALL a new secondary antenna cable amplifier to left-rear quarter glass wiring harness. TEST the system for normal operation.

PINPOINT TEST C : POOR QUALITY/DISTORTED SOUND FROM ONE OR MORE MAIN SPEAKERS (NOT ALL SPEAKERS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE SPEAKER RESISTANCE	
	1 Disconnect Affected Speaker.
 E93747	2 Measure the resistance between the following affected speaker pins, component side. • (Front speakers) pin 1 and pin 4. • (Third row speakers) pins 1 and 2 (if equipped). • (Rear speakers) pin 1 and pin 4.
	Is the resistance approximately 4.0 ohms? **Yes** GO to C2. **No** INSTALL a new speaker. TEST the system for normal operation.
C2: CHECK SPEAKER INPUT FOR SHORT TO GROUND	
	1 Disconnect Audio Unit CME03A.
 E93748	2 Measure the resistance between affected speaker connector pin 1, harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** GO to C3.

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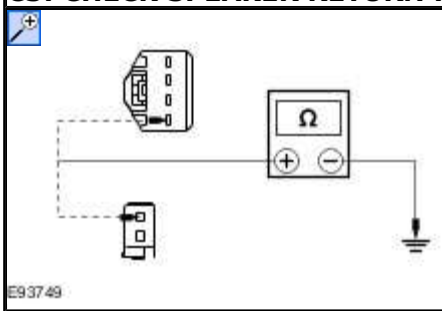
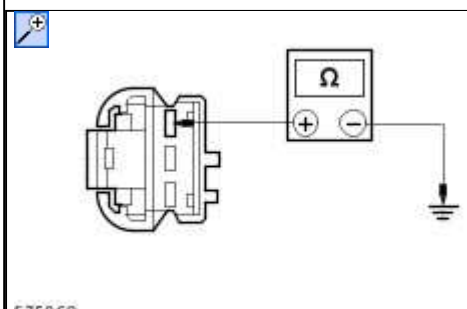
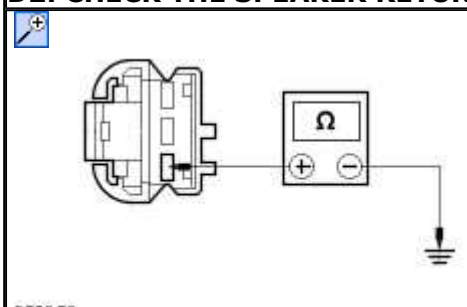
	No REPAIR the speaker input circuit. TEST the system for normal operation.
C3: CHECK SPEAKER RETURN FOR SHORT TO GROUND	
	1 Measure the resistance between the following affected speaker connector pins, harness side and ground: • (Front speakers) pin 4 and ground. • (Third row speakers) pin 2 and ground (if equipped). • (Rear speakers) pin 4 and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new speaker. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation). **No** REPAIR the speaker return circuit. TEST the system for normal operation.

PINPOINT TEST D : POOR QUALITY/DISTORTED SOUND FROM ONE OR MORE FRONT TWEETER SPEAKERS (NOT ALL SPEAKERS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE SPEAKER INPUT FOR SHORT TO GROUND	
	1 Disconnect Audio Unit C2ME03D.
	2 Disconnect Affected Front Tweeter Speaker.
	3 Measure the resistance between affected front tweeter speaker connector pin 1, harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** GO to D2. **No** REPAIR the speaker input circuit. TEST the system for normal operation.
D2: CHECK THE SPEAKER RETURN FOR SHORT TO GROUND	
	1 Measure the resistance between affected front tweeter speaker connector pin 3, harness side and ground.

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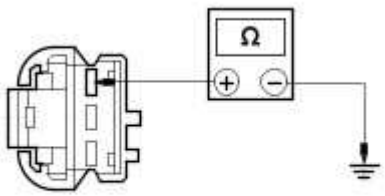
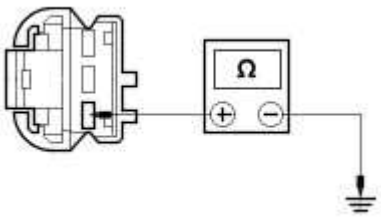
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new tweeter speaker. TEST the system for normal operation. **No** REPAIR the speaker return circuit. TEST the system for normal operation.

PINPOINT TEST E : POOR QUALITY/DISTORTED SOUND FROM ONE OR MORE REAR TWEETER SPEAKERS (NOT ALL SPEAKERS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE SPEAKER INPUT FOR SHORT TO GROUND	
	1 Disconnect Affected Rear Tweeter Speaker.
	2 Disconnect Rear Speaker On Affected Rear Tweeter Speaker Side.
 E75069	3 Measure the resistance between affected rear tweeter speaker connector pin 1, harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** GO to E2. **No** REPAIR the speaker input circuit. TEST the system for normal operation.
E2: CHECK THE SPEAKER OUTPUT FOR SHORT TO GROUND	
 E75070	1 Measure the resistance between affected rear tweeter speaker connector pin 3, harness side and ground.
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new tweeter speaker. TEST the system for normal operation. **No** REPAIR the speaker output circuit. TEST the system for normal operation.

PINPOINT TEST F : NO SOUND FROM ONE OR MORE OF THE MAIN SPEAKERS (NOT ALL SPEAKERS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE SPEAKER RESISTANCE	
	1 Disconnect Affected Speaker.

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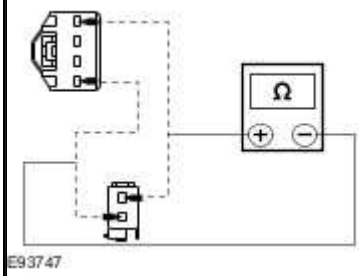
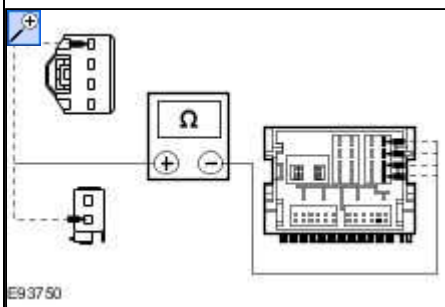
 E93747	2 Measure the resistance between the following affected speaker pins, component side. • (Front speakers) pin 1 and pin 4. • (Third row speakers) pins 1 and 2 (if equipped). • (Rear speakers) pin 1 and pin 4.
	Is the resistance approximately 4.0 ohms? **Yes** GO to F2. **No** INSTALL a new speaker. TEST the system for normal operation.
F2: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR INPUT CIRCUIT(S)	
	1 Disconnect Audio Unit C2ME03D.
 E93750	2 Measure the resistance between the following audio unit C2ME03D pins, harness side and the inoperative speaker(s) input circuit(s), harness side: • **Left-hand drive vehicles** (Left front speaker) C5ME07 pin 1, circuit VME07A (WH) to C2ME03D pin 3, circuit VME07C (WH). • **Left-hand drive vehicles** (Right front speaker) C6ME10 pin 1, circuit VME10A (WH/VT) to CME03D pin 2, circuit VME10C (WH/VT). • **Right-hand drive vehicles**(Left front speaker) C6ME10 pin 1, circuit VME10A (WH/VT) to C2ME03D pin 3, circuit VME07C (WH). • **Right-hand drive vehicles**(Right front speaker) C5ME07 pin 1, circuit VME07A (WH) to C2ME03D pin 2, circuit VME10C (WH/VT). • (Left third row speaker) C4ME09 pin 1, circuit VME09D (BN/GN) to C2ME03D pin 4, circuit VME09C (BN/GN). • (Right third row speaker) C4ME12 pin 1, circuit VME12B (BN/WH) to C2ME03D pin 1, circuit VME12C (BN/WH). • (Left rear speaker) C7ME09 pin 1, circuit VME09A (BN/GN) to C2ME03D pin 4, circuit VME09C (BN/GN). • (Right rear speaker) C8ME12 pin 1, circuit VME12A (BN/WH) to C2ME03D pin 1, circuit VME12C (BN/WH).
	Is the resistance less than 1 ohm? **Yes** GO to F3. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
F3: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR OUTPUT CIRCUIT(S)	

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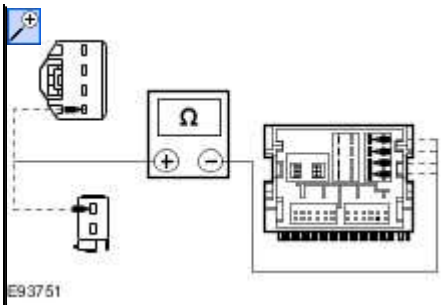


1 Measure the resistance between the following audio unit C2ME03D pins, harness side and the inoperative speaker(s) output circuit(s), harness side:

- **Left-hand drive vehicles** (Left front speaker) C5ME07 pin 4, circuit RME07A (WH/BN) to C2ME03D pin 7, circuit RME07C (WH/BN).
- **Left-hand drive vehicles** (Right front speaker) C6ME10 pin 4, circuit RME10A (WH/OG) to CME03D pin 6, circuit RME10C (WH/OG).
- **Right-hand drive vehicles**(Left front speaker) C6ME10 pin 4, circuit RME10A (WH/OG) to C2ME03D pin 7, circuit RME07C (WH/OG).
- **Right-hand drive vehicles**(Right front speaker) C5ME07 pin 4, circuit RME07A (WH/OG) to C2ME03D pin 6, circuit RME10C (WH/OG).
- (Left third row speaker) C4ME09 pin 2, circuit RME09D (BN/YE) to C2ME03D pin 8, circuit RME09C (BN/YE).
- (Right third row speaker) C4ME12 pin 2, circuit RME12B (BN/BU) to C2ME03D pin 5, circuit RME12C (BN/YE).
- (Left rear speaker) C7ME09 pin 4, circuit RME09A (BN/YE) to C2ME03D pin 8, circuit RME09C (BN/YE).
- (Right rear speaker) C8ME12 pin 4, circuit RME12A (BN/BU) to C2ME03D pin 5, circuit RME12C (BN/BU).

Is the resistance less than 1 ohm?

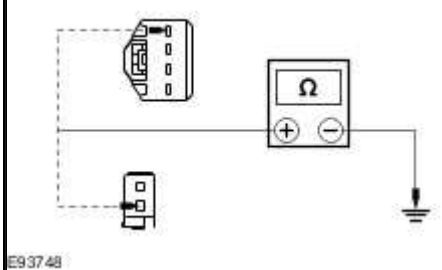
Yes

GO to F4.

No

REPAIR the circuit(s) in question. TEST the system for normal operation.

F4: CHECK THE INOPERATIVE SPEAKER(S) CIRCUIT FOR SHORT TO GROUND



1 Measure the resistance between the following inoperative speaker(s) input circuit(s), harness side and ground:

- **Left-hand drive vehicles** (Left front speaker) C5ME07 pin 1, circuit VME07A (WH).
- **Left-hand drive vehicles** (Right front speaker) C6ME10 pin 1, circuit VME10A (WH/VT).
- **Right-hand drive vehicles**(Left front speaker) C6ME10 pin 1, circuit VME10A (WH/VT).
- **Right-hand drive vehicles**(Right front speaker) C5ME07 pin 1, circuit VME07A (WH).
- (Left third row speaker) C4ME09 pin 1, circuit VME09D (BN/GN).

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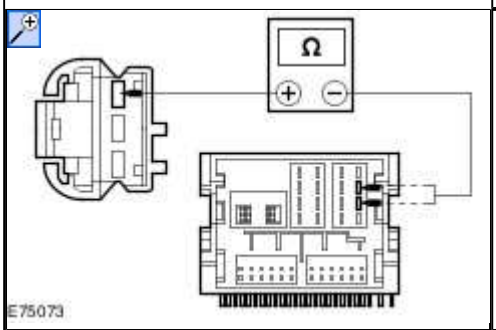
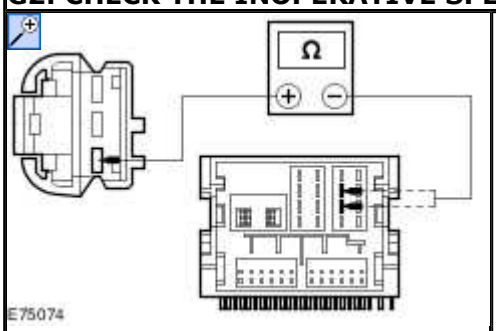
	• (Right third row speaker) C4ME12 pin 1, circuit VME12B (BN/WH). • (Left rear speaker) C7ME09 pin 1, circuit VME09A (BN/GN). • (Right rear speaker) C8ME12 pin 1, circuit VME12A (BN/WH).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new speaker. TEST the system for normal operation. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST G : NO SOUND FROM ONE OR MORE OF THE FRONT TWEETER SPEAKERS (NOT ALL SPEAKERS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR INPUT CIRCUIT(S)	
	1 Disconnect Affected Front Tweeter Speaker.
	2 Disconnect Audio Unit C2ME03D.
	3 Measure the resistance between the following audio unit C2ME03D pins, harness side and the inoperative front tweeter speaker(s) input circuit(s), harness side: • **Left-hand side** C2ME03D pin 3, circuit VME07D (WH) to C5MED8 pin 1, circuit VME07D (WH). • **Right-hand side** C2ME03D pin 2, circuit VME10D (WH/VT) to C6ME11 pin 1, circuit VME10D (WH/VT).
	Is the resistance less than 1 ohm? **Yes** GO to G2. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
G2: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR OUTPUT CIRCUIT(S)	
	1 Measure the resistance between the following audio unit C2ME03D pins, harness side and the inoperative front tweeter speaker(s) output circuit(s), harness side: • **Left-hand side** C2ME03D pin 7, circuit RME07D (WH/BN) to C5MED8 pin 3, circuit RME07D (WH/BN). • **Right-hand side** C2ME03D pin 6, circuit RME10D (WH/OG) to C6ME11 pin 3, circuit RME10D (WH/OG).
	Is the resistance less than 1 ohm? **Yes** GO to G3. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
G3: CHECK THE INOPERATIVE TWEETER SPEAKER(S) CIRCUIT FOR SHORT TO	

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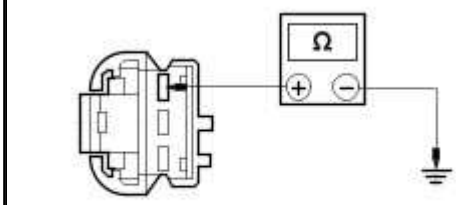
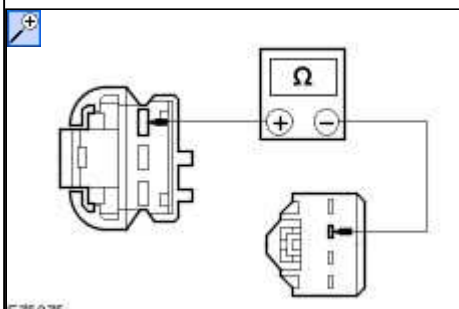
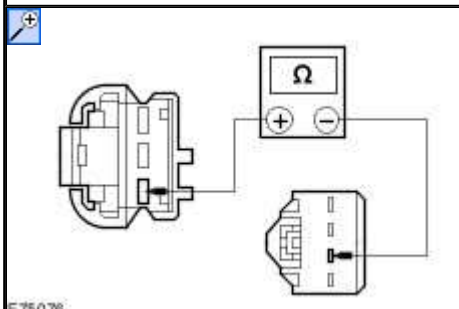
GROUND

 E75069	1 Measure the resistance between the following inoperative front tweeter speaker(s) input circuit(s), harness side and ground: • **Left-hand side** C5MED8 pin 1, circuit VME07D (WH). • **Right-hand side** C6ME11 pin 1, circuit VME10D (WH/VT).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new tweeter speaker. TEST the system for normal operation. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST H : NO SOUND FROM ONE OR MORE OF THE REAR TWEETER SPEAKERS (NOT ALL SPEAKERS)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR INPUT CIRCUIT(S)	
	1 Disconnect Affected Rear Tweeter Speaker.
	2 Disconnect Rear Speaker On Affected Rear Tweeter Speaker Side C7ME09 (Left-hand side) C8ME12 (Right-hand side).
 E75075	3 Measure the resistance between the following rear tweeter speaker pins, harness side and the inoperative tweeter speaker(s) input circuit(s), harness side: • **Left-hand side** C7ME09 pin 2, circuit VME39A (GN/BN), harness side and C7ME39 pin 1, circuit VME39A (GN/BN), harness side. • **Right-hand side** C8ME12 pin 2, circuit VME40A (BN/WH), harness side and C8ME4D pin 1, circuit VME40A (BN/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to H2. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
H2: CHECK THE INOPERATIVE SPEAKER(S) CONNECTOR OUTPUT CIRCUIT(S)	
 E75076	1 Measure the resistance between the following rear tweeter speaker pins, harness side and the inoperative tweeter speaker(s) input circuit(s), harness side: • **Left-hand side** C7ME09 pin 3, circuit RME39A (OG/WH), harness side and C7ME39 pin 3, circuit RME39A (OG/WH), harness side. • **Right-hand side** C8ME12 pin 3, circuit RME40A (OG/VT), harness side and C8ME4D pin 3, circuit RME40A (OG/VT), harness side.
	Is the resistance less than 1 ohm? **Yes**

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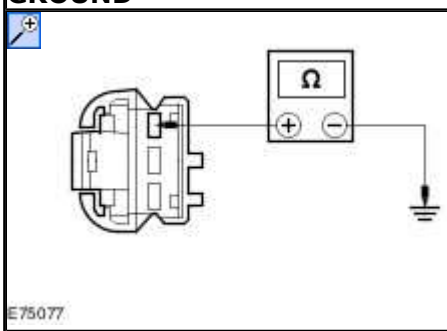
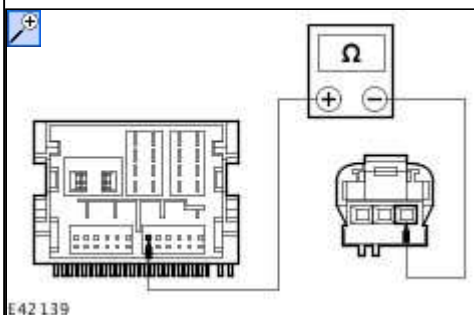
	GO to H3. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.
H3: CHECK THE INOPERATIVE TWEETER SPEAKER(S) CIRCUIT FOR SHORT TO GROUND	
 E75077	1 Measure the resistance between the following rear tweeter speaker pins, harness side and ground: • **Left-hand side** C7ME39 pin 1, circuit VME39A (GN/BN). • **Right-hand side** C8ME4D pin 1, circuit VME40A (BN/WH).
	Is the resistance greater than 10,000 ohms (open circuit)? **Yes** INSTALL a new tweeter speaker. TEST the system for normal operation. **No** REPAIR the circuit(s) in question. TEST the system for normal operation.

PINPOINT TEST I : THE AUDIO CONTROL SWITCH IS INOPERATIVE/DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK THE AUDIO UNIT OPERATES CORRECTLY USING THE AUDIO UNIT CONTROLS	
	1 Operate the audio unit using the audio unit controls.
	Does the audio unit operate correctly using the audio unit controls? **Yes** GO to I2. **No** INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
I2: CHECK CIRCUIT VME14A (GY/YE) FOR OPEN	
	1 Disconnect Audio Unit C2ME03B.
	2 Disconnect Clockspring C2LS41.
 E42139	3 Measure the resistance between the audio unit C2ME03B pin 6, circuit VME14A (GY/YE) harness side and the clockspring C2LS41 pin 11, circuit VME14A (GY/YE) harness side.
	Is the resistance less than 1 ohm? **Yes** GO to I3. **No** REPAIR the circuit. TEST the system for normal

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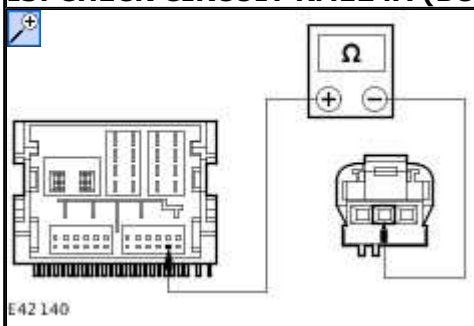
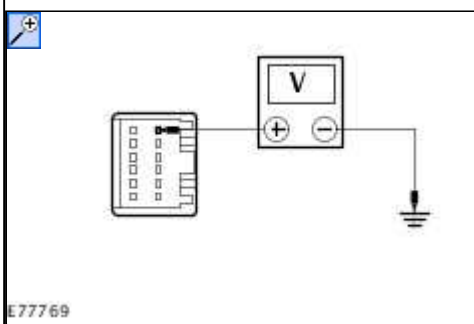
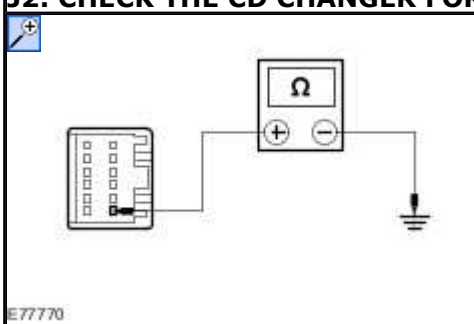
	operation.
I3: CHECK CIRCUIT RME24A (BU/WH) FOR OPEN	
	1 Measure the resistance between the audio unit C2ME03B pin 8, circuit RME24A (BU/WH) harness side and the clockspring CME14 pin 2, circuit RME24B (BU/WH) harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new audio control switch. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit. REFER to: Audio Unit (415-01 Information and Entertainment System, Removal and Installation). **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST J : THE CD CHANGER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE CD CHANGER FOR VOLTAGE	
	1 Disconnect CD changer C2ME27.
	2 Measure the voltage between the CD changer C2ME27 pin 1, circuit SBR05AWA (GY/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to J2. **No** REPAIR circuit SBR05AWA (GY/RD). TEST the system for normal operation.
J2: CHECK THE CD CHANGER FOR GROUND	
	1 Measure the resistance between the CD changer C2ME27 pin 6, circuit GD135M (BK/GY), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** GO to J3. **No**

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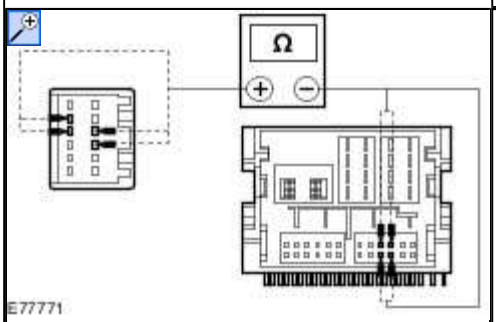
	REPAIR the circuit. TEST the system for normal operation.
J3: CHECK THE CD CHANGER TO AUDIO UNIT CIRCUIT(S) FOR OPEN	
	1 Disconnect Audio Unit C2ME03B.
	2 Measure the resistance between the following CD changer circuits and the audio unit circuit(s): • CD changer C2ME27 pin 3, circuit VME15B (GN/BK), harness side and audio unit C2ME03B pin 3, circuit VME15A (GN/BK), harness side. • CD changer C2ME27 pin 8, circuit RME15B (VT/GY), harness side and audio unit C2ME03B pin 9, circuit RME15A (VT/GY), harness side. • CD changer C2ME27 pin 4, circuit VME16B (GY/RD), harness side and audio unit C2ME03B pin 4, circuit RME16A (GY/RD), harness side. • CD changer C2ME27 pin 9, circuit RME16B (YE/GY), harness side and audio unit C2ME03B pin 10, circuit RME16A (YE/GY), harness side.
	Are the resistances less than 1 ohm? **Yes** INSTALL a new CD changer. TEST the system for normal operation. **No** REPAIR the circuits as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit.

PINPOINT TEST K : THE AUXILIARY INPUT DEVICE IS INOPERATIVE/DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK THE OPERATION OF THE AUXILIARY INPUT DEVICE	
	1 Operate the auxiliary input device outside of the vehicle.
	Does the auxiliary input device operate outside of the vehicle? **Yes** GO to K3. **No** REFER to the auxiliary input device Owner Guide.
K2: CHECK THE AUXILIARY INPUT DEVICE CONNECTOR	
	1 Check the auxiliary input device connector for signs of damage or debris.
	Is the auxiliary input device connector free of damage and debris? **Yes** GO to K3. **No** INSTALL a new auxiliary input device connector. TEST the system for normal operation.
K3: CHECK CIRCUIT VME37A (BU/RD) FOR OPEN	
	1 Disconnect Audio Unit C2ME03C.
	2 Measure the resistance between the audio unit C2ME03C pin 5, circuit VME37A (BU/RD), harness side and auxiliary input device C2ME37 pin 4, circuit

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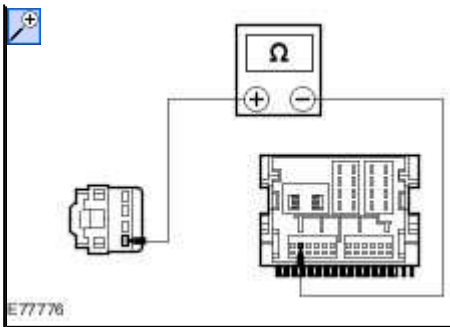
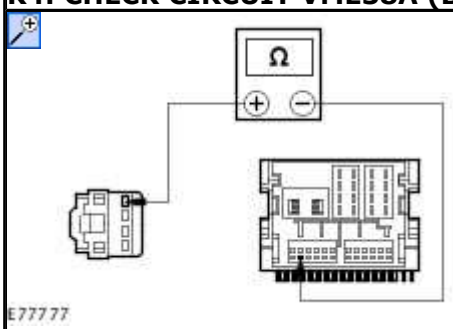
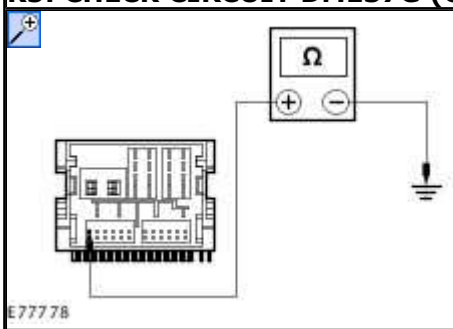
	VME37A (BU/RD), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to K4. **No** REPAIR circuit VME37A (BU/RD). TEST the system for normal operation.
K4: CHECK CIRCUIT VME38A (BN/RD) FOR OPEN	
	1 Measure the resistance between the audio unit C2ME03C pin 11, circuit VME38A (BN/RD), harness side and auxiliary input device C2ME37 pin 1, circuit VME38A (BN/RD), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to K5. **No** REPAIR circuit VME38A (BN/RD). TEST the system for normal operation.
K5: CHECK CIRCUIT DME37G (OG/GN) FOR GROUND	
	1 Measure the resistance between the audio unit C2ME03C pin 6, circuit DME37G (OG/GN), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new audio unit. TEST the system for normal operation. **No** REPAIR circuit DME37G (OG/GN). TEST the system for normal operation.

PINPOINT TEST L : THE DIGITAL VERSATILE DISC (DVD) PLAYER IS INOPERATIVE/DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE DVD PLAYER FOR POWER	
	1 Disconnect DVD Player C2MR-A.
	2 Measure the voltage between the DVD player C2MR-A pin 4, circuit C_SBR05D (GY/RD), harness side and

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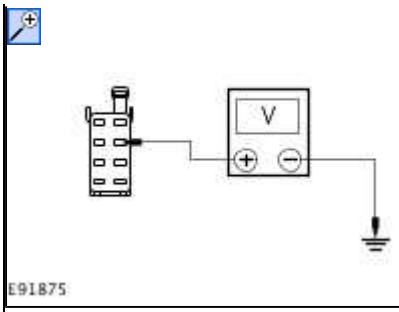
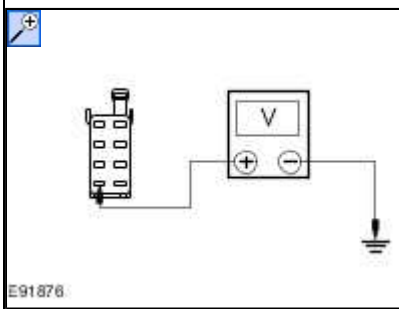
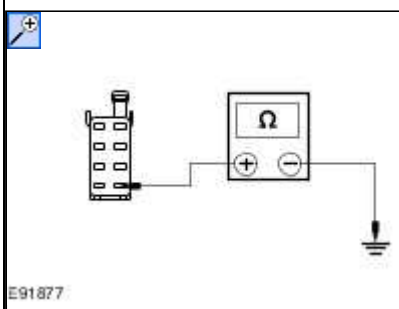
	ground.
	Is the voltage greater than 10 volts? **Yes** GO to L2. **No** REPAIR circuit C_SBR05D (GY/RD). TEST the system for normal operation.
L2: CHECK THE DVD PLAYER FOR SWITCHED POWER	
	1 Ignition switch in position II.
	2 Measure the voltage between the DVD player C2MR-A pin 7, circuit A_CBP04B (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to L3. **No** REPAIR circuit A_CBP04B (VT). TEST the system for normal operation.
L3: CHECK THE DVD PLAYER FOR GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the DVD player C2MR-A pin 8, circuit GD151L (BK/GN), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** GO to L4. **No** REPAIR circuit GD151L (BK/GN). TEST the system for normal operation.
L4: CHECK THE DVD PLAYER ILLUMINATION CIRCUIT FOR POWER	
	1 Turn the multi-function switch to the on position.
	2 Measure the voltage between the DVD player C2MR-A pin 6, circuit A_CLN17B (BN), harness side and ground.

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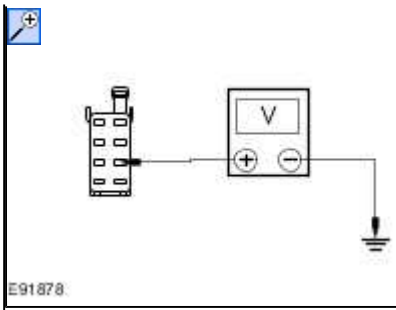


Is the voltage greater than 10 volts?

Yes

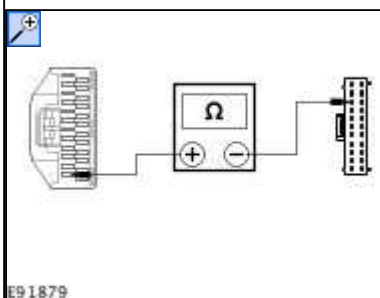
INSTALL a new DVD player.
REFER to: Digital Versatile Disc (DVD) Player (415-01, Removal and Installation).
TEST the system for normal operation.

No

REPAIR circuit GLN17B (BN). TEST the system for normal operation.

PINPOINT TEST M : THE VIDEO SYSTEM IS INOPERATIVE/DOES NOT OPERATE CORRECTLY

WARNING: Do not attempt to open or repair a video display as there are internal voltages in excess of 2000 volts. Failure to follow this instruction may result in personal injury.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK THE OPERATION OF THE VIDEO DISPLAY	
	1 Change the head restraints/video displays between the two front seats.
	Has the concern moved with the video display? **Yes** INSTALL a new head restraint/video display. TEST the system for normal operation. **No** For concern with the left-hand video display, GO to M2. For concern with the right-hand video display, GO to M18.
M2: CHECK CIRCUITS CMR13B (WH/GN) AND CMR13A (WH/GN) FOR OPEN	
	1 Disconnect DVD player C2MR-D.
	2 Disconnect Video display C33-T.
	3 Measure the resistance between the DVD player C2MR-D pin 1, circuit CMR13B (WH/GN), harness side and video display C33-T pin 3, circuit GMR13A (GN/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M3. **No** REPAIR circuit(s) GMR13B (WH/GN) or GMR13A (WH/GN). TEST the system for normal operation.
M3: CHECK CIRCUITS LMR01B (BU/WH) AND LMR01A (BU/WH) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-

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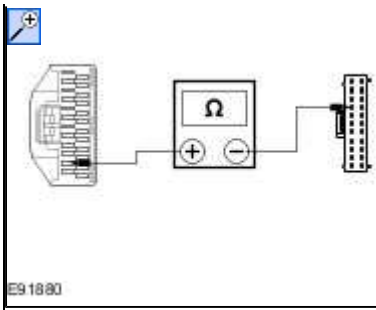
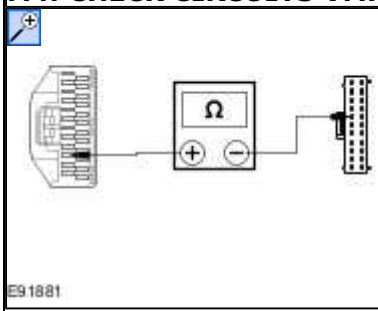
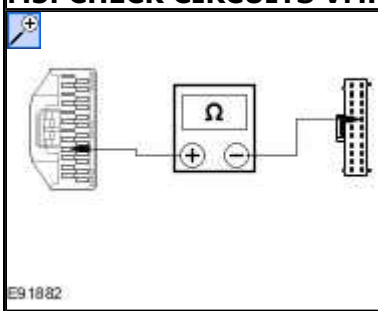
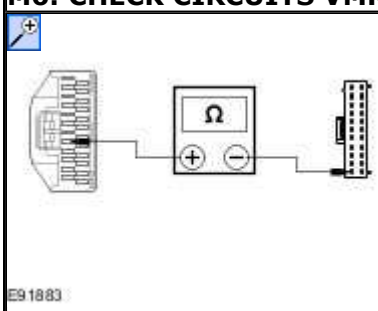
 E91880	D pin 2, circuit LMR01B (BU/WH), harness side and video display C33-T pin 4, circuit LMR01A (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M4. **No** REPAIR circuit(s) LMR01B (BU/WH) or LMR01A (BU/WH). TEST the system for normal operation.
M4: CHECK CIRCUITS VMR10B (GY/OG) AND VMR10A (GY/OG) FOR OPEN	
 E91881	1 Measure the resistance between the DVD player C2MR-D pin 3, circuit VMR10B (GY/OG), harness side and video display C33-T pin 5, circuit VMR10A (GY/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M5. **No** REPAIR circuit(s) VMR10B (GY/OG) or VMR10A (GY/OG). TEST the system for normal operation.
M5: CHECK CIRCUITS VMR11B (VT/OG) AND VMR11A (VT/OG) FOR OPEN	
 E91882	1 Measure the resistance between the DVD player C2MR-D pin 4, circuit VMR11B (VT/OG), harness side and video display C33-T pin 16, circuit VMR11A (VT/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M6. **No** REPAIR circuit(s) VMR11B (VT/OG) or VMR11A (VT/OG). TEST the system for normal operation.
M6: CHECK CIRCUITS VMR12B (GY/VT) AND VMR12A (GY/VT) FOR OPEN	
 E91883	1 Measure the resistance between the DVD player C2MR-D pin 5, circuit VMR12B (GY/VT), harness side and video display C33-T pin 11, circuit VMR11A (GY/VT), harness side.

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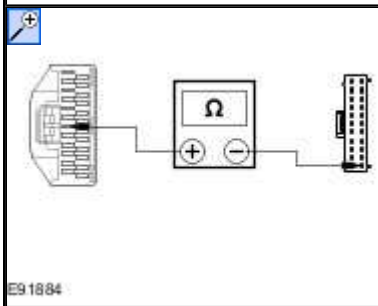
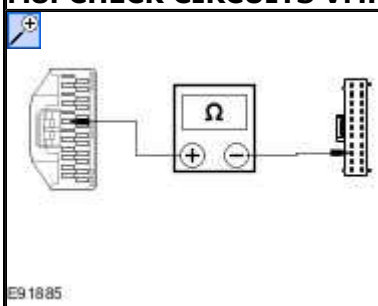
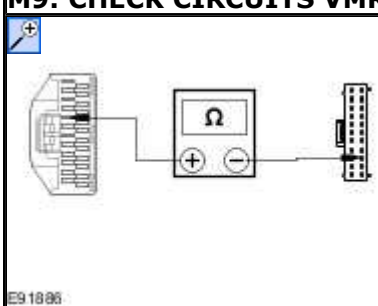
	Is the resistance less than 1 ohm? **Yes** GO to M7. **No** Repair circuit(s) VMR11B (GY/VT) or VMR11A (GY/VT). TEST the system for normal operation.
M7: CHECK CIRCUITS RMR02B (BK/BU) AND RMR02A (BK/BU) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-D pin 6, circuit RMR02B (BK/BU), harness side and video display C33-T pin 22, circuit RMR02A (BK/BU), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M8. **No** REPAIR circuits RMR02B (BK/BU) or RMR02A (BK/BU). TEST the system for normal operation.
M8: CHECK CIRCUITS VMR02B (GY/BK) AND VMR02A (GY/BK) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-D pin 7, circuit VMR02B (GY/BK), harness side and video display C33-T pin 9, circuit VMR02A (GY/BK), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M9. **No** REPAIR circuit(s) VMR02B (GY/BK) or VMR02A (GY/BK). TEST the system for normal operation.
M9: CHECK CIRCUITS VMR03B (GY/VT) AND VMR03A (GY/VT) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-D pin 8, circuit VMR03B (GY/VT), harness side and video display C33-T pin 20, circuit VMR03A (GY/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M10. **No** REPAIR circuit(s) VMR03B (GY/VT) or VMR03A (GY/VT). TEST the system for normal operation.
M10: CHECK CIRCUITS VME05B (GY/WH) AND VME05A (GY/WH) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-D pin 10, circuit VME05B (GY/WH), harness side and video display C33-T pin 10, circuit VME05A (GY/WH),

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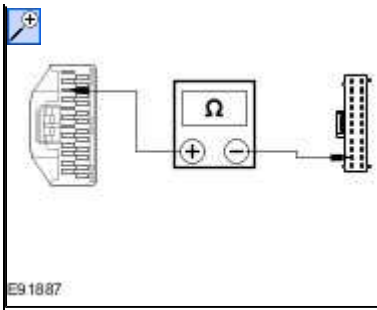
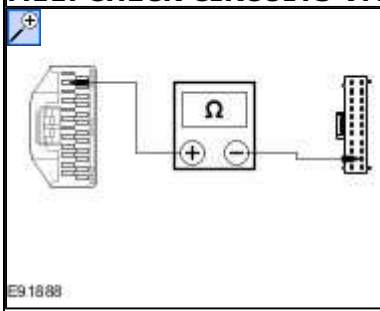
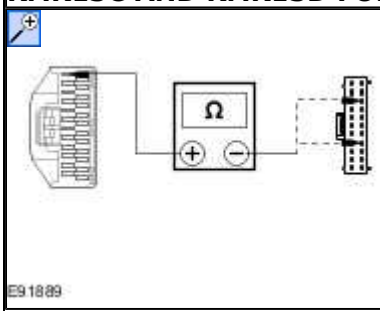
 E91887	harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M11. **No** REPAIR circuit(s) VME05B (GY/WH) or VME05A (GY/WH). TEST the system for normal operation.
M11: CHECK CIRCUITS VMR04B (GY/OG) AND VMR04A (GY/OG) FOR OPEN	
 E91888	1 Measure the resistance between the DVD player C2MR-D pin 11, circuit VMR04B (GY/OG), harness side and video display C33-T pin 21, circuit VMR04A (GY/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M12. **No** REPAIR circuit(s) VMR04B (GY/OG) or VMR04A (GY/OG). TEST the system for normal operation.
M12: CHECK CIRCUITS RMR13E (BN/BU), RMR13B (BN/BU), RMR13A (BN/BU), RMR13C AND RMR13D FOR OPEN	
 E91889	1 Measure the resistance between the following DVD player C2MR-D pins, harness side and video display C33-T pins, harness side. • C2MR-D pin 12, circuit RMR13E (BN/BU) and C33-T pin 14, circuit RMR13A (BN/BU). • C2MR-D pin 12, circuit RMR13E (BN/BU) and C33-T pin 19, circuit RMR13D.
	Are the resistances less than 1 ohm? **Yes** GO to M13. **No** REPAIR circuit(s) RMR13E (BN/BU), RMR13B (BN/BU), RMR13A (BN/BU), RMR13C or RMR13D. TEST the system for normal operation.
M13: CHECK CIRCUITS VMR09B (GN) AND VMR09A (GN) FOR OPEN	
	1 Connect DVD Player C2MR-D.
	2 Disconnect DVD Player C2MR-B.
	3 Measure the resistance between the DVD player C2MR-B pin 1, circuit VMR09B (GN), harness side and video display C33-T pin 6, circuit VMR09A (GN), harness side.

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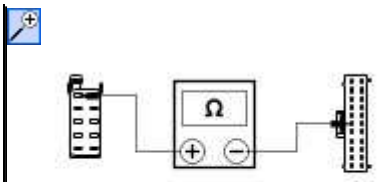
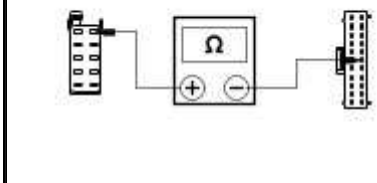


E91890

	Is the resistance less than 1 ohm? **Yes** GO to M14. **No** REPAIR circuit(s) VMR09B (GN) or VMR09A (GN). TEST the system for normal operation.

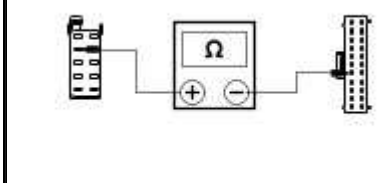
M14: CHECK CIRCUITS DMR08B AND DMR08A FOR OPEN



E91891

1	Measure the resistance between the DVD player C2MR-B pin 2, circuit DMR08B, harness side and video display C33-T pin 17, circuit DMR08A, harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M15. **No** REPAIR circuit(s) DMR08B or DMR08A. TEST the system for normal operation.

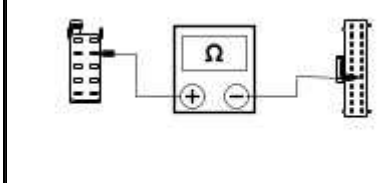
M15: CHECK CIRCUITS VMR06B (BK/RD) AND VMR06A (BK/RD) FOR OPEN



E91892

1	Measure the resistance between the DVD player C2MR-B pin 3, circuit VMR06B (BK/RD), harness side and video display C33-T pin 7, circuit VMR06A (BK/RD), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M15. **No** REPAIR circuit(s) VMR06B (BK/RD) or VMR06A (BK/RD). TEST the system for normal operation.

M16: CHECK CIRCUITS VMR07B (WH/BU) AND VMR07A (WH/BU) FOR OPEN



E91893

1	Measure the resistance between the DVD player C2MR-B pin 4, circuit VMR07B (WH/BU), harness side and video display C33-T pin 18, circuit VMR07A (WH/BU), harness side.

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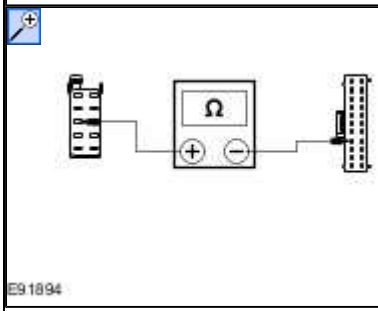
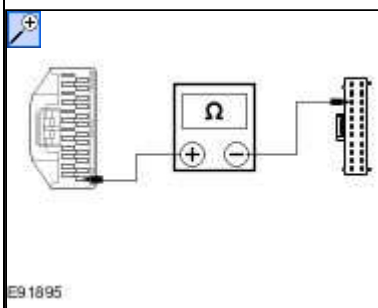
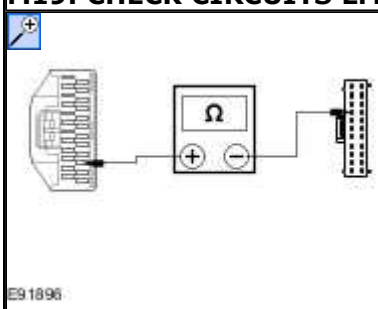
	Is the resistance less than 1 ohm? **Yes** GO to M15. **No** REPAIR circuit(s) VMR07B (WH/BU) or VMR07A (WH/BU). TEST the system for normal operation.
M17: CHECK CIRCUITS DMR06B AND DMR06A FOR OPEN	
 E91894	1 Measure the resistance between the DVD player C2MR-B pin 5, circuit DMR06B, harness side and video display C33-T pin 8, circuit DMR06A, harness side.
	Is the resistance less than 1 ohm? **Yes** CHECK the DVD player. GO to Pinpoint Test L. **No** REPAIR circuit(s) DMR06B or DMR06A. TEST the system for normal operation.
M18: CHECK CIRCUITS CMR27B (WH/OG) AND CMR27A (WH/OG) FOR OPEN	
	1 Disconnect DVD Player C2MR-D.
	2 Disconnect Video Display C33-U.
 E91895	3 Measure the resistance between the DVD player C2MR-D pin 13, circuit CMR27B (WH/OG), harness side and video display C33-U pin 3, circuit CMR27A (WH/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M19. **No** REPAIR circuit(s) CMR27B (WH/OG) or CMR27A (WH/OG). TEST the system for normal operation.
M19: CHECK CIRCUITS LMR15B (BU/OG) AND LMR15A (BU/OG) FOR OPEN	
 E91896	1 Measure the resistance between the DVD player C2MR-D pin 14, circuit LMR15B (BU/OG), harness side and video display C33-U pin 4, circuit LMR15A (BU/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M20. **No** REPAIR circuit(s) LMR15B (BU/OG) or LMR15A (BU/OG). TEST the system for normal operation.
M20: CHECK CIRCUITS VMR24B (GY/VT) AND VMR24A (GY/VT) FOR OPEN	
	1

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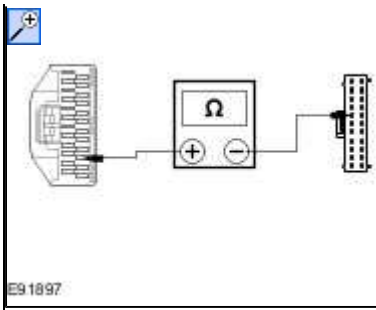
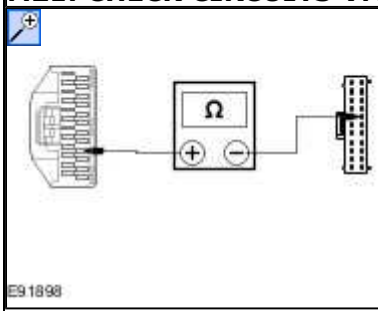
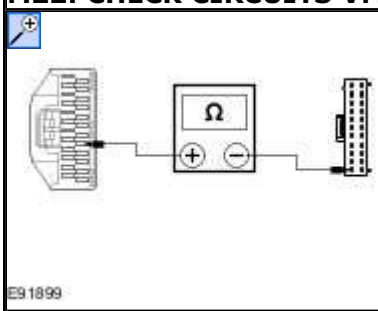
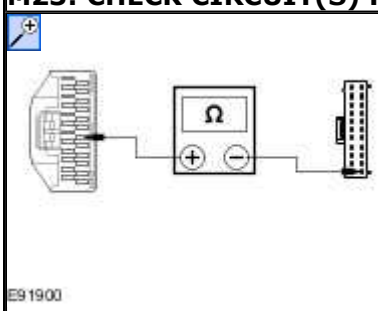
 E91897	1 Measure the resistance between the DVD player C2MR-D pin 15, circuit VMR24B (GY/VT), harness side and video display C33-U pin 5, circuit VMR24A (GY/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M21. **No** REPAIR circuit(s) VMR24B (GY/VT) or VMR24A (GY/VT). TEST the system for normal operation.
M21: CHECK CIRCUITS VMR25B (VT/GY) AND VMR25A (VT/GY) FOR OPEN	
 E91898	1 Measure the resistance between the DVD player C2MR-D pin 16, circuit VMR25B (VT/GY), harness side and video display C33-U pin 16, circuit VMR25A (VT/GY), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M22. **No** REPAIR circuit(s) VMR25B (VT/GY) or VMR25A (VT/GY). TEST the system for normal operation.
M22: CHECK CIRCUITS VMR26B (YE/OG) AND VMR26A (YE/OG) FOR OPEN	
 E91899	1 Measure the resistance between the DVD player C2MR-D pin 17, circuit VMR26B (YE/OG), harness side and video display C33-U pin 11, circuit VMR26A (YE/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M23. **No** REPAIR circuit(s) VMR26B (YE/OG) or VMR26A (YE/OG). TEST the system for normal operation.
M23: CHECK CIRCUIT(S) RMR16B (BK/BU) AND RMR16A (BK/BU) FOR OPEN	
 E91900	1 Measure the resistance between the DVD player C2MR-D pin 18, circuit RMR16B (BK/BU), harness side and video display C33-U pin 22, circuit RMR16A (BK/BU), harness side.

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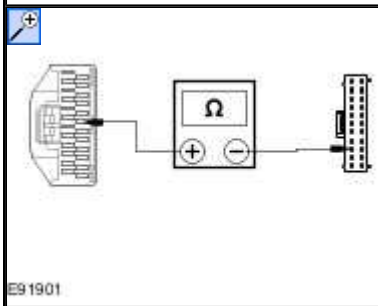
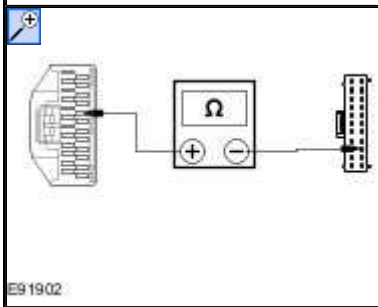
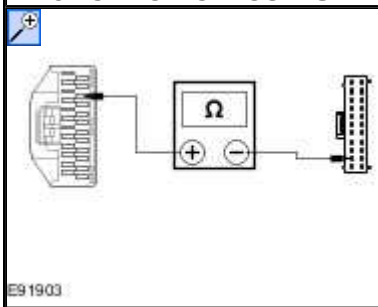
	Is the resistance less than 1 ohm? **Yes** GO to M24. **No** REPAIR circuit(s) RMR16B (BK/BU) or RMR16A (BK/BU). TEST the system for normal operation.
M24: CHECK CIRCUITS VMR16B (GY/BK) AND VMR16A (GY/BK) FOR OPEN	
 E91901	1 Measure the resistance between the DVD player C2MR-D pin 19, circuit VMR16B (GY/BK), harness side and video display C33-U pin 9, circuit VMR16A (GY/BK), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M25. **No** REPAIR circuit(s) VMR16B (GY/BK) or VMR16A (GY/BK). TEST the system for normal operation.
M25: CHECK CIRCUITS VMR17B (VT/GN) AND VMR17A (VT/GN) FOR OPEN	
 E91902	1 Measure the resistance between the DVD player C2MR-D pin 20, circuit VMR17B (VT/GN), harness side and video display C33-U pin 20, circuit VMR17A (VT/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M26. **No** REPAIR circuit(s) VMR17B (VT/GN) or VMR17A (VT/GN). TEST the system for normal operation.
M26: CHECK CIRCUITS VMR19B (WH/VT) AND VMR19A (WH/VT) FOR OPEN	
 E91903	1 Measure the resistance between the DVD player C2MR-D pin 22, circuit VMR19B (WH/VT), harness side and video display C33-U pin 10, circuit VMR19A (WH/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M27. **No** REPAIR circuit(s) VMR19B (WH/VT) or VMR19A (WH/VT). TEST the system for normal operation.
M27: CHECK CIRCUITS VMR18B (YE/GN) AND VMR19A (YE/GN) FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-D pin 23, circuit VMR18B (YE/GN), harness side and video display C33-U pin 21, circuit VMR19A (YE/GN),

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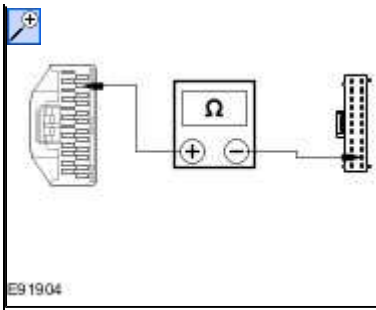
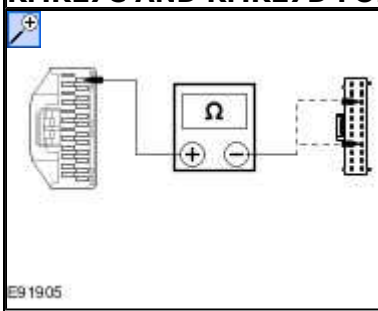
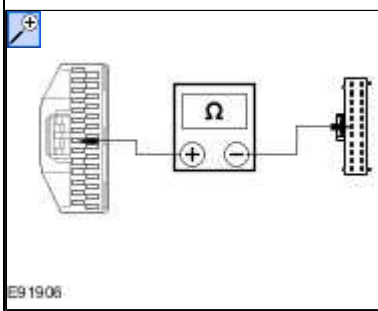
 E91904	harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M28. **No** REPAIR circuit(s) VMR18B (YE/GN) or VMR19A (YE/GN). TEST the system for normal operation.
M28: CHECK CIRCUITS RMR27E (BN/VT), RMR27B (BN/VT), RMR27A (BN/VT), RMR27C AND RMR27D FOR OPEN	
 E91905	1 Measure the resistance between the following DVD player C2MR-D pins, harness side and video display C33-U pins, harness side. • C2MR-D pin 24, circuit RMR27E (BN/VT) and C33-U pin 14, circuit RMR27A (BN/VT). • C2MR-D pin 24, circuit RMR27E (BN/VT) and C33-U pin 19, circuit RMR27D.
	Are the resistances less than 1 ohm? **Yes** GO to M29. **No** REPAIR circuit(s) RMR27E (BN/VT), RMR27B (BN/VT), RMR27A (BN/VT), RMR27C or RMR27D. TEST the system for normal operation.
M29: CHECK CIRCUITS VMR23B (GN/OG) AND VMR23A (GN/OG) FOR OPEN	
	1 Connect DVD Player C2MR-D.
	2 Disconnect DVD Player C2MR-C.
 E91906	3 Measure the resistance between the DVD player C2MR-C pin 7, circuit VMR23B (GN/OG), harness side and video display C33-U pin 6, circuit VMR23A (GN/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to M30. **No** REPAIR circuit(s) VMR23B (GN/OG) and VMR23A (GN/OG). TEST the system for normal operation.
M30: CHECK CIRCUITS DMR22B AND DMR22A FOR OPEN	
	1 Measure the resistance between the DVD player C2MR-C pin 21, circuit DMR22B, harness side and video display C33-U pin 17, circuit VMR24A (GY/VT), harness side.

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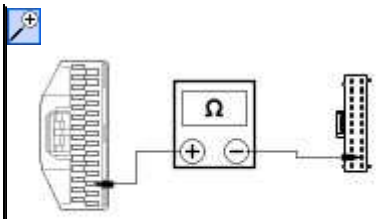
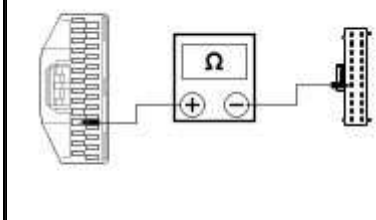


Is the resistance less than 1 ohm?
Yes
GO to M31.
No
REPAIR circuit(s) DMR22B and DMR22A. TEST the system for normal operation.

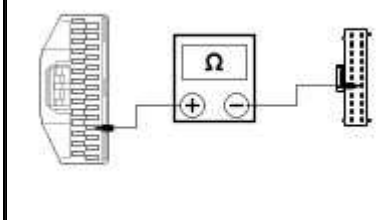
M31: CHECK CIRCUITS VMR20B (BN/WH) AND VMR20A (BN/WH) FOR OPEN



1 Measure the resistance between the DVD player C2MR-C pin 4, circuit VMR20B (BN/WH), harness side and video display C33-U pin 7, circuit VMR20A (BN/WH), harness side.

Is the resistance less than 1 ohm?
Yes
GO to M32.
No
REPAIR the circuit. TEST the system for normal operation.

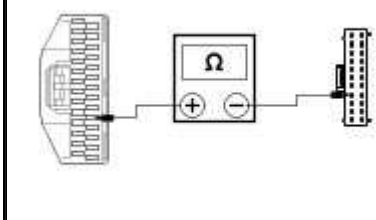
M32: CHECK CIRCUITS VMR21B (BU/BN) AND VMR21A (BU/BN) FOR OPEN



1 Measure the resistance between the DVD player C2MR-C pin 18, circuit VMR21B (BU/BN), harness side and video display C33-U pin 18, circuit VMR21A (BU/BN), harness side.

Is the resistance less than 1 ohm?
Yes
GO to M33.
No
REPAIR circuit(s) VMR21B (BU/BN) or VMR21A (BU/BN). TEST the system for normal operation.

M33: CHECK CIRCUITS DMR20B AND DMR20A FOR OPEN



1 Measure the resistance between the DVD player C2MR-C pin 19, circuit DMR20B, harness side and video display C33-U pin 8, circuit DMR20A, harness side.

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	Is the resistance less than 1 ohm? **Yes** CHECK the DVD player. GO to Pinpoint Test L. **No** REPAIR circuits DMR20B or DMR20A. TEST the system for normal operation.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 415-00, for schematic and connector information.

General Equipment

Ford diagnostic equipment

Principles of Operation

NOTE: Voice control will only operate with the ignition in position II and the components required switched ON.

Voice Control

The portable support electronics (PSE) module has a voice control system. The customer will be able to push the MODE button on the steering wheel switches, this will activate the PSE module and allow voice control. An audible noise will be heard through the audio unit speakers after which, a voice command can then be spoken into the microphone located on the overhead console or cellular phone.

The incoming calls and voice confirmation can be heard through the audio system speakers.

When a voice command is spoken into the microphone or cellular phone, it will be sent as a signal to the PSE module. The signal is then sent from the PSE module to the relevant components on the medium-speed controller area network (CAN) bus network. The component will then convert the signal back into the original voice command.

The components that the PSE module interacts with are as follows:

- audio unit
- navigation system display module
- cellular phone

For additional information on the cellular phone system, REFER to the cellular phone Owner's Guide.

Bluetooth

An input can be given through the cellular phone with or without the cellular phone connected to the handset holder, providing that the cellular phone is supplied with the Bluetooth technology and that the cellular phone is programmed to the PSE module.

The Bluetooth technology is a wireless system that interacts with the relevant component modules through the PSE module. The general operation of the Bluetooth is similar to the voice control.

Bluetooth technology cannot transfer the cellular phone's PHONEBOOK to the audio unit or navigation system display module. If the cellular phone is placed into the handset holder the PHONEBOOK data will be transferred to the audio unit or navigation system display module.

For additional information, REFER to the cellular phone Owner's Guide.

Inspection and Verification

NOTE: **Make sure that the PSE module and cellular phone are configured to each other before starting a system diagnosis. ENTER the following PIN number on the cellular phone to configure the cellular phone to the PSE module: 0000.**

1. **1.** Verify the customer concern by operating the system using the customers cellular phone.

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2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Wiring harness • Electrical connector(s) • Cellular phone • Microphone • Handset holder • PSE module • Audio unit • Instrument cluster • Navigation system display module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, connect the Ford diagnostic equipment to the data link connector (DLC).

5. **5.** SELECT the **TOOLBOX** menu.

6. **6.** SELECT the **ENTERTAINMENT/COMMUNICATION** menu.

7. **7.** SELECT the **SPEECH RECOGNITION MODULE** option and follow the instructions on the display.

8. **8.** Retrieve the diagnostic trouble codes (DTC)s and refer to the DTC Index Chart.

9. **9.** If no DTCs are retrieved or there is no communication with the module, proceed to the Symptom Chart to continue diagnostics.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description/Condition	Possible Source	Action
B1D7911	Microphone input circuit failure	Microphone defect or short to ground	GO to Pinpoint Test C.
B1D7912	Microphone input circuit failure	Microphone defect or short to battery	GO to Pinpoint Test C.
B1D7913	Microphone input signal circuit open	Microphone defect or not connected	GO to Pinpoint Test C.
B1D791E	Microphone bias circuit failure	No supply to microphone	GO to Pinpoint Test C.
B1D5911	Charger system short to ground	PSE module	GO to Pinpoint Test B.
B1D5912	Charger system short to battery	PSE module	GO to Pinpoint Test B.
U001088	Medium speed controller area network (CAN) communication bus off	Central junction box (CJB) and PSE module	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U202011	Handset holder supply circuit failure	Handset holder supply short to ground	GO to Pinpoint Test B.

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U202012	Handset holder supply circuit failure	Handset holder supply short to battery	GO to Pinpoint Test B.
U202013	Handset holder detection circuit failure	Handset holder detection circuit open	INSTALL a new handset holder. REFER to: Handset Holder - Vehicles With: Voice Control (415-01 Information and Entertainment System, Removal and Installation) / Handset Holder - Vehicles Without: Voice Control (415-01 Information and Entertainment System, Removal and Installation).
U20201E	Handset holder detection circuit failure	Handset holder detection circuit out of range	INSTALL a new handset holder. REFER to: Handset Holder - Vehicles With: Voice Control (415-01 Information and Entertainment System, Removal and Installation) / Handset Holder - Vehicles Without: Voice Control (415-01 Information and Entertainment System, Removal and Installation).
U210000	Configuration not complete	CJB	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U210100	Module configuration incompatible	CJB	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U300041	PSE module failure	PSE module	INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
U300045	PSE module program memory failure	PSE module	INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
U300046	PSE module calibration/parameter memory failure	PSE module	INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
U300051	PSE module not programmed	PSE module	REFER to the Ford diagnostic equipment.
U300054	PSE module missing calibration	PSE module	Calibrate the PSE module. REFER to the Ford diagnostic equipment.
U300317	Battery voltage high	Battery voltage above 16 volts	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
U300316	Battery voltage low	Battery voltage below 9 volts	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

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1. **1.** If the cause is not evident, refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
No communication with the portable support electronics (PSE) module	* Fuse(s). * Circuit(s). * PSE module.	* GO to Pinpoint Test A.
	* DLC.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
The audio unit display does not display PHONE	* Instrument cluster. * Audio unit. * Navigation system display module. * PSE module.	* CHECK all communication between the instrument cluster, audio unit, navigation system display module and PSE module. REFER to the Ford diagnostic equipment.
The handset battery does not charge	* Fuse(s). * Circuit(s). * PSE module. * Handset holder.	* GO to Pinpoint Test B.
	* Cellular phone battery.	* REFER to the cellular phone Owner's Guide.
The cellular phone microphone is not operating correctly	* Circuit(s). * Microphone. * PSE module.	* GO to Pinpoint Test C.
Reduced sound or no sound through the speakers	* Instrument cluster. * Audio unit. * Navigation system display module. * PSE module.	* CHECK all communication between the instrument cluster, audio unit, navigation system display module and PSE module. REFER to the Ford diagnostic equipment.
	* Circuit(s). * Audio unit. * PSE module.	* GO to Pinpoint Test D.
The cellular phone information is not displayed	* Instrument cluster. * Audio unit. * Navigation system display module. * PSE module.	* CHECK all communication between the instrument cluster, audio unit, navigation system display module and PSE module. REFER to the Ford diagnostic equipment.
The voice activated phone functions are inoperative	* Instrument cluster. * Audio unit. * Navigation system display module. * PSE module.	* CHECK all communication between the instrument cluster, audio unit, navigation system display module and PSE module. REFER to the Ford diagnostic equipment.
	* Circuit(s). * Cellular Phone. * Handset holder. * PSE module.	* GO to Pinpoint Test E.

Pinpoint Tests

NOTE: ENTER the following PIN number on the cellular phone to configure the cellular phone to the PSE module: 0000.

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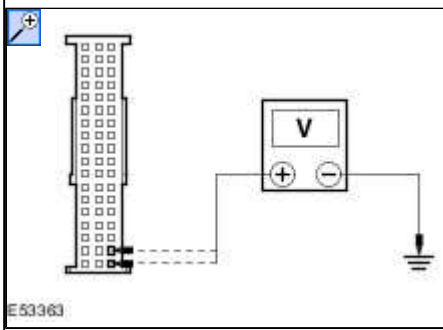
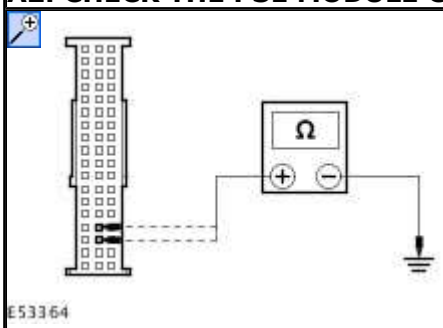
NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : NO COMMUNICATION WITH THE PORTABLE SUPPORT ELECTRONICS (PSE) MODULE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR VOLTAGE AT THE PSE MODULE	
	1 Disconnect PSE Module C2MM01-A.
	2 Measure the voltage between the PSE module C2MM01-A pin 17, circuit SBP06H (BN/RD), harness side and ground; and the PSE module C2MM01-A pin 18, circuit SBP06G (BN/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to A2. **No** REPAIR circuit SBP06H (BN/RD) or circuit SBP06G (BN/RD) as necessary. TEST the system for normal operation.
A2: CHECK THE PSE MODULE GROUND CIRCUIT(S)	
	1 Measure the resistance between the PSE module C2MM01-A pin 33, circuit GD103E (BK/BU), harness side and ground; and the PSE module C2MM01-A pin 34, circuit GD103F (BK/BU), harness side and ground.
	Are the resistances less than 1 ohm? **Yes** INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit GD103E (BK/BU) or circuit GD103F (BK/BU) as necessary. TEST the system for normal operation.

PINPOINT TEST B : THE HANDSET BATTERY DOES NOT CHARGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE CELLULAR PHONE DISPLAY WHEN BEING USED OUTSIDE OF THE VEHICLE	
	1 Operate the cellular phone outside of the vehicle.
	Does the cellular phone display low battery? **Yes** GO to B2. **No** CHECK the cellular phone battery. REFER to the cellular phone Owner's Guide.
B2: CHECK THE BATTERY SYMBOL ON CELLULAR PHONE	

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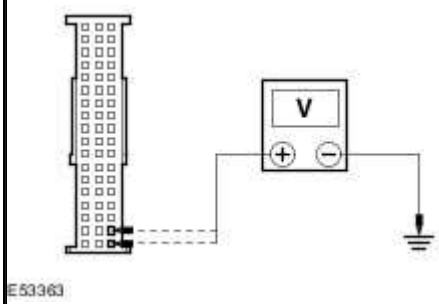
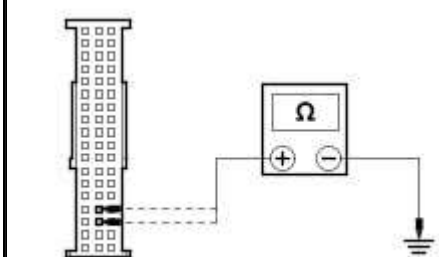
	1 Ignition switch in position II.
	INSTALL the cellular phone into the handset holder. Does the battery symbol flash? **Yes** Cellular phone battery charging correctly. WAIT for the cellular phone battery to charge. TEST the system for normal operation. **No** GO to B3.
B3: CHECK FOR VOLTAGE AT THE PSE MODULE	
	1 Disconnect PSE Module C2MM01-A.
 E53363	2 Measure the voltage between the PSE module C2MM01-A pin 17, circuit SBP06H (BN/RD), harness side and ground; and the PSE module C2MM01-A pin 18, circuit SBP06G (BN/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to B4. **No** REPAIR circuit SBP06H (BN/RD) or circuit SBP06G (BN/RD) as necessary. TEST the system for normal operation.
B4: CHECK THE PSE MODULE GROUND CIRCUIT(S)	
 E53364	1 Measure the resistance between the PSE module C2MM01-A pin 33, circuit GD103E (BK/BU), harness side and ground; and the PSE module C2MM01-A pin 34, circuit GD103F (BK/BU), harness side and ground.
	Are the resistances less than 1 ohm? **Yes** For vehicles with voice control. GO to B5. For vehicles without voice control. GO to B8. **No** REPAIR circuit GD103E (BK/BU) or circuit GD103F (BK/BU) as necessary. TEST the system for normal operation.
B5: CHECK FOR CHARGE VOLTAGE AT THE HANDSET HOLDER (WITH VOICE CONTROL)	
	1 Connect PSE Module C2MM01-A.
	2 Disconnect Handset Holder - with voice control C2MM17-A.
	3 Measure the voltage between the handset holder C2MM17-A pin 15, circuit CMM03B (VT), harness side and ground.

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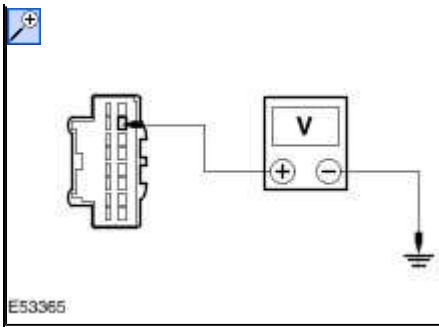


Is the voltage greater than 10 volts?

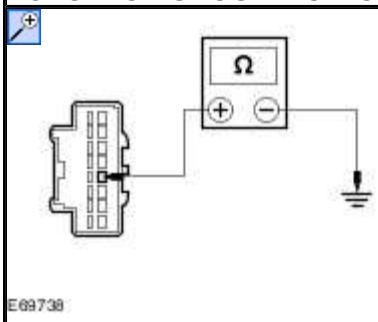
Yes

GO to B6.

No

NOTE: If the connector is damaged install a new harness. REPAIR the circuit CMM03B (VT). TEST the system for normal operation.

B6: CHECK GROUND CIRCUIT RMM17B (GN/BU)



1 Measure the resistance between the handset holder C2MM17-A pin 8, circuit RMM17B (GN/BU), harness side and ground.

Is the resistance less than 1 ohm?

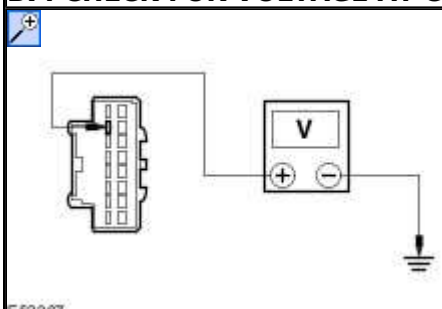
Yes

GO to B7.

No

REPAIR the circuit. TEST the system for normal operation.

B7: CHECK FOR VOLTAGE AT CIRCUIT LMM17B (WH/BU)



1 Measure the voltage between the handset holder C2MM17-A pin 7, circuit LMM17B (WH/BU), harness side and ground.

Is the voltage greater than 10 volts?

Yes

INSTALL a new PSE module.
REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation).
TEST the system for normal operation.

No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new handset holder.
REFER to: Handset Holder - Vehicles With: Voice Control (415-01 Information and Entertainment System, Removal and Installation).
TEST the system for normal operation.

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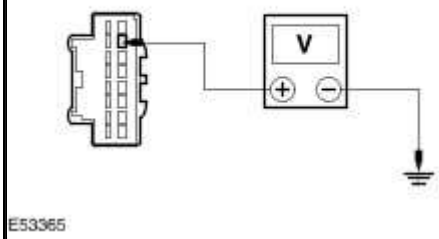
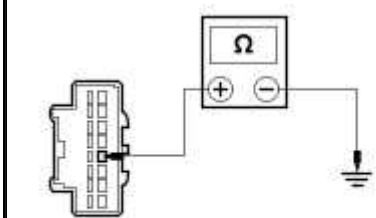
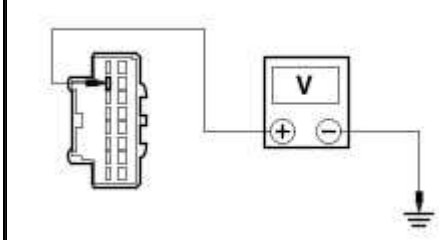
B8: CHECK FOR CHARGE VOLTAGE AT THE HANDSET HOLDER (WITHOUT VOICE CONTROL)

	1 Connect PSE Module C2MM01-A. 2 Disconnect Handset Holder - without voice control C2MM17.
 E53365	3 Measure the voltage between the handset holder C2MM17 pin 15, circuit CMM03A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to B9. **No** NOTE: If the connector is damaged install a new harness. REPAIR the circuit CMM03A (VT). TEST the system for normal operation.

B9: CHECK GROUND CIRCUIT RMM17A (GN/BU)

 E69738	1 Measure the resistance between the handset holder C2MM17 pin 8, circuit RMM17A (GN/BU), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** GO to B10. **No** REPAIR the circuit. TEST the system for normal operation.

B10: CHECK FOR VOLTAGE AT CIRCUIT LMM17A (WH/BU)

 E53367	1 Measure the voltage between the handset holder C2MM17 pin 7, circuit LMM17A (WH/BU), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal

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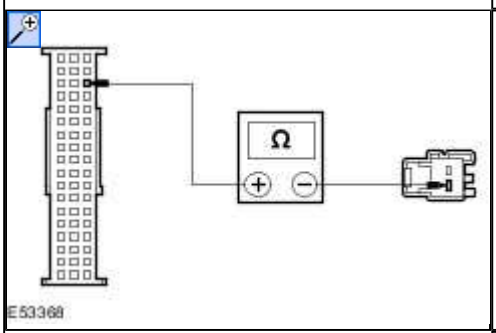
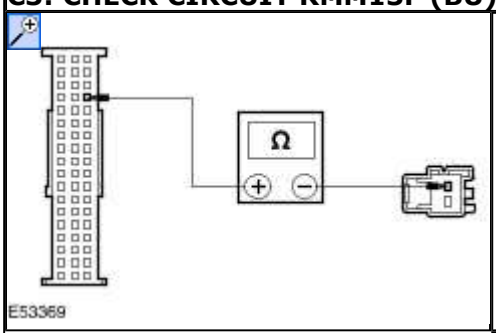
	operation. If the concern persists, INSTALL a new handset holder. REFER to: Handset Holder - Vehicles Without: Voice Control (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST C : THE CELLULAR PHONE MICROPHONE IS NOT OPERATING CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THAT THE VOICE IS BEING TRANSMITTED DURING A TELEPHONE CONVERSION OUTSIDE OF THE VEHICLE	
	1 Operate the cellular phone outside the vehicle.
	Does the cellular phone transmit the voice during a telephone conversation outside of the vehicle? **Yes** GO to C2. **No** REFER to the cellular phone Owner's Guide.
C2: CHECK CIRCUIT VMM13H (BN) AND CIRCUIT VMM13D (BN/RD) FOR OPEN	
	1 Disconnect PSE Module C2MM01-A.
	2 Disconnect Microphone C2MN02.
	3 Measure the resistance between the PSE module C2MM01-A pin 3, circuit VMM13H (BN), harness side and the microphone C2MN02 pin 1, circuit VMM13D (BN/RD), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to C3. **No** REPAIR the circuit. TEST the system for normal operation.
C3: CHECK CIRCUIT RMM13F (BU) AND CIRCUIT DME37F (BU/RD) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-A pin 4, circuit RMM13F (BU), harness side and the microphone C2MN02 pin 2, circuit DME37F (BU/RD), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new microphone. REFER to: Microphone (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new

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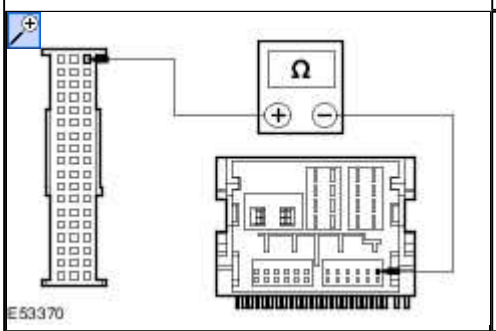
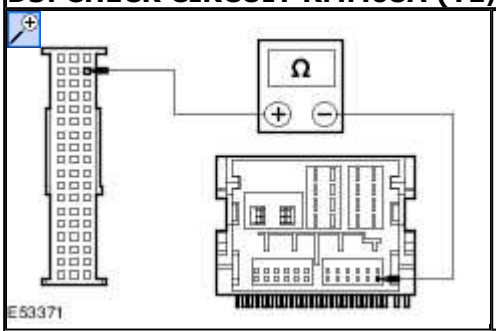
	PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST D : REDUCED SOUND OR NO SOUND THROUGH THE SPEAKERS	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE CELLULAR PHONE OPERATES CORRECTLY OUTSIDE THE VEHICLE	
	1 CARRY OUT an audio unit self-test. REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
	2 Operate the cellular phone outside the vehicle.
	Does the cellular phone operate correctly outside the vehicle? **Yes** GO to D2. **No** REFER to the cellular phone Owner's Guide.
D2: CHECK CIRCUIT VMM08A (WH/VT) FOR OPEN	
	1 Disconnect PSE Module C2MM01-A.
	2 Disconnect Audio Unit C2ME03-B.
	3 Measure the resistance between the PSE module C2MM01-A pin 1, circuit VMM08A (WH/VT), harness side and the audio unit C2ME03-B pin 1, circuit VMM08A (WH/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to D3. **No** REPAIR the circuit. TEST the system for normal operation.
D3: CHECK CIRCUIT RMM08A (YE/BU) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-A pin 2, circuit RMM08A (YE/BU), harness side and the audio unit C2ME03-B pin 7, circuit RMM08A (YE/BU), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.

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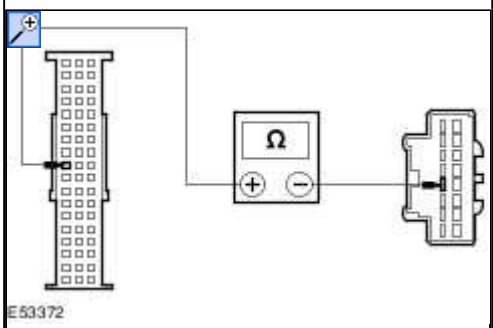
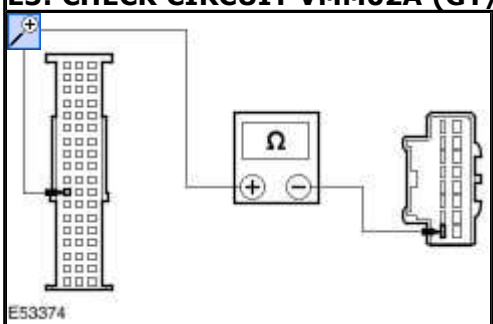
	No REPAIR the circuit. TEST the system for normal operation. If the concern persists, REFER to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).

PINPOINT TEST E : THE VOICE ACTIVATED PHONE FUNCTIONS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK CELLULAR PHONE SYSTEM INSTALLED TO THE VEHICLE	
	1 Check the cellular phone system installed to the vehicle. REFER to the cellular phone Owner's Guide.
	Is the cellular phone system a voice control/Bluetooth system? **Yes** GO to E2. **No** GO to E14.
E2: CHECK CIRCUIT VMM21A (GY/OG) TO CIRCUIT VMM21B (GY/OG) FOR OPEN	
	1 Disconnect PSE Module C2MM01-B. 2 Disconnect Handset Holder C2MM17-A.
	3 Measure the resistance between the PSE module C2MM01-B pin 45, circuit VMM21A (GY/OG), harness side and the handset holder C2MM17-A pin 4, circuit VMM21B (GY/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E3. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E3: CHECK CIRCUIT VMM02A (GY/VT) TO CIRCUIT VMM02B (GY/VT) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 47, circuit VMM02A (GY/VT), harness side and the handset holder C2MM17-A pin 1, circuit VMM02B (GY/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E4. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E4: CHECK CIRCUIT RMM02A (BU/WH) TO CIRCUIT RMM02B (BU/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 48, circuit RMM02A (BU/WH), harness

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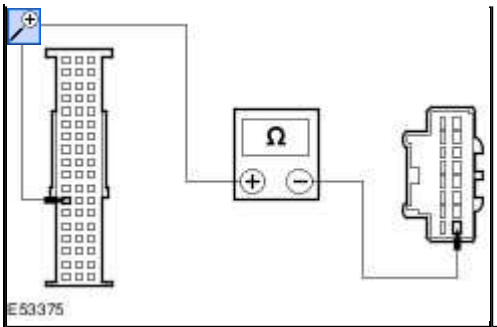
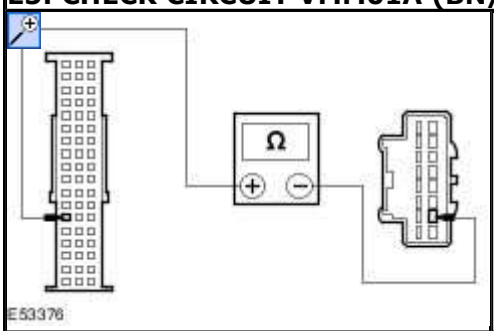
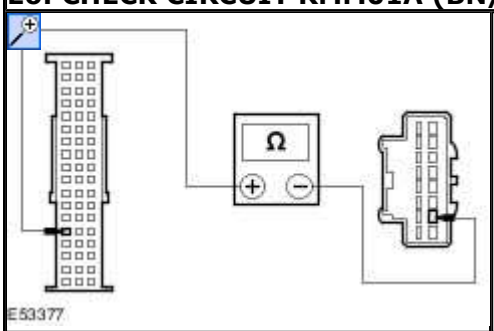
	side and the handset holder C2MM17-A pin 9, circuit RMM02B (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E5. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E5: CHECK CIRCUIT VMM01A (BN/GN) TO CIRCUIT VMM01B (BN/GN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 49, circuit VMM01A (BN/GN), harness side and the handset holder C2MM17-A pin 2, circuit VMM01B (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E6. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E6: CHECK CIRCUIT RMM01A (BN/WH) TO CIRCUIT RMM01B (BN/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 50, circuit RMM01A (BN/WH), harness side and the handset holder C2MM17-A pin 10, circuit RMM01B (BN/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E7. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E7: CHECK CIRCUIT LMM18A (GN/WH) TO CIRCUIT LMM18B (GN/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 42, circuit LMM18A (GN/WH), harness side and the handset holder C2MM17-A pin 3, circuit LMM18B (GN/WH), harness side.

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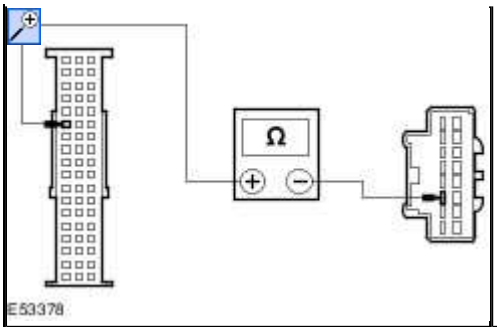


Is the resistance less than 1 ohm?

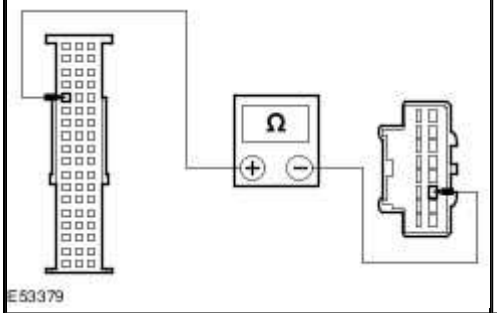
Yes

GO to E8.

No

REPAIR the circuit(s) as necessary. TEST the system for normal operation.

E8: CHECK CIRCUIT CMM19A (BN/YE) TO CIRCUIT CMM19B (BN/YE) FOR OPEN



1 Measure the resistance between the PSE module C2MM01-B pin 41, circuit CMM19A (BN/YE), harness side and the handset holder C2MM17-A pin 11, circuit CMM19B (BN/YE), harness side.

Is the resistance less than 1 ohm?

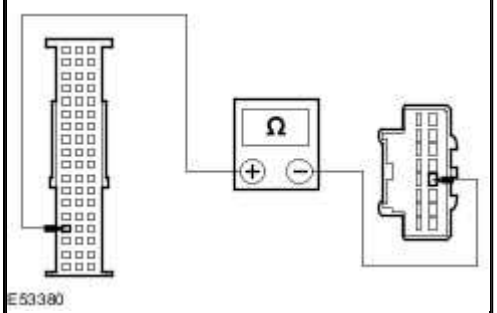
Yes

GO to E9.

No

REPAIR the circuit(s) as necessary. TEST the system for normal operation.

E9: CHECK CIRCUIT VMM20A (GN/BN) TO CIRCUIT VMM20B (GN/BN) FOR OPEN



1 Measure the resistance between the PSE module C2MM01-B pin 51, circuit VMM20A (GN/BN), harness side and the handset holder C2MM17-A pin 12, circuit VMM20B (GN/BN), harness side.

Is the resistance less than 1 ohm?

Yes

GO to E10.

No

REPAIR the circuit(s) as necessary. TEST the system for normal operation.

E10: CHECK CIRCUIT VMM09A (YE/GY) TO CIRCUIT VMM09B (YE/GY) FOR OPEN

1 Measure the resistance between the PSE module C2MM01-B pin 37, circuit VMM09A (YE/GY), harness side and the handset holder C2MM17-A pin 5, circuit VMM09B (YE/GY), harness side.

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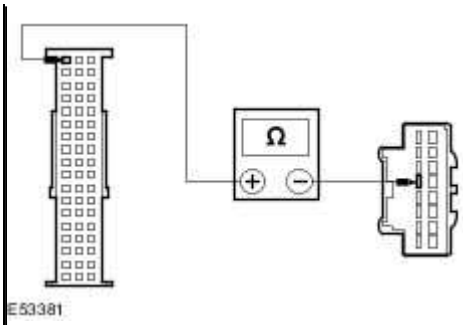
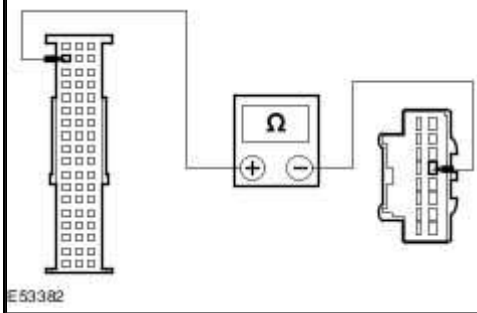
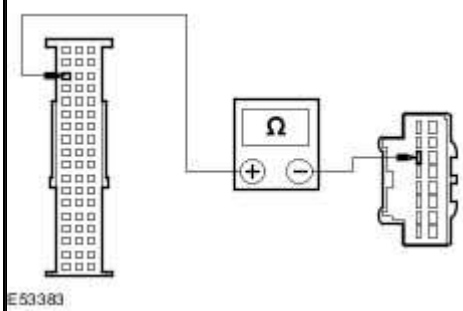
	
	Is the resistance less than 1 ohm? **Yes** GO to E11. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E11: CHECK CIRCUIT RMM09A (BU/GN) TO CIRCUIT RMM09B (BU/GN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 38, circuit RMM09A (BU/GN), harness side and the handset holder C2MM17-A pin 13, circuit RMM09B (BU/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E12. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E12: CHECK CIRCUIT VMM12AA (WH/BN) TO VMM12B (WH/BN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 39, circuit VMM12A (WH/BN), harness side and the handset holder C2MM17-A pin 6, circuit VMM12B (WH/BN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E13. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation.
E13: CHECK CIRCUIT RMM12A (VT/BN) TO CIRCUIT RMM12B (VT/BN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 40, circuit RMM12A (VT/BN), harness side and the handset holder C2MM17-A pin 14, circuit RMM12B (VT/BN), harness side.

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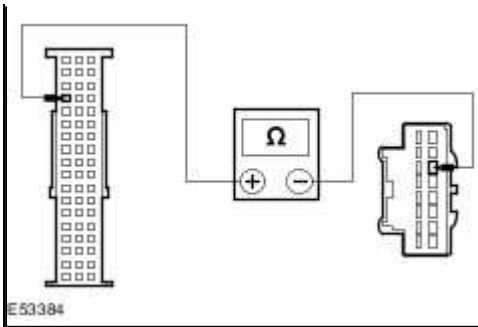
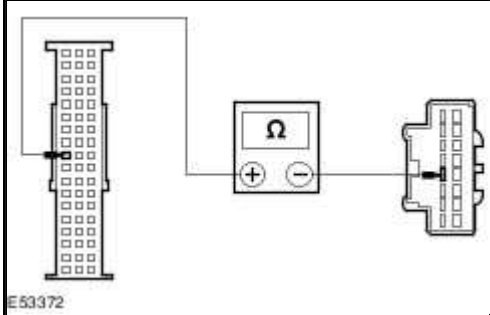
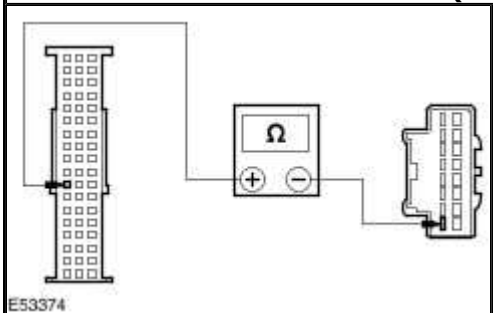
	
	Is the resistance less than 1 ohm? **Yes** INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new handset holder. REFER to: Handset Holder - Vehicles With: Voice Control (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
E14: CHECK CIRCUIT VMM21A (GY/OG) FOR OPEN	
	1 Disconnect PSE Module C2MM01-B.
	2 Disconnect Handset Holder C2MM17.
	3 Measure the resistance between the PSE module C2MM01-B pin 45, circuit VMM21A (GY/OG), harness side and the handset holder C2MM17 pin 4, circuit VMM21A (GY/OG), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E15. **No** REPAIR the circuit. TEST the system for normal operation.
E15: CHECK CIRCUIT VMM02A (GY/VT) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 47, circuit VMM02A (GY/VT), harness side and the handset holder C2MM17 pin 1, circuit VMM02A (GY/VT), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E16. **No**

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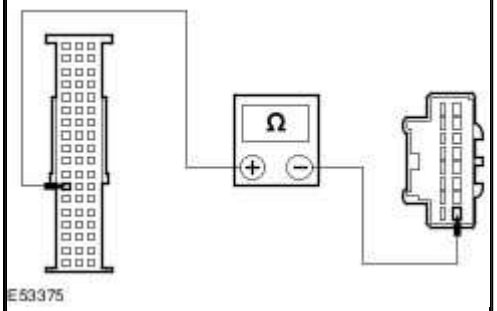
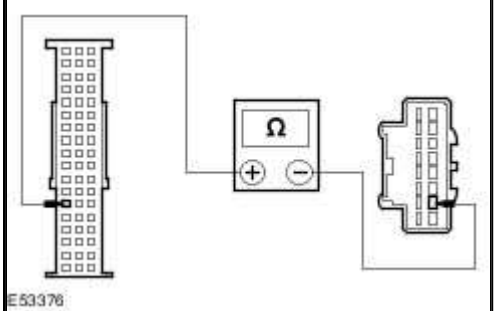
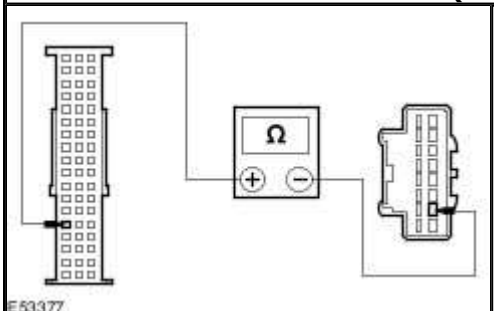
	REPAIR the circuit. TEST the system for normal operation.
E16: CHECK CIRCUIT RMM02A (BU/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 48, circuit RMM02A (BU/WH), harness side and the handset holder C2MM17 pin 9, circuit RMM02A (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E17. **No** REPAIR the circuit. TEST the system for normal operation.
E17: CHECK CIRCUIT VMM01A (BN/GN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 49, circuit VMM01A (BN/GN), harness side and the handset holder C2MM17 pin 2, circuit VMM01A (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E18. **No** REPAIR the circuit. TEST the system for normal operation.
E18: CHECK CIRCUIT RMM01A (BN/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 50, circuit RMM01A (BN/WH), harness side and the handset holder C2MM17 pin 10, circuit RMM01A (BN/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E19. **No** REPAIR the circuit. TEST the system for normal operation.
E19: CHECK CIRCUIT LMM18A (GN/WH) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 42, circuit LMM18A (GN/WH), harness side and the handset holder C2MM17 pin 3, circuit LMM18A (GN/WH), harness side.

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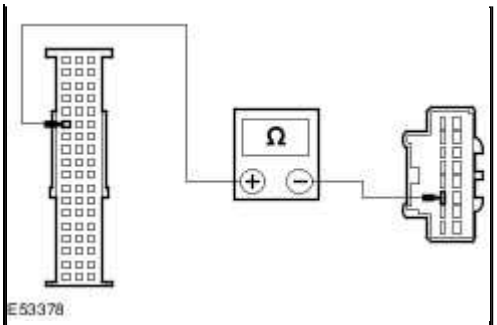


Is the resistance less than 1 ohm?

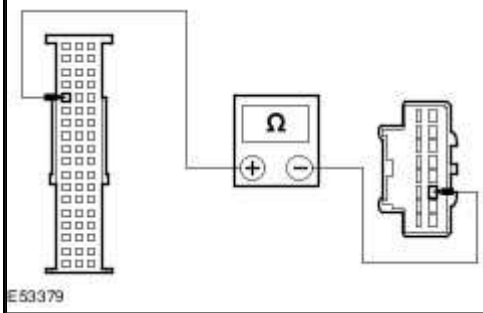
Yes

GO to E20.

No

REPAIR the circuit. TEST the system for normal operation.

E20: CHECK CIRCUIT CMM19A (BN/YE) FOR OPEN



1 Measure the resistance between the PSE module C2MM01-B pin 41, circuit CMM19A (BN/YE), harness side and the handset holder C2MM17 pin 11, circuit CMM19A (BN/YE), harness side.

Is the resistance less than 1 ohm?

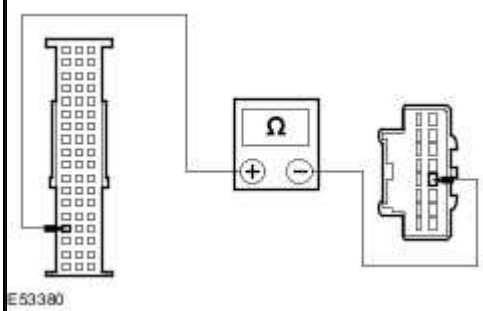
Yes

GO to E21.

No

REPAIR the circuit. TEST the system for normal operation.

E21: CHECK CIRCUIT VMM20A (GN/BN) FOR OPEN



1 Measure the resistance between the PSE module C2MM01-B pin 51, circuit VMM20A (GN/BN), harness side and the handset holder C2MM17 pin 12, circuit VMM20A (GN/BN), harness side.

Is the resistance less than 1 ohm?

Yes

GO to E22.

No

REPAIR the circuit. TEST the system for normal operation.

E22: CHECK CIRCUIT VMM09A (YE/GY) FOR OPEN

1 Measure the resistance between the PSE module C2MM01-B pin 37, circuit VMM09A (YE/GY), harness side and the handset holder C2MM17 pin 5, circuit VMM09A (YE/GY), harness side.

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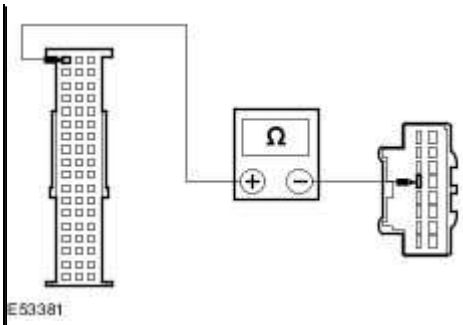
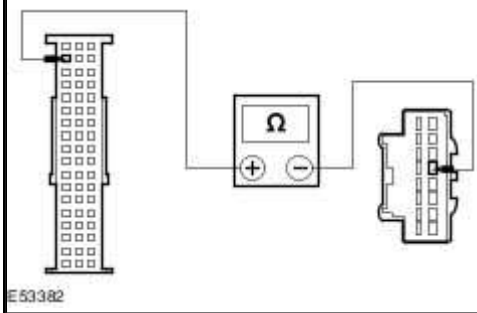
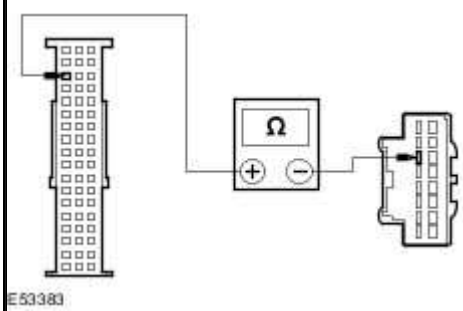
	
	Is the resistance less than 1 ohm? **Yes** GO to E23. **No** REPAIR the circuit. TEST the system for normal operation.
E23: CHECK CIRCUIT RMM09A (BU/GN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 38, circuit RMM09A (BU/GN), harness side and the handset holder C2MM17 pin 13, circuit RMM09A (BU/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E24. **No** REPAIR the circuit. TEST the system for normal operation.
E24: CHECK CIRCUIT VMM12A (WH/BN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 39, circuit VMM12A (WH/BN), harness side and the handset holder C2MM17 pin 6, circuit VMM12A (WH/BN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to E13. **No** REPAIR the circuit. TEST the system for normal operation.
E25: CHECK CIRCUIT RMM12A (VT/BN) FOR OPEN	
	1 Measure the resistance between the PSE module C2MM01-B pin 40, circuit RMM12A (VT/BN), harness side and the handset holder C2MM17 pin 14, circuit RMM12A (VT/BN), harness side.

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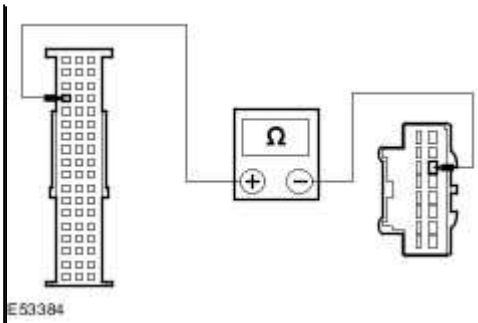	
	Is the resistance less than 1 ohm? **Yes** INSTALL a new PSE module. REFER to: Portable Support Electronics (PSE) Module (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new handset holder. REFER to: Handset Holder - Vehicles Without: Voice Control (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.

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Print

Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

NOTE: If a new navigation system display module is installed, allow the data from the navigation CD ROM to download (approximately 10 minutes) to the navigation system display module before inputting a destination into the navigation system display module. The vehicle must then be driven until the navigation system is fully calibrated. Route guidance will commence at approximately 30% of the calibration process and at 100% of calibration the route guidance will be accurate.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

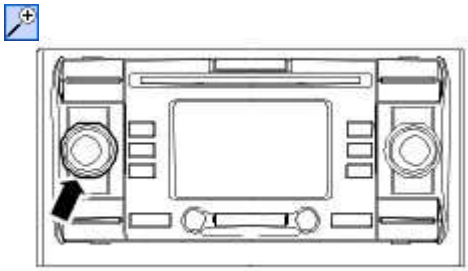
Mechanical	Electrical
• Navigation system display module • Navigation system antenna • Navigation CD ROM	• Fuse(s) • Wiring harness • Electrical connector(s) • Navigation system display module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4. **4.** If the cause is not visually evident, refer to the Self-Diagnostic Mode.

Self-Diagnostic Mode

NOTE: It is necessary to carry out part of the system diagnosis outside of the workshop. Make sure there that are no large buildings/obstructions or metal objects in the immediate vicinity.
NOTE: Make sure the navigation CD ROM is installed in the navigation system display module before entering the Self-Diagnostic Mode.
NOTE: The navigation system display module will stay activated for up to ten minutes after the unit has been switched OFF.



E49332

Switch the navigation system display module ON.

The navigation system constantly monitors it's inputs and outputs. If a concern is detected, a diagnostic trouble code (DTC) will be stored in the navigation system memory.

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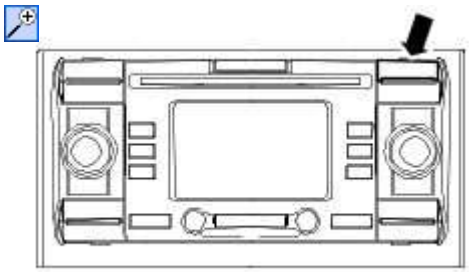
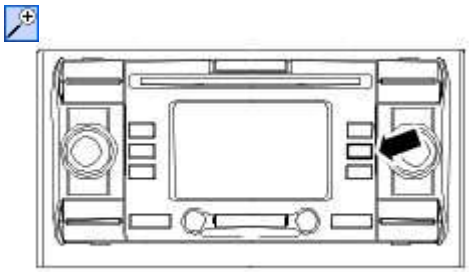


E51405

1. **1.** PRESS the NAV button

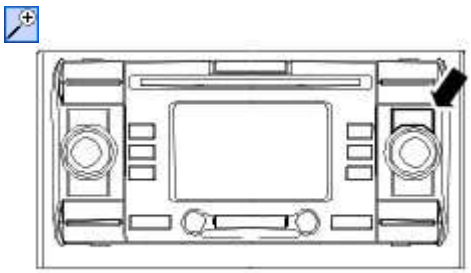


E51406

2. **2.** PRESS the S5 button to enter the GPS INFO menu.

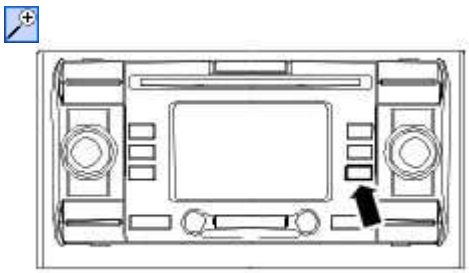
NOTE: The minimum number of satellites received by the navigation system display module for correct operation is four. If the satellites received is below the minimum requirement, the navigation system will not operate correctly. Move the vehicle to a position where the required amount of satellites are received.

3. **3.** Check the amount of satellites received by the navigation system display module.



E49336

4. **4.** PRESS ESC to return to the previous menu.



E49334

5. **5.** With the navigation system display module in the navigation main menu, PRESS

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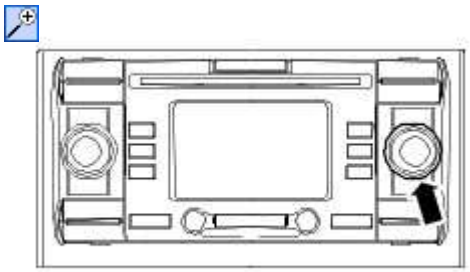
the S6 (EXTRA) button.

NOTE: ROTATE the right-hand rotary knob to highlight the mode required and PRESS the right-hand rotary knob (ENTER) to select the mode.



E49035

6. **6.** SELECT SENSOR TEST and PRESS the right-hand rotary knob. CHECK that all of the sensors shown on the screen are operating correctly.

NOTE: When checking the wheel speed sensor it is necessary to drive the vehicle ten meters forwards above 4 km/h (2.5 mph) to make the value change.
NOTE: When checking the direction sensor select the reverse gear and drive the vehicle ten meters rearwards above 4 km/h (2.5 mph) to make the value change.
NOTE: When checking the navigation system display module internal gyroscope manually move the vehicle from side to side to make the value change. If the value does not change when the vehicle is being moved, INSTALL a new navigation system display module.
REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
NOTE: When checking the GPS antenna self-diagnostic function, disconnect the GPS antenna from the rear of the navigation system display module and TEST the system for normal operation.
REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
If the navigation system display module is operating correctly, the display will show a GPS error. If no message is displayed with the GPS antenna disconnected, INSTALL a new navigation system display module.
REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
NOTE: Connect the GPS antenna to the navigation system display module and REFER to the following list to diagnose the GPS antenna.
NOTE: The following list will not apply if the fault is induced by disconnecting the GPS antenna.

- If the GPS antenna sensor test displays OPEN, the GPS antenna is open circuit. REFER to the DTC Index Chart and DTC TBD13 ACTION. Follow the instructions to diagnose the GPS antenna.
- If the GPS antenna sensor test displays SHORT, the GPS antenna is out of specification. REFER to the WDS, check the DTCs. If DTC TBD12 is retrieved, REFER to the DTC Index Chart to diagnose the GPS antenna.
- If the GPS antenna sensor test displays OK, the GPS antenna is OK.

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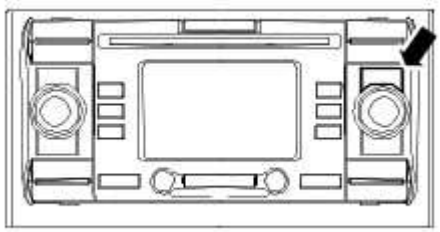

E49336

7. **7.** PRESS ESC to return to the previous menu.

8. **8.** If the cause is not visually evident after the Self-Diagnostic Mode, connect the WDS to the data link connector (DLC).

9. NOTE: Do not select the NAV from the WDS menu as this is for vehicles with digital versatile disc (DVD) navigation system with touchscreen.
   9. Select the ACU from the WDS menu.

10. **10.** Retrieve the DTCs and refer to the DTC Index Chart.

Diagnostic Trouble Code (DTC) Index Chart

DTC	Description/Condition	Possible Source	Action
B1342	Navigation system display module failure	Navigation system display module	INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
B2408	Speaker line short circuit	Speaker(s), Circuit(s)	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
B1097	Tweeter line short circuit	Speaker(s), Circuit(s)	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
B1893	GPS antenna connection open circuit	Antenna fault open circuit	CHECK the navigation system antenna connections and antenna base ground connection. TEST the system for normal operation. IF the concern persists, INSTALL a new navigation system antenna cable.
B2204	GPS antenna connection short circuit	Antenna fault short	Disconnect the navigation system antenna. TEST the system for normal operation. If the DTC is still present with the navigation system antenna disconnected, INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation). IF the DTC B1893 is shown, REFER to DTC B1893 in this section.
B2206	Gyroscope error	Invalid values from gyroscope for 30 seconds	INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel

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			Pilot EX (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
B2477	Module configuration failure	Navigation system display module not configured	REFER to the WDS.
U1900	Controller area network (CAN) BUS failure	CAN	REFER to: Communications Network (418-00, Diagnosis and Testing).
B2406	Internal audio CD player failure	Navigation system display module	INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
B1035	CD ROM read test	CD ROM	INSPECT the CD ROM for damage. INSTALL a new CD ROM. TEST the system for normal operation.
B2410	FM receiving signal error	Antenna cable	REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
B1317	Battery voltage low	Battery voltage below 9 volts	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).
B1318	Battery voltage high	Battery voltage above 16 volts	REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing).

1. **1.** If the cause is not evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
Navigation system does not operate but radio does	* Incorrectly installed navigation CD ROM.	* Install the navigation CD ROM correctly.
Navigation system will not switch on	* Circuit(s). * Navigation system display module.	* GO to Pinpoint Test A.
Navigation system not operating correctly	* Wheel speed sensor.	* REFER to: Road Test Form - Anti-Lock Brake System (ABS) (206-09A Anti-Lock Control, Diagnosis and Testing).
	* Antenna signal.	* REFER to the Self-Diagnostic Mode.
	* Reversing lamp(s).	* REFER to: Reversing Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
	* Gyroscope.	* With the navigation system display module in Self-Diagnostic Mode, check the Gyro value changes when the vehicle is moved side to side. If the value changes with the movement of the vehicle, the internal gyroscope is operating correctly. If the value does not change, INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel Pilot EX

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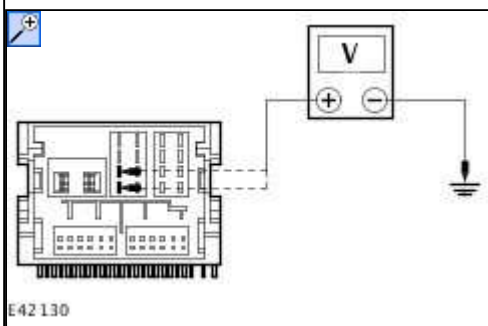
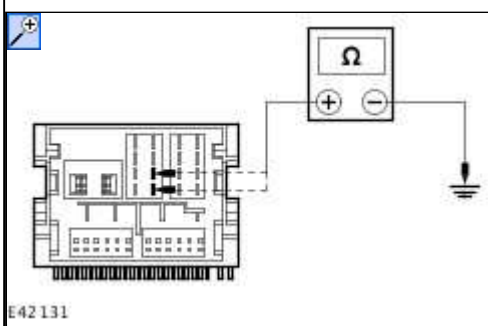
		(415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.

Pinpoint Tests

CAUTION: If the navigation system display module is to be removed for testing or new component installation, remove any audio media (if possible) from within the navigation system display module and return it to the customer. Failure to follow this instruction may result in damage to the navigation system display module.
NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : NAVIGATION SYSTEM WILL NOT SWITCH ON	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR VOLTAGE TO NAVIGATION SYSTEM DISPLAY MODULE	
	1 Disconnect Navigation System Display Module CME03B.
	2 Ignition switch in position I.
	3 Measure the voltage between the navigation system display module C2ME03-A pin 15, circuit SBP06E (BN/RD), harness side and ground; and between the navigation system display module C2ME03-A pin 16, circuit CDC33C (VT/GN), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to A2. **No** REPAIR circuit SBP06E (BN/RD) or circuit CDC33C (VT/GN). TEST the system for normal operation.
A2: CHECK THE NAVIGATION SYSTEM DISPLAY MODULE FOR GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the navigation system display module C2ME03-A pin 11, circuit GD103C (BK/BU), harness side and ground; and between the navigation system display module C2ME03-A pin 12, circuit GD103A (BK/BU), harness side and ground.
	Are the resistances less than 1 ohm? **Yes** GO to A3. **No** REPAIR circuit GD103C (BK/BU) or circuit GD103A (BK/BU). TEST the system for normal operation.
A3: CHECK CIRCUIT RME24A (BU/WH) TO GROUND	
	1 Connect Navigation System Display Module C2ME03-A.
	2 Disconnect Navigation System Display Module C2ME03-B.
	3 Measure the resistance between the navigation

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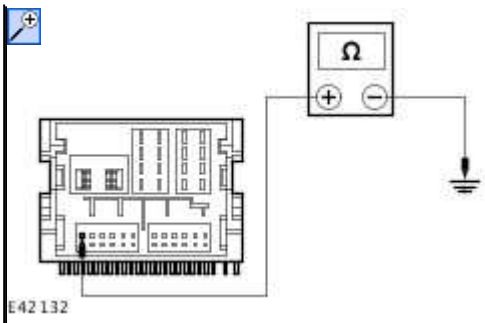	system display module C2ME03-B pin 8, circuit RME24A (BU/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new navigation system display module. REFER to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit RME24A (BU/WH). TEST the system for normal operation.

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Diagnosis and Testing

General Equipment

Ford diagnostic equipment

Inspection and Verification

NOTE: If a new navigation system display module is installed, allow the data from the navigation CD ROM to download (approximately 10 minutes) to the navigation system display module before inputting a destination into the navigation system display module. The vehicle must then be driven until the navigation system is fully calibrated. Route guidance will commence at approximately 30% of the calibration process and at 100% of calibration the route guidance will be accurate.

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

Visual Inspection Chart

Mechanical	Electrical
• Navigation system display module • Navigation system antenna • Navigation CD ROM	• Fuse(s) • Wiring harness • Electrical connector(s) • Navigation system display module

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, refer to the Dealer/Service Mode.

Dealer/Service Mode

NOTE: It is necessary to carry out part of the system diagnosis outside of the workshop. Make sure there that are no large buildings/obstructions or metal objects in the immediate vicinity.
NOTE: Make sure the navigation CD ROM is installed in the navigation system display module before entering the Self-Diagnostic Mode.
NOTE: The navigation system display module will stay activated for up to ten minutes after the unit has been switched OFF.
NOTE: The minimum number of satellites received by the navigation system display module for correct operation is four. If the satellites received is below the minimum requirement, the navigation system will not operate correctly. Move the vehicle to a position where the required amount of satellites are received.

1. **1.** Turn the ignition key to the ON position.
2. **2.** Switch the navigation system display module ON.
3. **3.** PRESS the NAV and SET buttons simultaneously for one second.

The navigation system display module now displays the following Dealer/Service menu options:

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- SW versions
- Lock CD drive (or Unlock CD drive depending on current status)
- Radio test
- Fault log (not available in all software versions)
- Display test
- GPS info
- SD Card info
- Shipping mode time stamps (not available in all software versions)
- System software installation from CD (not available in all software versions)

NOTE: ROTATE the right-hand rotary knob to highlight the mode required and PRESS the right-hand rotary knob (ENTER) to select the mode.

4. **4.** PRESS ESC to return to the Dealer/Service menu.

SW versions

This screens displays the software versions currently installed within the unit.

Lock CD drive

This screen displays a four digit entry facility, using the number buttons at the top of the unit. When the correct keycode for the unit has been entered, PRESS the OK button to lock the CD drive. The same process is used to unlock the CD drive. This feature is an anti-theft feature and may be used by car rental companies.

Radio test

This screen displays the following options and they can be selected by ROTATING the right-hand rotary knob to highlight the mode required and PRESSING the right-hand rotary knob (ENTER) to select the mode:

- **FM Step** This can be toggled between 100 kHz and 50 kHz by PRESSING the right-hand rotary knob. The 50 kHz option is for engineering use only and the setting should be left on 100 kHz.
- **High-Cut** This can be toggled ON and OFF by PRESSING the right-hand rotary knob. NOTE: This function is for engineering use only and should be left ON.
- **SHARX** This can be toggled ON and OFF by PRESSING the right-hand rotary knob. NOTE: This function is for engineering use only and should be left ON.
- **Radio quality parameters** This mode display the current quality settings within the unit and the following sub-menu can be selected by ROTATING the right-hand rotary knob to highlight the mode required and PRESSING the right-hand rotary knob (ENTER) to select the mode:
  - Frequency
  - Programme service name
  - Programme identification
  - Signal strength
  - Multipath value
  - Adj, channel interference
  - RDS quality
  - High-Cut
  - SHARX
- **RDS parameters** This mode display the current RDS settings within the unit and the following sub-menu can be selected by ROTATING the right-hand rotary knob to highlight the mode required and PRESSING the right-hand rotary knob (ENTER) to select the mode:
  - Frequency
  - Programme service name
  - Programme identification
  - Traffic announcement
  - Traffic programme
  - TMC

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- Alt. freq. list length

Fault log (not available in all software versions)

This screen displays any diagnostic trouble codes (DTC)s that have been flagged by the navigation system display module. Each DTC can be selected by ROTATING the right-hand rotary knob to highlight the specific DTC and PRESSING the right-hand rotary knob (ENTER) to display further information regarding diagnosing the DTC.

Display test

The Display test can be selected by ROTATING the right-hand rotary knob to highlight the mode required and PRESSING the right-hand rotary knob (ENTER) the display background color changes after each press.

GPS info

The GPS info screen displays the following information:

- Latitude
- Longitude
- Altitude (the height of the vehicle above sea level)
- Satellites (the amount of satellites visible to the navigation system antenna)

SD Card info

This screen displays the settings of the SD card that is inserted into the front of the navigation system display module.

Shipping mode time stamps (not available in all software versions)

This screen shows time stamps from the GPS clock indicating when the vehicle ordered the navigation system to enter shipping mode. This can also occur if the vehicle enters low-power mode 2, which would also be indicated in the message center.

System software installation from CD (not available in all software versions)

This function is used if it is necessary to update the system software from an update CD.

5. **5.** If the cause is not visually evident, verify the symptom and refer to the diagnostic tab within the Ford diagnostic equipment.

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Diagnosis and Testing

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

NOTE: If the navigation system display module displays either of the following:

- serial number(s) are incompatible
- vehicle identification number (VIN) does not match

Use the WDS to configure the navigation system display module and the navigation digital versatile disc (DVD) unit to each other.

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

Visual Inspection Chart

Mechanical	Electrical
• Navigation system display module • Audio unit • Navigation system DVD unit • Antenna • Steering column audio controls	• Fuse(s) • Wiring harness • Electrical connector(s) • Navigation system display module • Audio unit • Navigation system DVD unit • Steering column audio controls • Central junction box (CJB)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, refer to the Self-Diagnostic Mode.

Self-Diagnostic Mode

NOTE: It is necessary to carry out part of the system diagnosis outside the workshop. Make sure that there are no large buildings/obstructions or metal objects in the immediate vicinity.

1. **1.** Turn the ignition switch to position II.
2. **2.** To access the diagnostic menu, PRESS and HOLD the MENU button for approximately 10 seconds, until a audible beep is heard and the screen changes to the personal identification number (PIN) number display.
3. **3.** ENTER the following PIN number on the display to access the additional diagnostic menus: **6414**.
4. **4.** PRESS the ENTER button on the display screen to confirm PIN number input.

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The display screen will show the following sub-menu(s):

- General Info
- Manual Check
- Display Info
- Navigation Info
- S/W Update
- Self Check

5. **5.** TOUCH the display screen to select the required sub-menu.

Additional menus can be accessed from the following sub-menus:

General Info

This sub-menu contains vehicle configuration information.

The additional menus from this sub-menu are as follows:

- Audio Diagnostics - Allows audio unit diagnosis

Manual Check

This sub-menu allows access to key test screens.

The additional menus from this sub-menu are as follows:

- DIAGNOSTIC ERROR CODES - This will display a list of all set diagnostic trouble codes (DTC)s.
- NAV RGB TEST - Display color confirmation.
- TOUCH SCREEN CHECK - Allows the display touch calibration.
- DISPLAY HARDKEY CHECK - On screens icons are illuminated when a hard key is pressed.

Display Info

This sub-menu contains software version information for the display.

Navigation Info

This sub-menu allows access to the global positioning system (GPS) information screens.

The additional menus from this sub-menu are as follows:

- RESET POSITION - Allows the vehicle position to be reset to the current map DVD default country (Belgium).
- VEHICLE/GYRO SIGNALS - Displays the vehicle direction, speed and distance. Also displays the gyro information.
- GPS INFORMATION - Displays the GPS satellites signals to the navigation system and their position.

S/W Update

This sub-menu allows the update of the navigation system DVD unit software from a separate DVD ROM sent when an update is required and is available. This cannot be done from the normal navigation system DVD ROM.

Self-Check

This sub-menu displays error codes detected after an internal self-diagnostic check of the navigation DVD unit.

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6. **6.** Turn the ignition switch to position 0 to exit the diagnostic menu.

7. **7.** If the cause is not visually evident after the Self-Diagnostic Mode, connect the WDS to the data link connector (DLC).

8. **8.** Retrieve the DTCs and refer to the DTC Index Chart.

Diagnostic Trouble Code (DTC) Index Chart - Navigation System Display

DTC	Description/Condition	Possible Source	Action
B1342	Display defective	Navigation system display module	INSTALL a new navigation system display module. REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01 Information and Entertainment System, Removal and Installation).
B2995	Video feed missing	Navigation system DVD unit or navigation system display module signal	GO to Pinpoint Test B.

Diagnostic Trouble Code (DTC) Index Chart - Navigation system Module

DTC	Description/Condition	Possible Source	Action
B1342	Navigation system display module failure	Navigation system display module	INSTALL a new navigation system display module. REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01, Removal and Installation).
B2204	GPS antenna connection open or short circuit	Antenna fault open or short circuit	CHECK the navigation system antenna connections and antenna base ground connection. TEST the system for normal operation. IF the concern persists, INSTALL a new navigation system antenna cable.
B2477	Module configuration failure	Navigation configuration failure	Refer to the WDS.

9. **9.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The navigation system display module shows incomplete street/map information	* DVD ROM.	* CHECK the navigation DVD ROM level. * INSPECT the DVD ROM for damage. INSTALL a new DVD ROM. TEST the system for normal operation.
Navigation system will not switch on	* Instrument cluster.	* REFER to the WDS.
	* Circuit(s). * Navigation system display module.	* GO to Pinpoint Test A.
Navigation system does not operate correctly	* Instrument cluster.	* REFER to the WDS.

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	* Circuit(s). * Navigation system display module. * Navigation system DVD unit.	* GO to Pinpoint Test B.
The audio unit is inoperative/does not operate correctly	* Instrument cluster. * Audio unit. * Navigation system display module. * Navigation system DVD unit.	* CHECK all communication between the instrument cluster, audio unit, navigation system display module and navigation system DVD unit. REFER to the WDS.
	* Compact disc (CD) changer.	* REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
The display is blank	* Instrument cluster.	* REFER to WDS.
	* Navigation system display module. * Navigation system DVD unit.	* GO to Pinpoint Test B.
Poor quality/distorted sound from one or more speakers (not all speakers)	* Speaker(s). * Circuit. * Audio unit.	* REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
No sound from all speakers	* Audio unit.	* INSTALL a new audio unit. REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation.
No sound from one or more of the speakers (not all speakers)	* Speaker(s). * Circuit. * Audio unit.	* REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).
The auxiliary audio control is inoperative/does not operate correctly.	* Circuit. * Audio control switch. * Audio unit.	* REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

Pinpoint Tests

CAUTION: Remove the DVD ROM before removing the navigation system DVD unit for circuit testing. Failure to follow this instruction may result in damage to the DVD ROM.
NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : NAVIGATION SYSTEM WILL NOT SWITCH ON	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE NAVIGATION SYSTEM DISPLAY MODULE FOR VOLTAGE	
	1 Disconnect Navigation System Display Module C2ME03-F.

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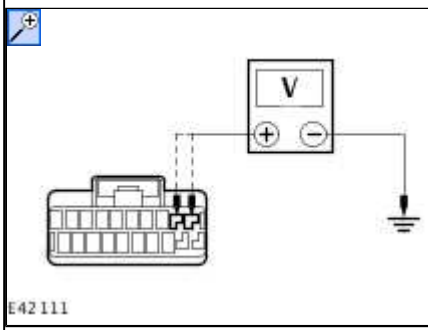
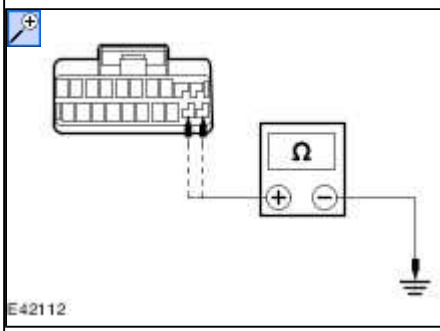
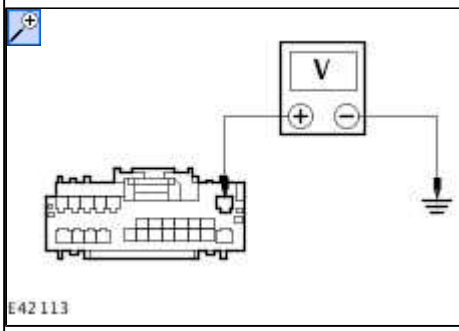
	2 Ignition switch in position I.
	3 Measure the voltage between the navigation system display module C2ME03-F pin 1, circuit SBP06J (BN/RD), harness side and ground; and between the navigation system display module C2ME03-F pin 2, circuit CDC33D (VT/GN), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to A2. **No** REPAIR circuit SBP06J (BN/RD) or circuit CDC33D (VT/GN). TEST the system for normal operation.
A2: CHECK THE NAVIGATION SYSTEM DISPLAY MODULE GROUND CIRCUITS FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the navigation system display module C2ME03-F pin 11, circuit GD138BF (BK/WH), harness side and ground; and between the navigation system display module C2ME03-F pin 12, circuit GD138BG (BK/WH), harness side and ground.
	Are the resistances less than 1 ohm? **Yes** INSTALL a new navigation system display module. REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01 Information and Entertainment System, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit GD138BF (BK/WH) or GD138BG (BK/WH). TEST the system for normal operation.

PINPOINT TEST B : NAVIGATION SYSTEM DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE NAVIGATION SYSTEM DVD UNIT FOR VOLTAGE	
	1 Disconnect Navigation System DVD Unit C2ME04.
	2 Measure the voltage between the navigation system DVD unit C2ME04 pin 1, circuit SBP06F (BN/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to B2.

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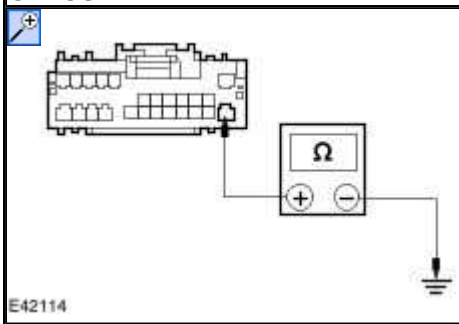
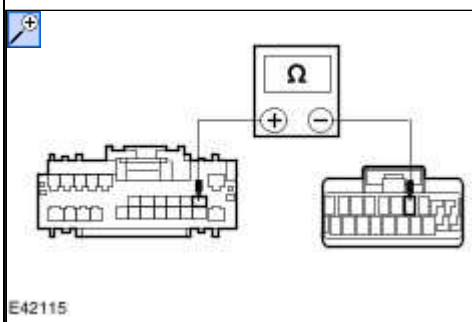
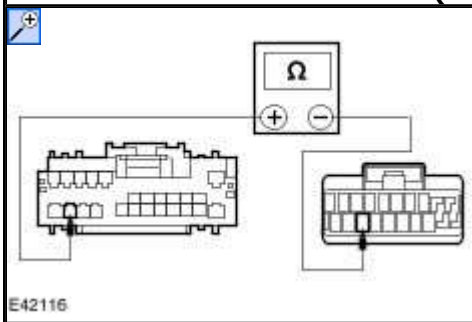
	No REPAIR the circuit SBP06F (BN/RD). TEST the system for normal operation.
B2: CHECK THE NAVIGATION SYSTEM DVD UNIT GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation system DVD unit C2ME04 pin 13, circuit GD138BH (BK/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** GO to B3. **No** REPAIR the circuit GD138BH (BK/WH). TEST the system for normal operation.
B3: CHECK CIRCUIT CMN13A (YE/OG) FOR OPEN CIRCUIT	
	1 Disconnect Navigation System Display Module C2ME03-F.
	2 Measure the resistance between the navigation system display module C2ME03-F pin 4, circuit CMN13A (YE/OG), harness side and the navigation system DVD unit C2ME04 pin 2, circuit CMN13A (YE/OG), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B4. **No** REPAIR the circuit. TEST the system for normal operation.
B4: CHECK CIRCUIT DMN08A (NO) FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation system display module C2ME03-F pin 18, circuit DMN08A (NO), harness side and the navigation system DVD unit C2ME04 pin 23, circuit DMN08A (NO), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to B5. **No** REPAIR the circuit. TEST the system for normal operation.
B5: CHECK CIRCUIT VMN08A (VT/GY) FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation

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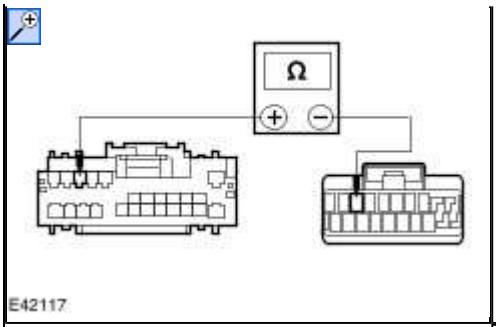
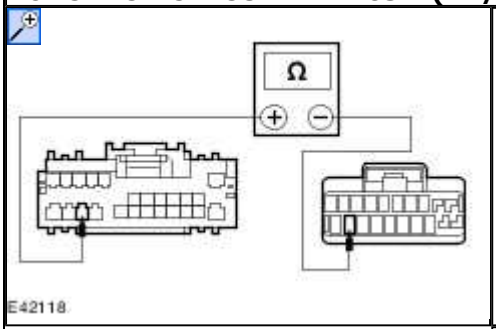
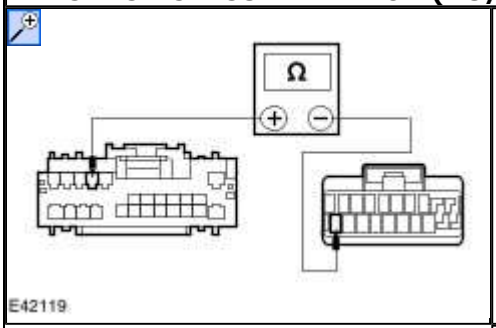
	system display module C2ME03-F pin 8, circuit VMN08A (VT/GY), harness side and the navigation system DVD unit C2ME04 pin 10, circuit VMN08A (VT/GY), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to B6. **No** REPAIR the circuit. TEST the system for normal operation.
B6: CHECK CIRCUIT VMN09A (VT/GY) FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation system display module C2ME03-F pin 19, circuit VMN09A (VT/GY), harness side and the navigation system DVD unit C2ME04 pin 22, circuit VMN09A (VT/GY), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to B7. **No** REPAIR the circuit. TEST the system for normal operation.
B7: CHECK CIRCUIT VMN10A (BU/WH) FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation system display module C2ME03-F pin 20, circuit VMN10A (BU/WH), harness side and the navigation system DVD unit C2ME04 pin 9, circuit VMN10A (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to B8. **No** REPAIR the circuit. TEST the system for normal operation.
B8: CHECK CIRCUIT VMN11A (GR/RD) FOR OPEN CIRCUIT	
	1 Measure the resistance between the navigation system display module C2ME03-F pin 10, circuit VMN11A (GR/RD), harness side and the navigation system DVD unit C2ME04 pin 21, circuit VMN11A (GR/RD), harness side.

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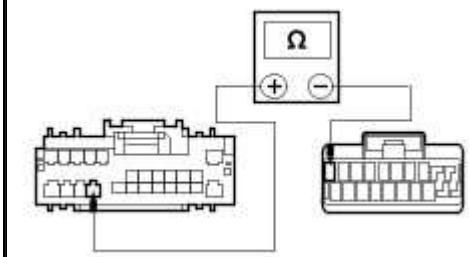


Is the resistance less than 1 ohm?

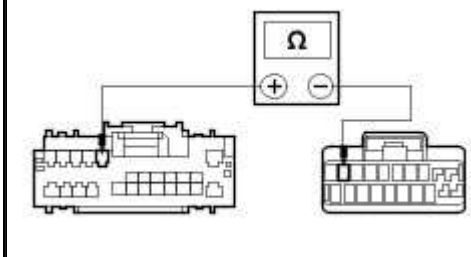
Yes

GO to B9.

No

REPAIR the circuit. TEST the system for normal operation.

B9: CHECK CIRCUIT VMN12A (GN/BK) FOR OPEN CIRCUIT



1 Measure the resistance between the navigation system display module C2ME03-F pin 9, circuit VMN12A (GN/BK), harness side and the navigation system DVD unit C2ME04 pin 8, circuit VMN12A (GN/BK), harness side.

Is the resistance less than 1 ohm?

Yes

GO to B10.

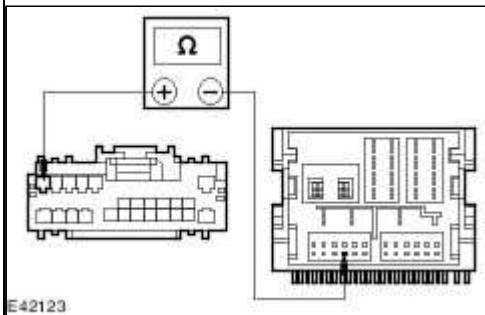
No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new navigation system display module.
REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01 Information and Entertainment System, Removal and Installation).
TEST the system for normal operation.

B10: CHECK CIRCUIT RMN14A (BU/RD) FOR OPEN CIRCUIT

1 Connect Navigation System Display Module C2ME03-F.

2 Disconnect Audio Unit C2ME03-C.



3 Measure the resistance between the navigation system DVD unit C2ME04 pin 12, circuit RMN14A (BU/RD), harness side and the audio unit C2ME03-C pin 9, circuit RMN14A (BU/RD), harness side.

Is the resistance less than 1 ohm?

Yes

GO to B11.

No

REPAIR the circuit. TEST the system for normal operation.

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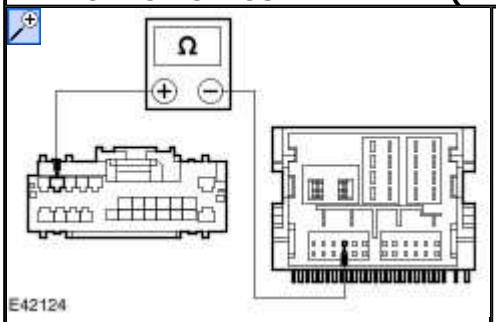
B11: CHECK CIRCUIT VMN14A (BN/RD) FOR OPEN CIRCUIT



1 Measure the resistance between the navigation system DVD unit C2ME04 pin 11, circuit VMN14A (BN/RD), harness side and the audio unit C2ME03-C pin 3, circuit VMN14A (BN/RD), harness side.

Is the resistance less than 1 ohm?

Yes

INSTALL a new navigation system DVD unit.
REFER to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).
TEST the system for normal operation.

No

REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new audio unit.
REFER to: Navigation System Display Module - Vehicles With: DVD Navigation System with Touchscreen (415-01 Information and Entertainment System, Removal and Installation).
TEST the system for normal operation.

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General Procedures

1. Switch the ignition to the ON position.

NOTE: Remove the button.

2.

3.

NOTE: Carefully remove the front cover.

4. Press the <NAV> and <MENU> button at the same time.
5. Select <Eject DVD> and enter the RADIO PIN CODE.
6. Remove the road data DVD.
7. Insert the new road data DVD.
8. NOTE: The update will start automatically after a short wait. Do NOT abort this process and do NOT change the ignition key position.
   NOTE: The display will show the software version available on the DVD.
   Select <Continue> to start the update.

NOTE: Installation position of the spring for the front cover.

9.

10.

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11. NOTE: The navigation system will need to recalibrate itself after this update. As a result, the vehicle position may be displayed incorrectly for the first few miles. This will be corrected after the vehicle has been driven a short while and has changed direction a few times.
Drive the vehicle for approximately five miles/eight kilometers.

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Print

Diagnosis and Testing

1. **1.** REFER to: (415-00 Information and Entertainment System - General Information)

   Information and Entertainment System (Diagnosis and Testing),
   Navigation System - Vehicles With: Travel Pilot EX (Diagnosis and Testing),
   Navigation System - Vehicles With: Digital Versatile Disc (DVD) Navigation System (Diagnosis and Testing),
   Cellular Phone (Diagnosis and Testing).

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Removal and Installation

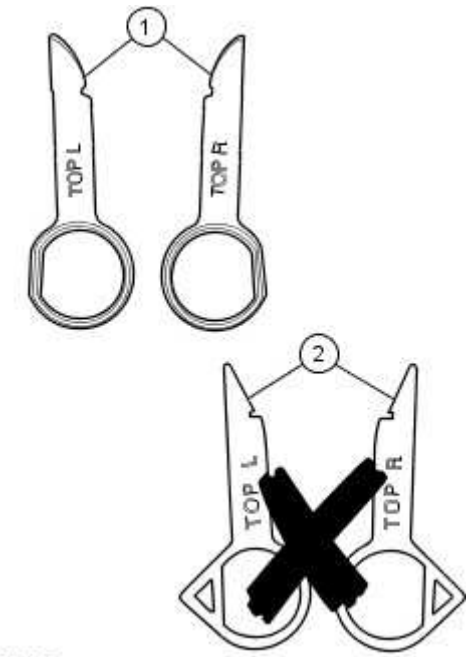
General Equipment

Audio unit removal tools (GV3301)

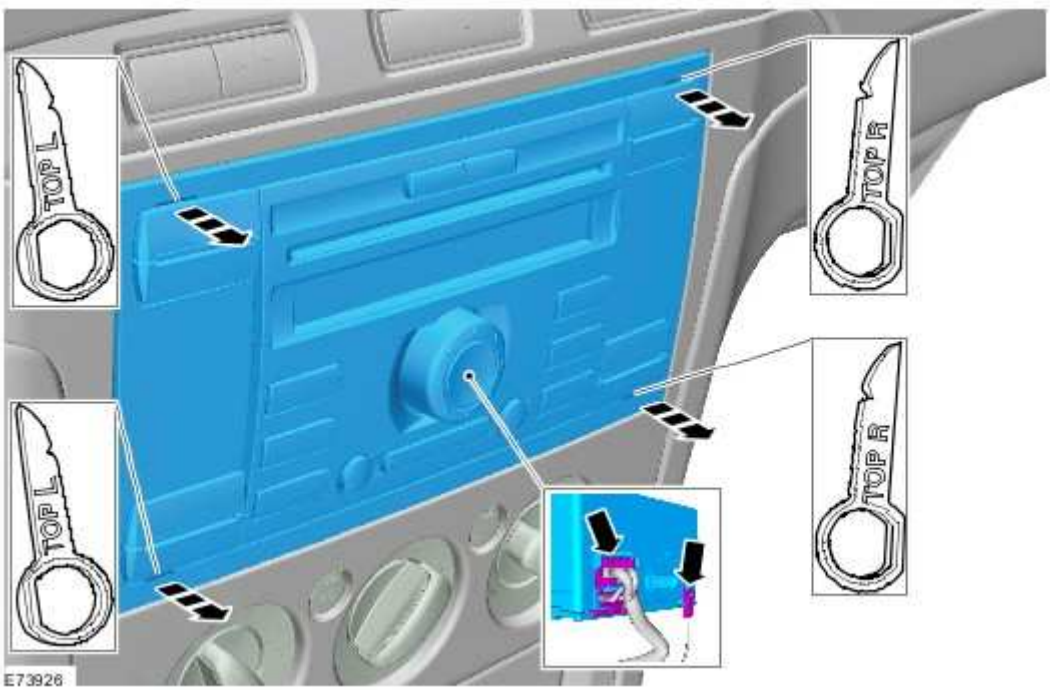
Removal

NOTE: Make sure that any media is ejected from the unit.

1.



E54927



E73926

2. CAU
Take ext
care not
damage
wiring
harnesse
General
Equipme
Audio un
removal
(GV3301

3. Remove the audio unit removal tools from the audio

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

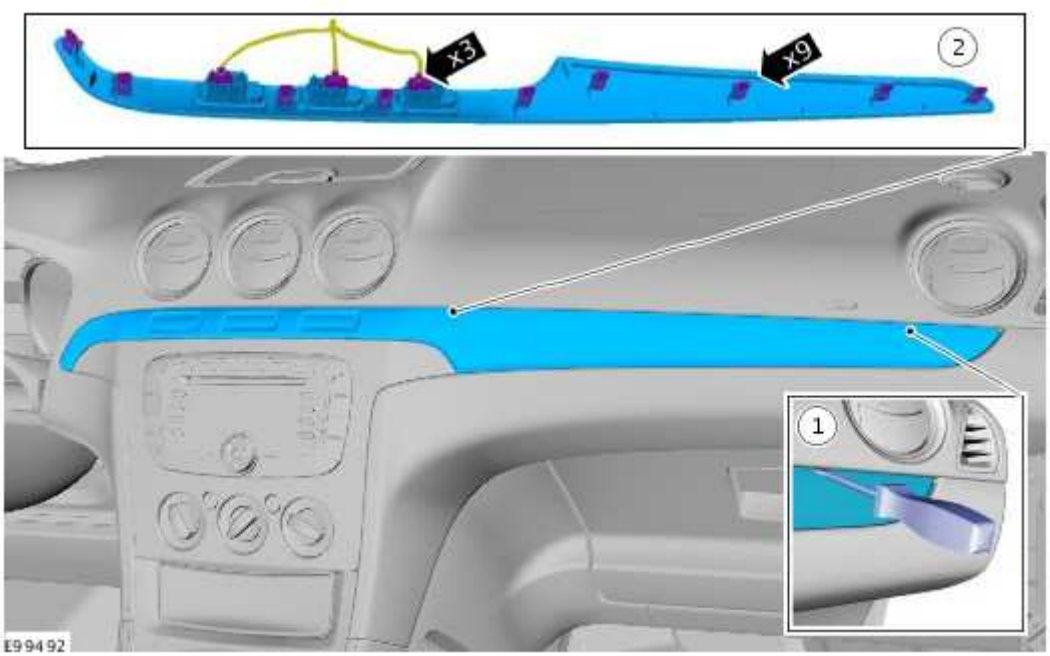
Flat-bladed screwdriver
Ford diagnostic equipment

Removal

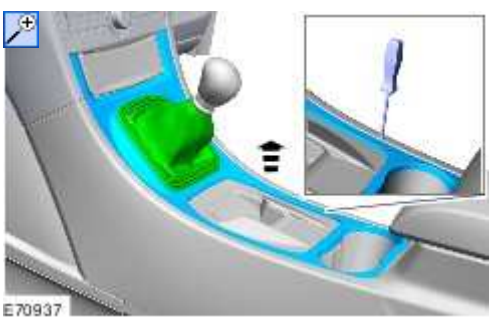
NOTE: Make sure that any media is ejected from the unit.

1. NOTE: This step is only necessary when installing component.
   Connect the diagnostic tool and upload the audio uni configuration information using the Programmable M Installation Routine, prior to commencing the remov audio unit.

   General Equipment: Ford diagnostic equipment



2. CAU
   Use suit packing material prevent damage compon
   General Equipme
   bladed screwdri



3. CAUTION: Use suitable packing material to pr damage to the component.
   General Equipment: Flat-bladed screwdriver

Vehicles with manual temperature control

4.

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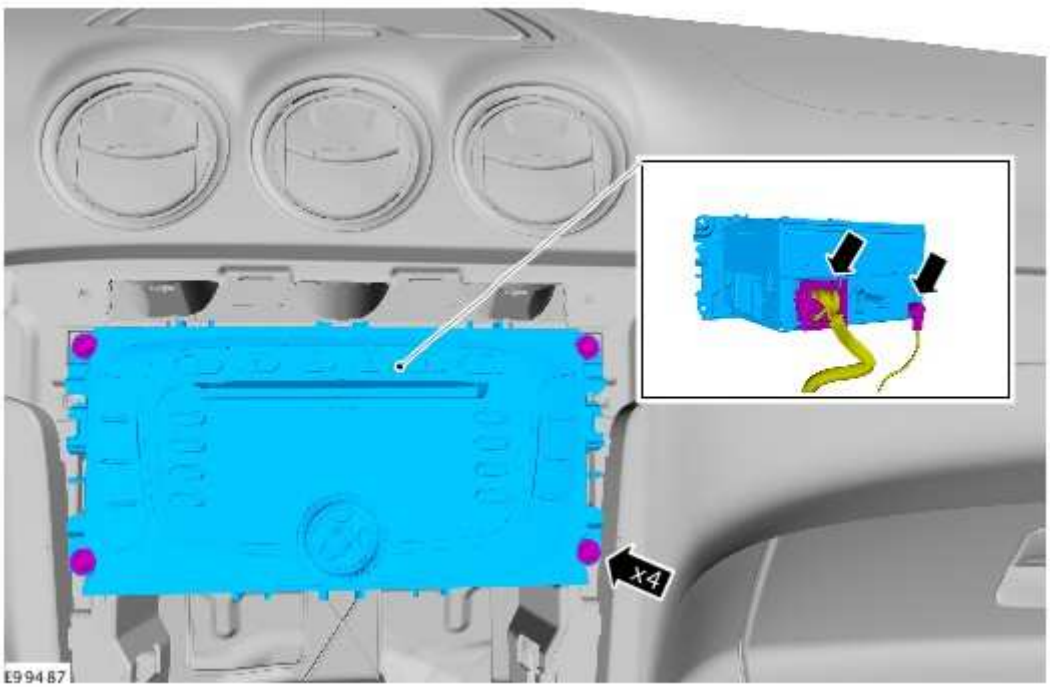
Vehicles with electronic automatic temperature control (EA

5.

All vehicles

6.



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Installation

1. NOTE: New units must be configured using the Programmable Module Installation Routine in the diagnostic tool.
   To install, reverse the removal procedure.

   General Equipment: Ford diagnostic equipment

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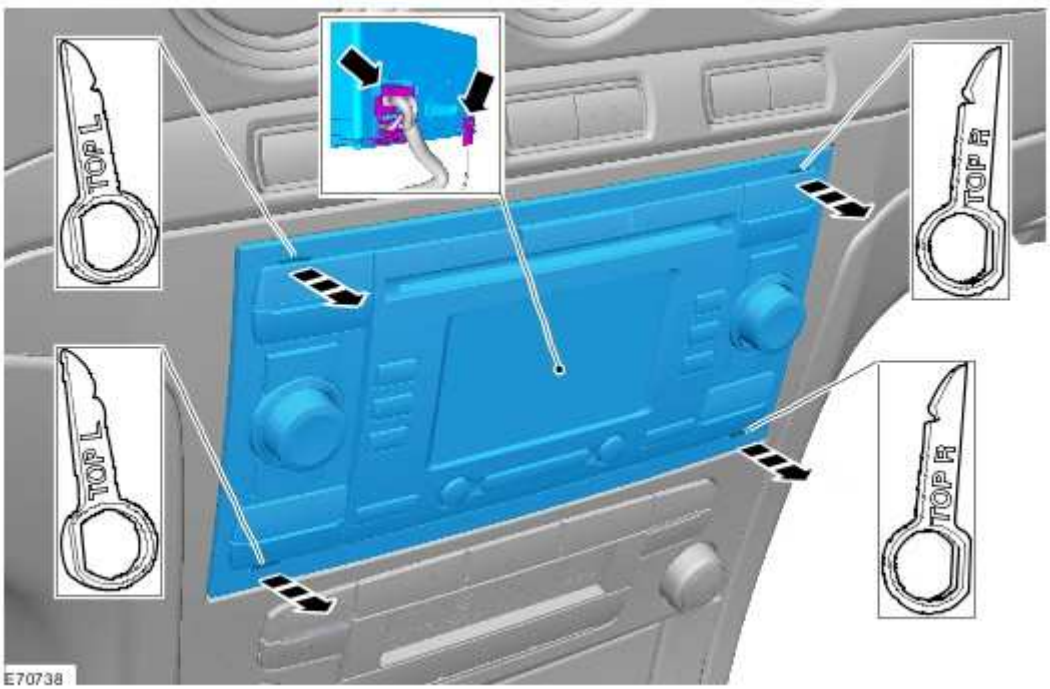
Removal and Installation

General Equipment

Audio unit removal tools (GV3301)

Removal

NOTE: Make sure that any media is ejected from the unit.



1. CAU
   Take ext
   care not
   damage
   wiring
   harnesse
   General
   Equipme
   Audio un
   removal
   (GV3301

Installation

1. To install, reverse the removal procedure.
2. NOTE: This step is only necessary when installing component.
   Install the navigation compact disc (CD) read only m (ROM) disc.

3. NOTE: This step is only necessary when installing component.
   NOTE: It is necessary to carry out part of the syst diagnosis outside of the workshop. Make sure ther no large buildings, obstructions or metal objects ir immediate vicinity.
   1. Switch the navigation system display module
   2. With the navigation system display module in navigation main menu. PRESS the S6 (EXTRA)
   3. SELECT NEW INSTALLATION and PRESS the ri hand rotary knob (ENTER), to continue to the screen
   4. Follow the instructions on the display, until cal

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is confirmed in the display.

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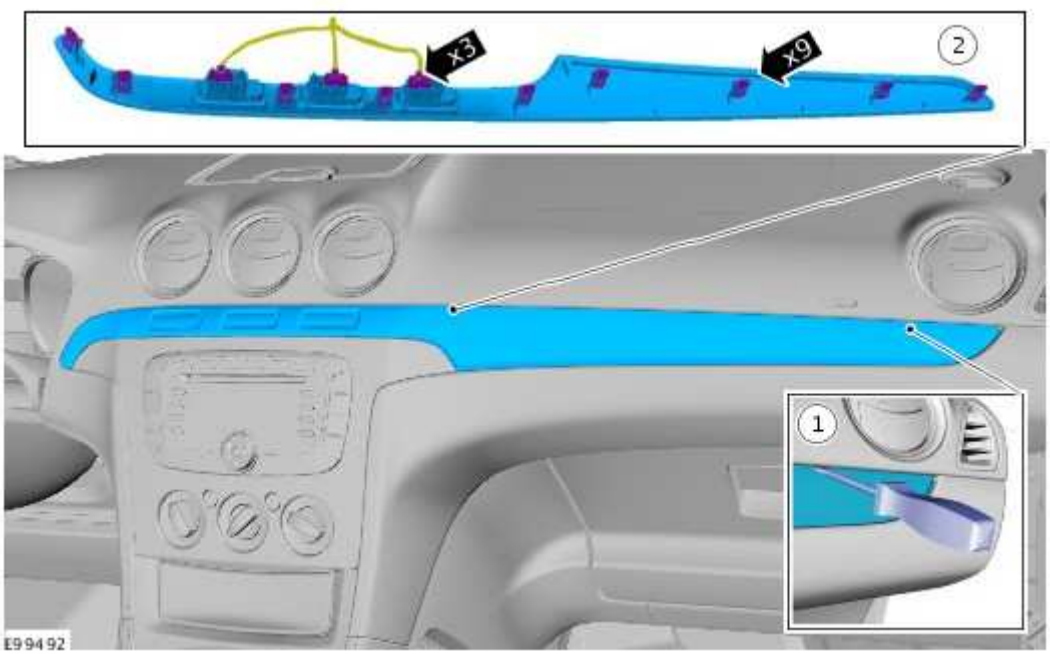
Removal and Installation

General Equipment

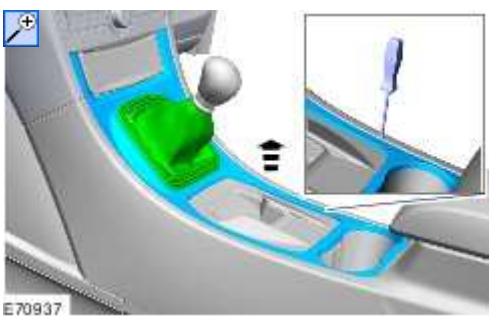
Flat-bladed screwdriver

Removal

NOTE: Make sure that any media is ejected from the unit.



1. CAU
Use suit
packing
material
prevent
damage
compon
General Equipme
bladed
screwdri



2. CAUTION: Use suitable packing material to pr
damage to the component.
General Equipment: Flat-bladed screwdriver

Vehicles with manual temperature control

3.

Vehicles with electronic automatic temperature control (EA

4.

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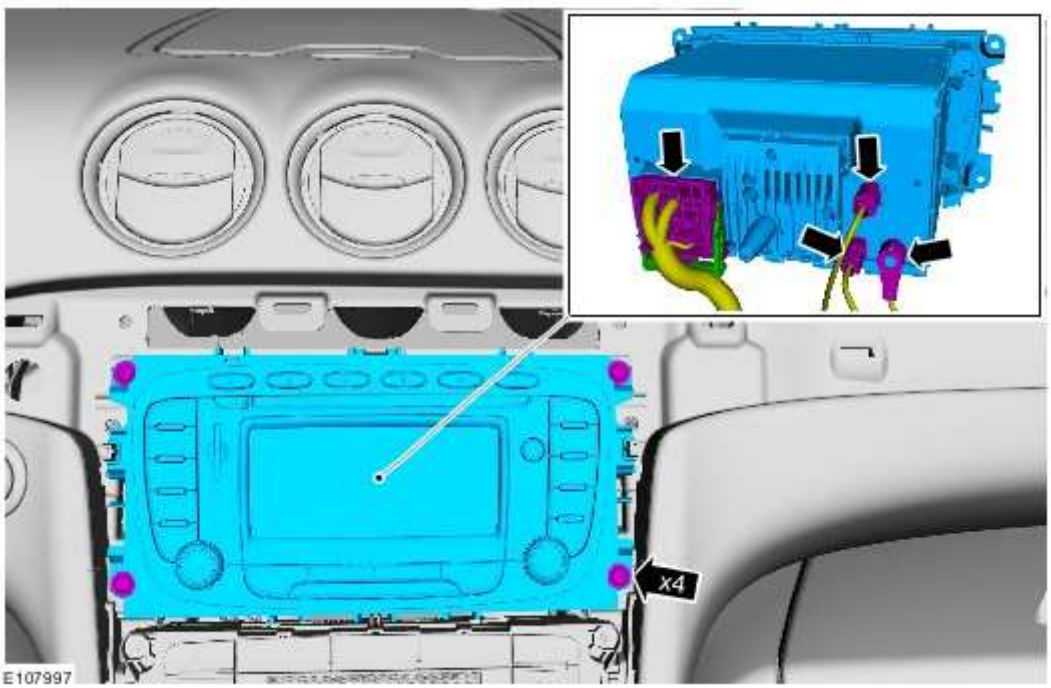
All vehicles

5.



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

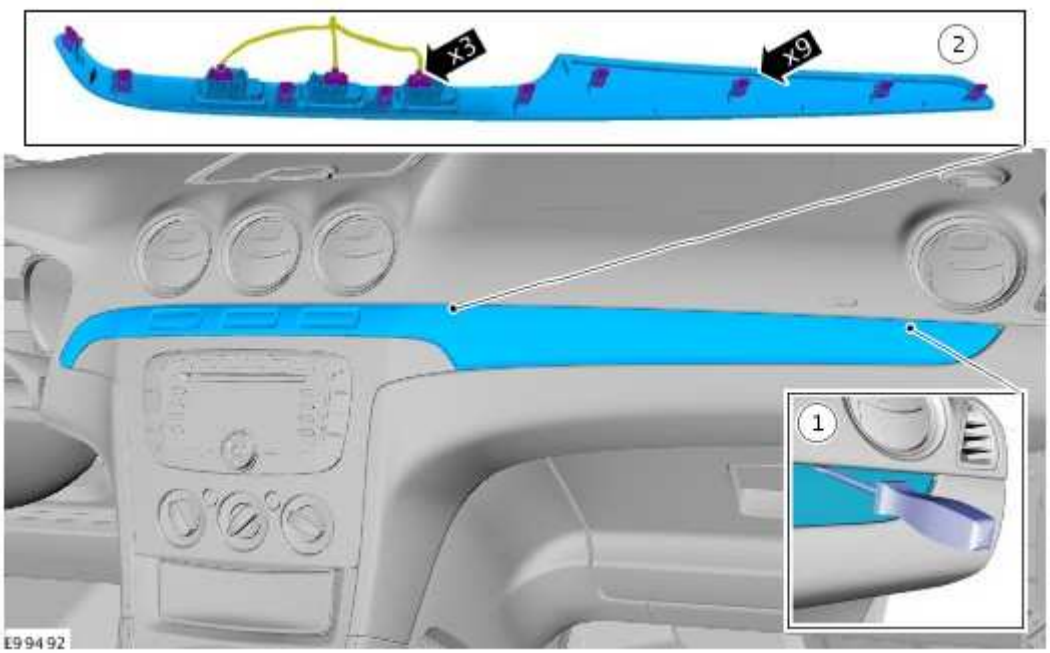
Audio unit removal tools (GV3301)
Flat-bladed screwdriver
Ford diagnostic equipment

Removal

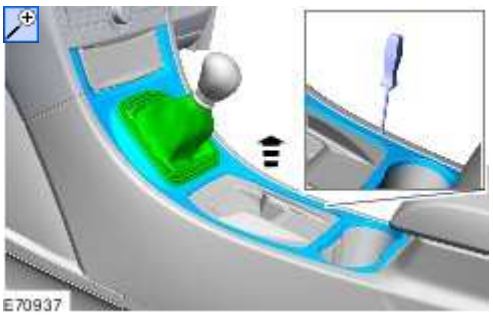
NOTE: Make sure that any media is ejected from the unit.

1. NOTE: This step is only necessary when installing component.
   Connect the diagnostic tool and upload the audio uni configuration information using the Programmable M Installation Routine, prior to commencing the remov audio unit.

   General Equipment: Ford diagnostic equipment



2. CAU
   Use suit packing material prevent damage compon
   General Equipme
   bladed screwdri



3. CAUTION: Use suitable packing material to pr damage to the component.
   General Equipment: Flat-bladed screwdriver

4.

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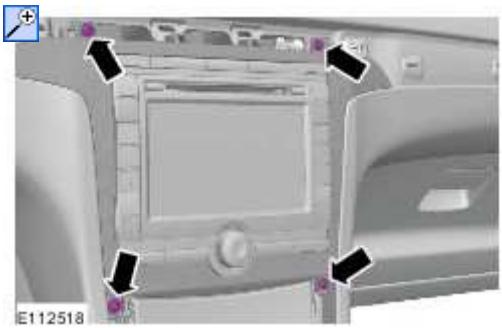

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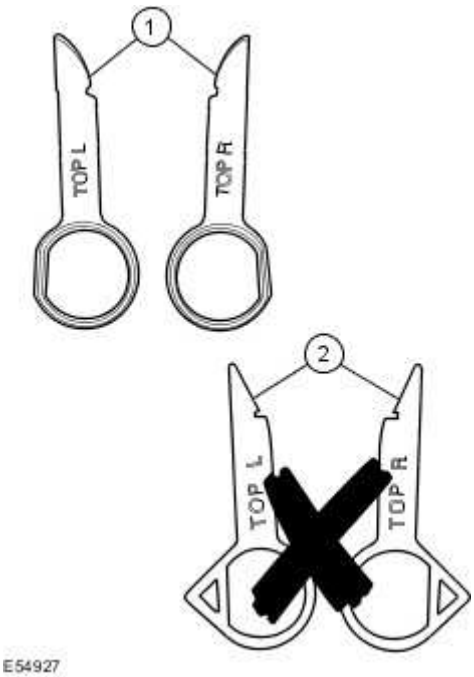

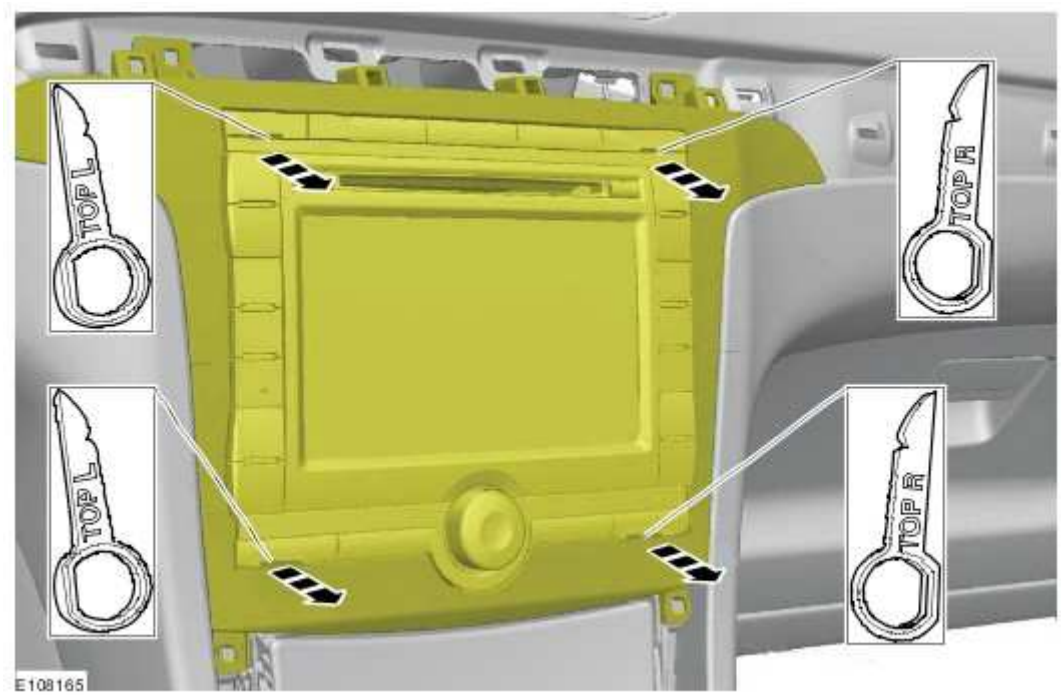

6. *General Equipme* Audio un removal (GV3301

7.

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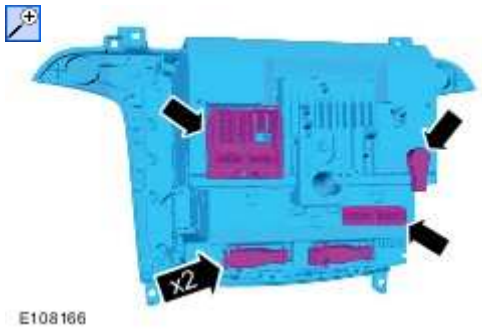

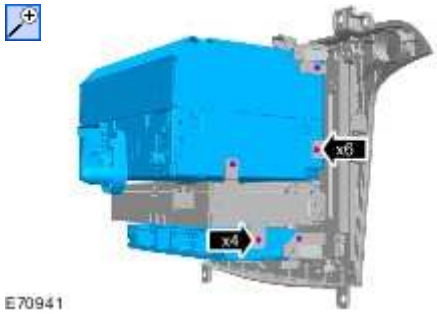

8. NOTE: This step is only necessary when installing component.

9. NOTE: This step is only necessary when installing new component.

Installation

1. NOTE: New units must be configured using the Programmable Module Installation Routine in the diagnostic tool.
   To install, reverse the removal procedure.

   General Equipment: Ford diagnostic equipment

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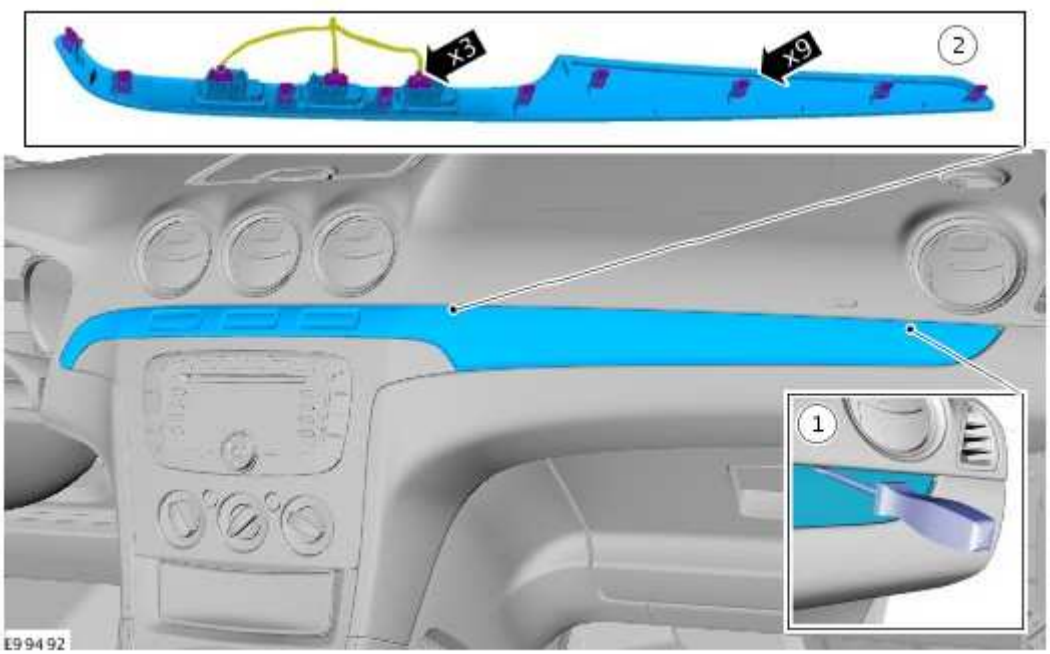
Removal and Installation

General Equipment

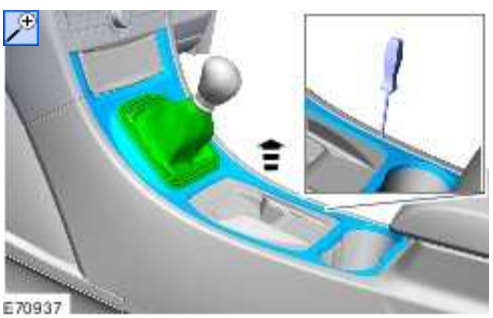
Audio unit removal tools (GV3301)
Flat-bladed screwdriver

Removal

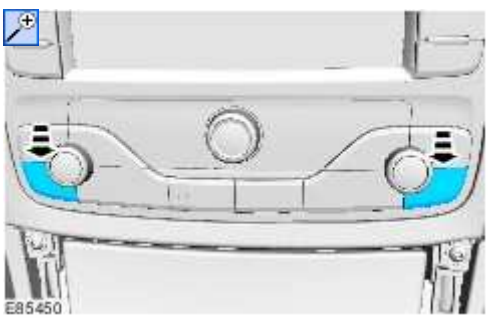
NOTE: Make sure that any media is ejected from the unit.



1. CAU
Use suit
packing
material
prevent
damage
compon
General Equipme
bladed
screwdri



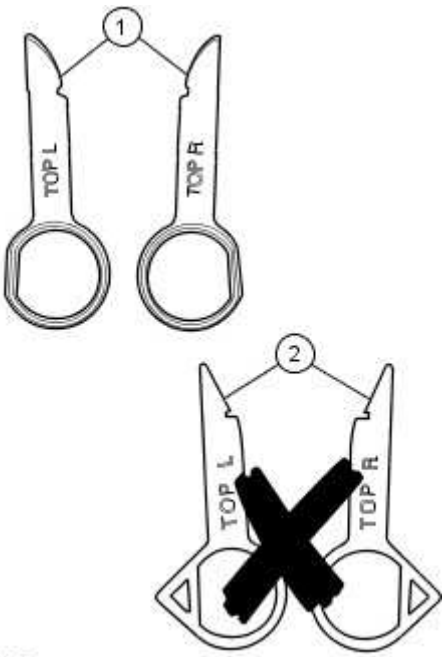
2. CAUTION: Use suitable packing material to pr
damage to the component.
General Equipment: Flat-bladed screwdriver



3.

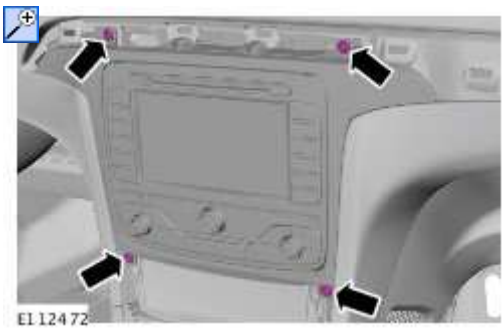
4.

http://vnx.su



E54927

5.



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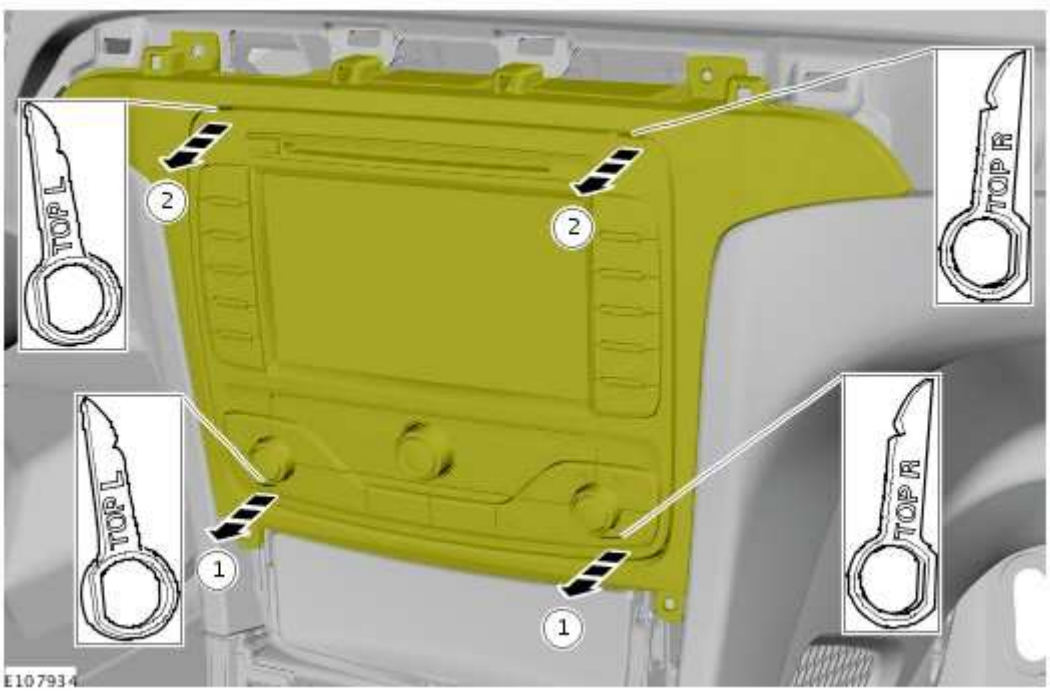
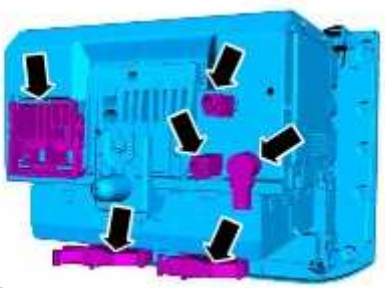


E107934

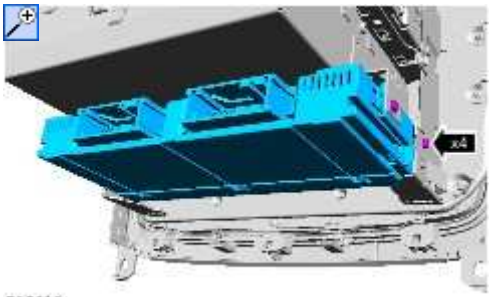
6. *General Equipme* Audio un removal (GV3301

7.

http://vnx.su



E107935



E85392

8. NOTE: This step is only necessary when installing component.

E99544

9. NOTE: This step is only necessary when installing new component.

Installation

1. To install, reverse the removal procedure.

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Print

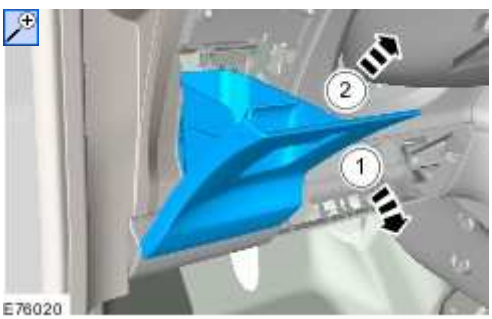
Removal and Installation

Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
2. Remove the driver lower air bag.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



3.

4.

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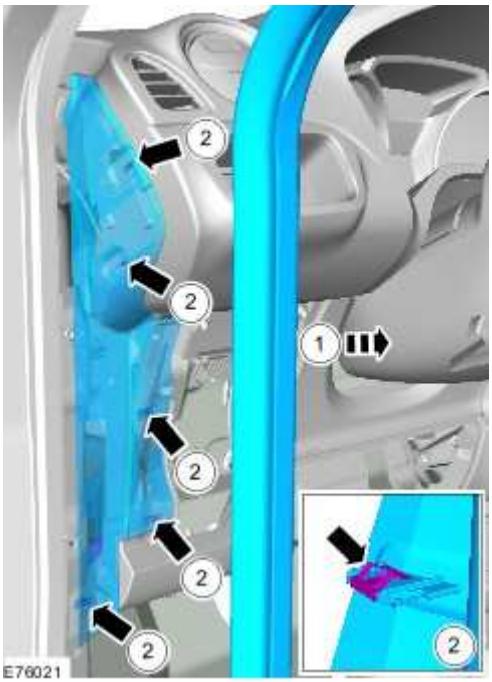

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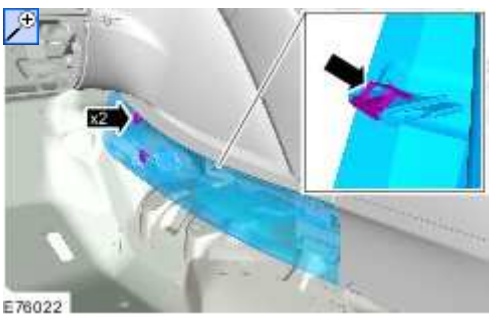

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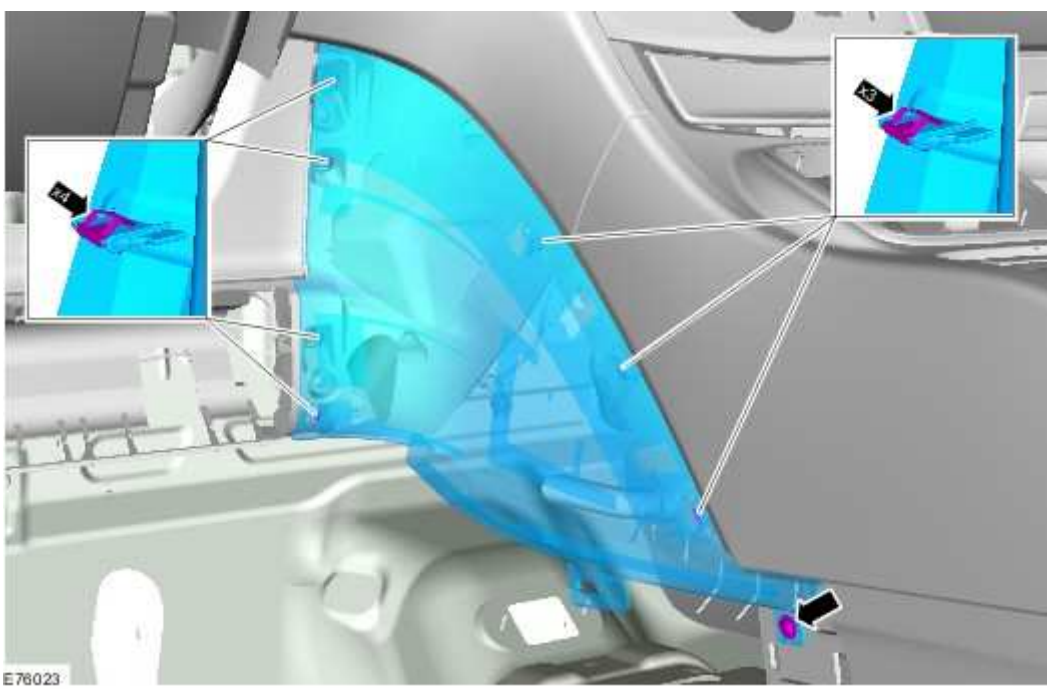

7.

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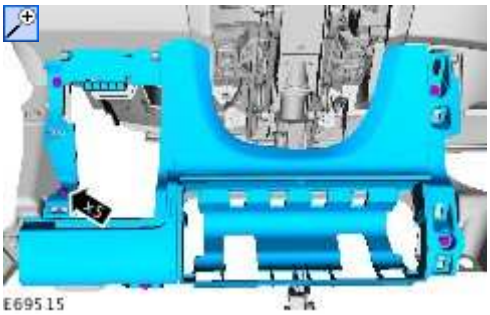

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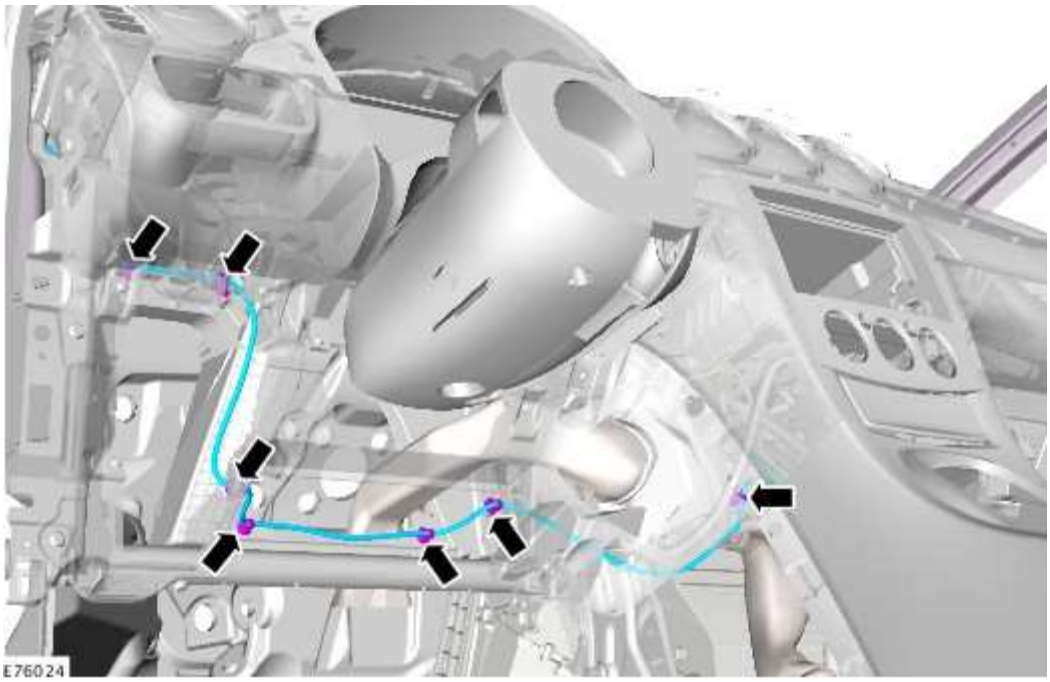
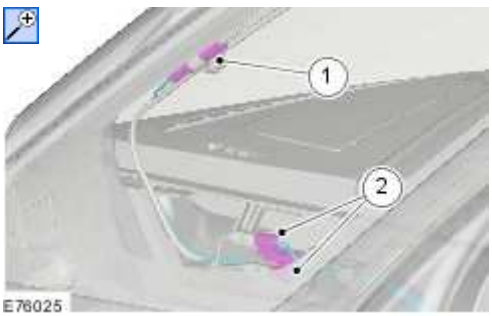


9. Remove the A-pillar trim panel.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



10.
   2. If equipped.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

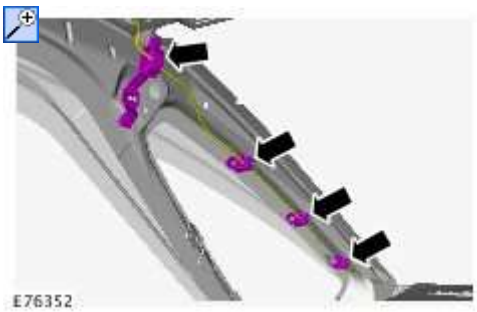
General Equipment

Flat-bladed screwdriver

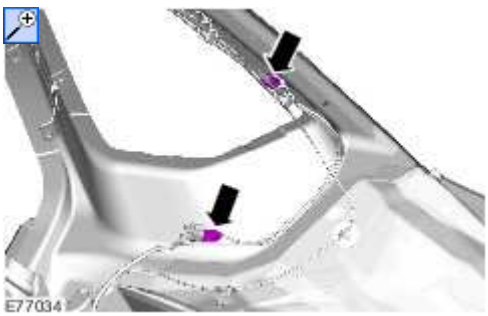
Removal

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

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.



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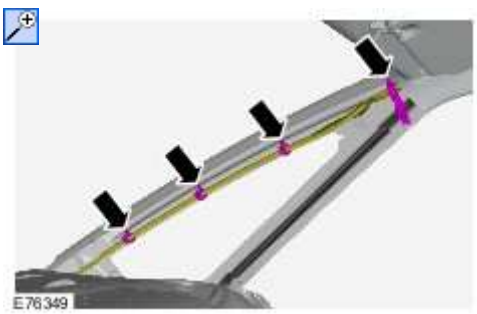

4.

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

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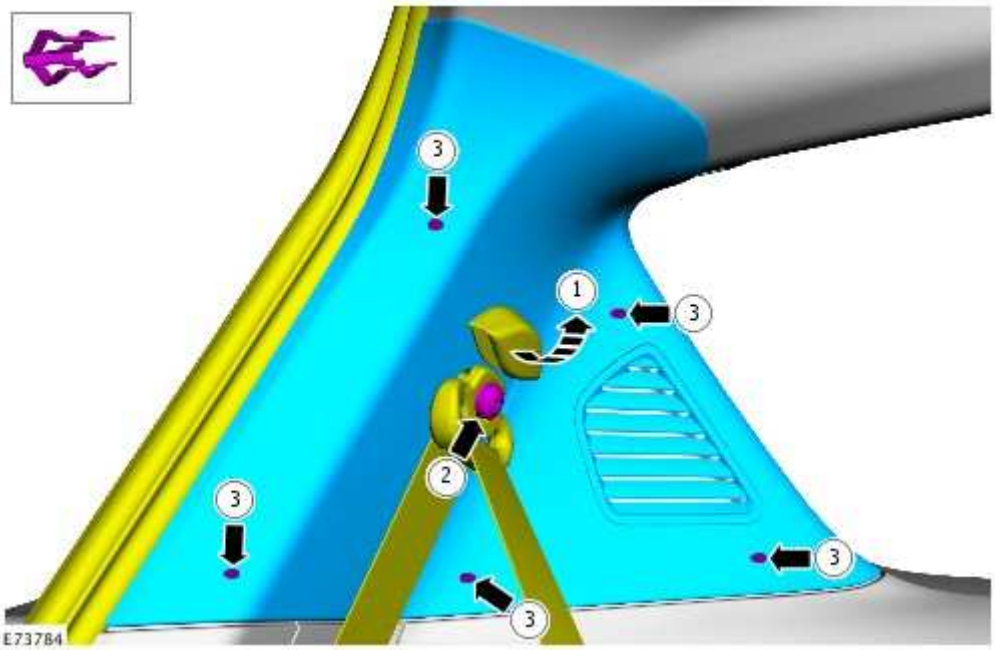
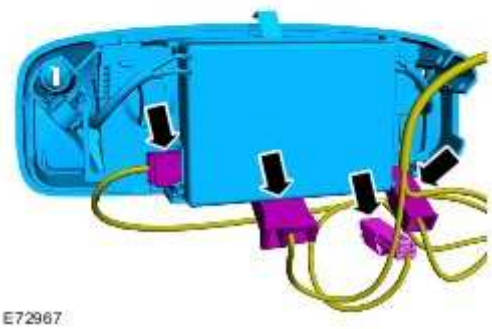


8. *General Equipment:* Flat-bladed screwdriver



9.

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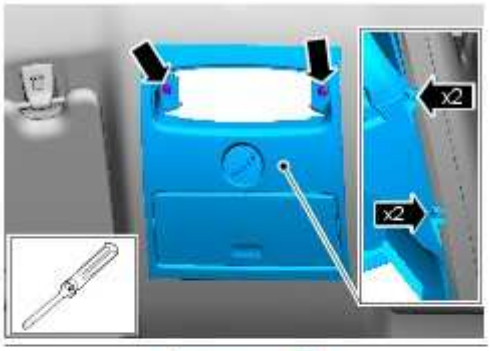
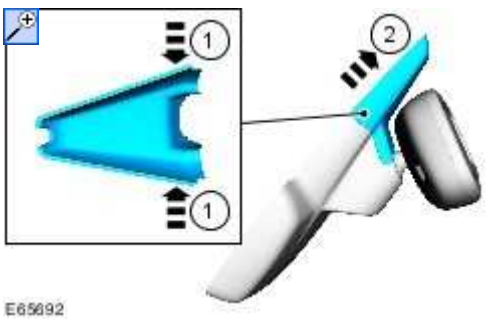
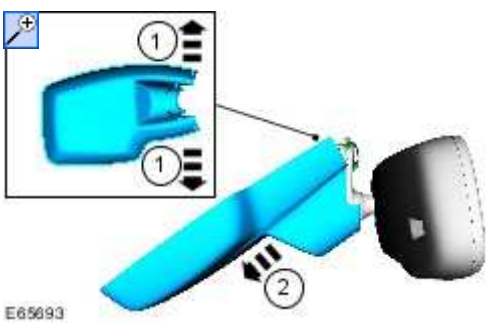
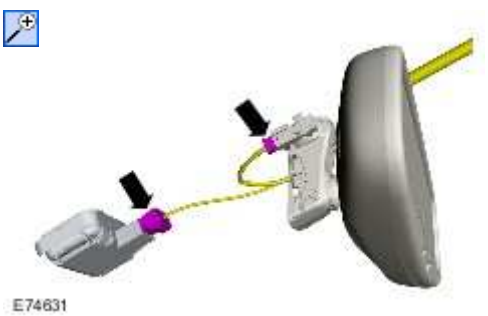




10. If equipped.



11. If equipped.



12. If equipped.

13. On both sides.

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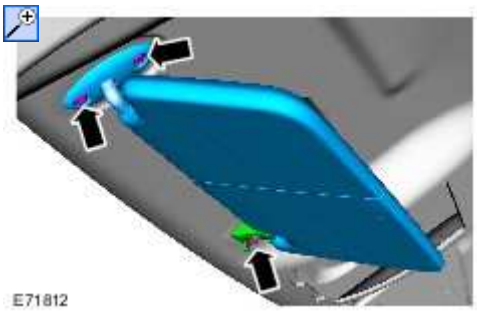
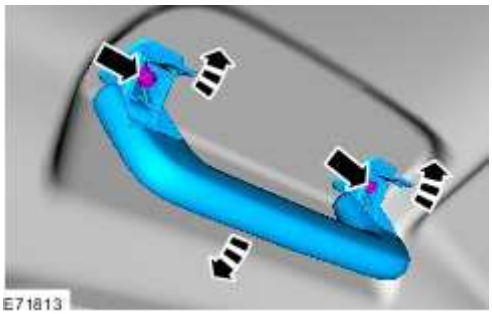
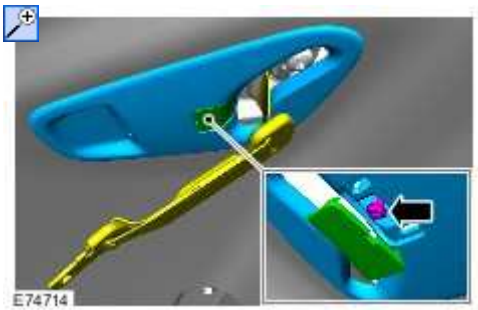
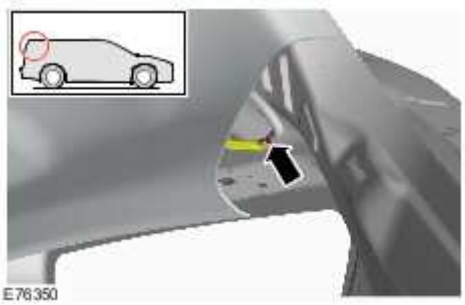




14. On both sides.



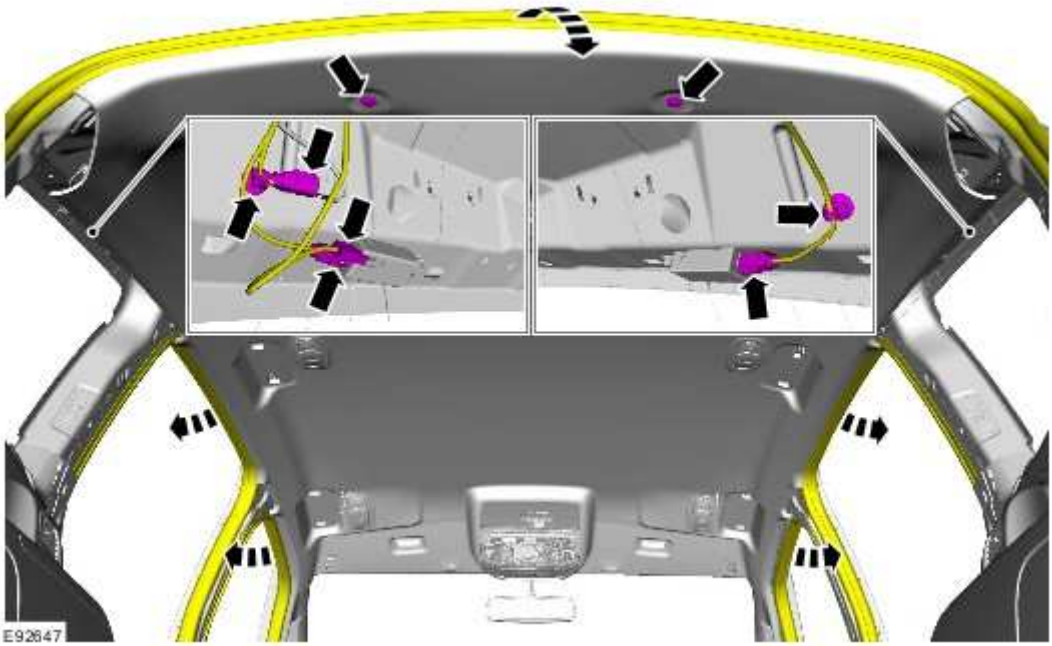
15.



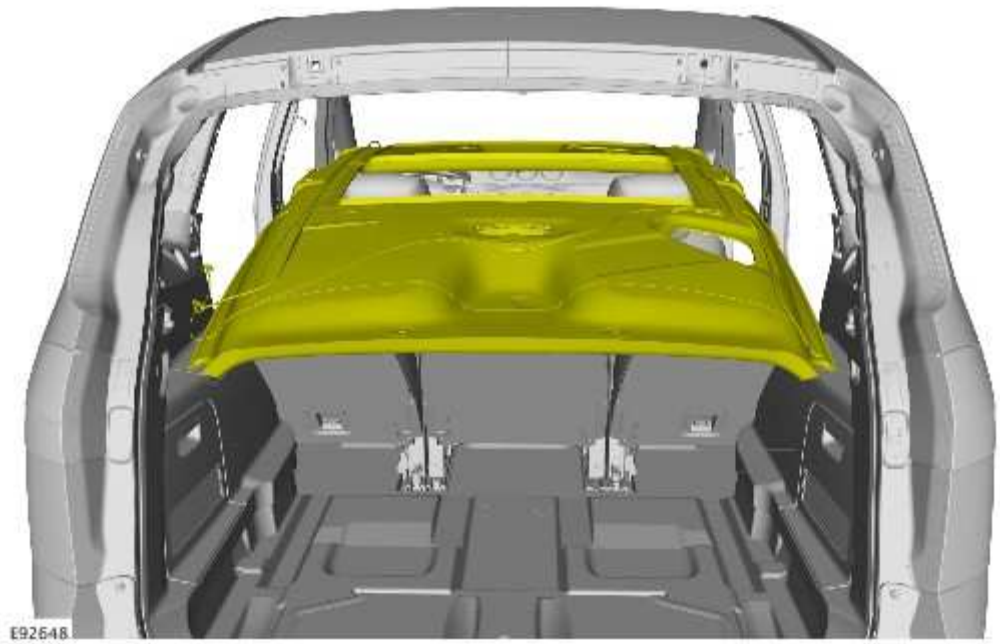
16.

17.

http://vnx.su



18. Recline the front seats backrests.
19. Recline the rear seats backrests.
20. Support the headliner.



Left-hand drive vehicles

21. NOTE: Note the position of each component before removal.

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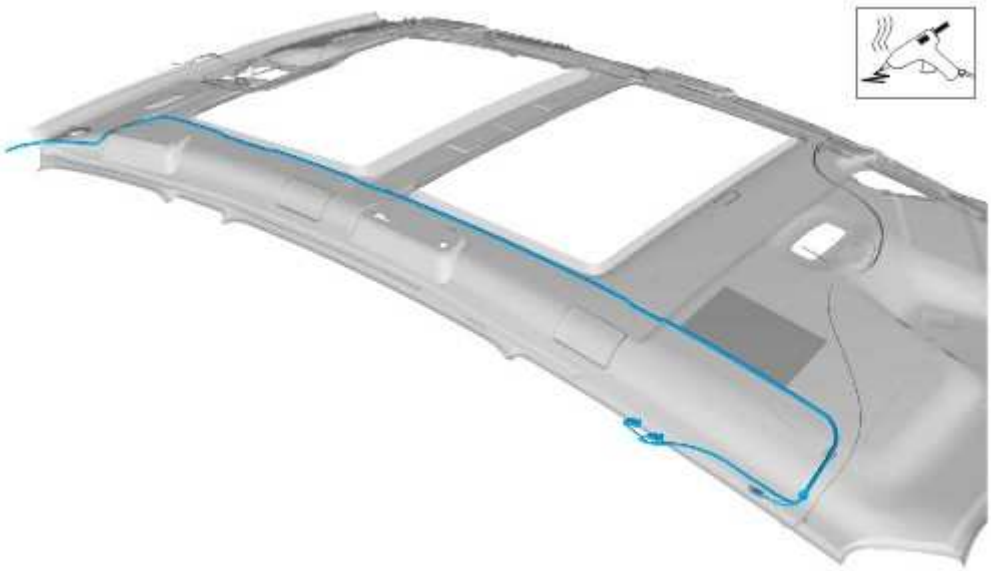
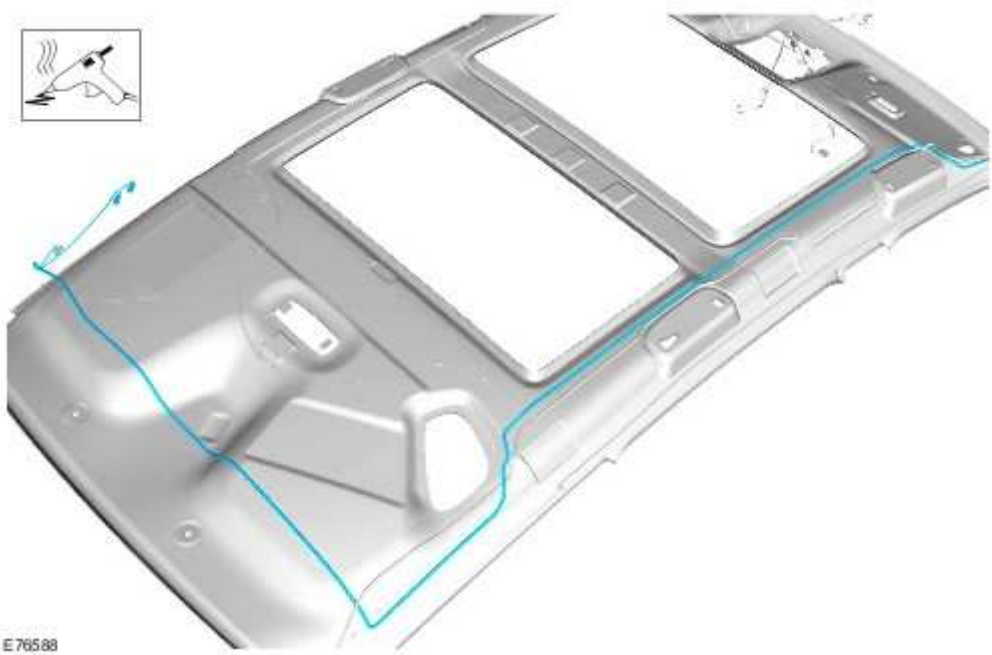


E76587

Right-hand drive vehicles



E76588

22. NOTE: Note the position of each component before removal.

Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the antenna cable to the headliner.
2. To install, reverse the removal procedure.

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Removal and Installation

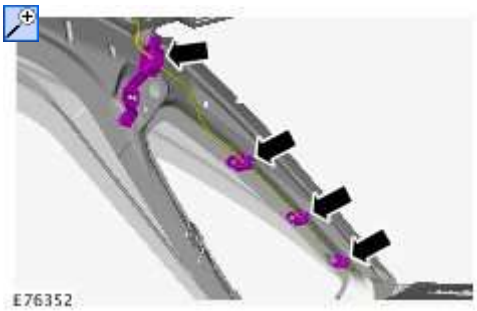
General Equipment

Flat-bladed screwdriver

Removal

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

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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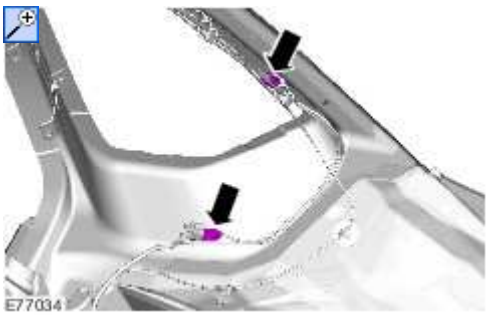
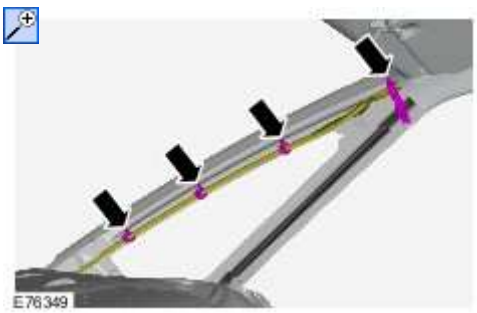


3.



4.

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

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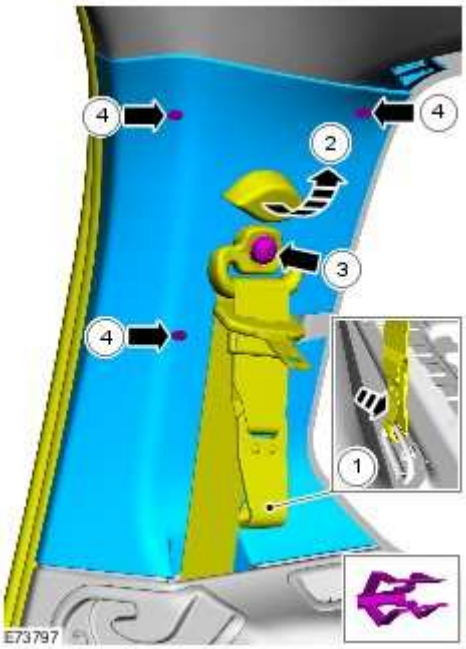

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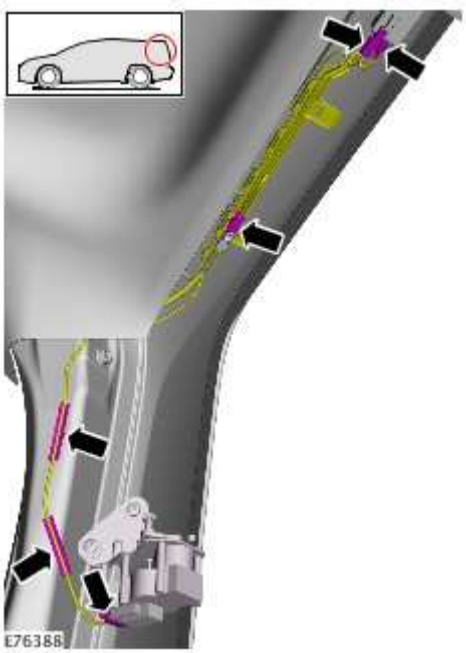
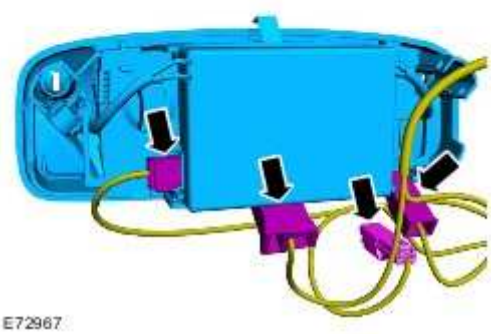


9.

http://vnx.su

10. *General Equipment:* Flat-bladed screwdriver



11.

12. If equipped.

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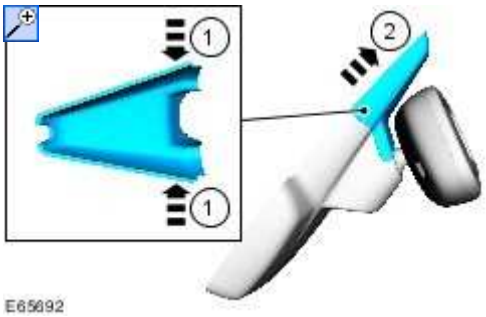
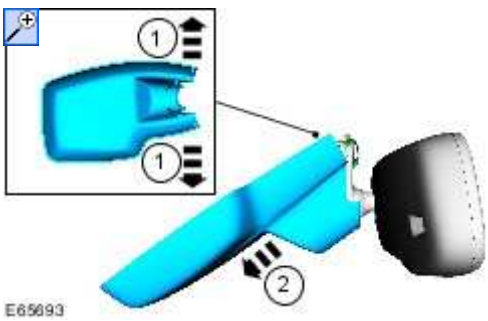
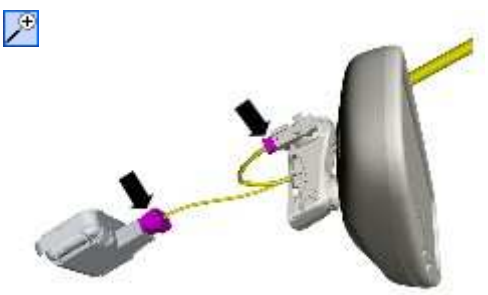


E65892

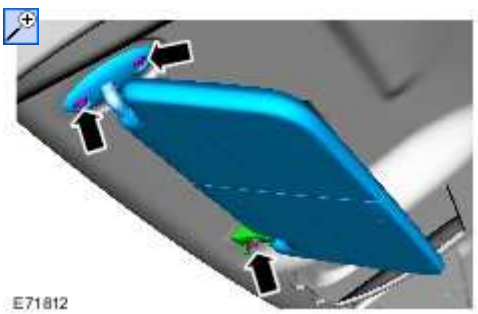


E65893

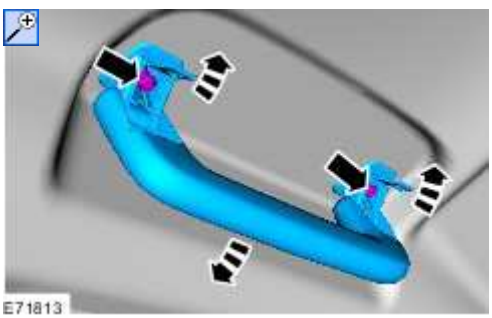
13. If equipped.


E74631

14. If equipped.


E71812

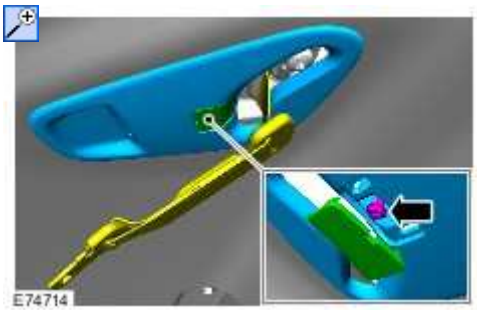
15. On both sides.

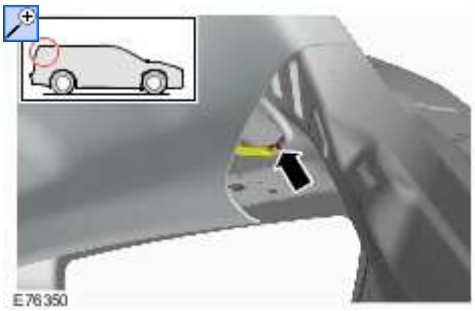

E71813

16. On both sides.

17.

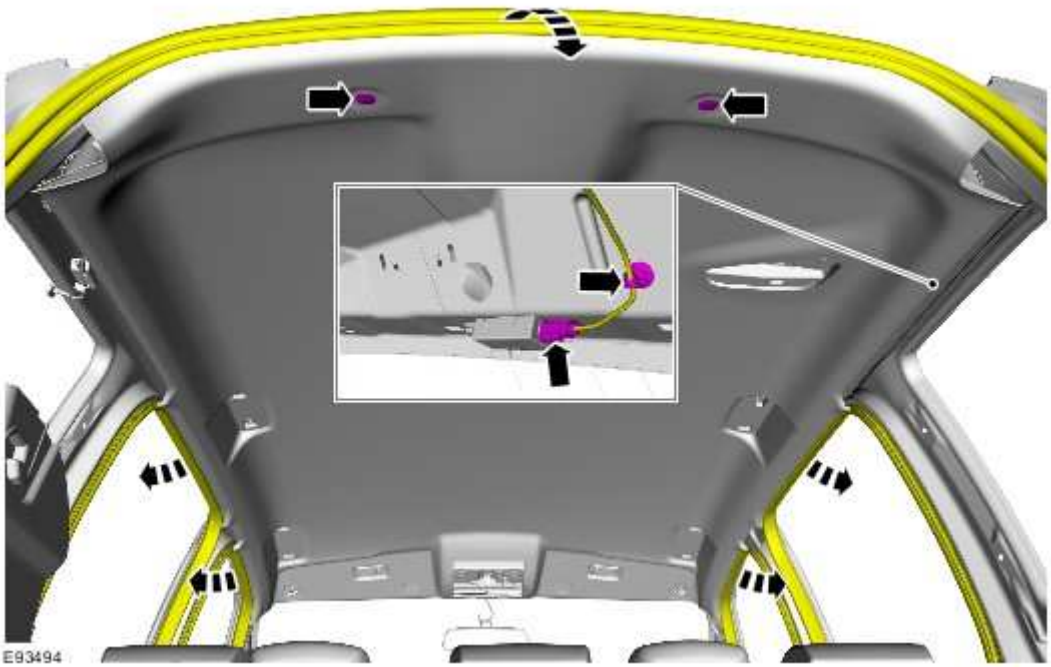
http://vnx.su





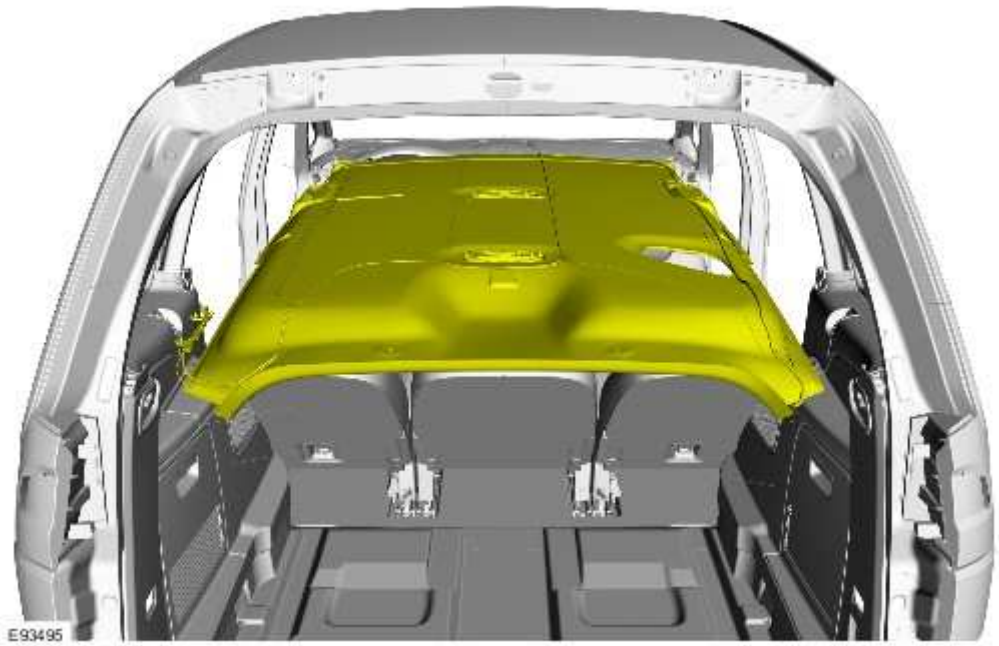
18.

19. Recline the front seats backrests.
20. Recline the rear seats backrests.
21. Support the headline

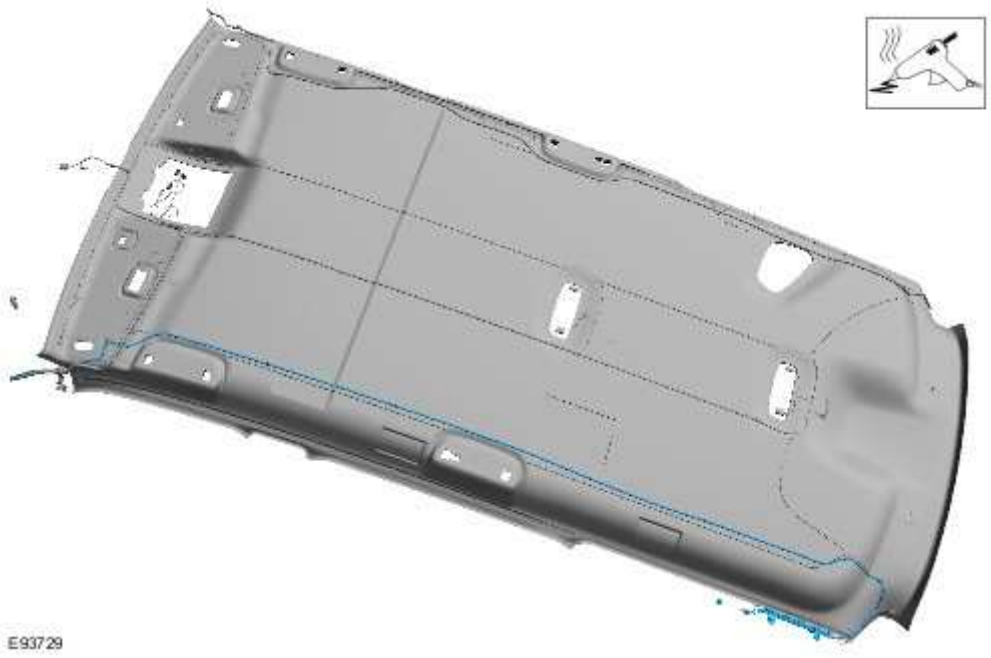


22.

http://vnx.su



Left-hand drive vehicles



Right-hand drive vehicles

23. NOTE: Note the position of each component before removal.

24. NOTE: Note the position of each component before removal.

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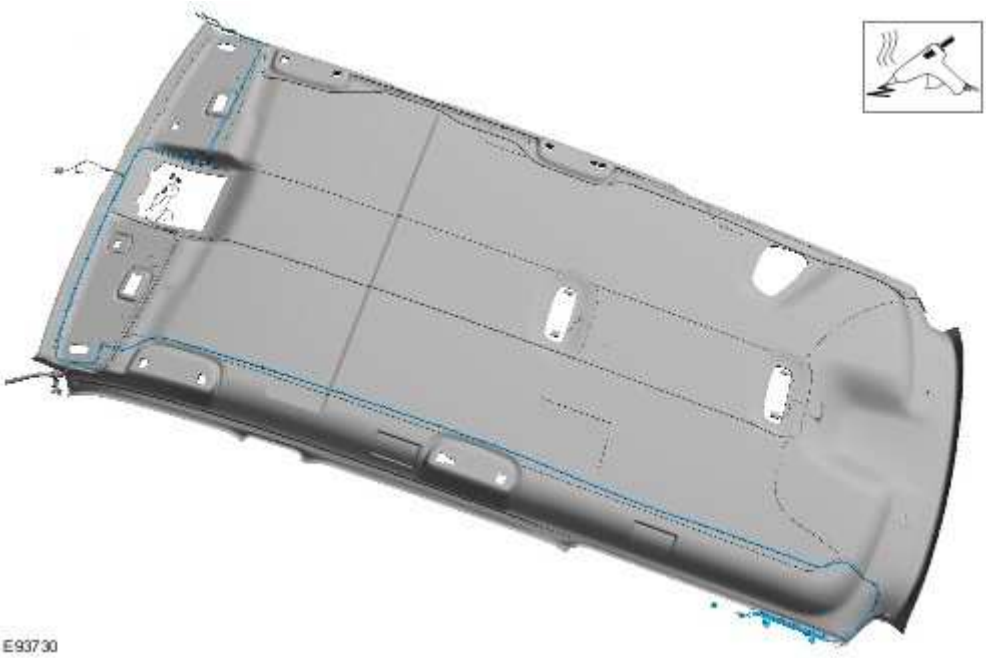

Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the antenna cable tc the headliner.
2. To install, reverse the removal procedure.

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Removal and Installation

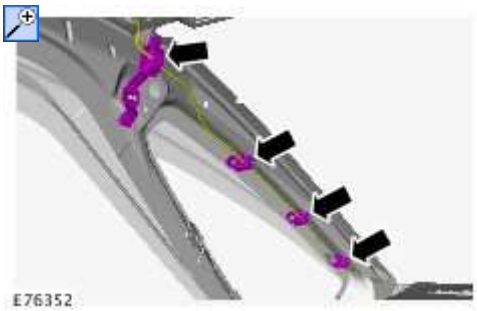
General Equipment

Flat-bladed screwdriver

Removal

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

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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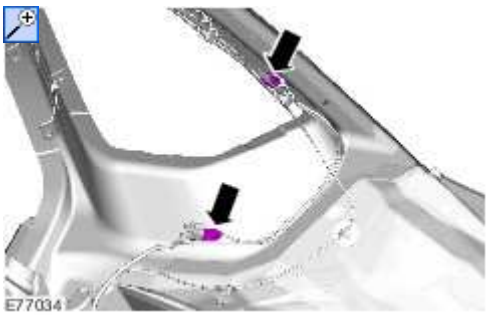

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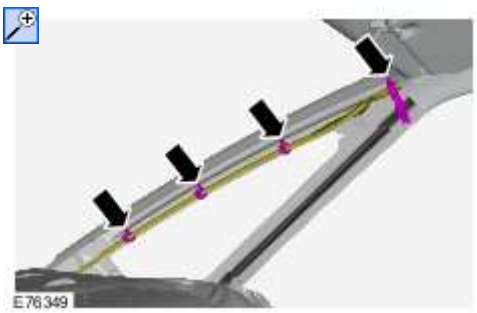
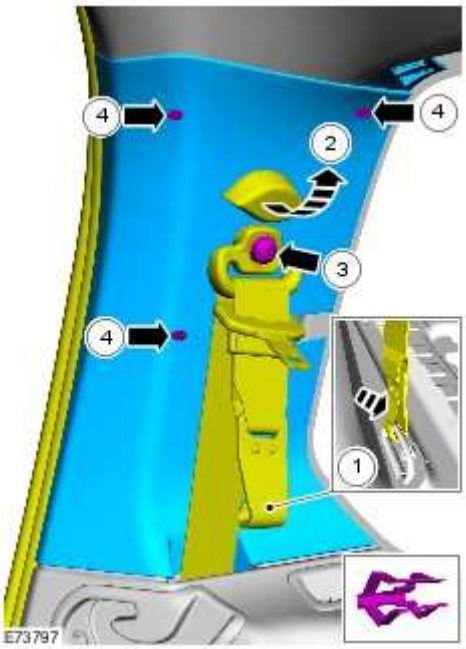


4.

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

http://vnx.su



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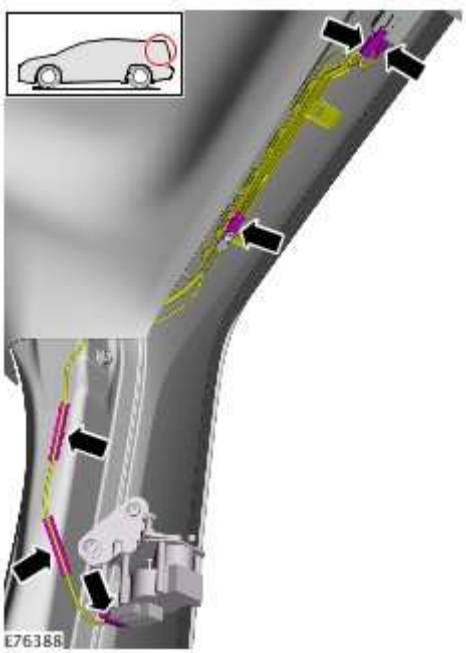
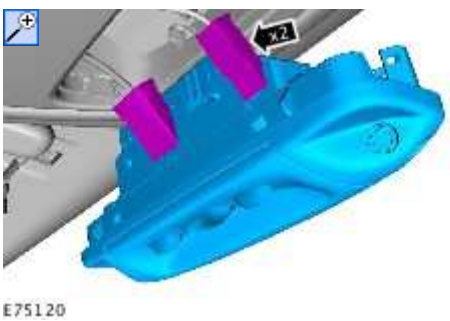


9.

http://vnx.su

10. *General Equipment:* Flat-bladed screwdriver



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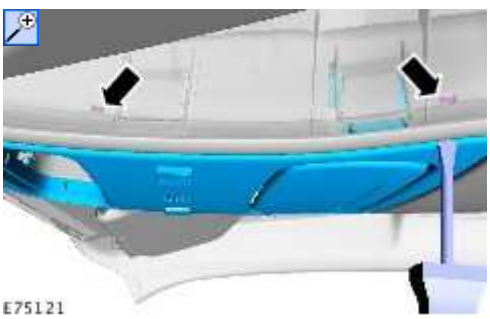
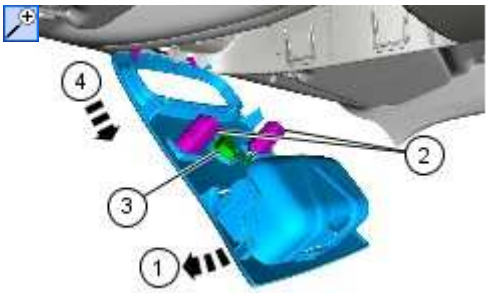


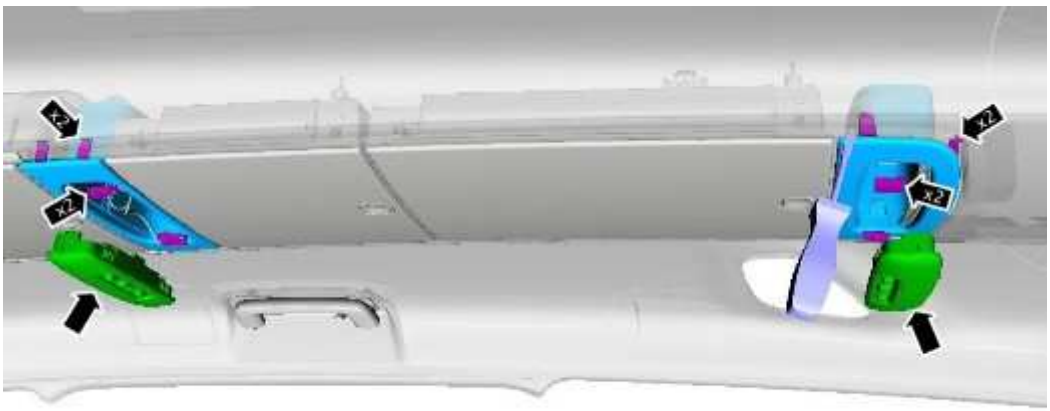
12. *General Equipment:* Flat-bladed screwdriver

13.

http://vnx.su

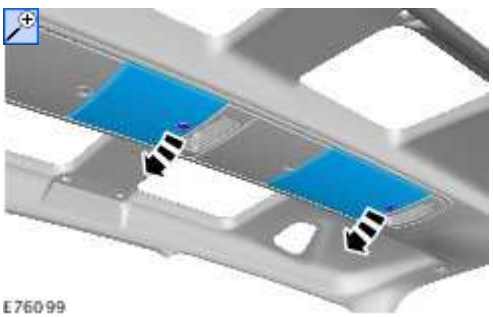


E75122



E75123

14. *General Equipment* Flat-blade screwdrive



E76099

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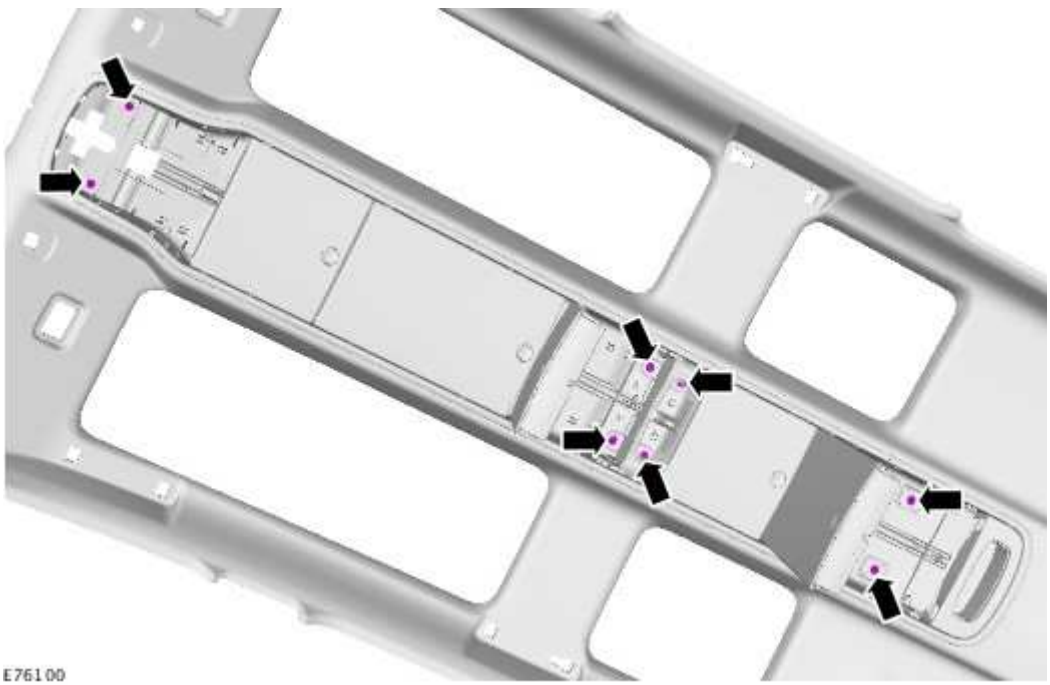
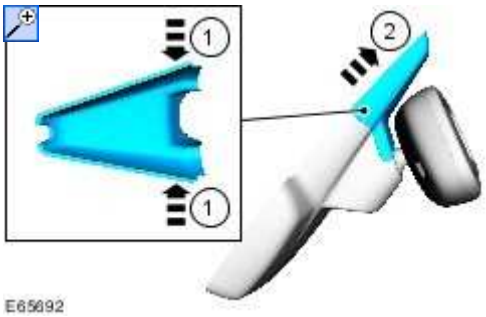


E76100

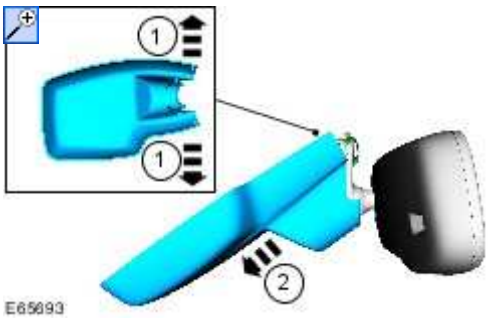
16.

17. If equipped.

http://vnx.su

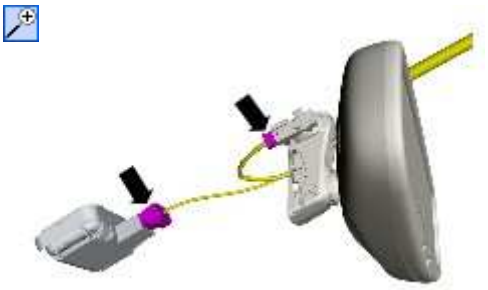


E65892

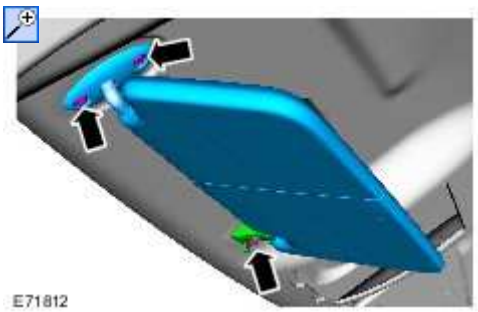


E65893

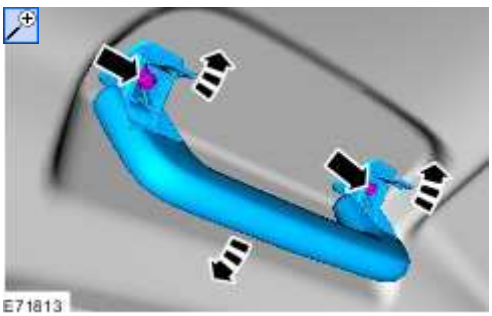
18. If equipped.


E74631

19. If equipped.


E71812

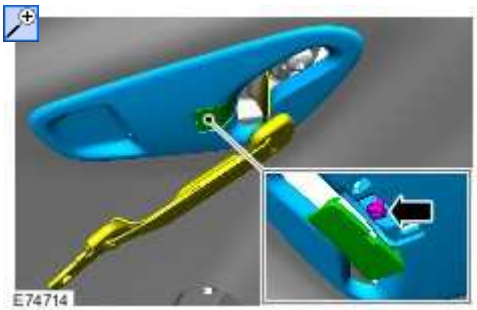
20. On both sides.

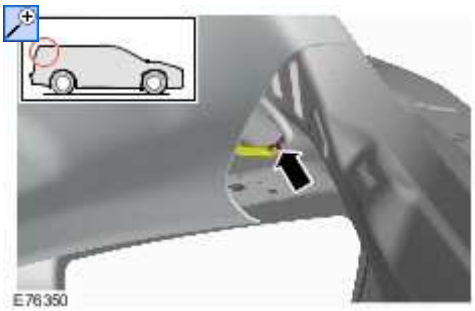

E71813

21. On both sides.

22.

http://vnx.su





23.

24. Recline the front seats backrests.
25. Recline the rear seats backrests.
26. Support the headliner.

27.

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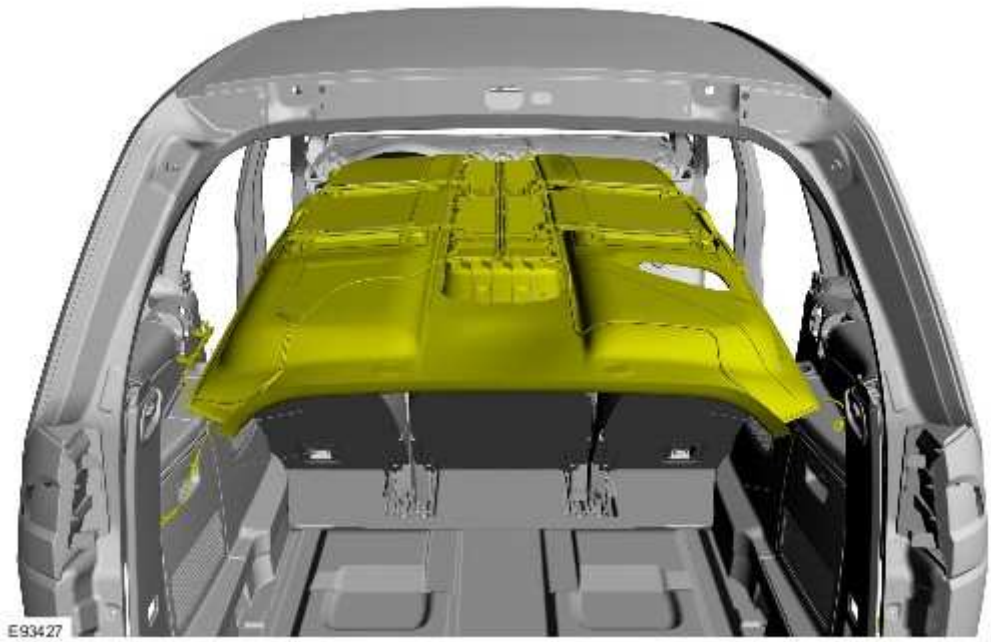
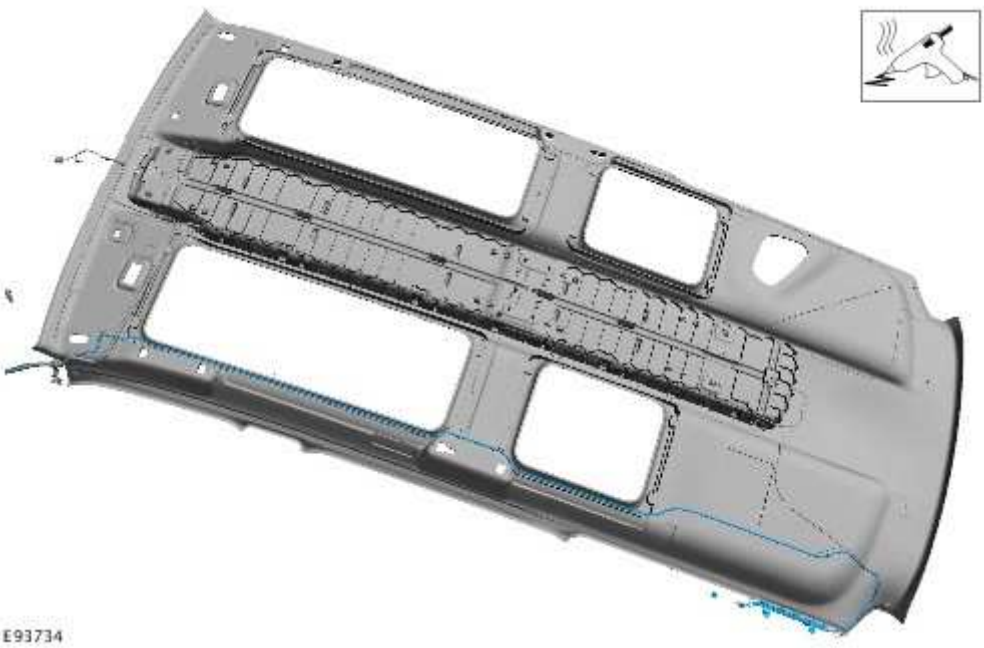


Left-hand drive vehicles



Right-hand drive vehicles

28. NOTE: Note the position of each component before removal.

29. NOTE: Note the position of each component before removal.

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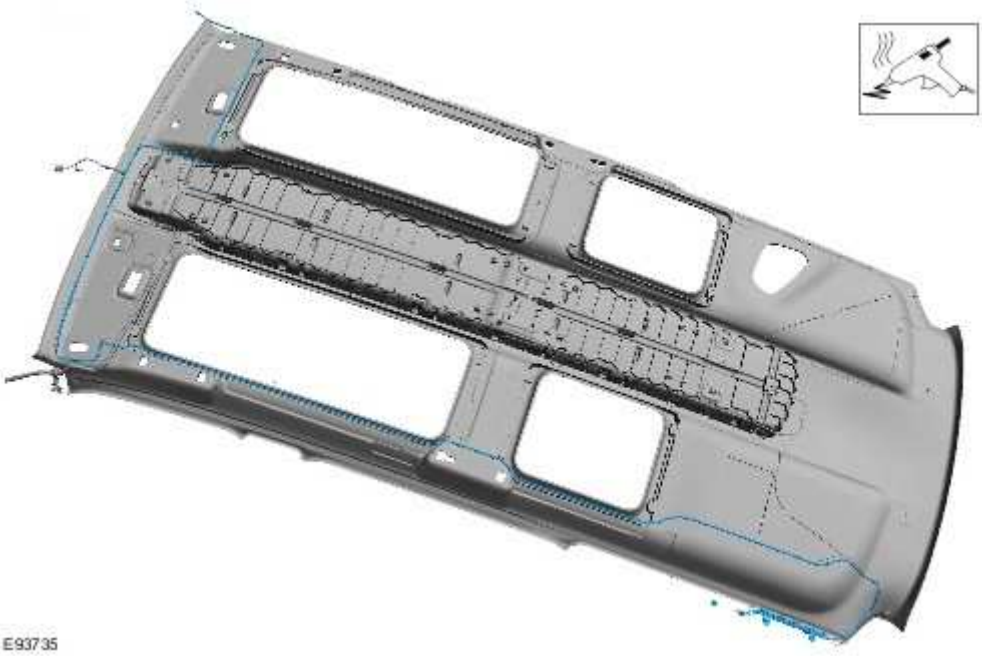

Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the antenna cable tc the headliner.
2. To install, reverse the removal procedure.

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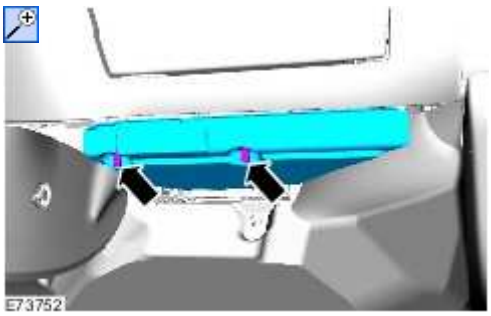
Print

Removal and Installation

Removal

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

Vehicles with glove compartment cooling



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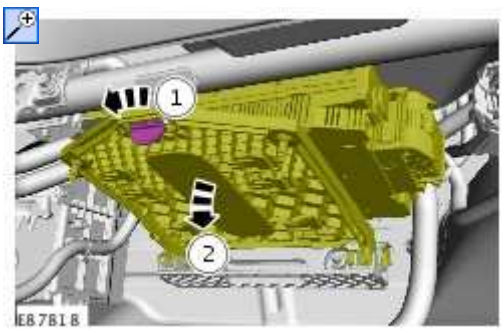
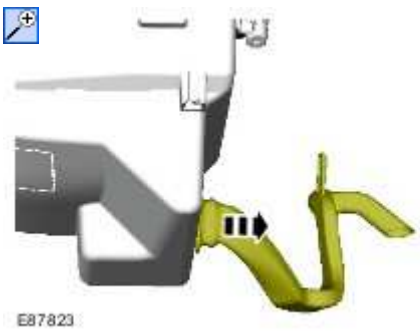


2.

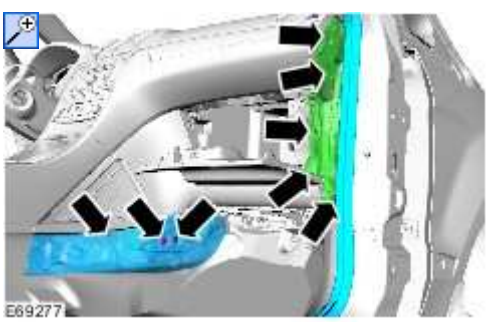


3.

Vehicles with DVD navigation system with Touchscreen

4. Refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).

All vehicles



5.

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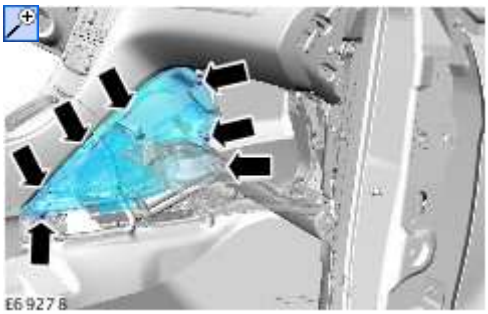

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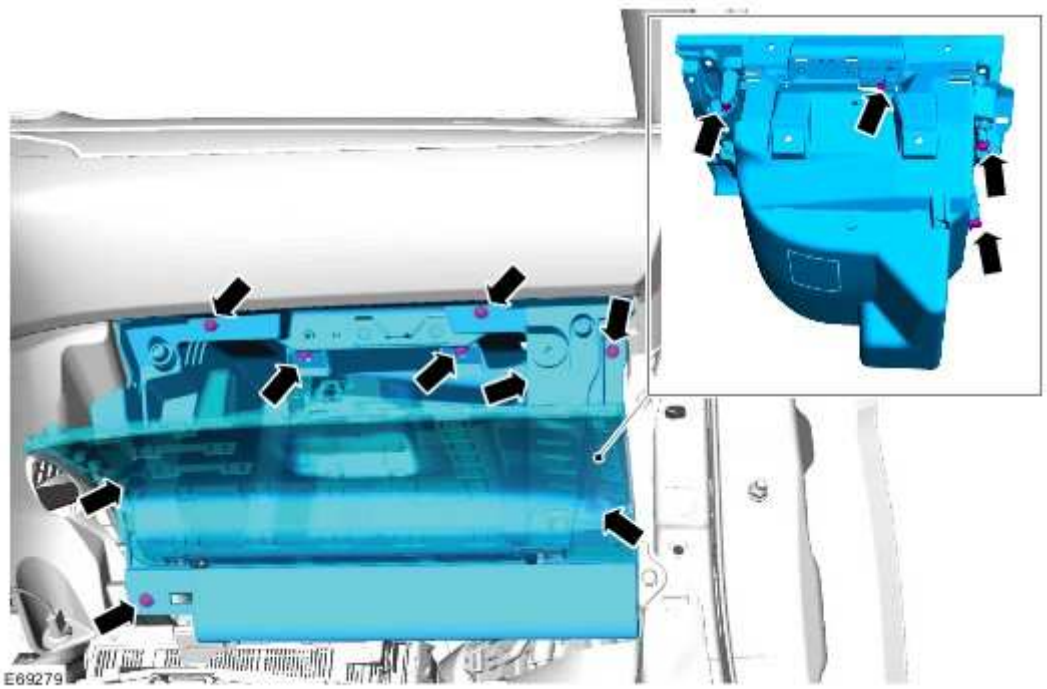

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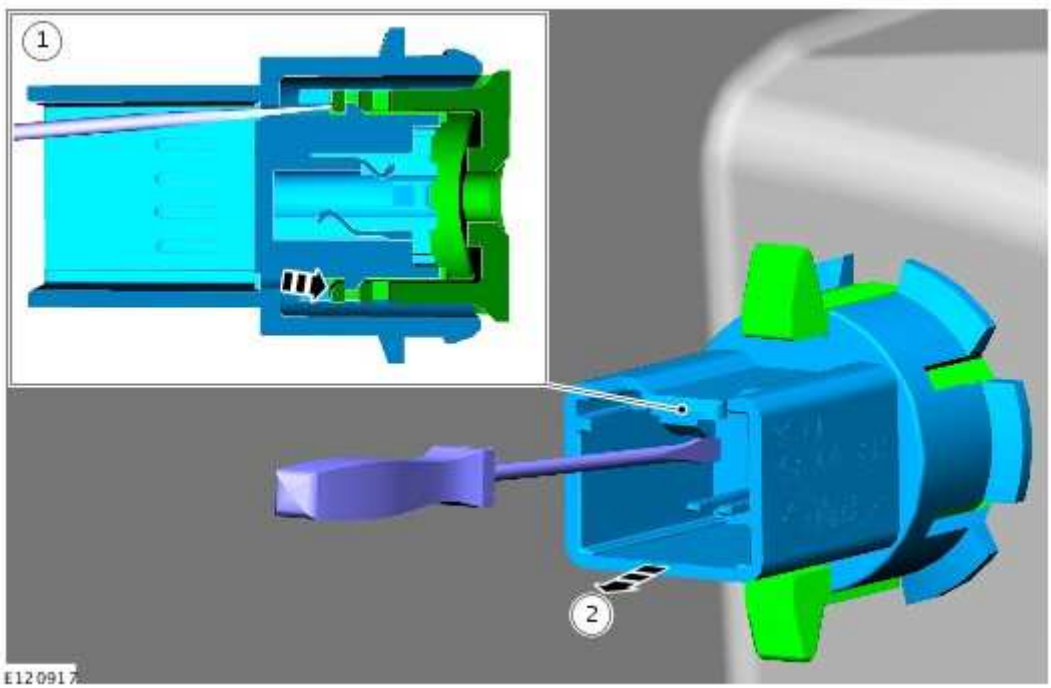

8.

Installation

1. To install, reverse the removal procedure.

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Print

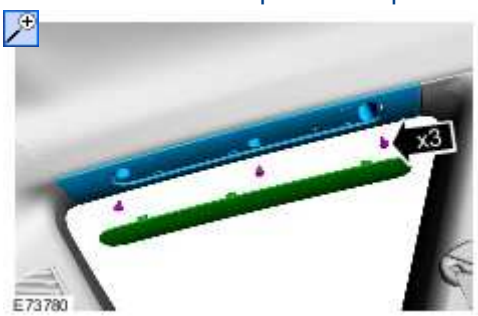
Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

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



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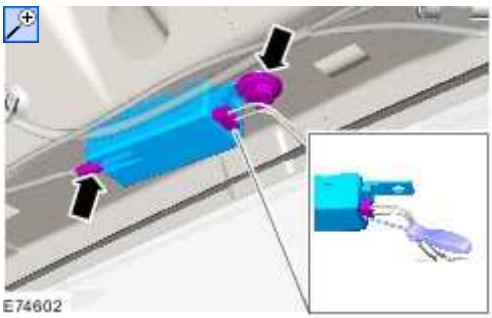

2. *General Equipment:* Flat-bladed screwdriver

Installation

1. To install, reverse the removal procedure.

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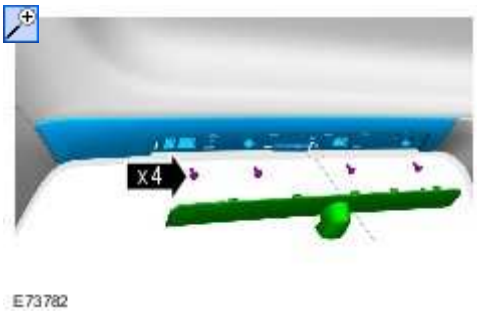
Print

Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal



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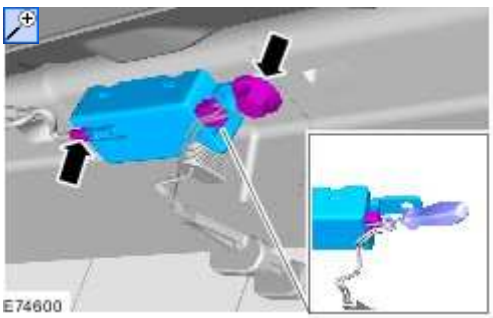

2. *General Equipment:* Flat-bladed screwdriver

Installation

1. To install, reverse the removal procedure.

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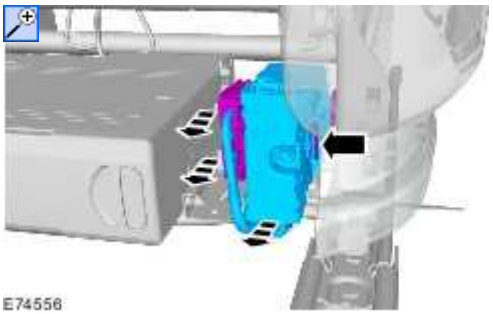
Removal and Installation

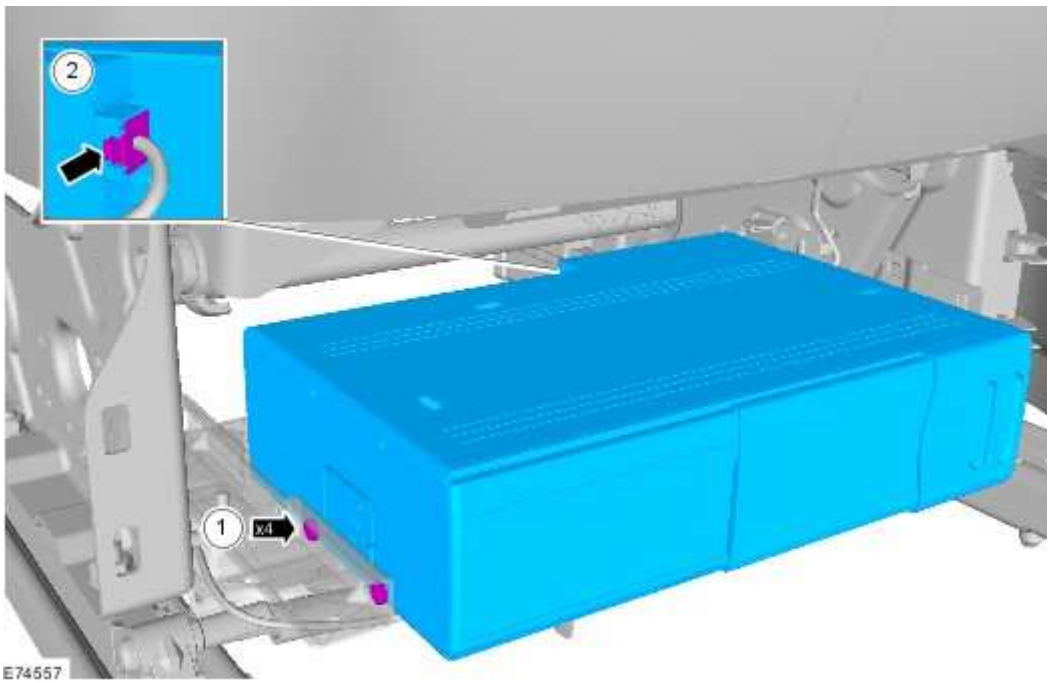
General Equipment

Worldwide Diagnostic System (WDS)

Removal

1. Remove the CD changer magazine from the CD char
2. Slide the passenger side front seat assembly back fu
3.





4. CAUT
Take extra care not t damage th wiring harnesses

Installation

1. NOTE: New units must be configured using the Programmable Module Installation Routine in the Worldwide Diagnostic System (WDS).
To install, reverse the removal procedure.

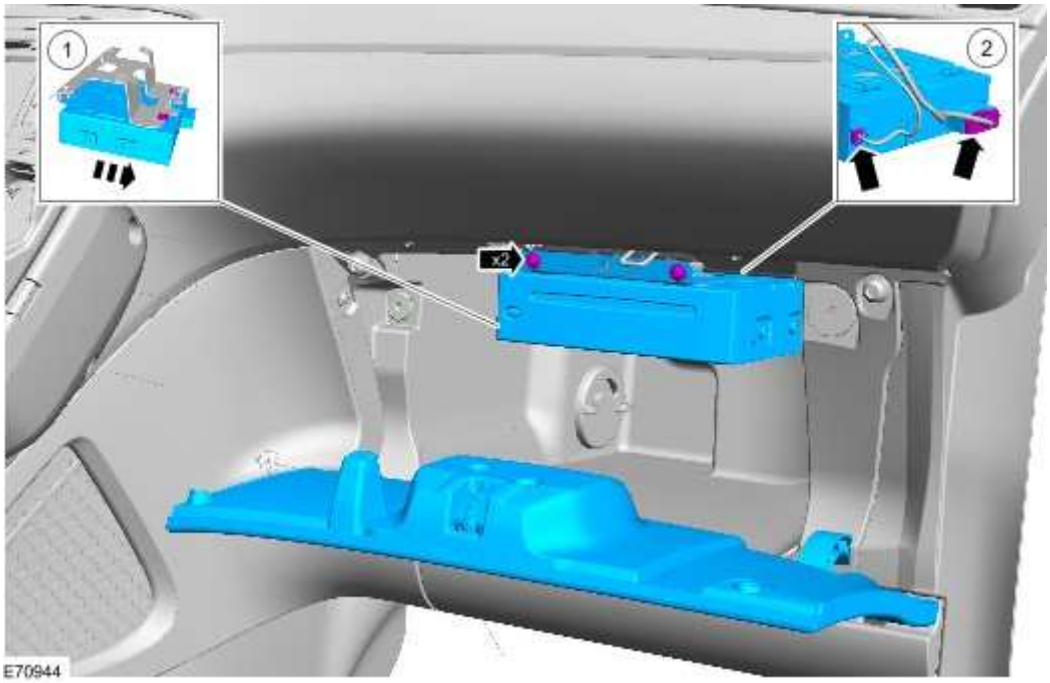
General Equipment: Worldwide Diagnostic System (\

http://vnx.su

Removal and Installation

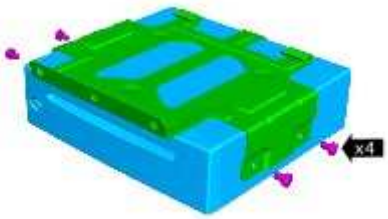
Removal

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



1. CAUT
   Take extra care not t damage th wiring harnesses
   Torque: 5

2. *Torque:* 5 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new navigation system DVD unit is installed, a destination must be inputted into the navigation syst display module and the vehicle must be driven until route guidance is initiated.

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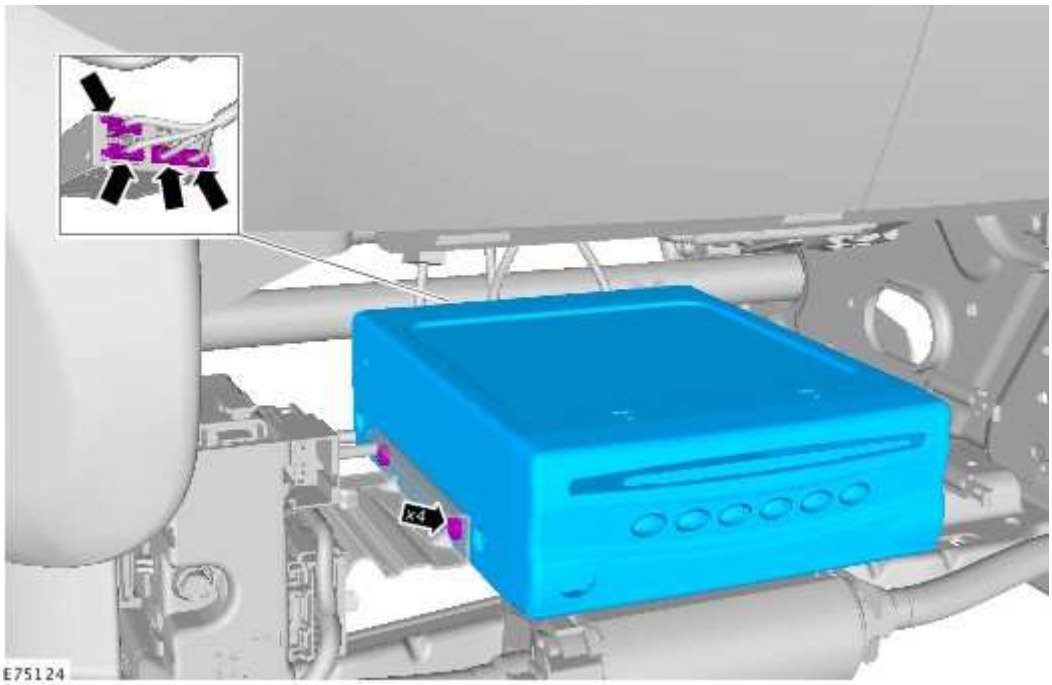
Removal and Installation

Removal

1. Slide the passenger front seat assembly fully rearwa



2. CAUT
Take extra
care not t
damage th
wiring
harnesses

Installation

1. To install, reverse the removal procedure.

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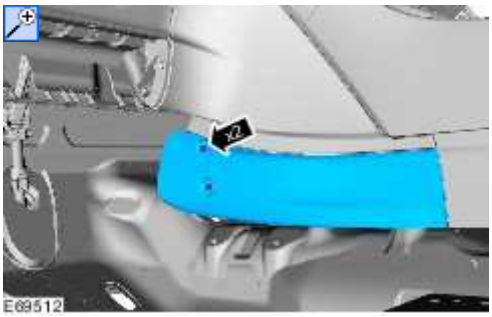
Print

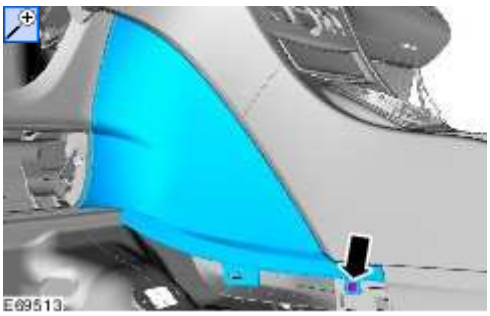
Removal and Installation

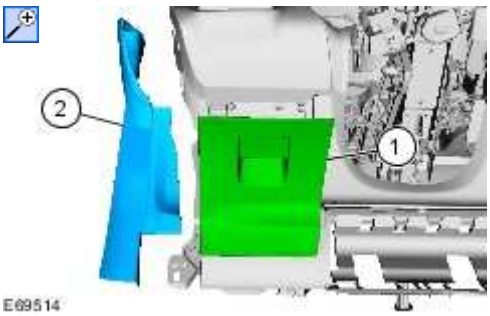
Removal

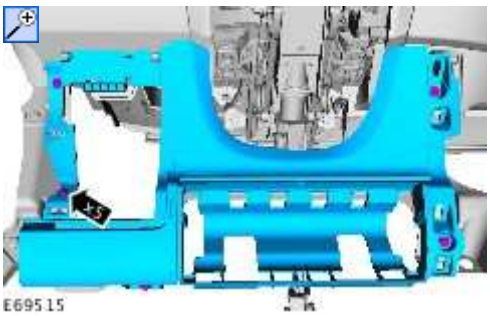
1. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

2. 

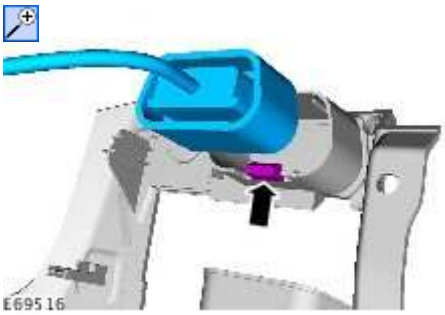
3. 

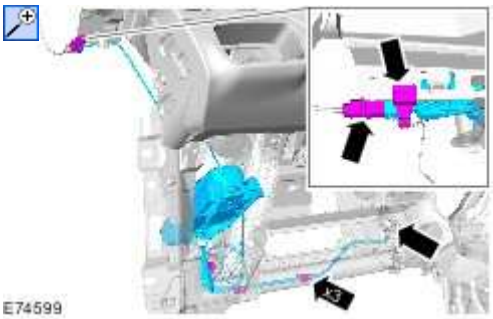
4. 

5. 

6.

http://vnx.su





7.

Installation

1. CAUTION: Make sure that no part of the wiring harness is trapped.
   To install, reverse the removal procedure.

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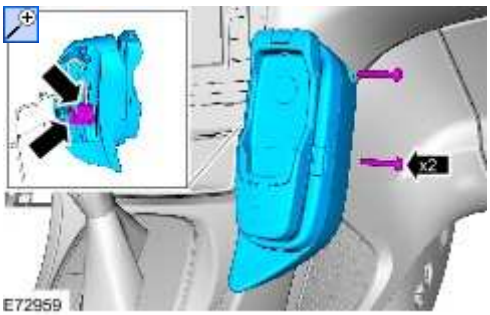
Print

Removal and Installation

Removal

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



1. CAUTION: Take extra care not to damage the wiring harnesses.
   Torque: 3 Nm

Installation

1. CAUTION: Make sure that no part of the wiring harness is trapped.
   To install, reverse the removal procedure.

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Print

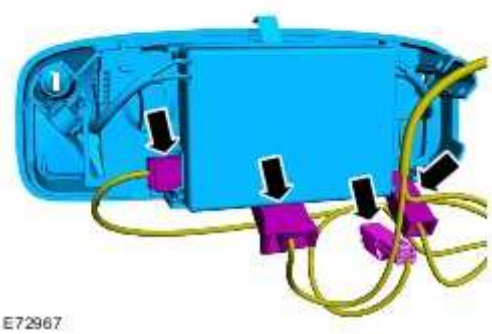
Removal and Installation

General Equipment

Flat-bladed screwdriver

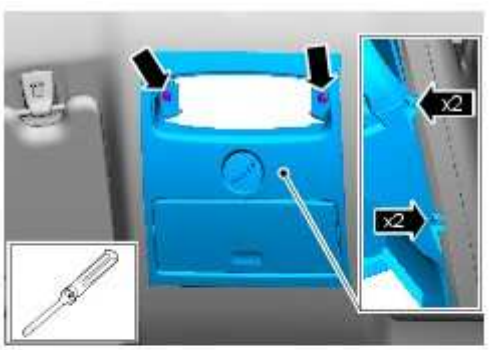
Removal

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



E72967

1. *General Equipment:* Flat-bladed screwdriver

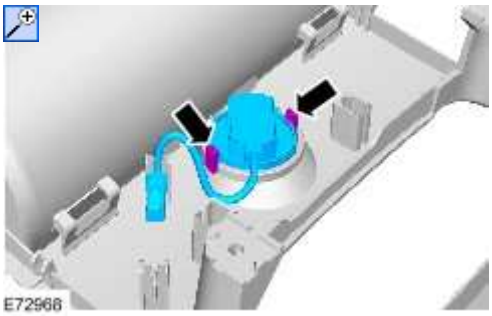


E72966

2. *Torque:* 2 Nm

3.

http://vnx.su



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

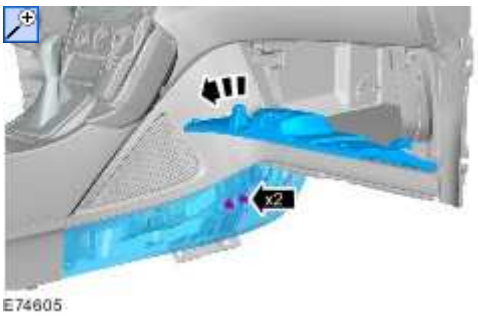
NOTE: Removal steps in this procedure may contain installation details.

Vehicles with navigation system

1. Remove the navigation system digital versatile disc (DVD) unit.

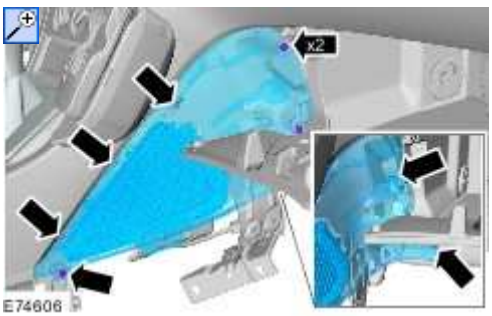
   Refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).

All vehicles



E74605

2.



E74606

3.

4.

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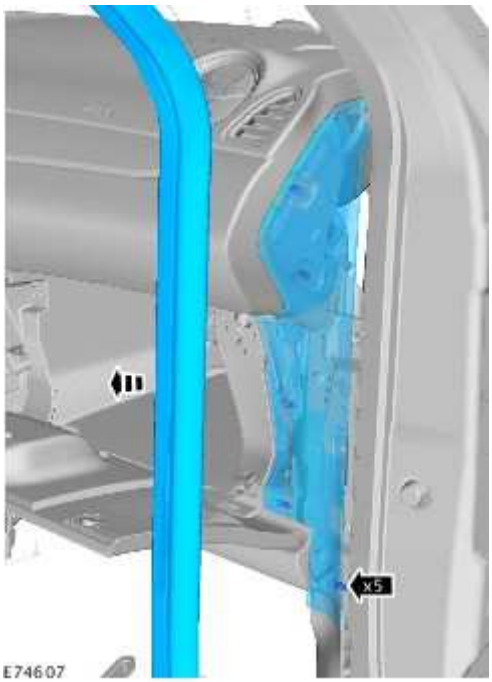
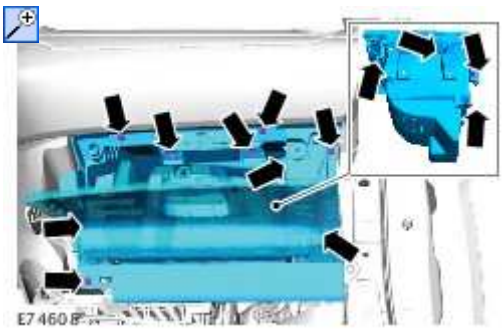
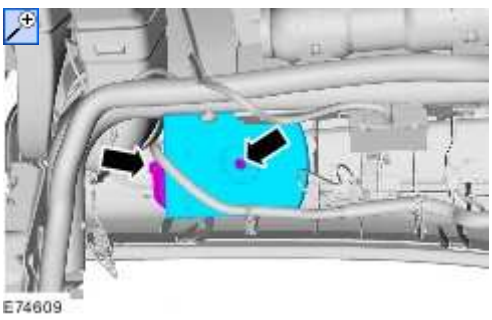




5. CAUTION: Take extra care not to damage the wiring harnesses.



6. *Torque:* 2 Nm

Installation

1. CAUTION: Make sure that no part of the wiring harness is trapped.
   To install, reverse the removal procedure.

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Removal and Installation

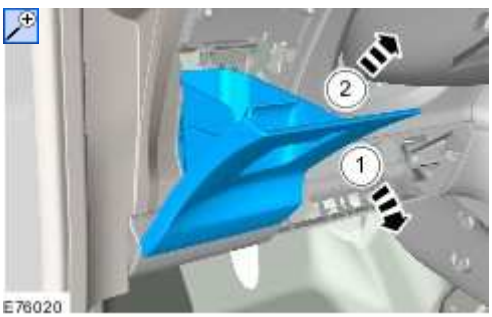
Removal

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

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles With: Travel Pilot EX (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
2. Remove the handset holder.

   Refer to: Handset Holder - Vehicles Without: Voice Control (415-01 Information and Entertainment System, Removal and Installation).
3. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).
4. 

5.

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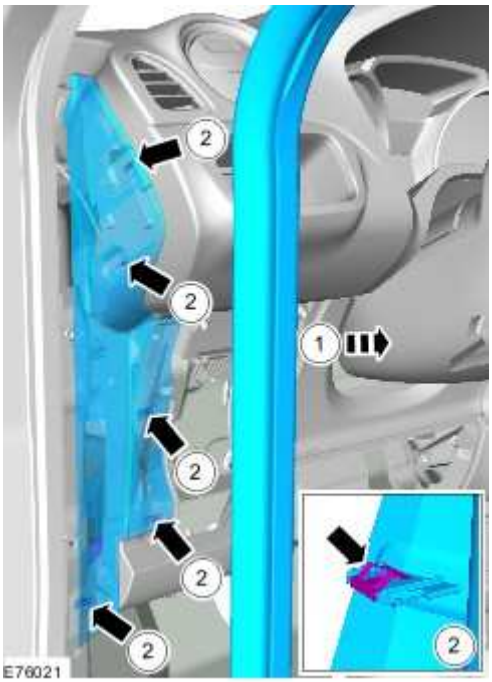

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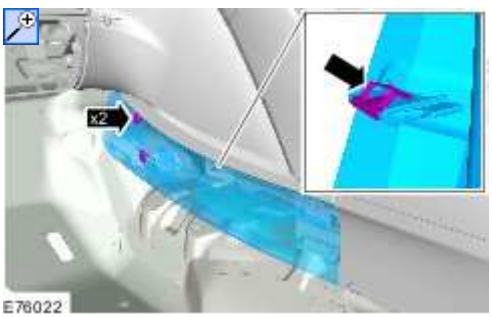

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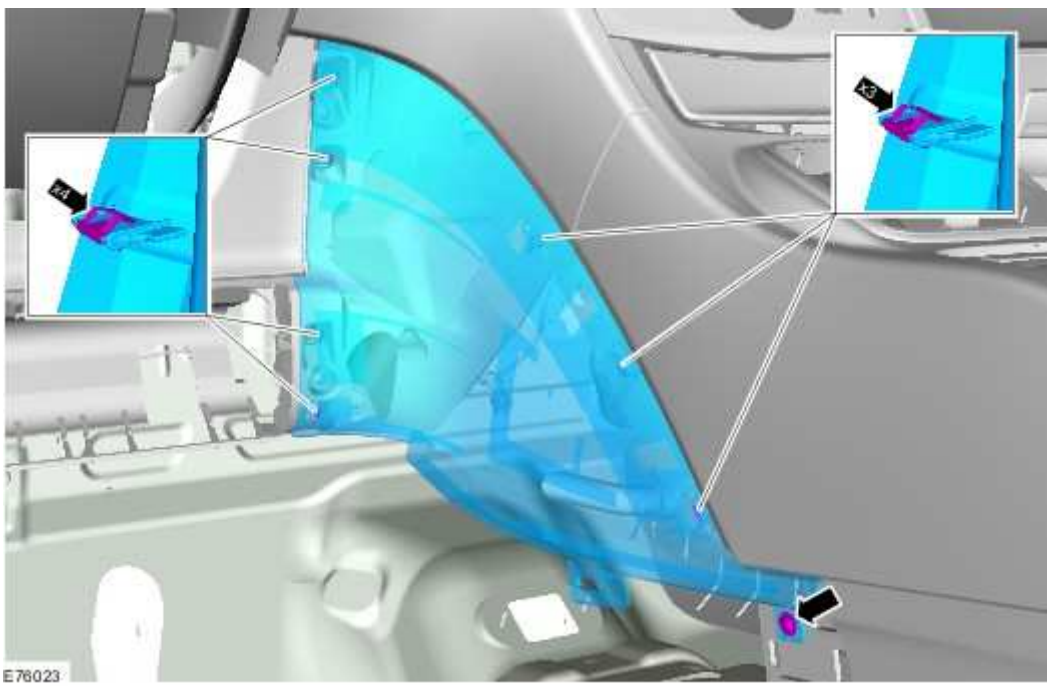

8.

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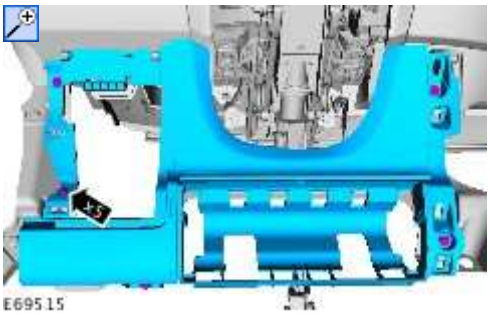

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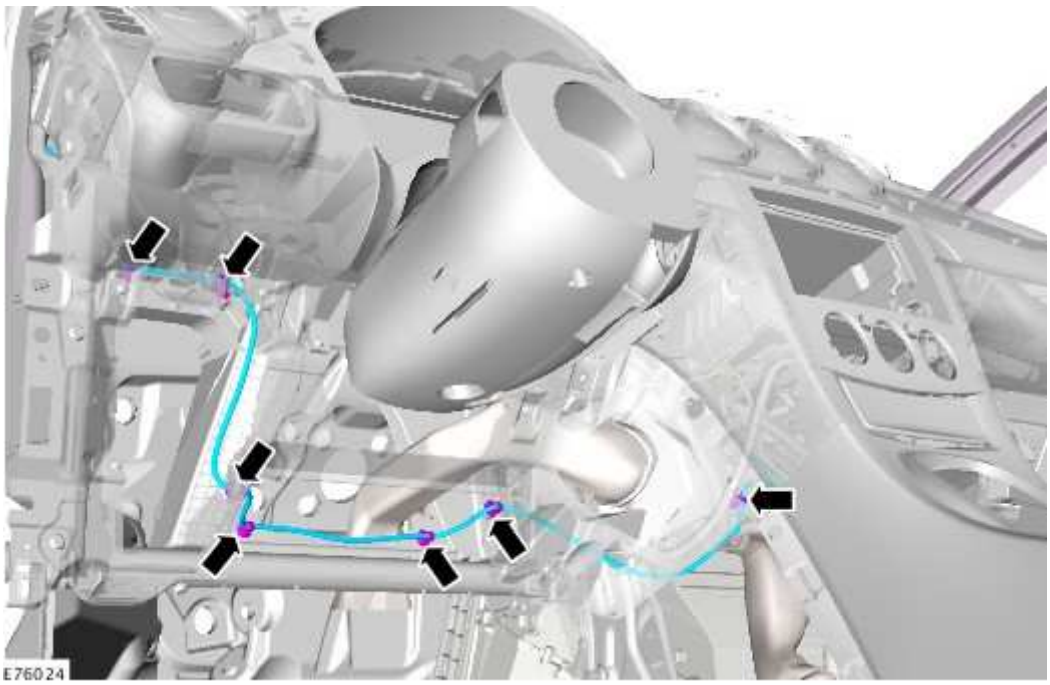

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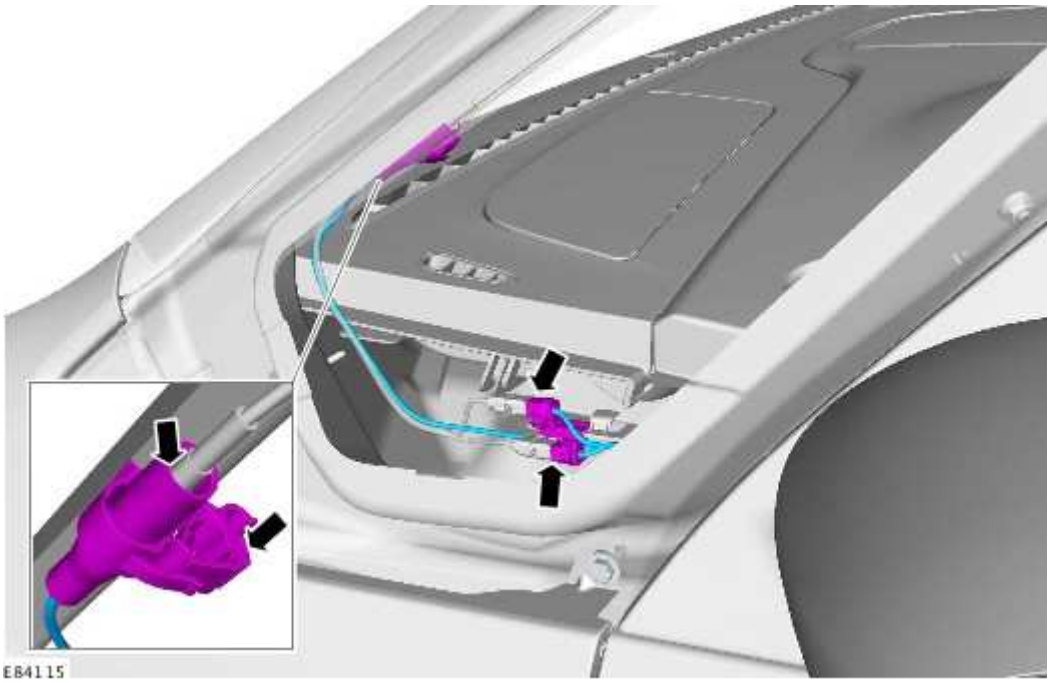

11. Remove the audio unit antenna to connector cable.

Refer to: Audio Unit Antenna to Connector Cable - VIN Plate Body Style Code: S (415-01 Information and Entertainment System, Removal

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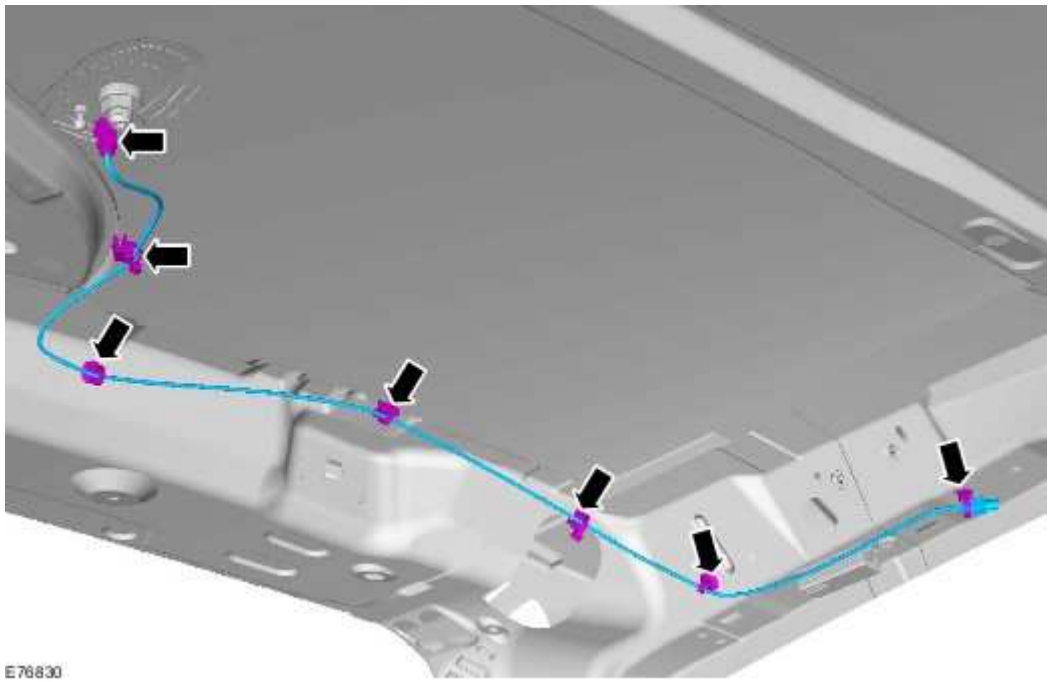
and Installation).

12.



Installation

1. To install, reverse the removal procedure.

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Headlamp Adjustment Setting

	Adjust
Headlamp	X = 10 cm/10 m = 0 34' = 1.0 %

Front Fog Lamp Adjustment Setting

	Adjust
Front fog lamps	X = 22 cm/10 m = 1 16' = 2.2 %

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Description and Operation

Conventional headlamps

E69422

Item	Part Number	Description
1	-	Turn signal lamp
2	-	Main beam headlamps
3	-	Dipped beam headlamps

The headlamp units are primarily made of plastic and make use of free-form reflectors in order to optimize light distribution.

The transparent plastic cover is made from polycarbonate, which is coated for protection against scratches and cracks.

In the event of damage to the cover the entire headlamp unit needs to be replaced.

The headlamp unit also houses the turn signal lamp and the main beam headlamp.

The manual headlamp leveling control is activated via an electric motor which is controlled via a rotary regulator in the light switch.

The headlamp leveling positioning motor cannot be replaced by itself. If necessary, it needs to be replaced together with the complete headlamp unit.

For conventional headlamps, adapting the vehicle to conform to country-specific traffic situations (left/right-hand side traffic) during travel is accomplished by affixing punched adhesive strips to specific areas of the headlamp.

All conventional headlamps use 12 V bulbs with a spiral-wound filament.

Lamp	Bulb	Current draw	Bulb color
Dipped beam headlamps	H7	55W	Clear
Main beam headlamps	H1	55W	Clear
Turn signal lamp	PY21W	21W	Orange

Projection headlamps with dynamic adaptive front lighting and cornering lights

E69423

Item	Part Number	Description
	-	

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1		Turn signal lamp
	2 -	Main beam headlamps
3	-	Dipped beam headlamps
4	-	Adaptive front light

Lamp	Bulb	Current draw	Bulb color
Dipped beam headlamps	H7	55W	Clear
Main beam headlamps	H1	55W	Clear
Adaptive front light	H1	55W	Clear
Turn signal lamp	PY21W	21W	Orange

Vehicles with conventional lighting can be optionally equipped with adaptive front lighting. In this case the dipped beam headlamps are implemented with a projection lens. The system is not compatible with automatic headlamp inclination and only works when the lights are switched on.

When the dipped beam headlamps are in use only the projection headlamp is active. In full beam mode the full beam headlamps and the dipped beam headlamps are used.

While cornering, the dipped beam projectors swivel toward the inside of the bend, whereby the maximum attainable correction angles are 9° for the projector on the outside of the bend and 14° for the projector on the inside of the bend.

When reverse is engaged, adaptive front lighting is disabled. When reverse gear is disengaged again and the vehicle moves at a speed above 3 km/h, the adaptive front lighting follows the relevant steering movements.

During parking maneuvers at speeds of less than 3 km/h the adaptive front lighting does is not activated in order to prevent dazzling oncoming traffic when the steering wheel is being turned from one side to the other.

The adaptive front lighting actuator motors are stepper motors.

The headlamp leveling positioning motor cannot be replaced by itself. If necessary, it needs to be replaced together with the complete headlamp unit.

The headlamp leveling system motors are DC motors.

Before performing the headlamp alignment, check the steering with the aid of the Worldwide Diagnosis System (WDS). To do this, the headlamp leveling must be set to "0" and the steering wheel must be in the "0" position (+/- 3°).

System error

In the event of any system error(s) in the adaptive front lighting actuating motors the error message "Advanced Front Light Failure" is displayed on the driver information display in the instrument cluster. In the event of a headlamp leveling motor fault, both headlamps are moved to the central position by means of the adaptive front lighting actuator motors and they remain in this position. In the event of an adaptive front lighting actuator motor fault, the headlamp leveling motor moves the relevant headlamp to the lowest position where it remains. The intact headlamp is moved to the "0" position by the adaptive front lighting actuator motor.

The adaptive front headlamps can be adapted to different traffic requirements in different countries (e.g. driving on the left/right) by applying pre-cut adhesive template strips to specific areas of the headlamps.

Gas discharge headlamps with adaptive front lighting

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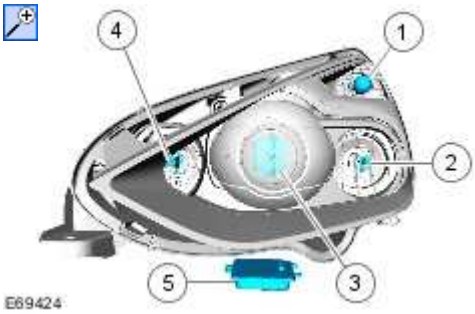

Item	Part Number	Description
1	-	Turn signal lamp
2	-	Main beam headlamps
3	-	Dipped beam headlamps (gas discharge headlamps)
4	-	Adaptive front light
5	-	Gas discharge headlamps module

WARNING: High voltages of up to 30 kV are present in the system. Ensure that the headlamp assembly electrical connector is disconnected if the headlamp assembly is removed.

High intensity discharge headlamps are optionally available.

A single Xenon gas discharge lamp in the center projector is used for both the dipped beam and main beam headlamps.

In main beam mode the 15° aperture required for dipped beam operation is pushed out from the light beam by a positioning motor, as a result of which the full light beam of the gas discharge lamp becomes available.

An additional reflector with a conventional filament bulb is available for main beam operation. This bulb is also switched when the headlamp flashers are used.

The headlamp leveling positioning motor cannot be replaced by itself. If necessary, it needs to be replaced together with the complete headlamp unit.

The gas discharge headlamps can be adapted to different traffic requirements in different countries (e.g. driving on the left/right) by applying pre-cut adhesive template strips to specific areas of the headlamps.

Lamp	Bulb	Current draw	Bulb color
Dipped beam headlamps	D1S	35W	Clear
Main beam headlamps	H1	55W	Clear
Adaptive front light	H1	55W	Clear
Turn signal lamp	PY21W	21W	Orange

Headlamp leveling system

An automatic headlamp leveling system is a legal requirement for vehicles with gas discharge headlamps.

The automatic headlamp leveling system is a second-generation dynamic system which provides additional benefits for the driver in terms of improved illumination of the road due to improved control over the headlamp beam.

In a static system, the vehicle is only considered as a stationary object, whereas a dynamic system also takes into account the dynamic changes to the inclination of the vehicle owing to load changes whilst driving.

The system is designed to respond to changes in the inclination of the vehicle caused by the long-term effects of aerodynamic forces acting on the vehicle (e.g. due to continuous

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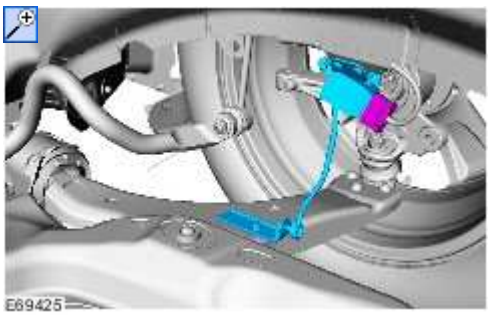
driving at high speeds).

In order to prevent unnecessary changes in the height of the headlamp beam, the system filters out surface irregularities and any pitching of the vehicle under braking and acceleration.

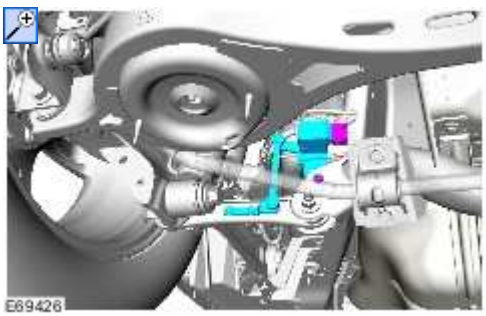
The following components are part of the headlamp leveling system:

- Control module
- Actuator motors for headlamp leveling
- Headlamp leveling sensors on the front and rear axles

Front headlamp leveling sensor



Rear headlamp leveling sensor



The front and rear sensors are Hall sensors, which transmit an analog signal to the control module.

Accordingly, the system needs to be set up with WDS after any components are replaced or any other repairs are carried out.

Adaptive front light

On vehicles with projection headlamps with dynamic adaptive front lighting or with gas discharge headlamps, an additional cornering light system is provided which is located in the inner part of the headlamp unit.

The cornering lights are switched on depending on the vehicle speed (up to 80 km/h max.) in conjunction with the steering angle (approx. 30° with the vehicle stationary). As a requirement for this, either the dipped beam headlamps or the main beam headlamps need to be switched on.

During cornering only the cornering light on the inside of the bend is switched on to improve illumination of the bend.

Automatic headlamps

The low beam headlamps and side lamps are switched on automatically if all of the following conditions are satisfied:

- Ignition switch in the "II" or "III" position

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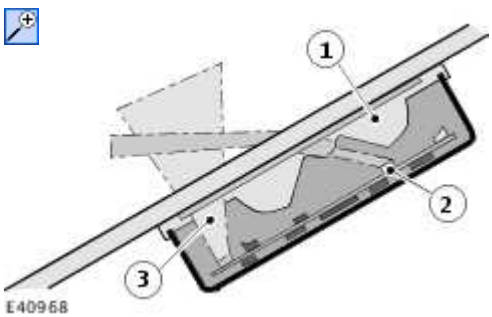
- Light switch in the "AUTO" position
- Detected ambient light conditions below a stored threshold value

The dipped beam headlamps and the side lights are switched on or off by the generic electronic module (GEM) depending on the input signals of the combined rain sensor/light sensor.

Combined rain sensor/light sensor



Item	Part Number	Description
1	-	Lens
2	-	Front light sensor
3	-	Ambient light sensor

The combined rain sensor/light sensor is attached to the windshield, near the interior rear view mirror.

The ambient light sensor determines the general light intensity.

For this purpose, it detects the light over as wide an angle as possible, without taking the direction of incidence into account.

The front light sensor determines the light intensity directly in front of the vehicle.

If both the ambient light sensor and the front light sensor detect a sudden reduction in light intensity at the same time, then an algorithm-based calculation is used to determine the fact that the vehicle has entered a tunnel.

In this type of case a request to switch on the exterior lights and the display lamps in the instrument cluster is transmitted to the GEM.

Front fog lamps

LMV

Item	Part Number	Description
1	-	Fog lamp
2	-	Side light

SAV

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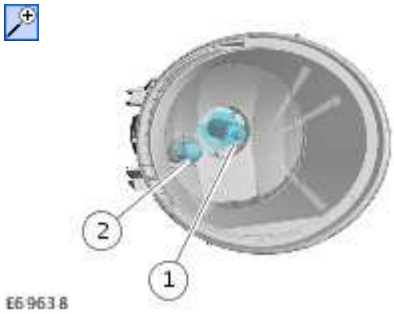


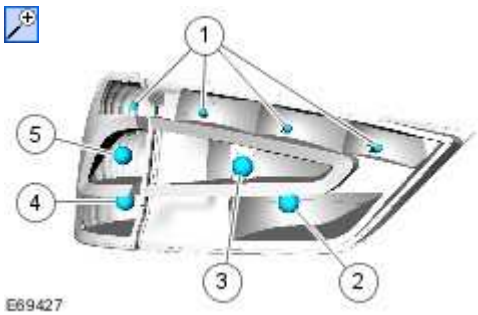
Item	Part Number	Description
1	-	Fog lamp
2	-	Side light

Lamp	Bulb	Current draw	Bulb color
Fog lamp - LMV	HB4	55W	Clear
Fog lamp - SAV	H8	35W	Clear
Side light	W5W	5W	Clear

The front fog lamps are integrated in the bumper on both variants. They also contain the side lights and are therefore fitted as standard.

Rear lights

LMV



Item	Part Number	Description
1	-	Side lights
2	-	Rear fog lamp
3	-	Backup Lamp
4	-	Stop lamp
5	-	Turn signal lamp

Lamp	Bulb	Current draw	Bulb color
Side lights	W5W	5W	Clear
Rear fog lamp	P21W	21W	Clear
Backup Lamp	P21W	21W	Clear
Stop lamp	P21W	21W	Clear
Turn signal lamp	PY21W	21W	Orange

SAV

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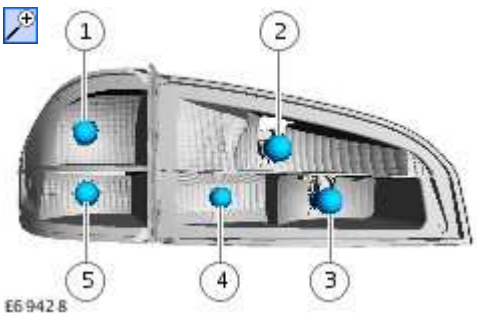

Item	Part Number	Description
1	-	Turn signal lamp
2	-	Backup Lamp
3	-	Rear fog lamp
4	-	Side light
5	-	Stoplamp/side light

Lamp	Bulb	Current draw	Bulb color
Side light	R5W	5W	Clear
Rear fog lamp	P21W	21W	Clear
Backup Lamp	P21W	21W	Clear
Stoplamp/side light	P21/5W	21/5W	Clear
Turn signal lamp	PY21W	21W	Orange

The tail lamps are divided into two parts and differ both in terms of installation and the bulbs between SAV and LMV versions.

Backup lamps

On the SAV version, the backup lamps are automatically switched off by the GEM after 10 minutes, if the vehicle is not moving. This is intended as an overheating protection for the tail lamps.

Stoplamp

The additional high-mounted stoplamp is mounted in the middle of the tailgate above the rear window and also incorporates the washer nozzle for the rear window. A W16W glass base bulb is used.

The stoplamps are switched on via the stoplamp switch on the brake pedal as soon as the brake pedal is actuated.

On vehicles with an electronic parking brake or adaptive speed control system the stoplamps are additionally actuated via the CAN bus.

Parking lamps

The parking lamps are switched on for the relevant side of the vehicle via the turn signal lever when the ignition switch is in position "0". In addition, there is also a parking lights function on the light switch which can be used to switch on all side lights.

Light switch

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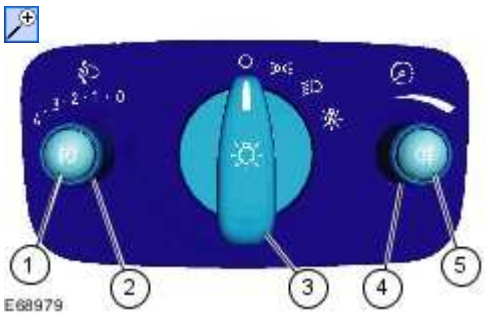

Item	Part Number	Description
1	-	Front fog lamps
2	-	Headlamp leveling (only on vehicles with manual operation)
3	-	Parking lamps, dipped beam headlamps, automatic headlamps (optional)
4	-	Instrument lighting dimmer
5	-	Rear fog lamp

The light switch has been modified and now includes electronic controls. The light switch is connected to the GEM via the LIN bus.

After switching the ignition off and back on again the front fog lamps and the rear fog lamp are deactivated. They then need to be switched back on again if they are required.

Lamp failure detection

Failure of the following lighting components is indicated to the driver via the display in the instrument panel:

- Dipped beam headlamps
- Stop lamp
- Rear fog lamp
- Trailer turn signal lamp (only in trailer mode; controlled by the trailer module)
- Trailer stoplamp (only in trailer mode; controlled by the trailer module)

The indicator lamp in the instrument cluster flashes at twice the normal frequency to indicate failure of the turn signal lamp.

Malfunction of the bulb control module on vehicles with adaptive front lighting is indicated via the display in the instrument cluster.

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Print

Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of electrical (or mechanical) damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Headlamp • Connector • Switch • Wiring harness

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. CHECK system operates correctly
4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis with the diagnostic unit and RECTIFY any displayed faults in accordance with the displayed fault description. CHECK system operates correctly
5. **5.** For vehicles with no stored fault(s), PROCEED in accordance with the symptom chart according to the fault symptom.
6. **6.** After testing or rectifying the fault and after completion of operations, READ OUT the fault memories of all vehicle modules and DELETE any stored faults. READ OUT all fault memories again after a road test.

Diagnostic Trouble Code (DTC) Table - Generic Electronic Module (GEM)

DTC	Description	Action
B1D06-13	Circuit of left-hand turn signal lamps faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D06-11	Circuit of left-hand turn signal lamps faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B11D3-11	Circuit of left-hand side turn signal	REFER to: Turn Signal, Cornering and Hazard

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	lamp faulty (short to ground).	Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B11D3-13	Circuit of left-hand side turn signal lamp faulty (open circuit).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D07-11	Circuit of right-hand turn signal lamps faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D07-13	Circuit of right-hand turn signal lamps faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B11CB-11	Circuit of right-hand side turn signal lamp faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B11CB-13	Circuit of right-hand side turn signal lamp faulty (open circuit).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B113C-11	Circuit of hazard warning switch illumination faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B113C-15	Circuit of hazard warning switch illumination faulty (short to voltage or open circuit).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D35-24	Circuit of hazard warning switch faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1130-07	Light switch unit, component fault.	REFER TO: Symptom chart.
B1D00-11	Circuit of left-hand headlamp faulty (short to ground).	REFER TO: Symptom chart.
B1D01-11	Circuit of right-hand headlamp faulty (short to ground).	REFER TO: Symptom chart.
B1D00-13	Circuit of left-hand headlamp faulty (open circuit).	REFER TO: Symptom chart.
B1D01-13	Circuit of right-hand headlamp faulty (open circuit).	REFER TO: Symptom chart.
B1098-11	Circuit of left-hand marker lamp faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1098-13	Circuit of left-hand marker lamp faulty (open circuit).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1099-11	Circuit of right-hand marker lamp faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1099-13	Circuit of right-hand marker lamp faulty (open circuit).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B109B-13	Circuit of license plate lamps faulty.	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B109B-11	Circuit of license plate lamps faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A79-13	Circuit of rear fog lamps faulty.	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A79-11	Circuit of rear fog lamps faulty (short to ground).	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
C0023-11.	Stop lamp circuit faulty.	REFER to: Stoplamps (417-01 Exterior

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C0023-13		Lighting, Diagnosis and Testing).
B1115-11	Circuit of high-mounted stop lamp faulty (short to ground).	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1115-13	Circuit of high-mounted stop lamp faulty (open circuit).	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
B10AD-09	Rain sensor/light sensor, component fault.	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing), Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10AD-04	Internal circuit of rain sensor/light sensor faulty.	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing), Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).

Diagnostic Trouble Code (DTC) Table - Lighting Control Module

DTC	Description	Action
B1041-54	Headlamp range control, faulty configuration	RE-CALIBRATE the lighting control module with the diagnostic unit. CHECK system operates correctly
B1041-55	Headlamp range control, internal fault	CLEAR the fault memory. If the fault occurs again after a functional test, RENEW the adaptive front lighting module.
B10AE-11	Motor - headlamp range control, short to ground	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B10AE-12	Motor - headlamp range control, short to voltage supply	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B10AE-64	Signal from headlamp range control motor faulty	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B11A2-11	Circuit of headlamp switch faulty (short to ground or open circuit).=	REFER TO: Symptom chart.
B11A2-12	Circuit of headlamp switch faulty (short to voltage).	REFER TO: Symptom chart.
B1A57-01	Left headlamp, headlamp range control motor	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A57-87	Left headlamp, headlamp range control motor	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A58-01	Right headlamp, headlamp range control motor	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A58-87	Right headlamp, headlamp range control motor	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A59-11	Power supply of angle of inclination sensor, short to ground	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A59-12	Power supply of angle of inclination sensor, short to voltage supply	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B1A98-83	LIN bus	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1A98-86	LIN bus	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1A98-88	Circuit of LIN bus faulty	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1C98-11	Circuit of left cornering light, short to ground	REFER TO: Symptom chart.
B1C98-	Circuit of left cornering light, open	REFER TO: Symptom chart.

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13	circuit	
B1C99-11	Circuit of right cornering light, short to ground	REFER TO: Symptom chart.
B1C99-13	Circuit of right cornering light, open circuit	REFER TO: Symptom chart.
B1D64-01	Status of adaptive front lighting servo motor faulty	RENEW left-hand headlamp.
B1D64-87	No communication possible with left-hand adaptive front lighting servo motor	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). RENEW left-hand headlamp.
B1D65-01	Status of adaptive front lighting servo motor faulty	RENEW right-hand headlamp.
B1D65-87	No communication possible with right-hand adaptive front lighting servo motor	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). RENEW right-hand headlamp.
U0001-88	No communications possible via the HS CAN bus	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0122-00	No communication possible with the integrated vehicle dynamics control (IVDC) module	CHECK the integrated vehicle dynamics control (IVDC) module. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0126-00	No communication possible with the steering angle sensor module	CHECK the steering wheel angle sensor (SAS). REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0140-00	No communication possible with the central junction box (CJB)	CHECK the CJB. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U2100-00	Incomplete vehicle configuration parameters	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U2101-00	Vehicle configuration parameters faulty	CHECK the vehicle configuration parameters. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U3003-16	Battery voltage too low, voltage less than 10.5 volts	CHECK the battery and charging system.
U3003-17	Battery voltage too high, voltage more than 16 volts	CHECK the battery and charging system.
U3003-62	Power supply to CJB too low.	CHECK the battery and charging system.

Symptom Chart

Symptom	Possible Sources	Action
Dipped beam and main beam inoperative	* Fuse(s) * Circuit(s) * Central junction box (CJB): * Engine junction box (EJB)	* GO to Pinpoint Test A.
The Low Beams Are Inoperative	* Central junction box (CJB):	* CHECK central junction box (CJB) with diagnostics unit and if necessary RENEW.
The High Beams Are Inoperative	* Circuit(s) * Steering wheel/steering column module * High beam headlamp switch	* GO to Pinpoint Test B.

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	* Central junction box (CJB):	
One low beam headlamp is inoperative	* Fuse * Circuit(s) * Conventional headlamp * Xenon headlamp * Central junction box (CJB):	* GO to Pinpoint Test C.
One high beam headlamp is inoperative	* Fuse * Circuit(s) * Conventional headlamp * Xenon headlamp * Central junction box (CJB):	* GO to Pinpoint Test D.
The Headlamps Are On Continuously	* Circuit(s) * Lights control module * Steering wheel/steering column module * High beam headlamp switch * Conventional headlamp * Xenon headlamp * Central junction box (CJB):	* GO to Pinpoint Test E.
Headlamp flasher inoperative (high beam OK)	* Circuit(s) * Steering wheel/steering column module (SWM) * High beam headlamp switch	* GO to Pinpoint Test F.
Adaptive front lighting inoperative	* No communication with the adaptive front lighting module REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). * Circuit(s) * Adaptive front lighting module * Steering wheel rotation sensor.	* GO to Pinpoint Test G.
Automatic headlamps inoperative	* Circuit(s) * Steering wheel/steering column module (SWM) * Rain sensor	* REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing).
Cornering lights inoperative or permanently on	* No communication with the adaptive front lighting module REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). * Circuit(s) * Steering wheel/steering column module (SWM) * Steering wheel rotation sensor. * Adaptive front lighting module	* GO to Pinpoint Test H.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : DIPPED BEAM AND MAIN BEAM INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F17 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F17 (60 A) (EJB).
	3 CHECK fuse F17 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A2. **No**

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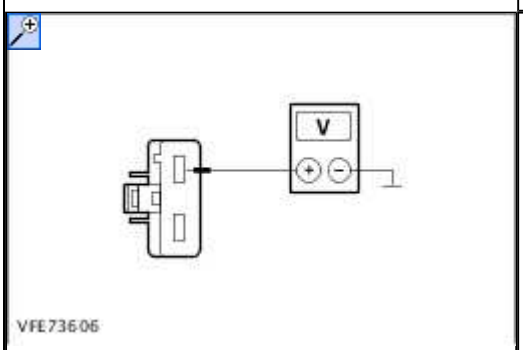
	RENEW fuse F17 (60 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK THE VOLTAGE AT FUSE F17 (60 A) (EJB)	
	1 Connect fuse F17 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F17 (60A) (EJB) and ground.
	Does meter display battery voltage? **Yes** GO to A3. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F17 (60 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
A3: CHECK FUSE F18 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F18 (60 A) (EJB).
	3 CHECK fuse F18 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A4. **No** RENEW fuse F18 (60 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A4: CHECK THE VOLTAGE AT FUSE F18 (60 A) (EJB)	
	1 Connect fuse F18 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F18 (60 A) (EJB) and ground.
	Does meter display battery voltage? **Yes** GO to A5. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F18 (60 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
A5: CHECK THE VOLTAGE SUPPLY TO THE CENTRAL JUNCTION BOX (CJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02G.
	3 Ignition switch in position II.
	4 Measure the voltage between the CJB, connector C1BP02G, pin 1, circuit SBB17A (RD), wiring harness side and ground.
	Does the meter display battery voltage?

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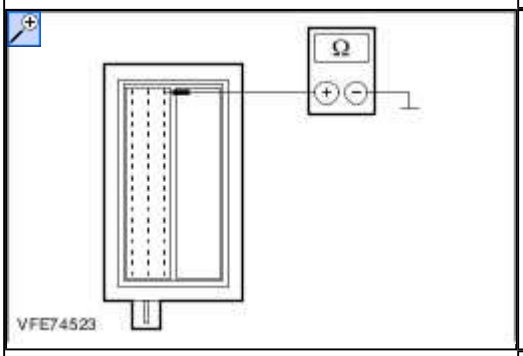
	Yes GO to A6. **No** LOCATE and RECTIFY the break in the circuit between the CJB and fuse F17 (60 A) (EJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
A6: CHECK THE GROUND CONNECTION OF THE CENTRAL JUNCTION BOX (CJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.
	3 Measure the resistance between the CJB, connector C1BP02A, pin 54, circuit GD123F (BK/GY), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A7. **No** LOCATE and RECTIFY the break in the circuits between the CJB and ground connection G1D132B with the aid of the Wiring Diagrams. CHECK system operates correctly
A7: CHECK THE GROUND CONNECTION OF THE CENTRAL JUNCTION BOX (CJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02B.
	3 Measure the resistance between the CJB, connector C1BP02B, pin 65: • LHD: circuit GD140J (BK/GN), wiring harness side and ground. • RHD: circuit GD134U (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW THE CJB. CHECK system operates correctly **No** - LHD: LOCATE and RECTIFY the break in the circuits between the CJB and ground connection G3D138 with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the circuits between the CJB and ground connection G3D133 with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST B : THE HIGH BEAMS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

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B1: DETERMINE THE FAULT CONDITION

1. Ignition switch in position II.
2. CHECK the high beam headlamps after every step.
3. OPERATE headlamp flasher.
4. TURN ON the high beam.

Do the high beam headlamps only work in one switch position?

Yes

GO to B8.

No

GO to B2.

B2: CHECK FUSE F9 (15 A) (CJB).

1. Ignition switch in position 0.
2. Disconnect Fuse F9 (15 A) (CJB).
3. CHECK Fuse F9 (15 A) (CJB).

Is the fuse OK.?

Yes

GO to B3.

No

RENEW fuse F9 (15 A) (CJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly

B3: CHECK THE VOLTAGE SUPPLY TO FUSE F9 (15 A) (CJB) FOR OPEN CIRCUIT

1. Connect Fuse F9 (15 A) (CJB).
2. Ignition switch in position II.
3. Measure the voltage between fuse F9 (15 A) (CJB) and ground.

Does the meter display battery voltage?

Yes

GO to B4.

No

LOCATE AND RECTIFY the break in the voltage supply of fuse F9 (15 A) (CJB) using the Wiring Diagrams. CHECK system operates correctly

B4: CHECK FUSE F7 (7.5 A) (CJB).

1. Ignition switch in position 0.
2. Disconnect Fuse F7 (7.5 A) (CJB).
3. CHECK Fuse F7 (7.5 A) (CJB).

Is the fuse OK.?

Yes

GO to B5.

No

RENEW fuse F7 (7.5 A) (CJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly

B5: CHECK THE VOLTAGE SUPPLY TO FUSE F7 (7.5 A) (CJB) FOR OPEN CIRCUIT

1. Connect Fuse F7 (7.5 A) (CJB).
2. Ignition switch in position II.
3. Measure the voltage between fuse F7 (7.5 A) (CJB) and ground.

Does meter display battery voltage?

Yes

GO to B6.

No

LOCATE AND RECTIFY the break in the voltage supply of fuse F7 (7.5 A) (CJB) using the Wiring Diagrams. CHECK system operates correctly

B6: CHECK THE VOLTAGE SUPPLY TO THE STEERING WHEEL/STEERING COLUMN MODULE FOR OPEN CIRCUIT

1. Ignition switch in position 0.

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	2 Disconnect Steering wheel/steering column module from connector C2LS41.
	3 Measure the resistance between the CJB, connector C1BP02C, pin 70, circuit SBP07A (WH/RD), wiring harness side and the steering wheel/steering column module, connector C2LS41, pin 1, circuit SBP07A (WH/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B7. **No** LOCATE and RECTIFY the break in the circuits between the steering wheel/steering column module and fuse F7 (7.5 A) (CJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
B7: CHECK THE GROUND CONNECTION OF THE STEERING WHEEL/STEERING COLUMN MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the steering wheel/steering column module, connector C2LS41, pin 14, circuit GD138AY (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B8. **No** LOCATE and RECTIFY the break in the circuits between the steering wheel/steering column module and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK system operates correctly
B8: RULE OUT THE HIGH BEAM HEADLAMP SWITCH AS THE CAUSE OF THE FAULT	
	1 CHECK the high beam headlamp switch according to the component tests at the end of this subsection:
	Is the high beam headlamp switch OK? ? **Yes** CHECK the CJB and the steering wheel/steering column module with the aid of WDS and RENEW if necessary. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** RENEW the high beam headlamp switch. CHECK system operates correctly

PINPOINT TEST C : ONE LOW BEAM HEADLAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 SWITCH ON the dipped beam.
	Is the left-hand low beam inoperative? **Yes** GO to C2. **No** GO to C6.
C2: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 SWITCH ON the dipped beam.
	5 Measure the voltage between left-hand headlamp, connector C1LF08, pin 10, circuit CLF04A (BN/BU), wiring harness side and ground.

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	Does the meter display battery voltage? **Yes** GO to C5. **No** GO to C3.
C3: CHECK THE VOLTAGE SUPPLY AT THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.
	3 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 10, circuit CLF04A (BN/BU), wiring harness side and the CJB, connector C1BP02A, pin 76, circuit CLF04A (BN/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C4. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
C4: CHECK CIRCUIT BETWEEN THE CJB AND LEFT-HAND HEADLAMP FOR A SHORT TO GROUND	
	1 Measure the resistance between the CJB, connector C1BP02A, pin 76, circuit CLF04A (BN/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK the CJB, if necessary INSTALL a new one. CHECK system operates correctly **No** LOCATE and RECTIFY the short to ground in circuit CLF04A (BN/BU) between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
C5: CHECK GROUND SUPPLY OF LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 7, circuit GD130T (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in circuit GD130T (BK/YE) between the headlamp and soldered connection SP371 using the Wiring Diagrams. CHECK system operates correctly
C6: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 SWITCH ON the dipped beam.
	5 Measure the voltage between the right-hand headlamp, connector C1LF09, pin 10, circuit CLF05A (BU/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to C9. **No** GO to C7.
C7: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.

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	3 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 10, circuit CLF05A (BU/GN), wiring harness side and the CJB, connector C1BP02A, pin 75, circuit CLF05A (BU/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C8. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
C8: CHECK CIRCUIT BETWEEN THE CJB AND RIGHT-HAND HEADLAMP FOR A SHORT TO GROUND	
	1 Measure the resistance between the CJB, connector C1BP02A, pin 75, circuit CLF05A (BU/GN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK the CJB, if necessary INSTALL a new one. CHECK system operates correctly **No** LOCATE and RECTIFY the short to ground in circuit CLF05A (BU/GN) between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
C9: CHECK THE GROUND CONNECTION TO THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 7, circuit GD132M (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in circuit GD132M (BK/VT) between the headlamp and soldered connection SP380 using the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST D : ONE HIGH BEAM HEADLAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 SWITCH ON the dipped beam.
	3 TURN ON the high beam.
	Is the left-hand high beam inoperative? **Yes** GO to D2. **No** GO to D5.
D2: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 SWITCH ON the dipped beam.
	5 TURN ON the high beam.
	6 Measure the voltage between the left-hand headlamp, connector C1LF08, pin 5, circuit CLF02A (GY/BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to D4.

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	No GO to D3.
D3: CHECK THE VOLTAGE SUPPLY AT THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.
	3 Measure the resistance between the left-hand headlamp, connector C1BP02A, pin 5, circuit CLF02A (GY/BN), wiring harness side and the CJB, connector C1BP02A, pin 74, circuit CLF02A (GY/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW THE CJB. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
D4: CHECK GROUND SUPPLY OF LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 7, circuit GD130T (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in circuit GD130T (BK/YE) between the headlamp and soldered connection SP371 using the Wiring Diagrams. CHECK system operates correctly
D5: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 SWITCH ON the dipped beam.
	5 TURN ON the high beam.
	6 Measure the voltage between the right-hand headlamp, connector C1LF09 , pin 5, circuit CLF03A (VT/OG), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to D7. **No** GO to D6.
D6: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.
	3 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 5, circuit CLF03A (VT/OG), wiring harness side and the CJB, connector C1BP02A, pin 75, circuit CLF03A (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW THE CJB. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the headlamp and the CJB using the Wiring Diagrams. CHECK system operates correctly
D7: CHECK THE GROUND CONNECTION TO THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand headlamp, connector

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	C1LF09, pin 7, circuit GD132M (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in circuit GD132M (BK/VT) between the headlamp and soldered connection SP380 using the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST E : THE HEADLAMPS ARE ON CONTINUOUSLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: DETERMINE THE FAULT CONDITION	
	1 Ignition switch in position II.
	2 Lights control module set to OFF.
	3 CHECK the headlamp.
	Do the low beams illuminate continuously? **Yes** GO to E2. **No** GO to E10.
E2: DETERMINE VEHICLE EQUIPMENT LEVEL	
	1 Find out whether the vehicle is fitted with the daytime running lamps (DRL) option.
	Does the vehicle have daytime running lamps? **Yes** CHECK the software configuration of the GEM with the aid of WDS and update it as required. CHECK system operates correctly If the concern persists: GO to E3. **No** GO to E3.
E3: CHECK FUSE F33 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F33 (5 A) (EJB).
	3 CHECK fuse F33 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to E4. **No** RENEW fuse F33 (5 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
E4: CHECK THE VOLTAGE SUPPLY TO FUSE F33 (5 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F33 (5 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F33 (5 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to E5. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F33 (5 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
E5: CHECK THE VOLTAGE SUPPLY TO THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	

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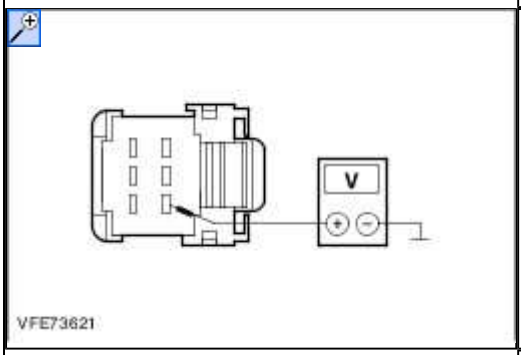
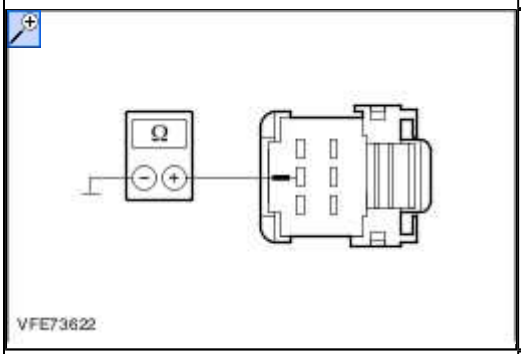
	1 Ignition switch in position 0.
	2 Disconnect Lights control module from connector C2LF23D.
	3 Ignition switch in position II.
 VFE73621	4 Measure the voltage between the lights control module, connector C2LF23D, pin 1, circuit SBB33B (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to E6. **No** LOCATE and RECTIFY the break in the circuits between fuse F33 (5 A) (EJB) and the lights control module with the aid of the wiring diagrams. CHECK system operates correctly
E6: CHECK THE GROUND CONNECTION OF THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
 VFE73622	2 Measure the resistance between the lights control module, connector C2LF23D, pin 5, circuit GD133BT (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to E7. **No** LOCATE and RECTIFY the break in the circuits between the lights control module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK system operates correctly
E7: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTING CONTROL MODULE AND THE CENTRAL JUNCTION BOX (CJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector G3D134 .
	3 Measure the resistance between the lighting control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and the CJB, connector C1BP02C, pin 52, circuit VLF25A (GN/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to E8. **No** LOCATE and RECTIFY the break in circuit VLF25A

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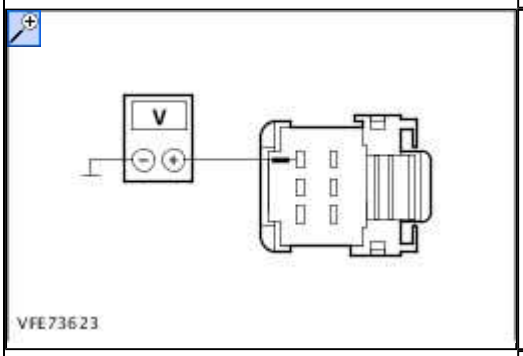
	(GN/VT) between the lighting control module and the CJB with the aid of the Wiring Diagrams. CHECK system operates correctly
E8: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE CENTRAL JUNCTION BOX (CJB) FOR SHORT TO BATTERY VOLTAGE	
	1 Disconnect Lights control module from connector C2LF23D.
	2 Disconnect CJB from connector G3D134 .
	3 Ignition switch in position II.
	4 Measure the voltage between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to E9. **No** LOCATE and RECTIFY the short to battery voltage in circuit VLF25A (GN/VT) between the lighting control module and the CJB with the aid of the Wiring Diagrams. CHECK system operates correctly
E9: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTING CONTROL MODULE AND THE CENTRAL JUNCTION BOX (CJB) FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to E10. **No** LOCATE and RECTIFY the short to ground in circuit VLF25A (GN/VT) between the lighting control module and the CJB with the aid of the Wiring Diagrams. CHECK system operates correctly
E10: RULE OUT THE CENTRAL JUNCTION BOX (CJB) AS CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02A.
	3 Ignition switch in position II.
	4 CHECK the headlamp.
	Is the left-hand low beam permanently lit? **Yes** - Left-hand low beam permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CLF04A (BN/BU) between the CJB and the headlamp using the Wiring Diagrams. CHECK system operates correctly **No** - Right-hand low beam permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CLF05A (BU/GN) between the CJB and the

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	headlamp using the Wiring Diagrams. CHECK system operates correctly - Left-hand main beam permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CLF02A (GY/BN) between the CJB and the headlamp using the Wiring Diagrams. CHECK system operates correctly - Right-hand high beam permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CLF03A (VT/OG) between the CJB and the headlamp using the Wiring Diagrams. CHECK system operates correctly - None of the headlamps is permanently lit: RENEW THE CJB. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

PINPOINT TEST F : HEADLAMP FLASHER NOT FUNCTIONING	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 SWITCH ON the low beam.
	3 CHECK the headlamps in every setting of the switch.
	4 OPERATE headlamp flasher.
	5 TURN ON the high beam.
	Are the high beam and headlamp flasher inoperative? **Yes** GO to Pinpoint Test B. **No** GO to F2.
F2: RULE OUT THE HIGH BEAM HEADLAMP SWITCH AS THE CAUSE OF THE FAULT	
	1 CHECK the high beam headlamp switch according to the component tests at the end of this subsection:
	Is the high beam headlamp switch OK? ? **Yes** CHECK the CJB and the steering wheel/steering column module with the aid of WDS and RENEW if necessary. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** RENEW the high beam headlamp switch. CHECK system operates correctly

PINPOINT TEST G : ADAPTIVE FRONT LIGHTING INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: DETERMINE THE FAULT CONDITION	
NOTE: The adaptive front lighting module only adjusts the headlamps when the vehicle is driving at a speed greater than 3km/h.	
	1 Perform a road test to determine the exact conditions under which the fault occurs.
	Is the adaptive lighting inoperative on the left-hand side? **Yes** The adaptive lighting is inoperative on the left-hand side: GO to G12.

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	No - The adaptive lighting is inoperative on the right-hand side: GO to G15. - The adaptive lighting is inoperative on both sides: GO to G2.
G2: CHECK FUSE F43 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F43 (5 A) (EJB).
	3 CHECK fuse F43 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to G3. **No** RENEW fuse F43 (5 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
G3: CHECK THE VOLTAGE SUPPLY TO FUSE F43 (5 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F43 (5 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F43 (5 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to G4. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F43 (5 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
G4: CHECK FUSE F39 (15 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F39 (15 A) (EJB).
	3 CHECK fuse F39 (15 A) (EJB).
	Is the fuse OK.? **Yes** GO to G5. **No** RENEW fuse F39 (15 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
G5: CHECK THE VOLTAGE SUPPLY TO FUSE F39 (15 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F39 (15 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F39 (15 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to G6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
G6: CHECK VOLTAGE SUPPLY TO THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	Disconnect Adaptive front lighting module from

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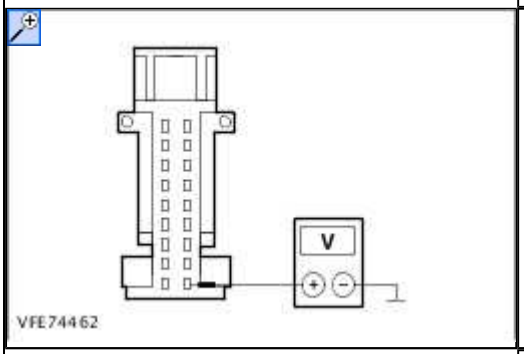
	2 connector C2LF23A.
	3 Ignition switch in position II.
	4 Measure the voltage between the adaptive front lighting module, connector C2LF23A, pin 10, circuit CBB43C (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to G7. **No** LOCATE and RECTIFY the break in the circuit(s) between fuse F43 (5 A) (EJB) and the adaptive front lighting module with the aid of the wiring diagrams. CHECK system operates correctly
G7: CHECK VOLTAGE SUPPLY TO THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23B.
	3 Ignition switch in position II.
	4 Measure the voltage between the adaptive front lighting module, connector C2LF23B, pin 1, circuit CBB39D (VT/WH), wiring harness side and ground.
	5 Measure the voltage between the adaptive front lighting module, connector C2LF23B, pin 2, circuit CBB39G (VT/WH), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to G8. **No** - If battery voltage is not measured during one of the measurements: LOCATE and RECTIFY the break in the relevant circuit(s) between soldered connection SP174 and the adaptive front lighting module with the aid of the Wiring Diagrams. CHECK system operates correctly - If battery voltage is not measured during both of the measurements: LOCATE and RECTIFY the break in the circuit(s) between fuse F39 (15 A) (EJB) and soldered connection SP174 with the aid of the Wiring Diagrams. CHECK system operates correctly
G8: CHECK THE GROUND CONNECTION OF THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 1, circuit GD138BU (BK/WH), wiring harness side and ground.

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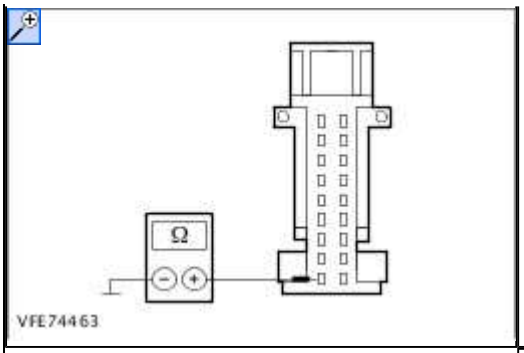


Is a resistance of less than 2 Ohms registered?

Yes

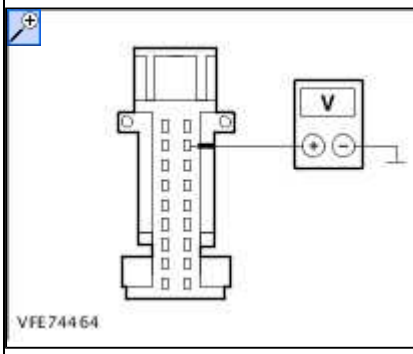
GO to G9.

No

LOCATE and RECTIFY the break in the circuit(s) between the adaptive front lighting module and soldered connection SP518 with the aid of the wiring diagrams. CHECK system operates correctly

G9: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE ADAPTIVE FRONT LIGHTING MODULE AND THE HEADLAMP FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Adaptive front lighting module from connector C2LF23B.
3. Disconnect Left-hand headlamp from connector C1LF08.
4. Disconnect Right-hand headlamp from connector C1LF09.
5. Ignition switch in position II.



6. Measure the voltage between the adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and ground.

Does the meter display battery voltage?

Yes

LOCATE and RECTIFY the short to battery voltage in the circuits connected to the adaptive front lighting module, connector C2LF23A, pin 17 using the Wiring Diagrams. CHECK system operates correctly

No

GO to G10.

G10: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE ADAPTIVE FRONT LIGHTING MODULE AND THE HEADLAMP FOR SHORT TO GROUND

1. Ignition switch in position 0.
2. Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and ground.

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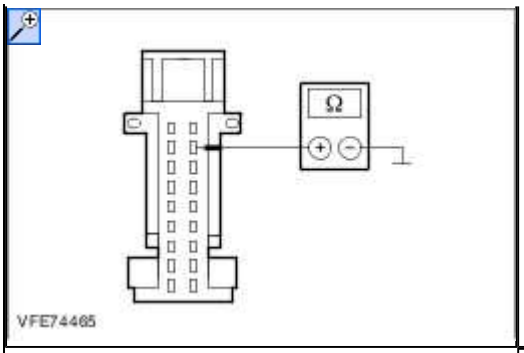

Is a resistance of more than 10,000 Ohm measured?

Yes

GO to G11.

No

LOCATE and RECTIFY the short to ground in the circuits connected to the adaptive front lighting module, connector C2LF23A, pin 17 using the Wiring Diagrams. CHECK system operates correctly

G11: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE ADAPTIVE FRONT LIGHTING MODULE AND THE HEADLAMP FOR OPEN CIRCUIT

1. Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and the left-hand headlamp, connector C1LF08, pin 14, circuit VLF23A (YE), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

No

LOCATE and RECTIFY the break in the circuit(s) between the adaptive front lighting module and intermediate connection C21A/B with the aid of the Wiring Diagrams. CHECK system operates correctly

G12: CHECK THE POWER SUPPLY TO THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT (ADJUSTMENT UNIT FOR THE ADAPTIVE LIGHTING)

1. Ignition switch in position 0.
2. Disconnect Left-hand headlamp from connector C1LF08.
3. Ignition switch in position II.
4. Measure the voltage between left-hand headlamp, connector C1LF08, pin 13, circuit CBB39E (VT/WH), wiring harness side and ground.

Does the meter display battery voltage?

Yes

GO to G13.

No

LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP172 using the wiring diagrams. CHECK system operates correctly

G13: CHECK THE GROUND CONNECTION OF THE LEFT-HAND HEADLAMP FOR OPEN CIRCUIT (ADJUSTMENT UNIT FOR THE ADAPTIVE LIGHTING)

1. Ignition switch in position 0.
2. Measure the resistance between the left-hand

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	headlamp, connector C1LF08, pin 11, circuit GD130AE (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to G14. **No** LOCATE and RECTIFY the break in the circuit(s) between the headlamp and soldered connection SP371 with the aid of the Wiring Diagrams. CHECK system operates correctly
G14: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LEFT-HAND HEADLAMP AND INTERMEDIATE CONNECTION C21A/B FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
	3 Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and the left-hand headlamp, connector C1LF08, pin 14, circuit VLF32A (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit(s) between the left-hand headlamp and intermediate connection C21A/B with the aid of the wiring diagrams. CHECK system operates correctly
G15: CHECK THE POWER SUPPLY TO THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT (ADJUSTMENT UNIT FOR THE ADAPTIVE LIGHTING)	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 Measure the voltage between the right-hand headlamp, connector C1LF09, pin 13, circuit CBB39F (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to G16. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP172 using the wiring diagrams. CHECK system operates correctly
G16: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT (ADJUSTMENT UNIT FOR THE ADAPTIVE LIGHTING)	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 11, circuit GD130W (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to G17.

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	No LOCATE and RECTIFY the break in the circuit(s) between the headlamp and soldered connection SP380 with the aid of the Wiring Diagrams. CHECK system operates correctly
G17: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE RIGHT-HAND HEADLAMP AND INTERMEDIATE CONNECTION C21A/B FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
	3 Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and the right-hand headlamp, connector C1LF09, pin 14, circuit VLF32C (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit(s) between the right-hand headlamp and intermediate connection C21A/B with the aid of the wiring diagrams. CHECK system operates correctly

PINPOINT TEST H : CORNERING LIGHTS INOPERATIVE OR PERMANENTLY ON	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
NOTE: The cornering lights are only switched on when the vehicle is driving at a speed of less than 80 km/h and the low beam headlamps are switched on.	
NOTE: The intensity of the cornering lights increases on a ramp up to the maximum value when they are switched on, and it decreases on a ramp until the cornering lights go out when they are switched off.	
NOTE: Only the cornering light on the inside of the bend is switched on.	
	1 SWITCH ON the low beam.
	2 Turn the steering approximately 30° to the left and right.
	3 CHECK the cornering lights on the left and right.
	Are the cornering lights inoperative in both cases? **Yes** GO to H2. **No** - Left-hand cornering light inoperative: GO to H9. - Right-hand cornering light inoperative: GO to H12. - One cornering light permanently lit: GO to H15. - Both cornering lights permanently on even though the steering wheel is in the straight ahead position: RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). - Both cornering lights permanently on during

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	cornering: RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
H2: CHECK FUSE F43 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F43 (5 A) (EJB).
	3 CHECK fuse F43 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to H3. **No** RENEW fuse F43 (5 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
H3: CHECK THE VOLTAGE SUPPLY TO FUSE F43 (5 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F43 (5 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F43 (5 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to H4. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F43 (5 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
H4: CHECK FUSE F39 (15 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F39 (15 A) (EJB).
	3 CHECK fuse F39 (15 A) (EJB).
	Is the fuse OK.? **Yes** GO to H5. **No** RENEW fuse F39 (15 A) (EJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
H5: CHECK THE VOLTAGE SUPPLY TO FUSE F39 (15 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F39 (15 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F39 (15 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to H6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK system operates correctly
H6: CHECK VOLTAGE SUPPLY TO THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.

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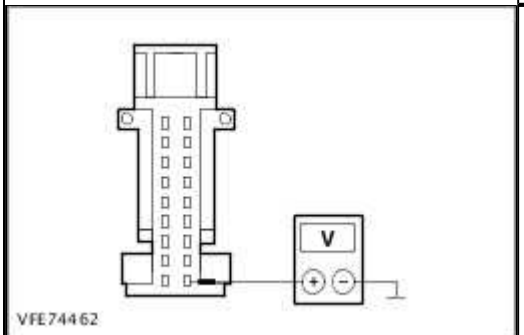
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
	3 Ignition switch in position II.
	4 Measure the voltage between the adaptive front lighting module, connector C2LF23A, pin 10, circuit CBB43C (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to H7. **No** LOCATE and RECTIFY the break in the circuit(s) between soldered connection SP171 and the adaptive front lighting module with the aid of the Wiring Diagrams. CHECK system operates correctly
H7: CHECK VOLTAGE SUPPLY TO THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23B.
	3 Ignition switch in position II.
	4 Measure the voltage between the adaptive front lighting module, connector C2LF23B, pin 1, circuit CBB39D (VT/WH), wiring harness side and ground.
	5 Measure the voltage between the adaptive front lighting module, connector C2LF23B, pin 2, circuit CBB39G (VT/WH), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to H8. **No** - If battery voltage is not measured during one of the measurements: LOCATE and RECTIFY the break in the relevant circuit(s) between soldered connection SP174 and the adaptive front lighting module with the aid of the Wiring Diagrams. CHECK system operates correctly - If battery voltage is not measured during both of the measurements: LOCATE and RECTIFY the break in the circuit(s) between fuse F39 (15 A) (EJB) and soldered connection SP174 with the aid of the Wiring Diagrams. CHECK system operates correctly
H8: CHECK THE GROUND CONNECTION OF THE ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the adaptive front lighting module, connector C2LF23A, pin 1, circuit GD138BU (BK/WH), wiring harness side and ground.

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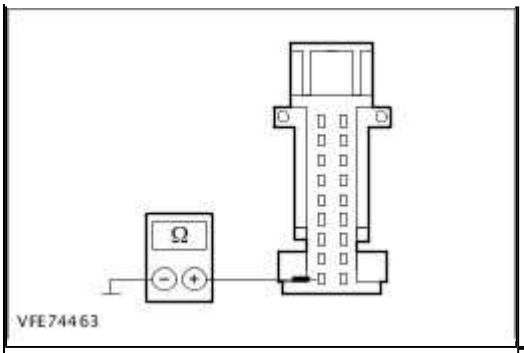

Is a resistance of less than 2 Ohms registered?

Yes

RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

No

LOCATE and RECTIFY the break in the circuit(s) between the adaptive front lighting module and soldered connection SP518 with the aid of the wiring diagrams. CHECK system operates correctly

H9: CHECK THE VOLTAGE SUPPLY TO THE CORNERING LIGHT, LEFT-HAND HEADLAMP, FOR OPEN CIRCUIT

NOTE: There is a delay before full battery voltage is applied to the cornering light on the inside of the bend.

1	Ignition switch in position 0.
2	Disconnect Left-hand headlamp from connector C1LF08.
3	Ignition switch in position II.
4	SWITCH ON the dipped beam.
5	Turn the steering approximately 30° to the left.
6	Measure the voltage between left-hand headlamp, connector C1LF08, pin 6, circuit CLF06B (BN/GN), wiring harness side and ground.

Does the meter display battery voltage?

Yes

GO to H11.

No

GO to H10.

H10: CHECK THE VOLTAGE SUPPLY TO THE CORNERING LIGHT, LEFT-HAND HEADLAMP

1	Ignition switch in position 0.
2	Disconnect Adaptive front lighting module from connector C2LF23A.
3	Measure the resistance between the left-hand headlamp, connector C1LF08, pin 6, circuit CLF06B (BN/GN), wiring harness side and the adaptive lighting module, connector C2LF23B, pin 6, circuit CLF06A (BN/GN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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	No LOCATE and RECTIFY break in the circuit(s) between the adaptive front lighting module and the headlamp with the aid of the Wiring Diagrams. CHECK system operates correctly
H11: CHECK THE GROUND CONNECTION OF THE CORNERING LIGHT, LEFT-HAND HEADLAMP, FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 9, circuit GD130AS (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK system operates correctly **No** -LOCATE and RECTIFY the break in circuit GD130AS (BK/YE) between the headlamp and soldered connection SP371 using the Wiring Diagrams. CHECK system operates correctly
H12: CHECK THE VOLTAGE SUPPLY TO THE CORNERING LIGHT, RIGHT-HAND HEADLAMP, FOR OPEN CIRCUIT	
NOTE: There is a delay before full battery voltage is applied to the cornering light on the inside of the bend.	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 SWITCH ON the dipped beam.
	5 Turn the steering approximately 30° to the right.
	6 Measure the voltage between the right-hand headlamp, connector C1LF09 , pin 6, circuit CLF07B (GY/OG), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to H14. **No** GO to H13.
H13: CHECK THE VOLTAGE SUPPLY TO THE CORNERING LIGHT, RIGHT-HAND HEADLAMP, FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23B.
	3 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 6, circuit CLF07B (GY/OG), wiring harness side and the adaptive lighting module, connector C2LF23B, pin 5, circuit CLF07A (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY break in the circuit(s) between the adaptive front lighting module and the

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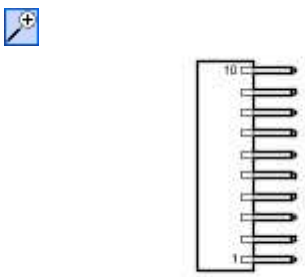
	headlamp with the aid of the Wiring Diagrams. CHECK system operates correctly
H14: CHECK THE GROUND CONNECTION OF THE CORNERING LIGHT, RIGHT-HAND HEADLAMP, FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF09, pin 9, circuit GD132X (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL A NEW headlamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in corresponding circuit GD132X (BK/VT) between soldered connection SP380 and the headlamp using the Wiring Diagrams. CHECK system operates correctly
H15: RULE OUT THE ADAPTIVE LIGHTING MODULE AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect fuse F39 (15 A) (EJB).
	3 Disconnect fuse F43 (5 A) (EJB).
	4 Ignition switch in position II.
	5 CHECK the cornering lights.
	Is the left-hand cornering light permanently on? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits between the adaptive lighting module and the left-hand headlamp with the aid of the Wiring Diagrams. CHECK system operates correctly **No** - Right-hand cornering light permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuits between the adaptive lighting module and the right-hand headlamp with the aid of the Wiring Diagrams. CHECK system operates correctly - None of the cornering lights is permanently lit: RENEW the adaptive front lighting module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Component Checks

High beam headlamp switch

Pin occupation, component side:



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NOTE: The value measured in the continuity test of the high beam switch should be less

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than 50 Ohm.

Circuit to test	Connect a digital multimeter with the following connections	Set the switch to the following position	Switch is OK when the following test readings are seen
Headlamp flasher	1 and 3	Off	Open circuit
		On	Closed circuit
High beam	1 and 6	Off	Open circuit
		On	Closed circuit
Left-hand turn signal	1 and 5	Neutral position	Open circuit
		On	Closed circuit
Right-hand turn signal	1 and 4	Neutral position	Open circuit
		On	Closed circuit

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: If a new generic electronic module (GEM) is being installed, the new module must be configured following installation. For this purpose, the vehicle-specific data or the data to be changed is read out of the module using WDS and is transferred to the new module.
NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.
NOTE: Ensure correct locking of the wiring harness connector.
NOTE: The rain sensor module is also responsible for actuating the automatic headlamps.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical (or mechanical) damage.

Visual Inspection

Mechanical	Electrical
• Check the adhesive pad between the rain sensor and the windshield for trapped air. • Clean wax residues from the windshield in the vicinity of the rain sensor. • Check the windshield for damage/cracks in the vicinity of the rain sensor. • Check that the rain sensor retaining frame is correctly attached to the windshield. • Check the wiper blades for residue-free wiping in the vicinity of the rain sensor.	• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the concern is not visually evident, PERFORM a fault diagnosis on the generic electronic module (GEM) with WDS and RECTIFY any displayed faults in accordance with the displayed fault description. CHECK the operation of the system.

5. **5.** On a vehicle without stored fault(s), continue according to the Symptom Chart and the corresponding symptom.

6. **6.** Following checking or elimination of the fault(s) and after completion of operations, the fault memory in the generic electronic module (GEM) must be READ OUT and any stored faults must be DELETED. After road testing and CHECKING the system, READ OUT the fault memory again.

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Diagnostic Trouble Code (DTC) Table - Generic Electronic Module (GEM)

DTC	Description	Action
B10AD-04	Rain sensor, internal system fault	GO to Pinpoint Test A.
B10AD-09	Rain sensor, component fault	GO to Pinpoint Test A.

Symptom Chart

Symptom	Possible Sources	Action
Automatic headlamps inoperative	* Fuse * BJB * Circuit(s) * Lighting control module (LCM) * Rain sensor	* GO to Pinpoint Test A.
Automatic headlamps on permanently	* Circuit(s) * BJB * Lighting control module (LCM) * Rain sensor	* GO to Pinpoint Test B.

Pinpoint Tests

NOTE: Use a digital multimeter for all measurements.

PINPOINT TEST A : AUTOMATIC HEADLAMPS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: DETERMINE THE FAULT CONDITION	
	1 Ignition switch in position II.
	2 SWITCH ON dipped beam.
	3 CHECK the operation of the dipped beam and the parking lamps.
	4 SWITCH ON the automatic headlamps.
	5 Cover rain sensor with opaque material to simulate insufficient light conditions.
	6 CHECK the operation of the dipped beam and the parking lamps.
	Is the normal dipped beam operative? **Yes** Automatic headlamps inoperative: GO to A2. **No** REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
A2: CHECK FUSE F1 (5 A) (CJB).	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F1 (5 A) (CJB).
	3 CHECK Fuse F1 (5 A) (CJB).
	Is the fuse OK.? **Yes** GO to A3. **No** RENEW fuse F1 (5 A) (CJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK THE VOLTAGE SUPPLY TO FUSE F1 (5 A) (CJB) FOR OPEN CIRCUIT	
	1 Connect Fuse F1 (5 A) (CJB).
	2 Ignition switch in position II.

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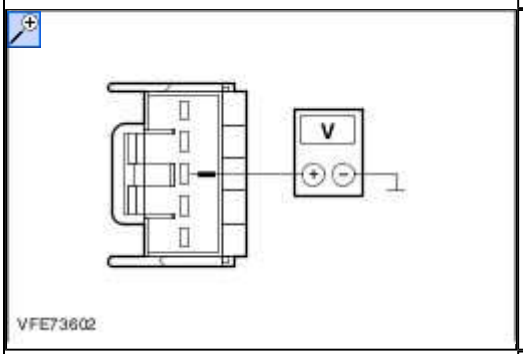
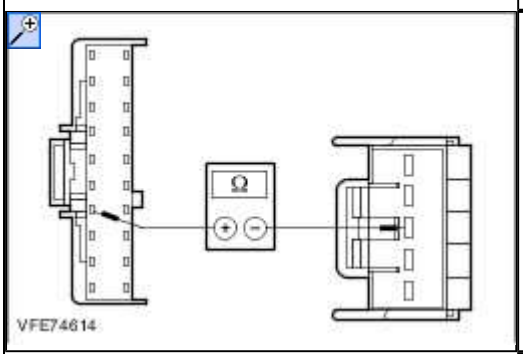
	3 Measure the voltage between fuse F1 (5 A) (CJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A4. **No** RENEW THE CJB. CHECK the operation of the system.
A4: CHECK VOLTAGE SUPPLY TO RAIN SENSOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Rain sensor from connector C9RW06.
	3 Ignition switch in position II.
	4 Measure the voltage between the rain sensor, connector C9RW06, pin 3, circuit CBP01B (BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** GO to A5.
A5: CHECK CIRCUIT CBP01B (BU) BETWEEN CENTRAL JUNCTION BOX (CJB) AND RAIN SENSOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect CJB from connector C1BP02H.
	3 Measure the resistance between the CJB, connector C1BP02H, pin 17, circuit CBP01B (BU), wiring harness side and the rain sensor, connector C9RW06, pin 3, circuit CBP01B (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW THE CJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between CJB and the rain sensor using the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK GROUND CONNECTION OF RAIN SENSOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the rain sensor, connector C9RW06, pin 2, circuit GD138V(BK/WH), wiring harness side and ground.

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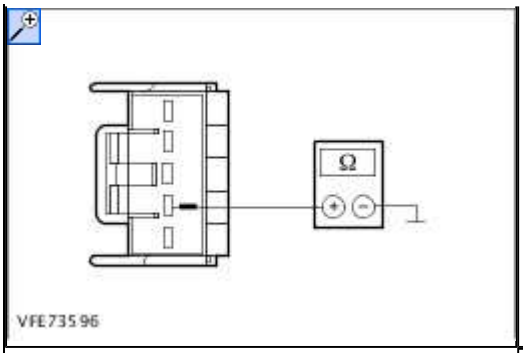


Is a resistance of less than 2 Ohms registered?

Yes

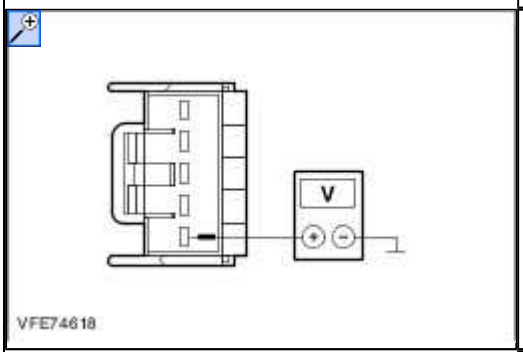
GO to A7.

No

LOCATE and RECTIFY the break in the circuit between the rain sensor and soldered connection SP523 using the Wiring Diagrams. CHECK the operation of the system.

A7: CHECK CIRCUIT (LIN 2 BUS) VRW26A (BN/YE) BETWEEN THE GENERIC ELECTRONIC MODULE (GEM) AND THE RAIN SENSOR FOR SHORT CIRCUIT TO BATTERY VOLTAGE

1. Disconnect GEM from connector C1BP02H.
2. Ignition switch in position II.



3. Measure the voltage between the rain sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side and ground.

Does the meter display battery voltage?

Yes

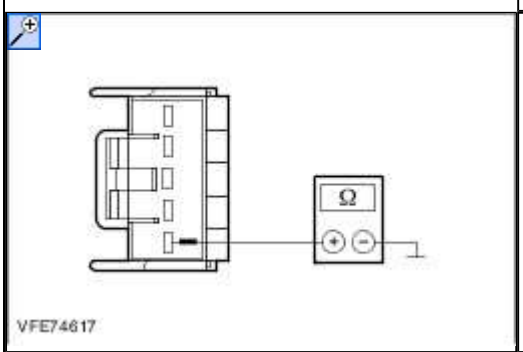
LOCATE and RECTIFY the short to battery voltage in the circuit between the (GEM) and the rain sensor using the Wiring Diagrams. CHECK the operation of the system.

No

GO to A8.

A8: CHECK CIRCUIT (LIN 2 BUS) VRW26A (BN/YE) BETWEEN THE GENERIC ELECTRONIC MODULE (GEM) AND THE RAIN SENSOR FOR SHORT CIRCUIT TO GROUND

1. Ignition switch in position 0.



2. Measure the resistance between the rain sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

Yes

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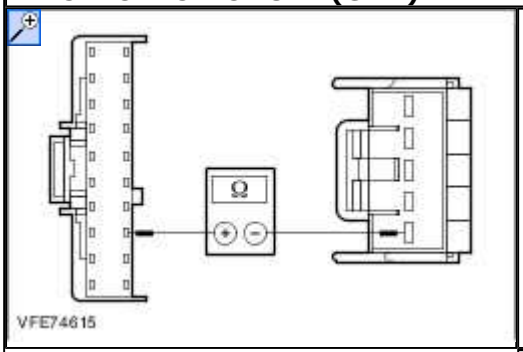
	GO to A9. **No** LOCATE and RECTIFY the short to ground in the circuit between the GEM and the rain sensor using the Wiring Diagrams. CHECK the operation of the system.
A9: CHECK CIRCUIT (LIN 2 BUS) VRW26A (BN/YE) BETWEEN THE GENERIC ELECTRONIC MODULE (GEM) AND THE RAIN SENSOR FOR OPEN CIRCUIT	
	1 Measure the resistance between the GEM, connector C1BP02H, pin 8, circuit VRW26A (BN/YE), wiring harness side and the rain sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW rain sensor. CHECK the operation of the system. If the concern persists, CHECK the CJB using WDS, RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between GEM and the rain sensor using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : AUTOMATIC HEADLAMPS ARE ON PERMANENTLY (LIGHTING CONTROL MODULE IN OFF POSITION)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
NOTE: For this test step, the rain sensor must be exposed to sufficient light.	
	1 Ignition switch in position II.
	2 Cover the rain sensor with opaque material.
	3 CHECK the dipped beam (automatic headlamps).
	4 Remove the opaque cover from the rain sensor.
	5 CHECK the dipped beam (automatic headlamps).
	Does the dipped beam (automatic headlamps) illuminate in both lighting conditions? **Yes** GO to B2. **No** RENEW rain sensor. CHECK the operation of the system.
B2: RULE OUT THE RAIN SENSOR AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F1 (5 A) (CJB).
	3 Ignition switch in position II.
	4 CHECK the dipped beam (automatic headlamps).
	Is the dipped beam (automatic headlamps) on permanently? **Yes** Check the CJB using WDS. CHECK the operation of the system. If the concern persists: REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).

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	No RENEW rain sensor. CHECK the operation of the system.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: A new GEM needs to be configured after installation. For this purpose, the vehicle-specific data are read out of the module to be changed using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: A new PCM needs to be configured after installation. For this purpose, the vehicle-specific data are read out of the module to be changed using WDS and is transferred to the new module.
REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical (or mechanical) damage.

Visual Inspection Chart

Mechanical	Electrical
• stoplamp switch adjustment	• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
The Stoplamps Are Inoperative	* Fuse * Circuit(s) * Stoplamp switch * Smart Junction Box	* GO to Pinpoint Test A.

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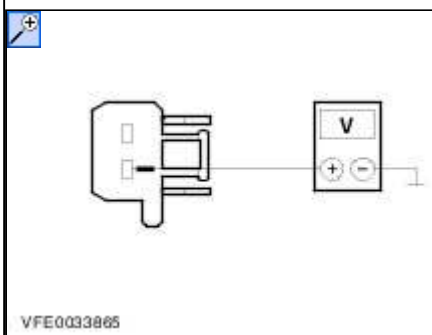
ONE OR MORE STOPLAMPS ARE INOPERATIVE	* Circuit(s) * Rear lamp assembly * Additional high-mounted stoplamp * Smart Junction Box	* GO to Pinpoint Test B.
One or more stoplamps inoperative	* Circuit(s) * Stoplamp switch * Smart Junction Box * Trailer socket	* GO to Pinpoint Test C.

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE STOPLAMPS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F28 (5 A) (SJB)	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F28 (5 A) (SJB).
	3 CHECK Fuse F28 (5 A) (SJB).
	Is the fuse OK.? **Yes** GO to A2. **No** RENEW fuse F28 (5 A) (SJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK THE VOLTAGE SUPPLY TO FUSE F28 (5 A) (SJB) FOR OPEN CIRCUIT	
	1 Connect Fuse F28 (5 A) (SJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F28 (5 A) (SJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A3. **No** LOCATE AND RECTIFY the break in the voltage supply to fuse F28 (5 A) (SJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
A3: CHECK THE VOLTAGE SUPPLY TO THE STOPLAMP SWITCH FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Stoplamp switch from connector C2CA29.
	3 Ignition switch in position II.
	4 Measure the voltage between the stoplamp switch, connector C2CA29, pin 1, circuit SBP28A (GN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A5.

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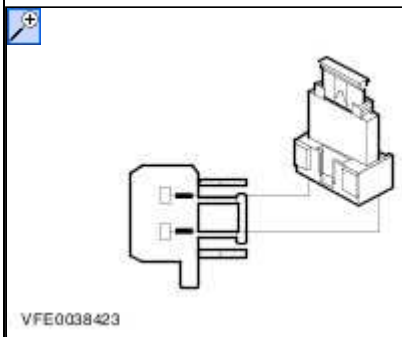
	No GO to A4.
A4: RULE OUT THE SMART JUNCTION BOX AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the stoplamp switch, connector C2CA29, pin 1, circuit SBP28A (GN/RD), wiring harness side and the Smart Junction Box, connector C1BP02B, pin 66, circuit SBP28A (GN/RD), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the stoplamp switch with the aid of the Wiring Diagrams. CHECK system operates correctly
A5: RULE OUT THE STOPLAMP SWITCH AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
 VFE0038423	2 Use a fused jumper lead (5 A) to connect the stoplamp switch, connector C2CA29, between pin 2, circuit CCA29C (GN/BU) and pin 1, circuit (GN/RD), wiring harness side.
	3 Ignition switch in position II.
	4 Check the stoplamps.
	Do the stoplamps come on? **Yes** RENEW the stoplamp switch. CHECK system operates correctly **No** GO to A6.
A6: CHECK THE CIRCUIT BETWEEN THE STOPLAMP SWITCH AND THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the stoplamp switch, connector C2CA29, pin 2, circuit CCA29C (GN/BU), wiring harness side and the Smart Junction Box, connector C1BP02B, pin 54, circuit CCA29C (GN/BU), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the stoplamp switch and the Smart Junction Box with the aid of the Wiring Diagrams.

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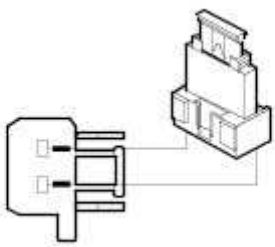
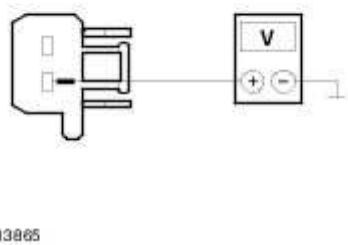
	CHECK system operates correctly

PINPOINT TEST B : ONE OR MORE STOPLAMPS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position 0.
	2 Disconnect Stoplamp switch from connector C2CA29.
 VFE0038423	3 Use a fused jumper lead (5 A) to connect the stoplamp switch, connector C2CA29, between pin 1, circuit SBP28A (GN/RD) and pin 2, circuit CCA29C (GN/BU), wiring harness side.
	4 Ignition switch in position II.
	5 Check the stoplamps.
	Is only the high mounted stoplamp inoperative? **Yes** GO to B2. **No** - Left-hand stoplamp and additional high-mounted stoplamp inoperative: LOCATE and RECTIFY the break in the circuit between soldered connection SP549 and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK system operates correctly - Left-hand stoplamp and right-hand stoplamp inoperative: GO to B5. - Left-hand stoplamp inoperative: GO to B6. - Right-hand stoplamp inoperative: GO to B8.
B2: CHECK THE VOLTAGE SUPPLY OF THE ADDITIONAL HIGH-MOUNTED STOPLAMP FOR OPEN CIRCUIT	
NOTE: The fused jumper lead remains connected during this test step.	
	1 Ignition switch in position 0.
	2 Disconnect Additional high-mounted stoplamp from connector C4LS50.
	3 Ignition switch in position II.
 VFE0033865	4 Measure the voltage between the additional high-mounted stoplamp, connector C4LS50, pin 1, circuit CLS17A (YE/GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B3. **No** GO to B4.
B3: CHECK THE GROUND CONNECTION OF THE ADDITIONAL HIGH-MOUNTED	

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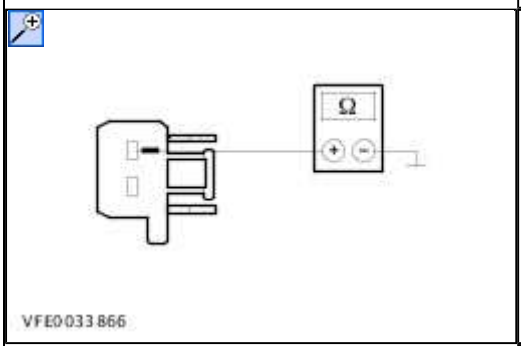
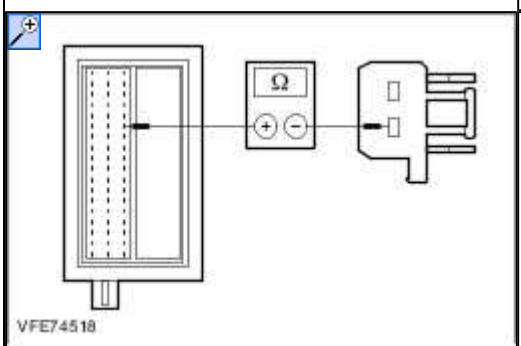
STOPLAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the additional high-mounted stoplamp, connector C4LS50, pin 2, circuit GD150J (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** RENEW additional high-mounted stoplamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the additional high-mounted stoplamp and the soldered connection SP534 using the wiring diagrams. CHECK system operates correctly

B4: CHECK THE VOLTAGE SUPPLY OF THE ADDITIONAL HIGH-MOUNTED STOPLAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box (SJB), connector C1BP02B, pin 49, circuit CLS17B (YE/GY), wiring harness side and the additional high-mounted stoplamp, connector C4LS50, pin 1, circuit CLS17A (YE/GY), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the additional high-mounted stoplamp with the aid of the Wiring Diagrams. CHECK system operates correctly

B5: CHECK THE SHARED POWER SUPPLY OF THE LEFT AND RIGHT-HAND STOPLAMPS FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 59, circuit CLS44F (VT/BN), wiring harness side and ground.
	Is a resistance of less than 10,000 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists:

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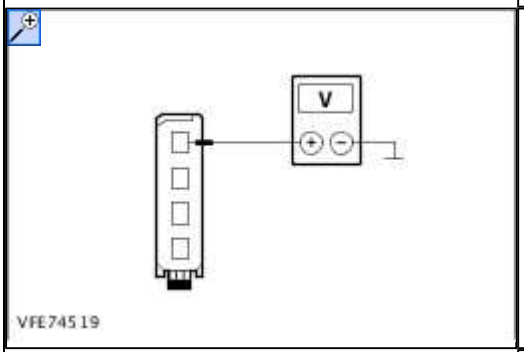
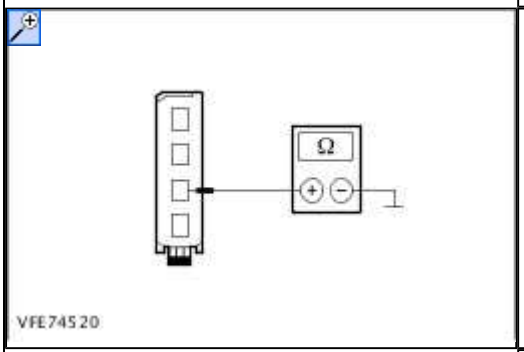
	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and soldered connection SP451 with the aid of the Wiring Diagrams. CHECK system operates correctly
B6: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND STOPLAMP FOR OPEN CIRCUIT	
NOTE: The fused jumper lead remains connected during this test step.	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand rear lamp assembly from connector C4LS18A.
	3 Ignition switch in position II.
	4 Measure the voltage between left-hand rear lamp assembly, connector C4LS18A, pin 1, circuit CLS44C (VT/BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B7. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP451 and the rear lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
B7: CHECK THE GROUND CONNECTION OF THE LEFT-HAND STOPLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand rear lamp assembly, connector C4LS18A, pin 3, circuit GD150C (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** RENEW the rear lamp assembly. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear lamp assembly and soldered connection SP549 with the aid of the Wiring Diagrams. CHECK system operates correctly
B8: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND STOPLAMP FOR OPEN CIRCUIT	
NOTE: The fused jumper lead remains connected during this test step.	

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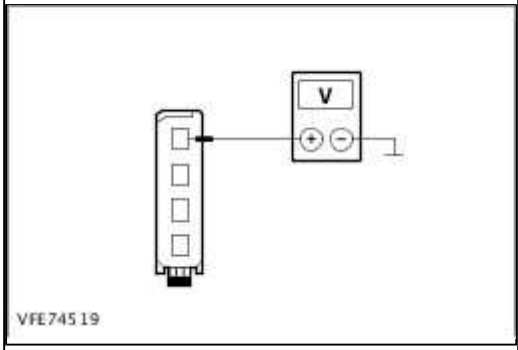
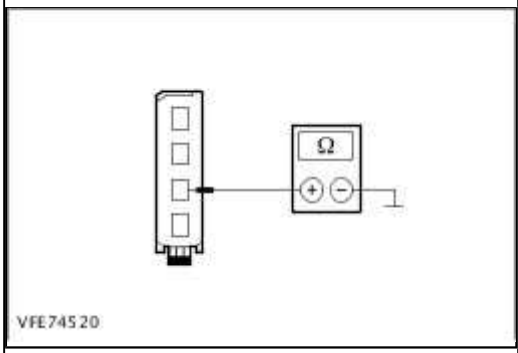
	1 Ignition switch in position 0.
	2 Disconnect Right-hand rear lamp assembly from connector C4LS19A.
	3 Ignition switch in position II.
 VFE74519	4 Measure the voltage between the right-hand rear lamp assembly, connector C4LS19A, pin 1, circuit CLS44A (VT/BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B9. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP451 and the rear lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
B9: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND STOPLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
 VFE74520	2 Measure the resistance between the right-hand rear lamp assembly, connector C4LS19A, pin 3, circuit GD152A (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** RENEW the rear lamp assembly. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear lamp assembly and soldered connection SP600 with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST C : ONE OR MORE STOPLAMPS PERMANENTLY LIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 Check the stoplamps.
	Are all stoplamps permanently lit? **Yes** GO to C2. **No** - Only the additional high-mounted stoplamp is permanently lit: GO to C4. - Only the left and right stoplamps are permanently

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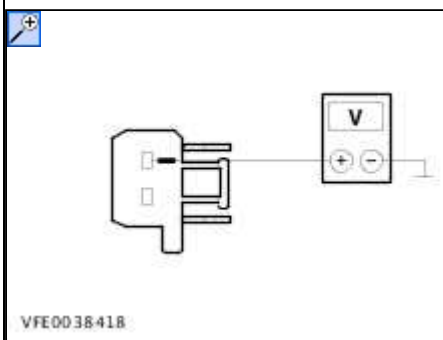
	lit: GO to C5.
C2: EXCLUDE THE STOPLAMP SWITCH AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Stoplamp switch from connector C2CA29.
	3 Ignition switch in position II.
	4 Check the stoplamps.
	Are all stoplamps permanently lit? **Yes** GO to C3. **No** RENEW brake light switch. CHECK system operates correctly
C3: CHECK THE CONTROL CIRCUIT BETWEEN THE STOPLAMP SWITCH AND THE SMART JUNCTION BOX FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 Measure the voltage between the stoplamp switch, connector C2CA29, pin 2, circuit CCA29C (GN/BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the stoplamp switch and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly **No** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
C4: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE ADDITIONAL HIGH-MOUNTED STOPLAMP FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 CHECK the high mounted stoplamp.
	Is the additional high-mounted stoplamp permanently lit? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits between the Smart Junction Box and the additional high-mounted stoplamp with the aid of the Wiring Diagrams. CHECK system operates correctly

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	No INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
C5: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE LEFT AND RIGHT-HAND STOPLAMPS FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 Check the stoplamps.
	Are only the left and right stoplamps permanently lit? **Yes** - Vehicles without trailer socket: Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in the circuits connected to soldered connection SP451. CHECK system operates correctly - Vehicles with a trailer socket: GO to C6. **No** INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
C6: RULE OUT THE TRAILER CONTROL MODULE AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect fuse FA11 (40 A) (RJB).
	3 Ignition switch in position II.
	4 Check the stoplamps.
	Are only the left and right stoplamps permanently lit? **Yes** Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in the circuits connected to soldered connection SP451. CHECK system operates correctly **No** INSTALL A NEW trailer control module. CHECK system operates correctly

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: A new GEM needs to be configured after installation. For this purpose, the vehicle-specific data is read out of the module to be changed using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom • CAN data bus • LIN data bus

3. **3.** Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
All turn signal lamps inoperative	* Circuit(s) * Steering wheel/steering column module * Central junction box (CJB):	* GO to Pinpoint Test A.
Hazard warning lights inoperative, turn	* Fuse(s)	* GO to Pinpoint

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signal function OK	* Circuit(s) * Hazard warning lights switch * Central junction box (CJB):	Test B.
Single or multiple turn signal lamps inoperative	* Circuit(s) * Steering wheel/steering column module	* GO to Pinpoint Test C.
One or more turn signal lamps flashing continuously	* Hazard warning lights switch * Steering wheel/steering column module * Central junction box (CJB):	* GO to Pinpoint Test D.
One or more turn signal lamps permanently lit	* Circuit(s) * Central junction box (CJB):	* GO to Pinpoint Test E.

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : ALL TURN SIGNAL LAMPS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F7 (7.5 A) (SJB).	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F7 (7.5 A) (SJB).
	3 CHECK Fuse F7 (7.5 A) (SJB).
	Is the fuse OK.? **Yes** GO to A2. **No** RENEW fuse F7 (7.5 A) (SJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK THE VOLTAGE SUPPLY TO FUSE F7 (7.5 A) (SJB) FOR OPEN CIRCUIT	
	1 Connect Fuse F7 (7.5 A) (SJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F7 (7.5 A) (SJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A3. **No** LOCATE and RECTIFY the break in the voltage supply of fuse F7 (7.5 A) (SJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
A3: CHECK FUSE F17 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F17 (60 A) (EJB).
	3 CHECK fuse F17 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A4. **No** RENEW fuse F17 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A4: CHECK THE VOLTAGE SUPPLY TO FUSE F17 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F17 (60 A) (EJB).
	2 Ignition switch in position II.

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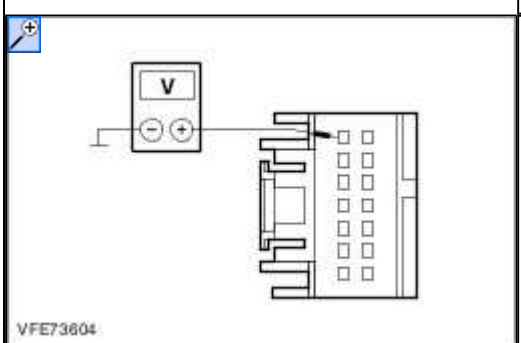
	3 Measure the voltage between fuse F17 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A5. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F17 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
A5: CHECK FUSE F18 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F18 (60 A) (EJB).
	3 CHECK fuse F18 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A6. **No** RENEW fuse F18 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A6: CHECK THE VOLTAGE SUPPLY TO FUSE F18 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F18 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F18 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A7. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F18 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
A7: CHECK THE VOLTAGE SUPPLY TO THE STEERING WHEEL/STEERING COLUMN MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Steering wheel/steering column module from connector C2LS41.
	3 Measure the voltage between the steering wheel/steering column module, connector C2LS41, pin 1, circuit SBP07A (WH/RD), wiring harness side and ground.
	4 Ignition switch in position II.
	Does the meter display battery voltage? **Yes** GO to A8. **No** LOCATE and RECTIFY the break in the circuits between fuse F7 (7.5 A) (SJB) and the steering wheel/steering column module with the aid of the Wiring Diagrams. CHECK system operates correctly

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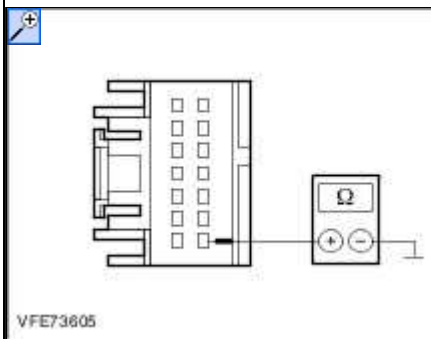
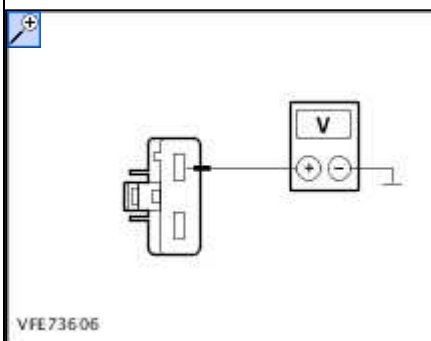
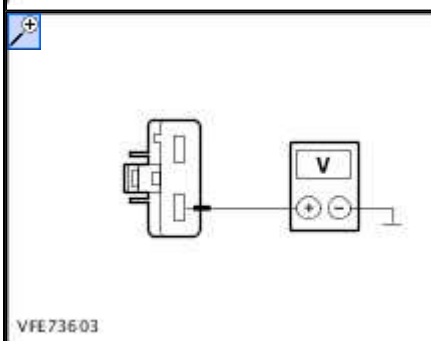
A8: CHECK THE GROUND CONNECTION OF THE STEERING WHEEL/STEERING COLUMN MODULE FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the steering wheel/steering column module, connector C2LS41, pin 14, circuit GD138AY (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A9. **No** LOCATE and RECTIFY the break in the circuits between the steering wheel/steering column module and soldered connection SP518 with the aid of the Wiring Diagrams. CHECK system operates correctly

A9: CHECK THE VOLTAGE SUPPLY TO THE SMART JUNCTION BOX (SJB) FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02G.
	3 Measure the voltage between the Smart Junction Box, connector C1BP02G, pin 1, circuit SBB17A (RD), wiring harness side and ground.
	4 Measure the voltage between the Smart Junction Box, connector C1BP02G, pin 2, circuit SBB18A (YE), wiring harness side and ground.
	5 Ignition switch in position II.
	Is battery voltage measured in both cases? **Yes** GO to A10. **No** LOCATE and RECTIFY the break in the relevant circuits between fuse F17 (60 A) (EJB) or F18 (60 A) (EJB) and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

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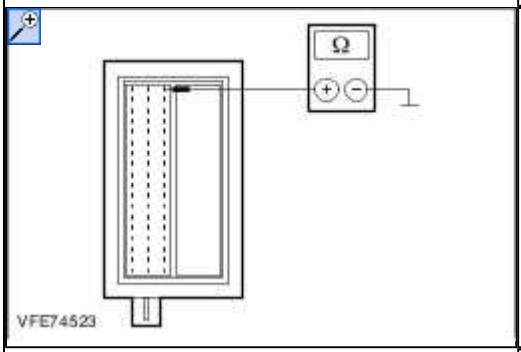
A10: CHECK THE GROUND CONNECTION OF THE SMART JUNCTION BOX FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 54, circuit GD123F (BK/GY), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A11. **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G1D132B with the aid of the Wiring Diagrams. CHECK system operates correctly

A11: CHECK THE GROUND CONNECTION OF THE SMART JUNCTION BOX FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 65: • LHD: circuit GD140J (BK/GN), wiring harness side and ground. • RHD: circuit GD134U (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A12. **No** - LHD: LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G3D138 with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G3D133 with the aid of the Wiring Diagrams. CHECK system operates correctly

A12: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE STEERING WHEEL/STEERING COLUMN MODULE AND THE SMART JUNCTION BOX FOR SHORT CIRCUIT TO BATTERY VOLTAGE

	1 Ignition switch in position II.
	2 Measure the voltage between the steering wheel/steering column module, connector C2LS41, pin 2, circuit VMC34A (WH), wiring harness side and ground.

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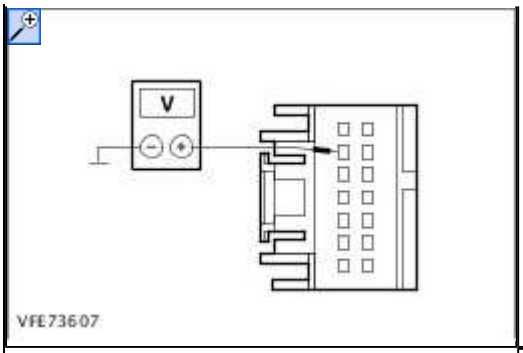


Does the meter display battery voltage?

Yes

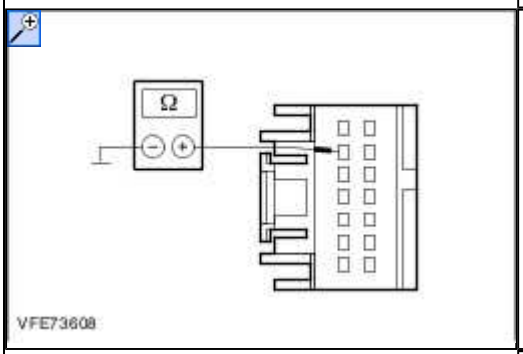
GO to A13.

No

LOCATE and RECTIFY the short to battery voltage in the circuits between the steering wheel/steering column module and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

A13: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR SHORT TO GROUND

1 Ignition switch in position 0.



2 Measure the resistance between the steering wheel/steering column module, connector C2LS41, pin 2, circuit VMC34A (WH), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

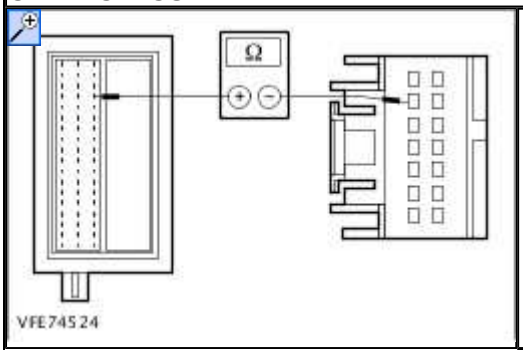
Yes

GO to A14.

No

LOCATE and RECTIFY the short to ground in the circuits between the steering wheel/steering column module and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

A14: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE STEERING WHEEL/STEERING COLUMN MODULE AND THE SMART JUNCTION BOX (SJB) FOR OPEN CIRCUIT



1 Measure the resistance between the steering wheel/steering column module, connector C2LS41, pin 2, circuit VMC34A (WH), wiring harness side and the Smart Junction Box, connector C1BP02C, pin 51, circuit VMC34A (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

RENEW the steering wheel/steering column module

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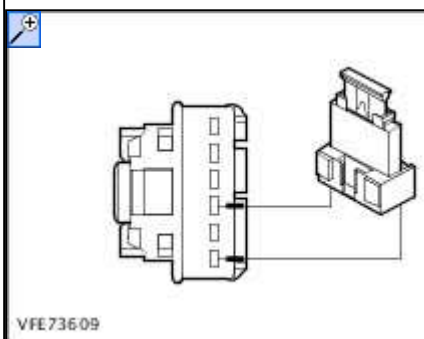
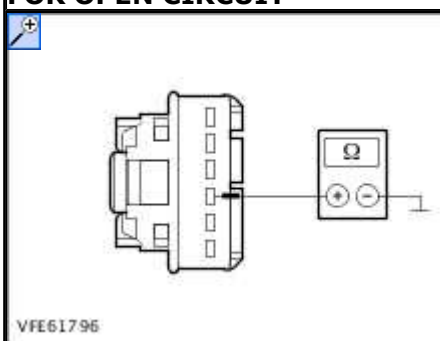
	CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuits between the steering wheel/steering column module and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST B : HAZARD WARNING LIGHTS INOPERATIVE, TURN SIGNAL FUNCTION OK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RULE OUT THE HIGH BEAM HEADLAMP SWITCH HAZARD WARNING LIGHT SYSTEM AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Hazard warning lights switch from connector C2LS32.
 VFE73609	3 Connect a fused jumper lead (5 A) to the hazard warning lights switch, connector C2LS32, between pin 6, circuit CLS32A (BN/YE) and pin 4, circuit GD133CF (BK), wiring harness side.
	4 Ignition switch in position II.
	5 CHECK the turn signal lamps.
	Do the hazard indicators operate? **Yes** INSTALL A NEW hazard warning lights switch. CHECK system operates correctly **No** GO to B2.
B2: CHECK THE GROUND CONNECTION OF THE HAZARD WARNING LIGHTS SWITCH FOR OPEN CIRCUIT	
 VFE61796	1 Measure the resistance between the hazard warning lights switch, connector C2LS32, pin 4, circuit GD133CF (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B3. **No** LOCATE and RECTIFY the break in the circuit between the hazard warning lights switch and ground connection G3D134 with the aid of the

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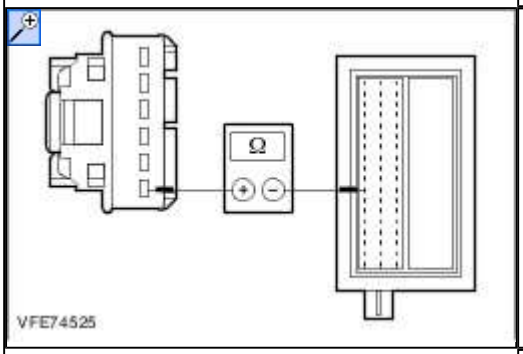
	wiring diagrams. CHECK system operates correctly
B3: CHECK THE CIRCUIT BETWEEN THE HAZARD WARNING LIGHTS SWITCH AND THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02C.
	3 Measure the resistance between the hazard warning lights switch, connector C2LS32, pin 6, circuit CLS32A (BN/YE), wiring harness side and the Smart Junction Box, connector C1BP02C, pin 8, circuit CLS32A (BN/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the hazard warning lights switch and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST C : SINGLE OR MULTIPLE TURN SIGNAL LAMPS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: DETERMINE THE CONDITION UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 CHECK the turn signal lamps.
	3 SWITCH ON the left-hand turn signal.
	4 SWITCH ON the right-hand turn signal.
	Is one or more turn signal lamp on the left-hand side inoperative? **Yes** - All turn signal lamps on left-hand side inoperative: CHECK and if necessary RENEW the steering wheel/steering column switch. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). - Left-hand front turn signal lamp is inoperative: GO to C2. - Left-hand rear turn signal lamp is inoperative: GO to C5. - Integrated turn signal lamp in the left-hand exterior mirror is inoperative: GO to C8. **No** - All turn signal lamps on right-hand side inoperative: CHECK and if necessary RENEW the steering wheel/steering column switch. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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	- Right-hand front turn signal lamp is inoperative: GO to C16. - Right-hand rear turn signal lamp is inoperative: GO to C19. - Integrated turn signal lamp in the right-hand exterior mirror is inoperative: GO to C22. - Integrated turn signal lamps in the exterior mirrors on both sides are inoperative: GO to C30.
C2: CHECK GROUND SUPPLY OF LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 7, circuit GD130T (BK/YE), wiring harness side and ground.
	4 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 9, circuit GD130AS (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohm measured in both cases? **Yes** GO to C3. **No** LOCATE and RECTIFY the break in the relevant circuit between the headlamp and soldered connection SP371 using the wiring diagrams. CHECK system operates correctly
C3: CHECK THE VOLTAGE SUPPLY OF THE FRONT LEFT-HAND TURN SIGNAL LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 CHECK the turn signal lamps.
	3 SWITCH ON the left-hand turn signal.
	4 Measure the voltage between the left-hand headlamp, connector C1LF08, pin 8, circuit CLS21A (BU/GN), wiring harness side and ground.
	Is fluctuating battery voltage measured? **Yes** CHECK the left-hand headlamp and RENEW it as necessary. CHECK system operates correctly **No** GO to C4.
C4: CHECK VOLTAGE SUPPLY OF THE FRONT LEFT-HAND TURN SIGNAL LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 19, circuit CLS21A (BU/GN), wiring harness side and the left-hand headlamp, connector C1LF08, pin 8, circuit CLS21A (BU/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the headlamp

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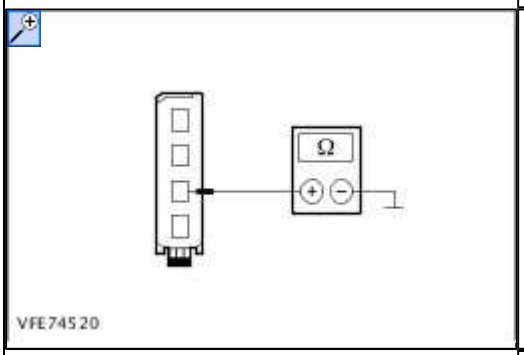
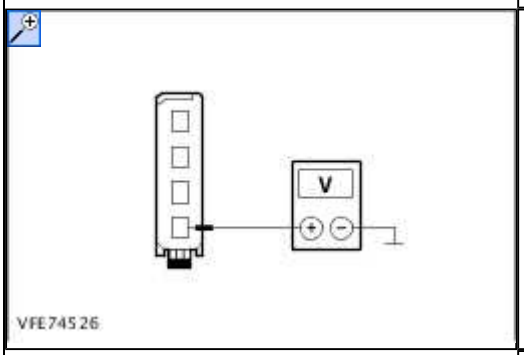
	with the aid of the Wiring Diagrams. CHECK system operates correctly
C5: CHECK GROUND CONNECTION TO LEFT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand rear lamp assembly from connector C4LS18A.
	3 Measure the resistance between the left-hand rear lamp assembly, connector C4LS18A, pin 3, circuit GD150C (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C6. **No** LOCATE and RECTIFY the break in the circuit between the rear lamp assembly and soldered connection SP549 with the aid of the Wiring Diagrams. CHECK system operates correctly
C6: CHECK VOLTAGE SUPPLY TO LEFT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 SWITCH ON the left-hand turn signal.
	3 Measure the voltage between the left-hand rear lamp assembly, connector C4LS18A, pin 4, circuit CLS23A (GY/OG), wiring harness side and ground.
	Is fluctuating battery voltage measured? **Yes** CHECK and if necessary RENEW the left-hand rear lamp assembly. CHECK system operates correctly **No** GO to C7.
C7: CHECK VOLTAGE SUPPLY TO LEFT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 36, circuit CLS23A (GY/OG), wiring harness side and the rear left lamp assembly, connector C4LS18A, pin 4, circuit CLS23A (GY/OG), wiring harness side.

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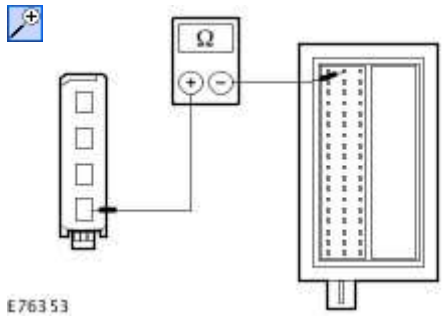	
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the Smart Junction Box with the aid of the WDS and RENEW it if required. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the rear lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
C8: CHECK FUSE FA1/FA2 (25 A) (RJB)	
	1 Ignition switch in position 0.
	2 Disconnect Fuse. • LHD: FA1 (25 A) (RJB) • RHD: FA2 (25 A) (RJB)
	3 CHECK Fuse. • LHD: FA1 (25 A) (RJB) • RHD: FA2 (25 A) (RJB)
	Is the fuse OK.? **Yes** GO to C9. **No** - LHD: RENEW fuse FA1 (25 A) (RJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly - RHD: RENEW fuse FA2 (25 A) (RJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
C9: CHECK THE VOLTAGE SUPPLY TO FUSE FA1/FA2 (25 A) (RJB) FOR OPEN CIRCUIT	
	1 Connect Fuse. • LHD: FA1 (25 A) (RJB) • RHD: FA2 (25 A) (RJB)
	2 Ignition switch in position II.
	3 Measure the voltage between fuse: • LHD: FA1 (25 A) (RJB) and ground. • RHD: FA2 (25 A) (RJB) and ground.
	Does the meter display battery voltage?

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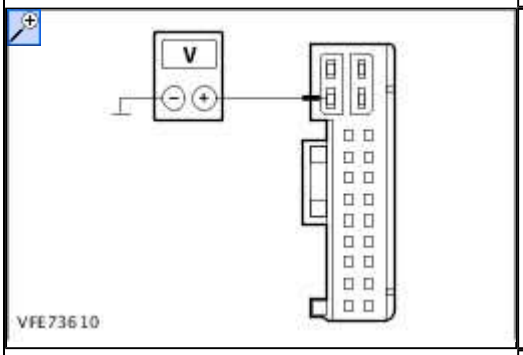
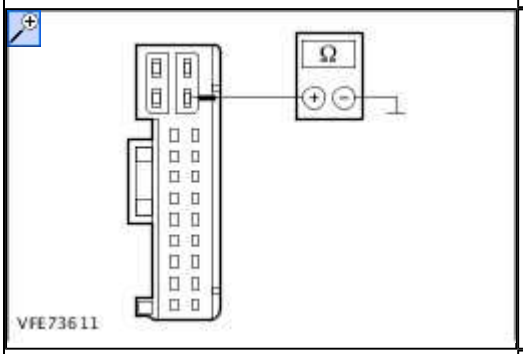
	Yes GO to C10. **No** - LHD: LOCATE and RECTIFY the break in the voltage supply of fuse FA1 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the voltage supply of fuse FA2 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
C10: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND DOOR CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Door control module, left-hand side from connector C5PL01A.
	3 Ignition switch in position II.
	4 Measure the voltage between the door control module, left-hand side, connector C5PL01A, pin 2, circuit SBR01A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to C11. **No** - LHD: LOCATE and RECTIFY the break in the circuit between the door control module and fuse FA1 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the circuit between the door control module and fuse FA2 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
C11: CHECK THE GROUND CONNECTION OF THE LEFT-HAND DOOR CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand door control module, connector C5PL01A, pin 13, circuit GD134H (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C12. **No** LOCATE and RECTIFY the break in the circuit between the door control module and soldered

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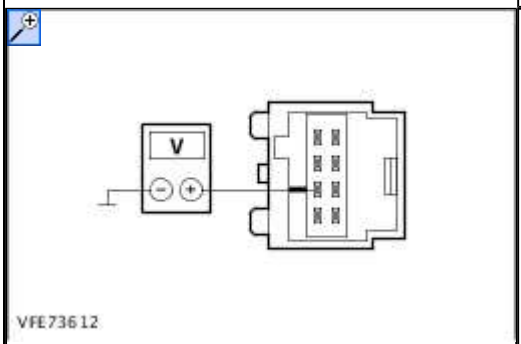
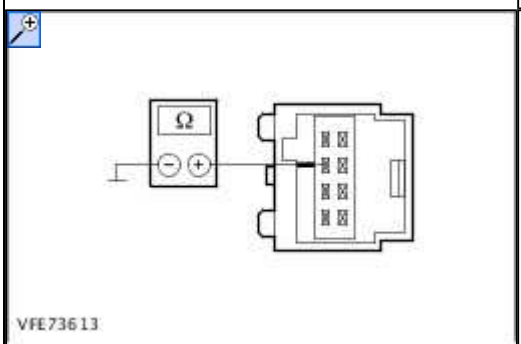
	connection SP386 with the aid of the Wiring Diagrams. CHECK system operates correctly
C12: CHECK THE VOLTAGE SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE LEFT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT	
	1 Connect Left-hand door control module to connector C5PL01A.
	2 Disconnect Left-hand integrated turn signal lamp from connector C5PM26A.
	3 Ignition switch in position II.
	4 SWITCH ON the left-hand turn signal.
 VFE73612	5 Measure the voltage between the integrated turn signal lamp, left-hand exterior mirror, connector C5PM26A, pin 7, circuit CLS22A (GN/BN), wiring harness side and ground.
	Is fluctuating battery voltage measured? **Yes** GO to C13. **No** GO to C15.
C13: CHECK THE GROUND SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE LEFT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
 VFE73613	2 Measure the resistance between the integrated turn signal lamp, left-hand exterior mirror, connector C5PM26A, pin 6, circuit RPM05A (VT/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the integrated turn signal lamp in the exterior mirror CHECK system operates correctly **No** GO to C14.
C14: CHECK THE GROUND CONNECTION BETWEEN THE DOOR CONTROL MODULE AND THE INTEGRATED TURN SIGNAL LAMP IN THE LEFT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT	
	1 Disconnect Door control module, left-hand side from connector C5PL01B.
	2 Measure the resistance between the integrated turn signal lamp, left-hand exterior mirror, connector C5PM26A, pin 6, circuit RPM05A (VT/GN), wiring harness side and the door control module, left-hand side, connector C5PL01B, pin 23, circuit RPM05A (VT/GN), wiring harness side.

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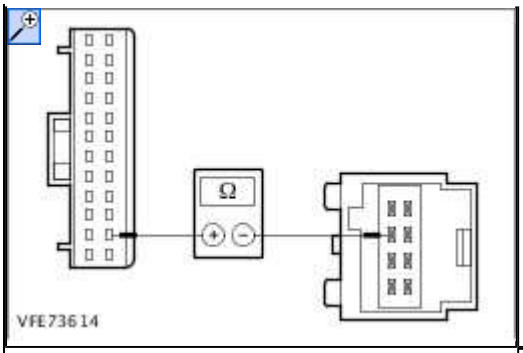


Is a resistance of less than 2 Ohms registered?

Yes

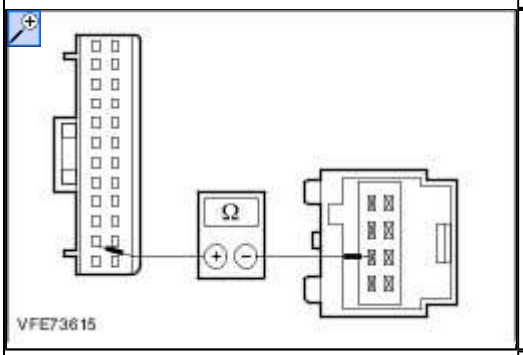
RENEW the door control module. CHECK system operates correctly

No

LOCATE and RECTIFY the break in the circuit between the integrated turn signal lamp in the exterior mirror and the door control module using the Wiring Diagrams. CHECK system operates correctly

C15: CHECK THE VOLTAGE SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE LEFT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect Left-hand door control module from connector C5PL01B.



3. Measure the resistance between the left-hand door control module, connector C5PL01B, pin 11, circuit CLS22A (GN/BN), wiring harness side and the integrated turn signal lamp, left-hand exterior mirror, connector C5PM26A, pin 7, circuit CLS22A (GN/BN), wiring harness side.

Is a resistance of less than 2 ohms registered?

Yes

CHECK and if necessary RENEW the door control module. CHECK system operates correctly If the concern persists:
REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

No

LOCATE and RECTIFY the break in the circuit between the door control module and the integrated turn signal lamp in the exterior mirror using the Wiring Diagrams. CHECK system operates correctly

C16: CHECK THE GROUND CONNECTION TO THE RIGHT-HAND HEADLAMP FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Measure the resistance between the right-hand headlamp, connector C1LF09, pin 7, circuit GD132M (BK/VT), wiring harness side and ground.
3. Measure the resistance between the right-hand headlamp, connector C1LF09, pin 9, circuit GD132X (BK/VT), wiring harness side and ground.

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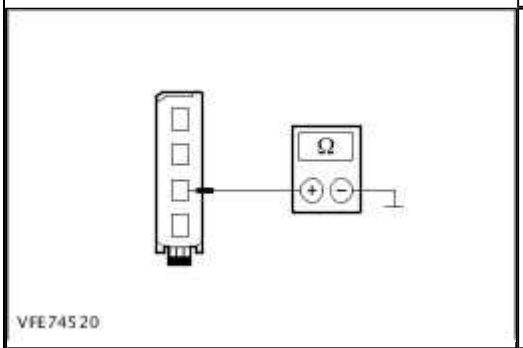
	Is a resistance of less than 2 Ohm measured in both cases? **Yes** GO to C17. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP380 using the wiring diagrams. CHECK system operates correctly
C17: CHECK THE VOLTAGE SUPPLY TO THE FRONT RIGHT-HAND TURN SIGNAL LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 SWITCH ON the right-hand turn signal.
	3 Measure the voltage between the right-hand headlamp, connector C1LF09, pin 8, circuit CLS25A (YE/VT), wiring harness side and ground.
	Is fluctuating battery voltage measured? **Yes** CHECK and if necessary RENEW the headlamp. CHECK system operates correctly **No** GO to C18.
C18: CHECK THE VOLTAGE SUPPLY TO THE FRONT RIGHT-HAND TURN SIGNAL LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 1, circuit CLS25A (YE/VT), wiring harness side and the right-hand headlamp, connector C1LF09, pin 8, circuit CLS25A (YE/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the headlamp and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly
C19: CHECK THE GROUND CONNECTION TO THE RIGHT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand rear lamp assembly from connector C4LS19A.
	3 Measure the resistance between the right-hand rear lamp assembly, connector C4LS19A, pin 3, circuit GD152A (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes**

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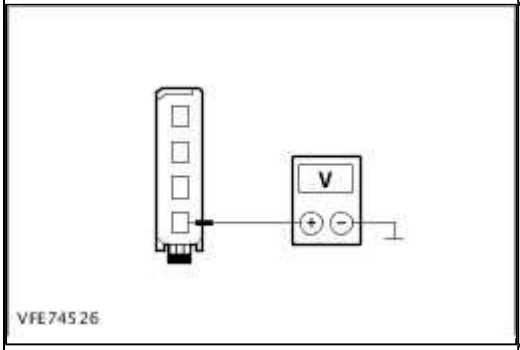
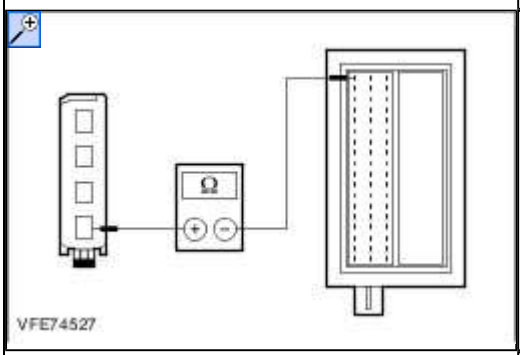
	GO to C20. **No** LOCATE and RECTIFY the break in the circuit between the rear lamp assembly and soldered connection SP600 with the aid of the Wiring Diagrams. CHECK system operates correctly
C20: CHECK VOLTAGE SUPPLY TO RIGHT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 SWITCH ON the right-hand turn signal.
	3 Measure the voltage between the right-hand rear lamp assembly, connector C4LS19A, pin 4, circuit CLS27A (GN/OG), wiring harness side and ground.
	Is fluctuating battery voltage measured? **Yes** CHECK and if necessary RENEW the right-hand rear lamp assembly. CHECK system operates correctly **No** GO to C21.
C21: CHECK VOLTAGE SUPPLY TO RIGHT-HAND REAR LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 18, circuit CLS27A (GN/OG), wiring harness side and the rear right lamp assembly, connector C4LS19A, pin 4, circuit CLS27A (GN/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear lamp assembly and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly
C22: CHECK FUSE FA2/FA1 (25 A) (RJB)	
	1 Ignition switch in position 0.
	2 Disconnect Fuse. • LHD: FA2 (25 A) (RJB) • RHD: FA1 (25 A) (RJB)

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	3 CHECK Fuse. • LHD: FA2 (25 A) (RJB) • RHD: FA1 (25 A) (RJB)
	Is the fuse OK.? **Yes** GO to C23. **No** - LHD: RENEW fuse FA2 (25 A) (RJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly - RHD: RENEW fuse FA1 (25 A) (RJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
C23: CHECK THE VOLTAGE SUPPLY TO FUSE FA2/FA1 (25 A) (RJB) FOR OPEN CIRCUIT	
	1 Connect Fuse. • LHD: FA2 (25 A) (RJB) • RHD: FA1 (25 A) (RJB)
	2 Ignition switch in position II.
	3 Measure the voltage between fuse: • LHD: FA2 (25 A) (RJB) and ground. • RHD: FA1 (25 A) (RJB) and ground.
	Does the meter display battery voltage? **Yes** GO to C24. **No** - LHD: LOCATE and RECTIFY the break in the voltage supply of fuse FA2 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the voltage supply of fuse FA1 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
C24: CHECK THE VOLTAGE SUPPLY TO THE RIGHT-HAND DOOR CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand door control module from connector C6PL01A.
	3 Ignition switch in position II.
	4 Measure the voltage between the door control module, right-hand side, connector C6PL01A, pin 2, circuit SBR02A (YE/RD), wiring harness side and ground.

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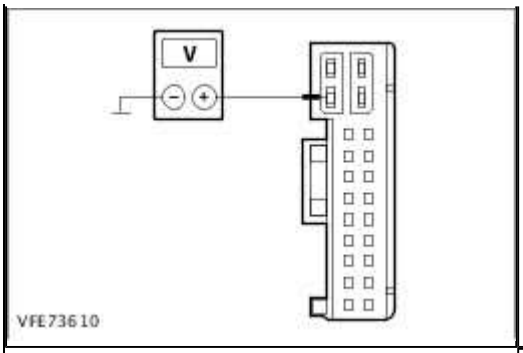
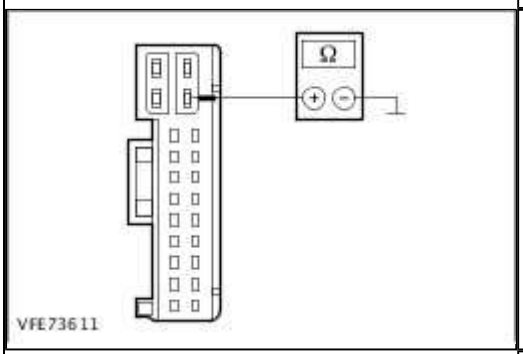
	
	Does the meter display battery voltage? **Yes** GO to C25. **No** - LHD: LOCATE and RECTIFY the break in the circuit between the door control module and fuse FA2 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the circuit between the door control module and fuse FA1 (25 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly
C25: CHECK THE GROUND SUPPLY OF THE RIGHT-HAND DOOR CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the voltage between the door control module, right-hand side, connector C6PL01A, pin 13, circuit GD140D (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C26. **No** LOCATE and RECTIFY the break in the circuit between the door control module and soldered connection SP392 with the aid of the Wiring Diagrams. CHECK system operates correctly
C26: CHECK THE VOLTAGE SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE RIGHT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT	
	1 Connect Right-hand door control module to connector C6PL01A.
	2 Disconnect Right-hand integrated turn signal lamp from connector C5PM31A.
	3 Ignition switch in position II.
	4 SWITCH ON the right-hand turn signal.
	5 Measure the voltage between the integrated turn signal lamp, right-hand exterior mirror, connector C5PM31A, pin 7, circuit CLS26A (BU/GY), wiring harness side and ground.

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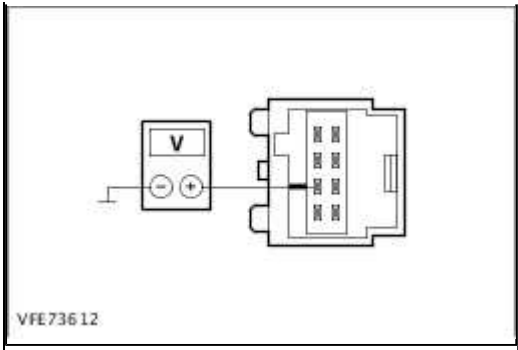
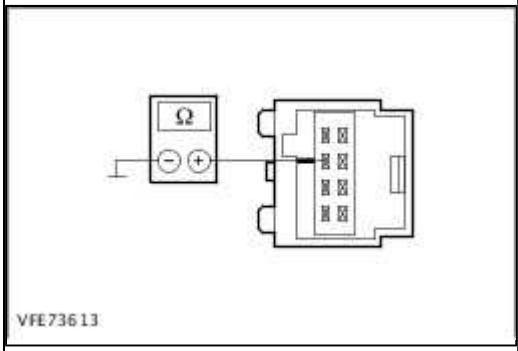


Is fluctuating battery voltage measured?
Yes
GO to C27.
No
GO to C29.

C27: CHECK THE GROUND SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE RIGHT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT

1 Ignition switch in position 0.

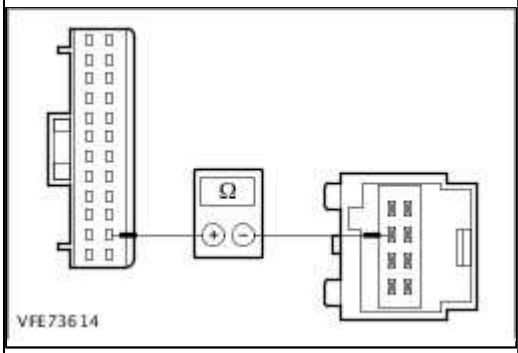


2 Measure the resistance between the integrated turn signal lamp, right-hand exterior mirror, connector C5PM31A, pin 6, circuit RPM08A (GN/BU), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?
Yes
RENEW the integrated turn signal lamp in the exterior mirror CHECK system operates correctly
No
GO to C28.

C28: CHECK THE GROUND CONNECTION BETWEEN THE RIGHT-HAND DOOR CONTROL MODULE AND THE INTEGRATED TURN SIGNAL LAMP IN THE RIGHT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT

1 Disconnect Door control module from connector C6PL01B.



2 Measure the resistance between the integrated turn signal lamp, right-hand exterior mirror, connector C5PM31A, pin 6, circuit RPM08A (GN/BU), wiring harness side and the door control module, right-hand side, connector C6PL01B, pin 23, circuit RPM08A (GN/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
RENEW the door control module. CHECK system operates correctly
No
LOCATE and RECTIFY the break in the circuit between the integrated turn signal lamp in the exterior mirror and the door control module using

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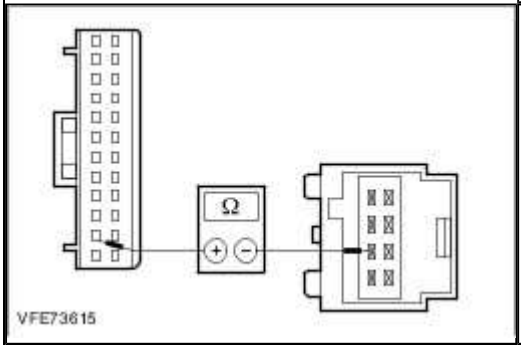
	the Wiring Diagrams. CHECK system operates correctly
C29: CHECK THE VOLTAGE SUPPLY TO THE INTEGRATED TURN SIGNAL LAMP IN THE RIGHT-HAND EXTERIOR MIRROR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand door control module from connector C6PL01B.
	3 Measure the resistance between the right-hand door control module, connector C6PL01B, pin 11, circuit CLS26A (BU/GY), wiring harness side and the integrated turn signal lamp, right-hand exterior mirror, connector C5PM31A, pin 7, circuit CLS26A (BU/GY), wiring harness side.
	Is a resistance of less than 2 ohms registered? **Yes** CHECK and if necessary RENEW the door control module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit between the door control module and the integrated turn signal lamp in the exterior mirror using the Wiring Diagrams. CHECK system operates correctly
C30: CHECK FUSE F19 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F19 (60 A) (EJB).
	3 CHECK fuse F19 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to C31. **No** RENEW fuse F19 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
C31: CHECK THE VOLTAGE SUPPLY TO FUSE F19 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F19 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F19 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to C32. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F19 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
C32: CHECK THE JOINT VOLTAGE SUPPLY OF THE INTEGRATED TURN SIGNAL LAMPS IN THE EXTERIOR MIRRORS FOR OPEN CIRCUIT	
	1

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	1 Measure the voltage between fuse FA1/FA2 (25 A) (RJB) and ground.
	Does the meter display battery voltage? **Yes** REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuits between fuse F19 (60 A) (EJB) and FA1/FA2 (25 A) (RJB) using the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST D : ONE OR MORE TURN SIGNAL LAMPS FLASHING CONTINUOUSLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: DETERMINE THE CONDITION UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 CHECK all turn signal lamps.
	Do the turn signal lamps on one side flash continuously? **Yes** GO to D2. **No** - Turn signal lamps on both sides are flashing continuously: GO to D3. - Individual turn signal lamp flashing continuously: CHECK the Smart Junction Box (SJB) and RENEW it if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). - One of the integrated turn signal lamps in the exterior mirrors is flashing continuously: CHECK and if necessary RENEW the door control module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). - Both of the integrated turn signal lamps in the exterior mirrors are flashing continuously: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
D2: RULE OUT THE STEERING WHEEL/STEERING COLUMN MODULE AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Steering wheel/steering column module from connector C2LS41.
	3 Ignition switch in position II.
	4 CHECK the turn signal lamps.
	Are the turn signal lamps flashing continuously? **Yes** CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00

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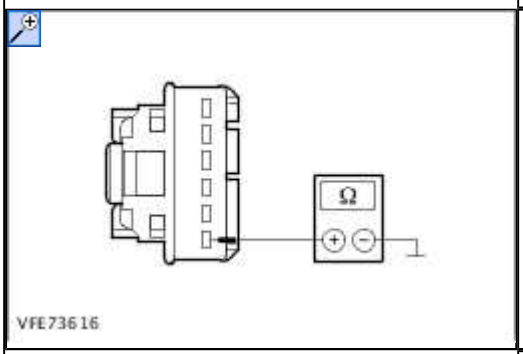
	Module Communications Network, Diagnosis and Testing). **No** RENEW the steering wheel/steering column module CHECK system operates correctly
D3: RULE OUT THE HIGH BEAM HEADLAMP SWITCH HAZARD WARNING LIGHT SYSTEM AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Hazard warning lights switch from connector C2LS32.
	3 Ignition switch in position II.
	4 CHECK the turn signal lamps.
	Are the turn signal lamps flashing continuously? **Yes** GO to D4. **No** RENEW the hazard warning lights switch. CHECK system operates correctly
D4: CHECK THE CONTROL CIRCUIT BETWEEN THE HAZARD WARNING LIGHTS SWITCH AND THE SMART JUNCTION BOX FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02C.
	3 Measure the resistance between the hazard warning lights switch, connector C2LS32, pin 6, circuit CLS32A (BN/YE), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly **No** LOCATE and RECTIFY the short to ground in the circuits between the hazard warning lights switch and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST E : ONE OR MORE TURN SIGNAL LAMPS PERMANENTLY LIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: DETERMINE THE CONDITION UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 CHECK the turn signal lamps.
	Are the turn signal lamps lit up permanently? **Yes** CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No**

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- Front left turn signal lamp permanently lit: GO to E2.
- Rear left turn signal lamp permanently lit: GO to E3.
- Front right turn signal lamp permanently lit: GO to E4.
- Rear right-hand turn indicator permanently lit: GO to E5.
- Integrated turn signal lamp in the left-hand exterior mirror permanently lit: GO to E6.
- Integrated turn signal lamp in the right-hand exterior mirror permanently lit: GO to E7.

E2: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE LEFT-HAND HEADLAMP FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Smart Junction Box from connector C1BP02A.
3. Ignition switch in position II.
4. CHECK the turn signal lamps.

Is the front left-hand turn signal permanently lit?

Yes

LOCATE and RECTIFY the short to battery voltage in the circuit between the headlamp and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

No

CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly

E3: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE LEFT-HAND REAR LAMP ASSEMBLY FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Left-hand rear lamp assembly from connector C4LS18A.
3. CHECK the turn signal lamps.
4. Ignition switch in position II.
5. CHECK the turn signal lamps.

Is the rear left-hand turn signal lamp permanently lit?

Yes

LOCATE and RECTIFY the short to battery voltage in the circuit between the rear lamp assembly and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

No

CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly

E4: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE RIGHT-HAND HEADLAMP FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Smart Junction Box from connector C1BP02A.
3. Ignition switch in position II.
4. CHECK the turn signal lamps.

Is the front right-hand turn signal permanently lit?

Yes

LOCATE and RECTIFY the short to battery voltage in the circuit between the headlamp and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly

No

CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly

E5: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE RIGHT-HAND REAR LAMP ASSEMBLY FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Smart Junction Box from connector C1BP02B.
3. Ignition switch in position II.

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	4 CHECK the turn signal lamps.
	Is the right-hand rear turn signal lamp on continuously? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the rear lamp assembly and the Smart Junction Box with the aid of the Wiring Diagrams. CHECK system operates correctly **No** CHECK the Smart Junction Box and RENEW it if required. CHECK system operates correctly
E6: RULE OUT THE LEFT-HAND DOOR CONTROL MODULE AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand door control module from connector C5PL01B.
	3 Ignition switch in position II.
	4 CHECK the turn signal lamp.
	Is the integrated turn signal lamp in the left-hand exterior mirror permanently lit? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the door control module and the integrated turn signal lamp in the exterior mirror using the Wiring Diagrams. CHECK system operates correctly **No** CHECK and if necessary RENEW the door control module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
E7: RULE OUT THE RIGHT-HAND DOOR CONTROL MODULE AS THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand door control module from connector C6PL01B.
	3 Ignition switch in position II.
	4 CHECK the turn signal lamp.
	Is the integrated turn signal lamp in the right-hand exterior mirror permanently lit? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the door control module and the integrated turn signal lamp in the exterior mirror using the Wiring Diagrams. CHECK system operates correctly **No** CHECK and if necessary RENEW the door control module. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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Print

Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: A new GEM needs to be configured after installation. For this purpose, the vehicle-specific data are read out of the module to be changed using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
The fog lamps are inoperative	* Fuse(s) * Circuit(s) * Lights Control Module * Smart Junction Box	* GO to Pinpoint Test A.
One or more fog lamps inoperative	* Circuit(s) * Front fog lamps * Tailgate lamps assembly * Smart Junction Box	* GO to Pinpoint Test B.

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The Fog Lamps are On Continuously	* Circuit(s) * Lights Control Module * Tailgate lamps assembly * Trailer socket	* GO to Pinpoint Test C.

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE FOG LAMPS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F33 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F33 (5 A) (EJB).
	3 CHECK fuse F33 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to A2. **No** RENEW fuse F33 (5 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK THE VOLTAGE SUPPLY TO FUSE F33 (5 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F33 (5 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F33 (5 A) (EJB) and ground.
	Does meter display battery voltage? **Yes** GO to A3. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F33 (5 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
A3: CHECK FUSE F17 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F17 (60 A) (EJB).
	3 CHECK fuse F17 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A4. **No** RENEW fuse F17 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A4: CHECK THE VOLTAGE SUPPLY TO FUSE F17 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F17 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F17 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A5. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F17 (60 A) (EJB) with the aid of the

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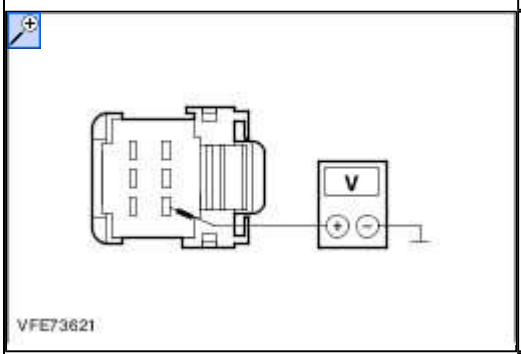
	wiring diagrams. CHECK system operates correctly
A5: CHECK FUSE F18 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F18 (60 A) (EJB).
	3 CHECK fuse F18 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A6. **No** RENEW fuse F18 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A6: CHECK THE VOLTAGE SUPPLY TO FUSE F18 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Connect fuse F18 (60 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F18 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A7. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F18 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
A7: CHECK THE VOLTAGE SUPPLY TO THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Lights control module from connector C2LF23D.
	3 Ignition switch in position II.
	4 Measure the voltage between the lights control module, connector C2LF23D, pin 1, circuit SBB33B (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A8. **No** LOCATE and RECTIFY the break in the circuits between fuse F33 (5 A) (EJB) and the lights control module with the aid of the wiring diagrams. CHECK system operates correctly
A8: CHECK THE GROUND CONNECTION OF THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the lights control module, connector C2LS23D, pin 5, circuit GD133BT (BK), wiring harness side and ground.

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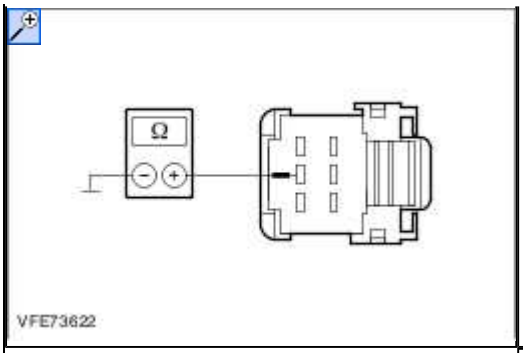


Is a resistance of less than 2 Ohm registered?
Yes
GO to A9.
No
LOCATE and RECTIFY the break in the circuits between the lights control module and soldered connection SP581 with the aid of the Wiring Diagrams. CHECK system operates correctly

A9: RULE OUT THE LIGHTS CONTROL MODULE AS A POSSIBLE CAUSE OF THE FAULT

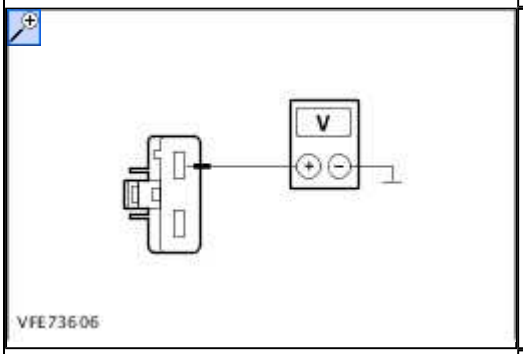
1 CHECK the lights control module.

Is the lights control module OK?
Yes
GO to A10.
No
INSTALL A NEW lights control module. CHECK system operates correctly

A10: CHECK THE VOLTAGE SUPPLY TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT

1 Disconnect Smart Junction Box from connector C1BP02G.

2 Ignition switch in position II.



3 Measure the voltage between the Smart Junction Box, connector C1BP02G, pin 1, circuit SBB17A (RD), wiring harness side and ground.

Does the meter display battery voltage?
Yes
GO to A11.
No
LOCATE and RECTIFY the break in the circuits between fuse F17 (60 A) (EJB) and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly

A11: CHECK THE VOLTAGE SUPPLY TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT

1 Measure the voltage between the Smart Junction Box, connector C1BP02G, pin 2, circuit SBB18A (YE), wiring harness side and ground.

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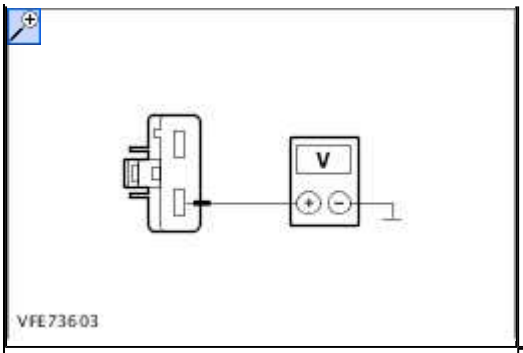
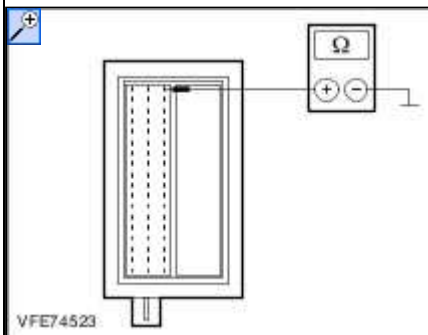


Does the meter display battery voltage?
Yes
GO to A12.
No
LOCATE and RECTIFY the break in the circuits between fuse F18 (60 A) (EJB) and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly

A12: CHECK THE GROUND CONNECTION TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect Smart Junction Box from connector C1BP02A.
3. Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 54, wiring harness side GD123F (BK/GY) and ground.



Is a resistance of less than 2 Ohm registered?
Yes
GO to A13.
No
LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground with the aid of the Wiring Diagrams. CHECK system operates correctly

A13: CHECK THE GROUND CONNECTION TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT

1. Disconnect Smart Junction Box from connector C1BP02B.
2. Measure the resistance between the lights control module, connector C1BP02B, pin 65:
   - LHD: circuit GD140J (BK/GN), wiring harness side and ground.
   - RHD: circuit GD134U (BK/VT), wiring harness side and ground.

Is a resistance of less than 2 Ohm registered?
Yes
GO to A14.
No

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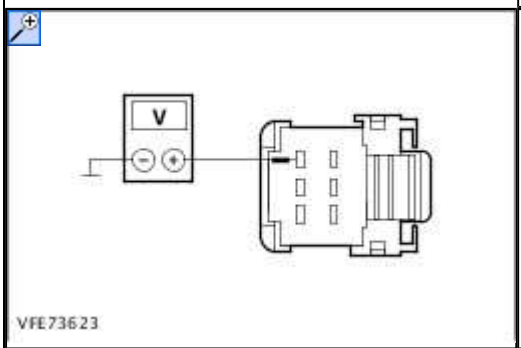
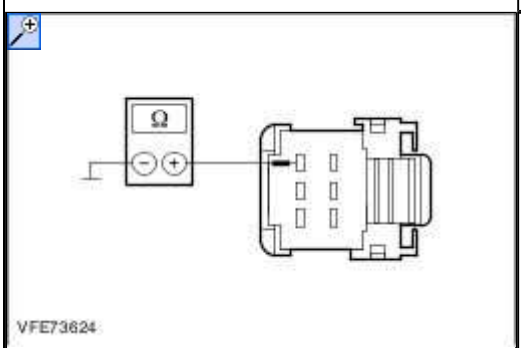
	- LHD: LOCATE AND RECTIFY the break in the circuits between the lights control module and ground connection G3D138 with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE AND RECTIFY the break in the circuits between the lights control module and ground connection G3D133 with the aid of the Wiring Diagrams. CHECK system operates correctly
A14: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR SHORT CIRCUIT TO BATTERY VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A15. **No** LOCATE and RECTIFY the short to battery voltage in the circuits between the lights control module and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly
A15: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR SHORT CIRCUIT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to A16. **No** LOCATE and RECTIFY the short to ground in the circuits between the lights control module and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly
A16: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Disconnect Smart Junction Box from connector C1BP02C.
	2 Measure the resistance between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and the Smart Junction Box, connector C1BP02C, pin 52, circuit

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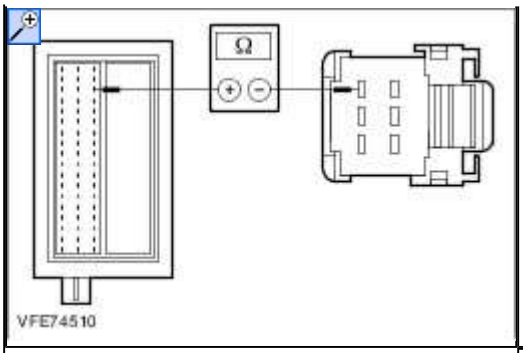

VLF25A (GN/VT), wiring harness side.

Is a resistance of less than 2 Ohm registered?

Yes

CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists:
REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

No

LOCATE and RECTIFY the open circuit in the circuits between the lights control module and the Smart Junction Box with the aid of the wiring diagrams.

PINPOINT TEST B : INDIVIDUAL OR MULTIPLE FOG LAMPS INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 SWITCH ON the front and rear fog lamps.
	3 CHECK fog lamps.
	Are one or more front fog lamps inoperative? **Yes** - Left-hand front fog lamp inoperative: GO to B4. - Right-hand front fog lamp inoperative: GO to B7. - Both front fog lamps inoperative: GO to B2. **No** - Left-hand rear fog lamp inoperative: GO to B11. - Right-hand rear fog lamp inoperative: GO to B14. - Both rear fog lamps inoperative: GO to B10.
B2: CHECK FUSE F13 (15 A) (SJB)	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F13 (15 A) (SJB).
	3 CHECK Fuse F13 (15 A) (SJB).
	Is the fuse OK.? **Yes** GO to B3. **No** RENEW fuse F13 (15 A) (SJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
B3: CHECK THE VOLTAGE SUPPLY TO FUSE F13 (15 A) (SJB) FOR OPEN CIRCUIT	
	1 Connect Fuse F13 (15 A) (SJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F13 (15 A) (SJB) and ground.
	Does meter display battery voltage? **Yes**

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	CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE AND RECTIFY the break in the voltage supply to fuse F13 (15A) (SJB) with the aid of the wiring diagrams. CHECK system operates correctly
B4: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND FRONT FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Front fog lamp from. • Vehicles with adaptive front lighting module, SAV5: Connector C1LF29B • All other vehicles: Connector C1LF29A
	3 Ignition switch in position II.
	4 Switch on the front fog lamps.
	5 Measure the voltage between the left-hand front fog lamp: • Vehicles with adaptive front lighting module, SAV5: connector C1LF29B, pin 1, circuit CLF29C (BN), wiring harness side and ground. • All other vehicles: connector C1LF29A, pin 1, circuit CLF29D (BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B5. **No** GO to B6.
B5: CHECK GROUND CONNECTION OF LEFT-HAND FRONT FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand front fog lamp: • Vehicles with adaptive front lighting module, SAV5: connector C1LF29B, pin 2, circuit GD130U (BK/YE), wiring harness side and ground. • All other vehicles: connector C1LF29A, pin 2, circuit GD130AU (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL an new fog lamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the front fog lamp and soldered connection SP371 using the Wiring Diagrams. CHECK system operates correctly

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B6: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND FRONT FOG LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 69: • Vehicles with adaptive front lighting module, SAV5: circuit CLF29C (BN), wiring harness side and the left-hand front fog lamp, connector C1LF29B, pin 1, circuit CLF29C (BN), wiring harness side. • All other vehicles: circuit CLF29B (BN), wiring harness side and the left-hand front fog lamp, connector C1LF29A, pin 1, circuit CLF29D (BN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the front fog lamp with the aid of the Wiring Diagrams. CHECK system operates correctly

B7: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND FRONT FOG LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Front fog lamp from connector C1LF28A.
	3 Ignition switch in position II.
	4 Switch on the front fog lamps.
	5 Measure the voltage between the right-hand front fog lamp, connector C1LF28A, pin 1, circuit A_CLF29B (BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B8. **No** GO to B9.

B8: CHECK GROUND CONNECTION OF RIGHT-HAND FRONT FOG LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand front fog lamp, connector C1LF28A, pin 2, circuit GD132V (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL an new fog lamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the front fog lamp and soldered connection SP380 using the Wiring Diagrams. CHECK system operates correctly

B9: CHECK THE VOLTAGE SUPPLY OF THE RIGHT-HAND FRONT FOG LAMP FOR OPEN

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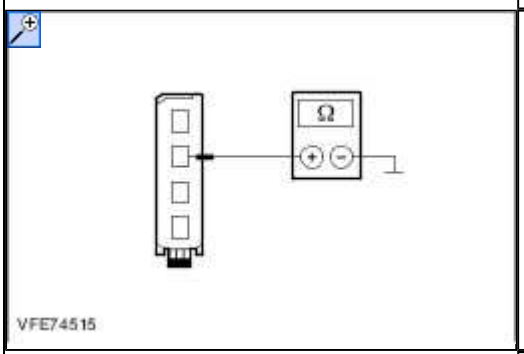
CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 68, circuit A_CLF29B (BN), wiring harness side and the right-hand front fog lamp, connector C1LF28A, pin 1, circuit A_CLF29B (BN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the front fog lamp with the aid of the Wiring Diagrams. CHECK system operates correctly

B10: CHECK THE SHARED GROUND CONNECTION OF THE REAR FOG LAMPS FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Left-hand rear lamp unit from connector C4LS35.
	3 Measure the resistance between the left-hand rear lamp unit, connector C4LS35, pin 2, circuit GD150P (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP534 and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK system operates correctly

B11: CHECK THE POWER SUPPLY TO THE LEFT-HAND REAR FOG LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Left-hand rear fog lamp from connector C4LS35.
	3 Ignition switch in position II.
	4 SWITCH ON the rear fog lamps.
	5 Measure the voltage between left-hand rear fog lamp, connector C4LS35, pin 1, circuit A_CLS45A (BN/GN), wiring harness side and ground.

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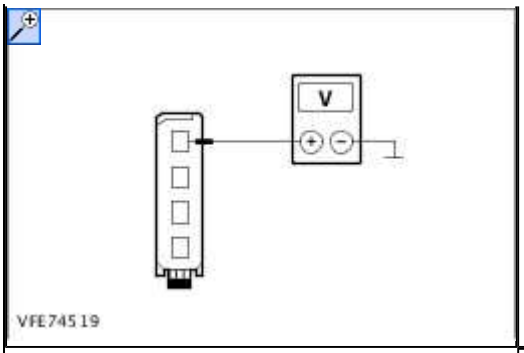
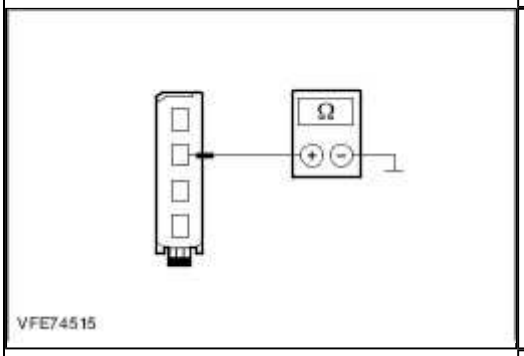
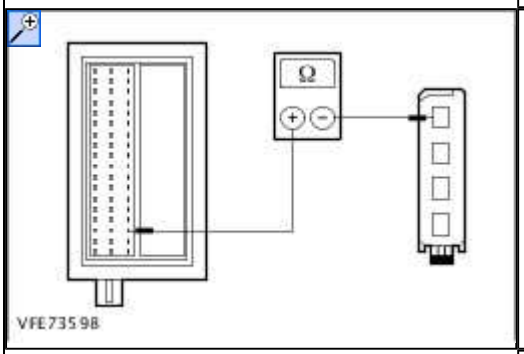
	
	Does the meter display battery voltage? **Yes** GO to B12. **No** GO to B13.
B12: CHECK GROUND SUPPLY OF LEFT-HAND REAR FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand rear fog lamp, connector C4LS35, pin 2, circuit GD150P (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW rear lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear lamp unit and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly
B13: CHECK THE POWER SUPPLY TO THE LEFT-HAND REAR FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 39, circuit A_CLS45B (BN/GN), wiring harness side and the left-hand rear fog lamp, connector C4LS35, pin 1, circuit A_CLS45A (BN/GN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit

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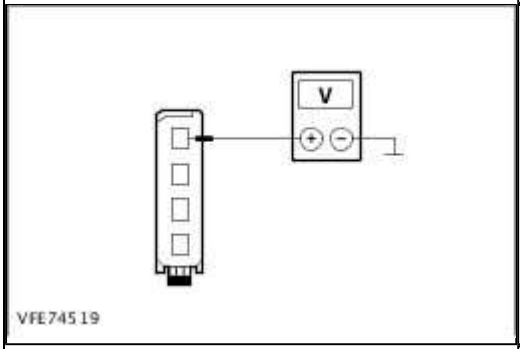
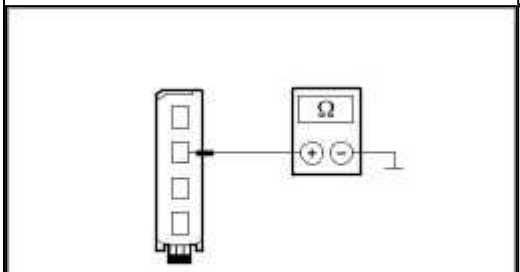
	between the Smart Junction Box and the rear lamp unit with the aid of the Wiring Diagrams. CHECK system operates correctly
B14: CHECK THE POWER SUPPLY TO THE RIGHT-HAND REAR FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand rear fog lamp from connector C4LS36.
	3 Ignition switch in position II.
	4 SWITCH ON the rear fog lamps.
 VFE74519	5 Measure the voltage between right-hand rear fog lamp, connector C4LS36, pin 1, circuit CLS45A (BN/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B15. **No** GO to B16.
B15: CHECK GROUND SUPPLY OF RIGHT-HAND REAR FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
 VFE74515	2 Measure the resistance between the right-hand rear fog lamp, connector C4LS36, pin 2, circuit GD150W (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW rear lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear fog lamp and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly
B16: CHECK THE POWER SUPPLY TO THE RIGHT-HAND REAR FOG LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 38, circuit CLS45B (BN/GN), wiring harness side and the right-hand rear fog lamp, connector C4LS36, pin 1, circuit CLS45A (BN/GN), wiring harness side.

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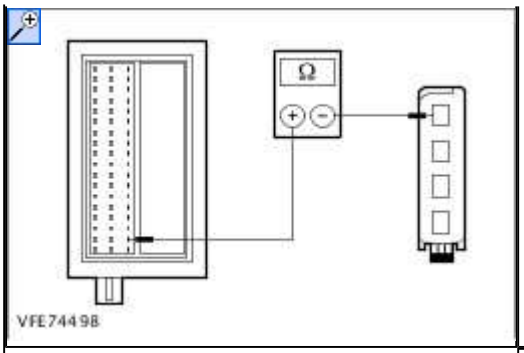

	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the rear lamp unit with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST C : THE FOG LAMPS ARE ON CONTINUOUSLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RULE OUT THE LIGHTS CONTROL MODULE AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect fuse F33 (5 A) (EJB).
	3 Ignition switch in position II.
	4 CHECK fog lamps.
	Are all the fog lamps permanently lit up? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). **No** - Both front fog lamps permanently lit:GO to C2. - Both rear fog lamps permanently lit: INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing). - One rear fog lamp permanently lit: GO to C3. - No fog lamp permanently lit: INSTALL A NEW lights control module. CHECK system operates correctly
C2: RULE OUT THE SMART JUNCTION BOX AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Ignition switch in position II.
	4 CHECK the front fog lamps.
	Is the left-hand front fog lamp lit up continuously? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the Smart Junction Box and the left-hand front fog lamp with the aid of the Wiring Diagrams. CHECK system operates correctly **No** - Right-hand front fog lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuit between the Smart Junction Box and the right-hand front fog lamp with the aid of the Wiring Diagrams. CHECK

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	system operates correctly - No front fog lamp permanently lit: INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
C3: RULE OUT THE SMART JUNCTION BOX AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 CHECK the rear fog lamps.
	Is the left-hand rear fog lamp lit up continuously? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuit between the Smart Junction Box and the left-hand rear fog lamp with the aid of the Wiring Diagrams. CHECK system operates correctly **No** - Right-hand rear fog lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuit between the Smart Junction Box and the right-hand rear fog lamp with the aid of the Wiring Diagrams. CHECK system operates correctly - No rear fog lamp permanently lit: INSTALL A NEW Smart Junction Box. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: If a new GEM module is being installed, the new module must be configured following installation. For this purpose, the vehicle-specific data is read out of the module to be changed using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
The Backup Lamps Are Inoperative	* Fuse(s) * Backup lamp switch * Circuit(s) * Central Junction Box (CJB)	* GO to Pinpoint Test A.
One backup lamp is inoperative	* Circuit(s) * Tailgate lamps assembly	* GO to Pinpoint Test B.
The Backup Lamps Are On Continuously	* Circuit(s) * Backup lamp switch	* GO to Pinpoint Test C.

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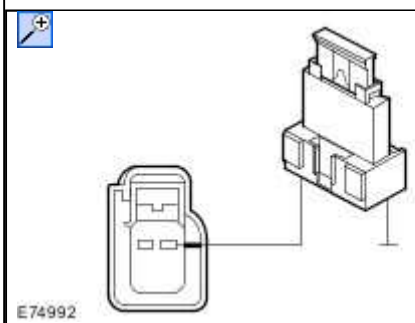
	* Trailer socket	

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE BACKUP LAMPS ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F11 (7.5 A) (SJB)	
	1 Ignition switch in position 0.
	2 Disconnect Fuse F11 (7.5 A) (SJB).
	3 CHECK Fuse F11 (7.5 A) (SJB).
	Is the fuse OK.? **Yes** GO to A2. **No** INSTALL A NEW fuse F11 (7.5 A) (SJB). CHECK system operates correctly If the fuse blows again, LOCATE and RECTIFY short using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK THE VOLTAGE SUPPLY TO FUSE F11 (7.5 A) (SJB) FOR OPEN CIRCUIT	
	1 Connect Fuse F11 (7.5 A) (SJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F11 (7.5 A) (SJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A3. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F11 (7.5 A) (SJB) using the Wiring Diagrams. CHECK system operates correctly
A3: RULE OUT THE BACKUP LAMP SWITCH AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Backup lamp switch from. • Manual transmission (SIGMA): Connector C1ET47B • Manual transmission (all other variants): Connector C1ET47A
	3 Manual transmission (SIGMA): Connect a fused (5 A) jumper lead at the backup lamp switch, connector C1ET47B, between pin 1, circuit (BU), wiring harness side and ground.
	4 Manual transmission (all other variants): Connect a fused jumper lead (5 A) at the backup lamp switch, connector C1ET47A, between pin 1, circuit (BU), wiring harness side and pin 2, circuit GD120S (BK/GN) / GD120B (BK/GN), wiring harness side.
	5 Ignition switch in position II.
	Are the backup lamps illuminated?

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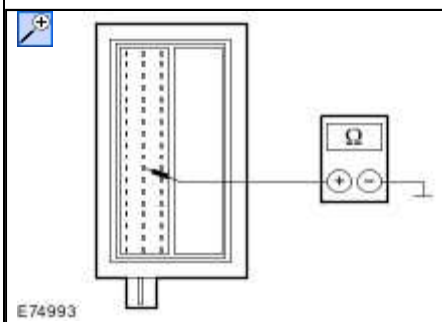
	Yes INSTALL A NEW backup lamp switch. CHECK system operates correctly **No** - Manual transmission (SIGMA): GO to A5. - Manual transmission (all other variants):GO to A4.
A4: CHECK THE GROUND CONNECTION OF THE BACKUP LAMP SWITCH FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the backup lamp switch, connector C1ET47A, pin 2, circuit GD120S (BK/GN) / GD120B (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** GO to A5. **No** LOCATE and RECTIFY the break in the circuit between the backup lamp switch and soldered connection SP358 using the Wiring Diagrams. CHECK system operates correctly
A5: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE BACKUP LAMP SWITCH FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Connect Backup lamp switch to. • Manual transmission (SIGMA): Connector C1ET47B • Manual transmission (all other variants): Connector C1ET47A
	4 ENGAGE the reverse gear.
	5 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 26, circuit CET47B (BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** GO to A6. **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the backup lamp switch with the aid of the Wiring Diagrams. CHECK system operates correctly
A6: CHECK THE SHARED GROUND OF THE BACKUP LAMPS FOR OPEN CIRCUIT	
	1 Disconnect Left-hand rear lamp assembly from connector C4LS35.
	2 Measure the resistance between the left-hand rear lamp assembly (tailgate), connector C4LS35, pin 2,

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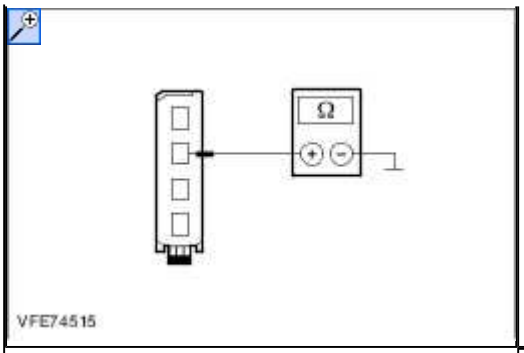
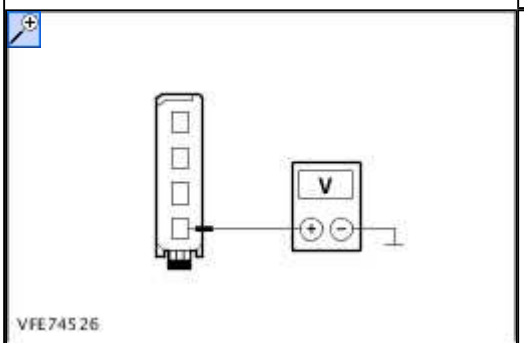
	circuit GD150P (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP534 and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST B : ONE BACKUP LAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 ENGAGE the reverse gear.
	3 CHECK the backup lamps.
	Is the left-hand backup lamp inoperative? **Yes** GO to B2. **No** Right-hand backup lamp inoperative: GO to B5.
B2: CHECK THE POWER SUPPLY OF THE LEFT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand tailgate lamp assembly from connector C4LS35.
	3 Ignition switch in position II.
	4 ENGAGE reverse gear.
	5 Measure the voltage between the left-hand tailgate lamp assembly, connector C4LS35, pin 4, circuit A_CLS10A (GN/BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B4. **No** GO to B3.
B3: CHECK THE POWER SUPPLY OF THE LEFT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.

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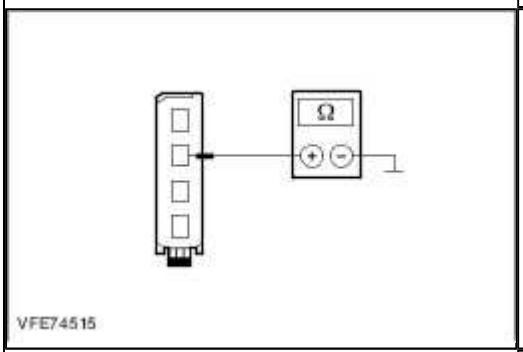
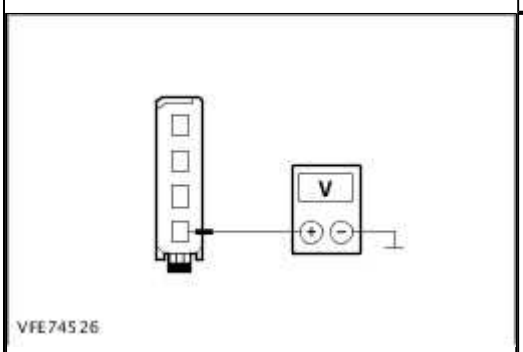
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 73, circuit A_CLS10B (GN/BN), wiring harness side and the left-hand tailgate lamp assembly, connector C4LS35, pin 4, circuit A_CLS10A (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the tailgate lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
B4: CHECK THE GROUND CONNECTION OF THE LEFT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand tailgate lamp assembly, connector C4LS35, pin 2, circuit GD150P (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW tailgate lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the tailgate lamp unit and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly
B5: CHECK THE POWER SUPPLY OF THE RIGHT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand tailgate lamp assembly from connector C4LS36.
	3 Ignition switch in position II.
	4 ENGAGE the reverse gear.
	5 Measure the voltage between the right-hand tailgate lamp assembly, connector C4LS36, pin 4, circuit CLS10A (GN/BN), wiring harness side and ground.
	Does the meter display battery voltage?

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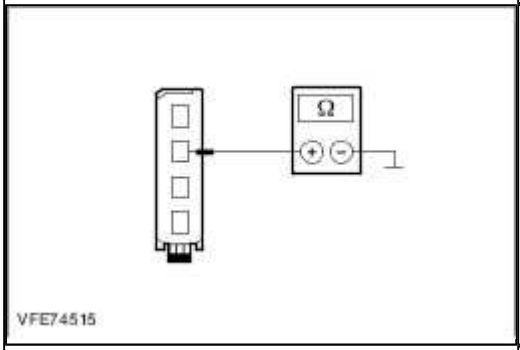
	Yes GO to B7. **No** GO to B6.
B6: CHECK THE POWER SUPPLY OF THE RIGHT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 62, circuit CLS10B (GN/BN), wiring harness side and the right-hand tailgate lamp assembly, connector C4LS36, pin 4, circuit CLS10A (GN/BN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the Smart Junction Box and the tailgate lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
B7: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND TAILGATE LAMP ASSEMBLY FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand tailgate lamp unit, connector C4LS36, pin 2, circuit GD150W (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW tailgate lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the tailgate lamp unit and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST C : THE BACKUP LAMPS ARE PERMANENTLY LIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RULE OUT THE BACKUP LAMP SWITCH AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Backup lamp switch from:. • Manual transmission (SIGMA): Connector C1ET47B • Manual transmission (all other variants): Connector C1ET47A

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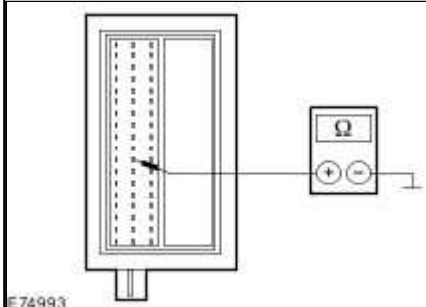
	3 Ignition switch in position II.
	4 CHECK the backup lamps.
	Are the backup lamps lit? **Yes** GO to C2. **No** INSTALL A NEW backup lamp switch. CHECK system operates correctly
C2: NARROW DOWN THE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Disconnect Smart Junction Box from connector C1BP02B.
	4 Ignition switch in position II.
	Is one backup lamp permanently lit? **Yes** - Left-hand backup lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuits between the Smart Junction Box and the left-hand backup lamp with the aid of the Wiring Diagrams. CHECK system operates correctly - Right-hand backup lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuits between the Smart Junction Box and the right-hand backup lamp with the aid of the Wiring Diagrams. CHECK system operates correctly **No** GO to C3.
C3: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE BACKUP LAMP SWITCH FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 26, circuit CET47B (BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and REPAIR the short to ground using the Wiring Diagrams. CHECK system operates correctly

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: If a new GEM module is being installed, the new module must be configured following installation. For this purpose, the vehicle-specific data or the data to be changed is read out of the module using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical systems
• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
The headlamp levelling is inoperative/does not operate correctly (vehicles with conventional headlamps)	* Fuse(s) * Circuit(s) * Lighting control module * Adaptive front lighting module * Headlamp * Central Junction	* GO to Pinpoint Test A.

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	Box (CJB)	
The headlamp levelling is inoperative/does not operate correctly (vehicles with xenon headlamps)	* Fuse(s) * Circuit(s) * Headlamp levelling motor. * Xenon headlamps * Headlamp levelling front sensor * Headlamp levelling rear sensor * Adaptive front lighting module * Central Junction Box (CJB)	* GO to Pinpoint Test B.

Pinpoint test

NOTE: Use a digital multimeter for all measurements.

PINPOINT TEST A : THE HEADLAMP LEVELLING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY (VEHICLES WITH CONVENTIONAL HEADLAMPS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 SWITCH ON dipped beam.
	3 ADJUST the headlamp levelling (UP/DOWN).
	4 CHECK the headlamp levelling.
	Is the headlamp levelling left-hand side and right-hand side inoperative? **Yes** GO to A2. **No** - Left-hand headlamp levelling inoperative: GO to A19. - Right-hand headlamp levelling inoperative: GO to A22.
A2: CHECK FUSE F43 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F43 (5 A) (EJB).
	3 CHECK fuse F43 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to A3. **No** RENEW fuse F43 (5 A) (EJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK THE VOLTAGE SUPPLY TO FUSE F43 (5 A) (EJB)	
	1 Connect fuse F43 (5 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F43 (5A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** - vehicles without adaptive front lighting module: GO to A6. - vehicles with adaptive front lighting module: GO to A4.

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	No LOCATE AND RECTIFY the break in the voltage supply of fuse F43 (5 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system.
A4: CHECK FUSE F39 (15 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F39 (15 A) (EJB).
	3 CHECK fuse F39 (15 A) (EJB).
	Is the fuse OK.? **Yes** GO to A5. **No** RENEW fuse F39 (15 A) (EJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK THE VOLTAGE SUPPLY TO FUSE F39 (15 A) (EJB)	
	1 Connect fuse F39 (15 A) (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F39 (15 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK THE COMMON VOLTAGE SUPPLY OF THE HEADLAMP LEVELLING MOTORS FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 Measure the voltage between left-hand headlamp, connector C1LF08, pin 1, circuit CBB43B (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A7. **No** LOCATE and RECTIFY the break in circuits between fuse F43 (5 A) (EJB) and soldered connection SP171 using the Wiring Diagrams. CHECK the operation of the system.
A7: CHECK THE COMMON CONTROL CIRCUIT FOR HEADLAMP LEVELLING FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Disconnect Lighting control module from connector C2LF23D.
	4 Disconnect Vehicles with adaptive front lighting module: Adaptive front lighting module from connector C2LF23A.
	5 Ignition switch in position II.
	6 Measure the voltage between the lighting control

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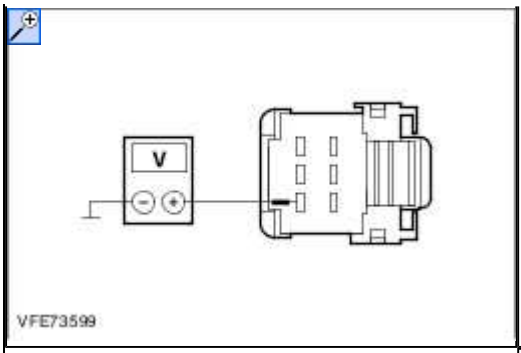
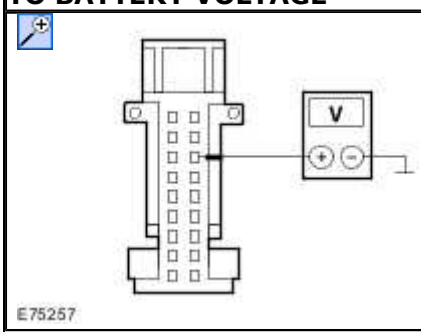
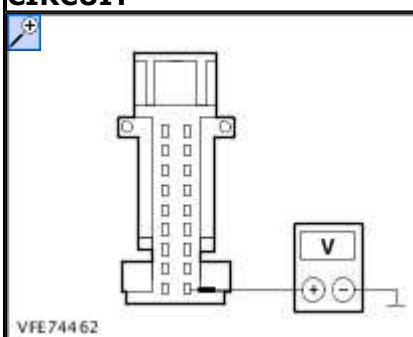
	module, connector C2LF23D, pin 4: • Vehicles without adaptive front lighting module: circuit VLF22B (VT/GN), wiring harness side and ground. • Vehicles with adaptive front lighting module: circuit A_VLF22A (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to the lighting control module, connector C2LF23D, pin 4 using the Wiring Diagrams. CHECK the operation of the system. **No** - vehicles without adaptive front lighting module: GO to A12. - vehicles with adaptive front lighting module: GO to A8.
A8: CHECK THE COMMON CONTROL CIRCUIT FOR HEADLAMP LEVELLING FOR SHORT TO BATTERY VOLTAGE	
	1 Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 16, circuit VLF22E (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to battery voltage in the circuits connected to the adaptive front lighting module, connector C2LF23A, pin 16 using the Wiring Diagrams. CHECK the operation of the system. **No** GO to A9.
A9: CHECK VOLTAGE SUPPLY TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 10, circuit CBB43C (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A10. **No**

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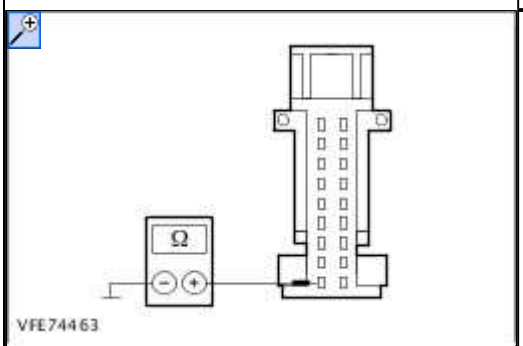
	LOCATE and RECTIFY break in circuit between soldered connection SP171 and adaptive front lighting module using the Wiring Diagrams. CHECK the operation of the system.
A10: CHECK VOLTAGE SUPPLY TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23B.
	3 Ignition switch in position II.
	4 Measure the voltage between adaptive front lighting module, connector C2LF23B, pin 1, circuit CBB39D (VT/WH), wiring harness side and ground.
	5 Measure the voltage between adaptive front lighting module, connector C2LF23B, pin 2, circuit CBB39G (VT/WH), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to A11. **No** - If battery voltage is not measured during both of the measurements: LOCATE and RECTIFY the break in circuits between soldered connection SP174 and fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system. - If battery voltage is not measured during one of the measurements: LOCATE and RECTIFY break in the affected circuit between soldered connection SP174 and adaptive front lighting module using the Wiring Diagrams. CHECK the operation of the system.
A11: CHECK GROUND CONNECTION TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 1, circuit GD138BU (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A12. **No** LOCATE and RECTIFY break in circuit between adaptive front lighting module and ground connection G6D139 using the Wiring Diagrams. CHECK the operation of the system.
A12: CHECK THE COMMON CONTROL CIRCUIT FOR HEADLAMP LEVELLING FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the lighting control module, connector C2LF23D, pin 4:

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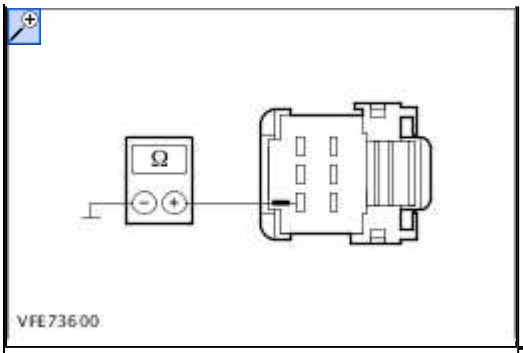


- Vehicles without adaptive front lighting module: circuit VLF22B (VT/GN), wiring harness side and ground.
- Vehicles with adaptive front lighting module: circuit A_VLF22A (VT/GN), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

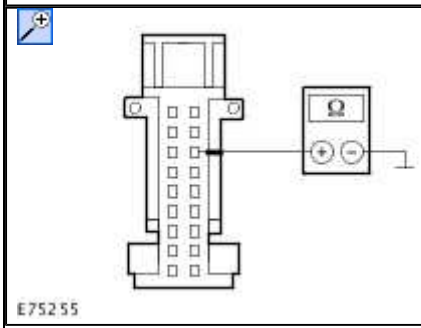
Yes

- vehicles without adaptive front lighting module: GO to A15. - vehicles with adaptive front lighting module: GO to A13.

No

LOCATE and RECTIFY the short to ground in the circuits connected to the lighting control module, connector C2LF23D, pin 4 using the Wiring Diagrams. CHECK the operation of the system.

A13: CHECK THE COMMON CONTROL CIRCUIT FOR HEADLAMP LEVELLING FOR SHORT TO GROUND



1 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 16, circuit VLF22E (VT/GN), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

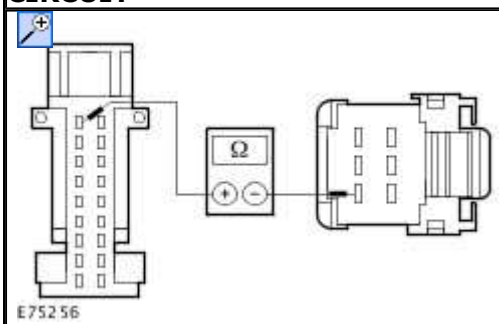
Yes

GO to A14.

No

LOCATE and RECTIFY the short to ground in the circuits connected to the adaptive front lighting module, connector C2LF23A, pin 16 using the Wiring Diagrams. CHECK the operation of the system.

A14: CHECK COMMON CONTROL CIRCUIT OF HEADLAMP LEVELLING FOR OPEN CIRCUIT



1 Measure the resistance between the lighting control module, connector C2LF23D, pin 4, circuit A_VLF22A (VT/GN), wiring harness side and adaptive front lighting module, connector C2LF23A, pin 9, circuit A_VLF22A (VT/GN), wiring harness side.

2 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 16, circuit VLF22E (VT/GN), wiring harness side and left-hand headlamp, connector C1LF08, pin 3, circuit VLF22A (VT/GN), wiring harness side.

Is a resistance of less than 2 Ohm measured in both

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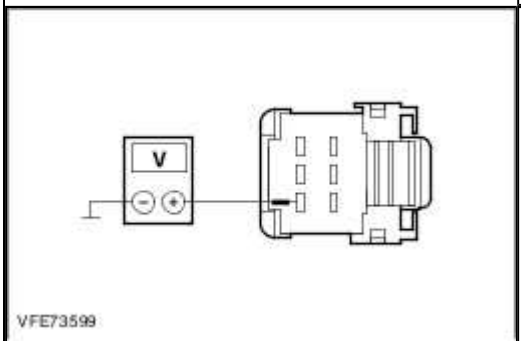
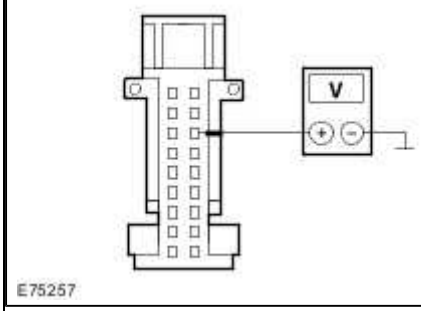
	cases? **Yes** GO to A16. **No** LOCATE and REPAIR the break in the affected circuit using the Wiring Diagrams. CHECK the operation of the system.
A15: CHECK COMMON CONTROL CIRCUIT OF HEADLAMP LEVELLING FOR OPEN CIRCUIT	
	1 Measure the resistance between adaptive front lighting module, connector C2LF23D, pin 4, circuit VLF22B (VT/GN), wiring harness side and left-hand headlamp, connector C1LF08, pin 3, circuit VLF22A (VT/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A16. **No** LOCATE and RECTIFY break in circuit between lighting control module and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.
A16: RULE OUT THE LEFT-HAND HEADLAMP AS A POSSIBLE CAUSE OF THE FAULT	
	1 Connect Left-hand headlamp to connector C1LF08A.
	2 Ignition switch in position II.
 VFE73599	3 Vehicles without adaptive front lighting module: Measure the voltage between adaptive front lighting module, connector C2LF23D, pin 4, circuit VLF22B (VT/GN), wiring harness side and ground.
 E75257	4 Vehicles with adaptive front lighting module: Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 16, circuit VLF22E (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** RENEW left-hand headlamp. CHECK the operation of the system. **No** GO to A17.
A17: RULE OUT THE RIGHT-HAND HEADLAMP AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Connect Right-hand headlamp to connector C1LF09.
	3 Ignition switch in position II.
	4 Vehicles without adaptive front lighting module:

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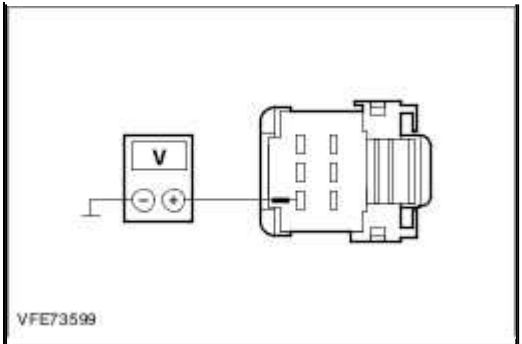
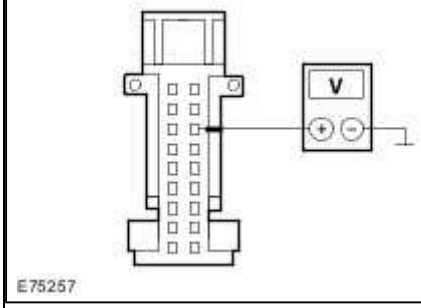
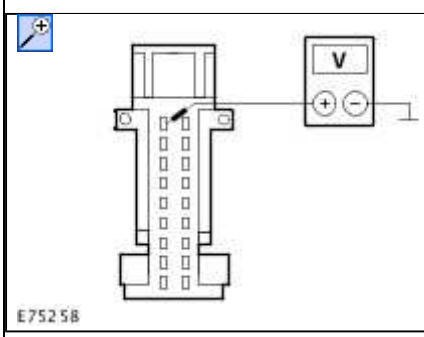
	Measure the voltage between adaptive front lighting module, connector C2LF23D, pin 4, circuit VLF22B (VT/GN), wiring harness side and ground.
	5 Vehicles with adaptive front lighting module: Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 16, circuit VLF22E (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** RENEW right-hand headlamp. CHECK the operation of the system. **No** - vehicles without adaptive front lighting module: RENEW lighting control module. CHECK the operation of the system. - vehicles with adaptive front lighting module: GO to A18.
A18: RULE OUT THE LIGHTING CONTROL MODULE AS A POSSIBLE SOURCE OF THE FAULT.	
	1 Ignition switch in position 0.
	2 Connect Lighting control module to connector C2LF23D.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
	5 OPERATE the headlamp levelling (UP/DOWN).
	6 Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 9, circuit A_VLF22A (VT/GN), wiring harness side and ground.
	Does the voltage measurement change in line with the headlamp levelling position. **Yes** RENEW adaptive front lighting module. CHECK the operation of the system. **No** RENEW lighting control module. CHECK the operation of the system.
A19: CHECK VOLTAGE SUPPLY OF LEFT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	

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	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
	5 Measure the voltage between left-hand headlamp, connector C1LF08, pin 1, circuit CBB43B (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A20. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP171 and headlamp using the Wiring Diagrams. CHECK the operation of the system.
A20: CHECK GROUND CONNECTION OF LEFT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 11, circuit GD130AE (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A21. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP371 using the Wiring Diagrams. CHECK the operation of the system.
A21: CHECK CONTROL CIRCUIT OF LEFT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Disconnect Right-hand headlamp from connector C1LF09.
	2 Measure the resistance between left-hand headlamp, connector C1LF08, pin 3, circuit VLF22A (VT/GN), wiring harness side and right-hand headlamp, connector C1LF09, pin 3, circuit VLF22C (VT/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW left-hand headlamp. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit between headlamp and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.
A22: CHECK VOLTAGE SUPPLY OF RIGHT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
	5 Measure the voltage between right-hand headlamp, connector C1LF09, pin 1, circuit CBB43A (GY), wiring harness side and ground.

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	Does the meter display battery voltage? **Yes** GO to A23. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP171 and headlamp using the Wiring Diagrams. CHECK the operation of the system.
A23: CHECK GROUND CONNECTION OF RIGHT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 11, circuit GD132W (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A24. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP380 using the Wiring Diagrams. CHECK the operation of the system.
A24: CHECK CONTROL CIRCUIT OF RIGHT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Disconnect Left-hand headlamp from connector C1LF08.
	2 Measure the resistance between left-hand headlamp, connector C1LF08, pin 3, circuit VLF22A (VT/GN), wiring harness side and right-hand headlamp, connector C1LF09, pin 3, circuit VLF22C (VT/GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW headlamp. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit between headlamp and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : THE HEADLAMP LEVELLING IS INOPERATIVE/DOES NOT OPERATE CORRECTLY (VEHICLES WITH XENON HEADLAMPS)	
WARNING: High voltages of up to 30 kV are present in the system. Ensure that the headlamp assembly electrical connector is disconnected if the headlamp assembly is removed.	
NOTE: It is not possible to adjust the headlamps manually.	
NOTE: For testing the basic function of the automatic headlamp levelling system, switch on the dipped beams and change the load (rear axle) of the vehicle. Check if the headlamp levelling system adjusts the headlamps correctly.	
NOTE: The headlamp levelling positioning motor cannot be replaced by itself. If necessary, it needs to be replaced together with the complete headlamp unit.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 SWITCH ON dipped beams.
	3 CHECK the headlamp levelling.

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	Is the headlamp levelling left-hand side and right-hand side inoperative? **Yes** GO to B2. **No** - Left-hand headlamp levelling inoperative: GO to B25. - Right-hand headlamp levelling inoperative: GO to B28.
B2: CHECK FUSE F43 (5 A) (EJB)	
	1 Ignition switch in position 0. 2 Disconnect fuse F43 (5 A) (EJB). 3 CHECK fuse F43 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to B3. **No** RENEW fuse F43 (5 A) (EJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK the operation of the system.
B3: CHECK THE VOLTAGE SUPPLY TO FUSE F43 (5 A) (EJB)	
	1 Connect fuse F43 (5 A) (EJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse F43 (5A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to B4. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F43 (5 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system.
B4: CHECK FUSE F39 (15 A) (EJB)	
	1 Ignition switch in position 0. 2 Disconnect fuse F39 (15 A) (EJB). 3 CHECK fuse F39 (15 A) (EJB).
	Is the fuse OK.? **Yes** GO to B5. **No** RENEW fuse F39 (15 A) (EJB). CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK the operation of the system.
B5: CHECK THE VOLTAGE SUPPLY TO FUSE F39 (15 A) (EJB)	
	1 Connect fuse F39 (15 A) (EJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse F39 (15 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to B6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system.

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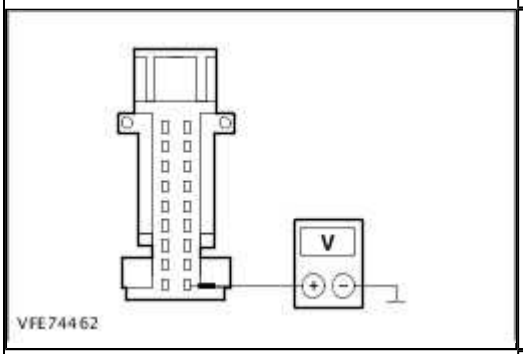
B6: CHECK THE COMMON VOLTAGE SUPPLY OF THE HEADLAMP LEVELLING MOTORS FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 Measure the voltage between left-hand headlamp, connector C1LF08, pin 13, circuit (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B7. **No** LOCATE and RECTIFY the break in circuit between fuse F39 (15 A) (EJB) and soldered connection SP172 using the Wiring Diagrams. CHECK the operation of the system.

B7: CHECK VOLTAGE SUPPLY TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
	3 Ignition switch in position II.
	4 Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 10, circuit CBB43C (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B8. **No** LOCATE and RECTIFY break in circuit between soldered connection SP171 and adaptive front lighting module using the Wiring Diagrams. CHECK the operation of the system.

B8: CHECK VOLTAGE SUPPLY TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23B.
	3 Ignition switch in position II.
	4 Measure the voltage between adaptive front lighting module, connector C2LF23B, pin 1, circuit CBB39D (VT/WH), wiring harness side and ground.
	5 Measure the voltage between adaptive front lighting module, connector C2LF23B, pin 2, circuit CBB39G (VT/WH), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to B9. **No**

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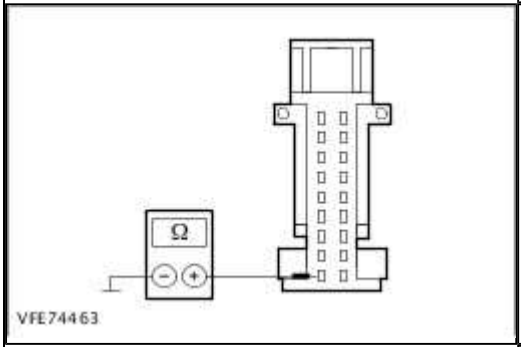
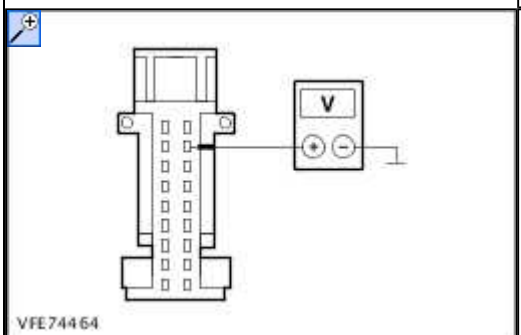
	- If battery voltage is not measured during both of the measurements: LOCATE and RECTIFY the break in circuits between soldered connection SP174 and fuse F39 (15 A) (EJB) using the Wiring Diagrams. CHECK the operation of the system. - If battery voltage is not measured during one of the measurements: LOCATE and RECTIFY break in the affected circuit between soldered connection SP174 and adaptive front lighting module using the Wiring Diagrams. CHECK the operation of the system.
B9: CHECK GROUND CONNECTION TO ADAPTIVE FRONT LIGHTING MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 1, circuit GD138BU (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B10. **No** LOCATE and RECTIFY break in circuit between adaptive front lighting module and ground connection G6D139 using the Wiring Diagrams. CHECK the operation of the system.
B10: CHECK LIN DATABUS CONNECTION BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND HEADLAMP LEVELLING MOTOR FOR SHORT CIRCUIT TO BATTERY VOLTAGE	
	1 Ignition switch in position II.
	2 Measure the voltage between adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to battery voltage in circuits between adaptive front lighting module and headlamp levelling motor using the Wiring Diagrams. CHECK the operation of the system. **No** GO to B11.
B11: CHECK LIN DATABUS CONNECTION BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND HEADLAMP LEVELLING MOTOR FOR SHORT CIRCUIT TO GROUND	
	1 Ignition switch in position 0.

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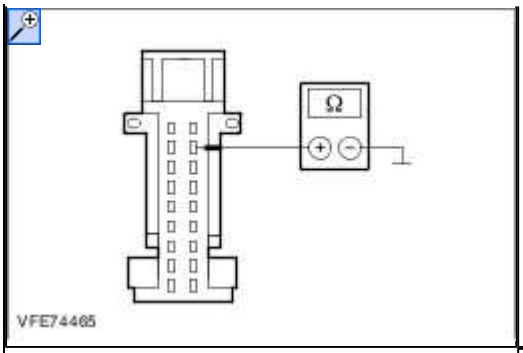	2 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to B12. **No** LOCATE and RECTIFY the short to ground in circuits between adaptive front lighting module and headlamp levelling motor using the Wiring Diagrams. CHECK the operation of the system.
B12: CHECK LIN DATABUS CONNECTION BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 17, circuit VLF32B (YE), wiring harness side and left-hand headlamp levelling motor, connector C1LF08, pin 14, circuit VLF32A (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B13. **No** LOCATE and RECTIFY break in circuits between adaptive front lighting module and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.
B13: CHECK FRONT HEADLAMP LEVELLING SENSOR	
	1 Disconnect Front headlamp levelling sensor from connector C5CD07.
	2 Check the front headlamp levelling sensor in accordance with the Component Checks in this operation.
	Is the front headlamp levelling sensor OK? **Yes** GO to B14. **No** INSTALL a new front headlamp levelling sensor. CHECK the operation of the system.
B14: CHECK REAR HEADLAMP LEVELLING SENSOR	
	1 Disconnect Rear headlamp levelling sensor from connector C7CD12.
	2 Check the rear headlamp levelling sensor in accordance with the Component Checks in this operation.
	Is the rear headlamp levelling sensor OK? **Yes** GO to B15. **No** INSTALL a new rear headlamp levelling sensor. CHECK the operation of the system.
B15: CHECK THE VOLTAGE SUPPLY TO THE HEADLAMP LEVELLING SENSORS FOR	

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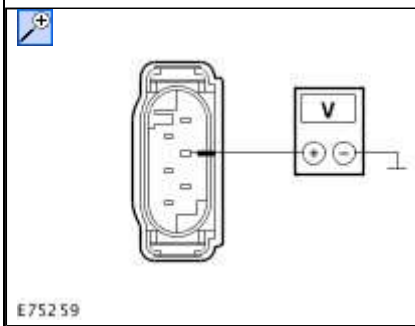
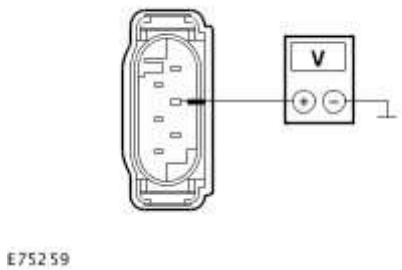
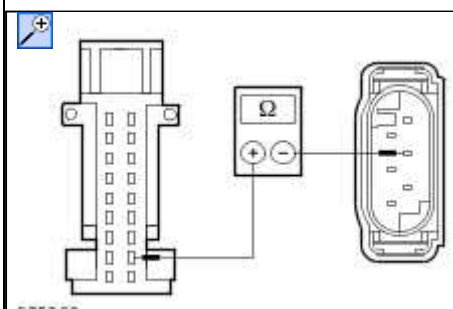
OPEN CIRCUIT

	1 Connect Adaptive front lighting module to connector C2LF23A.
	2 Connect Adaptive front lighting module to connector C2LF23B.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
 E75259	5 Measure the voltage between front headlamp levelling sensor, connector C5CD07, pin 5, circuit LCD23B (GN/OG), wiring harness side and ground.
 E75259	6 Measure the voltage between rear headlamp levelling sensor, connector C7CD12, pin 5, circuit LCD23D (GN/OG), wiring harness side and ground.
	Is a voltage of 5 Volts measured in both cases? **Yes** GO to B17. **No** - If no voltage is measured during both of the measurements: GO to B16. - Is a voltage of 5 Volts measured during just one measurement? LOCATE and RECTIFY break in the affected circuit between soldered connection SP406 and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.

B16: RULE OUT THE ADAPTIVE FRONT LIGHTING MODULE AS A POSSIBLE CAUSE OF THE FAULT

	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
 E75260	3 Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 11, circuit LCD23G (GN/OG), wiring harness side and front headlamp levelling sensor, connector C5CD07, pin 5, circuit LCD23B (GN/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the adaptive front lighting module. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit between

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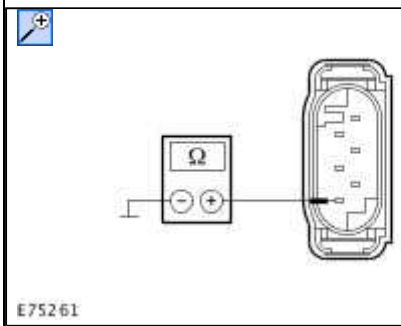
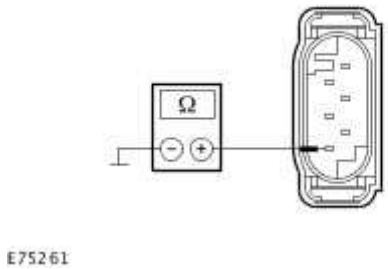
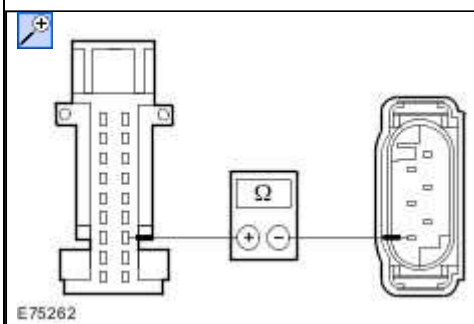
	adaptive front lighting module and soldered connection SP406 using the Wiring Diagrams. CHECK the operation of the system.
B17: RULE OUT THE ADAPTIVE FRONT LIGHTING MODULE AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 Measure the resistance between front headlamp levelling sensor, connector C5CD07, pin 1, circuit RCD02G (GN/BN), wiring harness side and ground.
	3 Measure the resistance between rear headlamp levelling sensor, connector C7CD12, pin 1, circuit RCD23D (WH/BN), wiring harness side and ground.
	Is a resistance of less than 2 Ohm measured in both cases? **Yes** GO to B19. **No** - If a resistance of less than 2 Ohm is not measured in either measurement: RENEW the adaptive front lighting module. CHECK the operation of the system. - If a resistance of less than 2 Ohm is measured in one measurement: GO to B18.
B18: RULE OUT THE ADAPTIVE FRONT LIGHTING MODULE AS A POSSIBLE CAUSE OF THE FAULT	
	1 Ignition switch in position 0.
	2 Disconnect Adaptive front lighting module from connector C2LF23A.
	3 Open circuit in ground connection to front headlamp levelling sensor: Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 12, circuit RCD02L (GN/BN), wiring harness side and front headlamp levelling sensor, connector C5CD07, pin 1, circuit RCD02G (GN/BN), wiring harness side.
	4 Open circuit in ground connection to rear headlamp levelling sensor: Measure the resistance between adaptive front lighting module, connector C2LF23A, pin 3, circuit RCD23K (WH/BN), wiring harness side and rear headlamp levelling sensor, connector C7CD12, pin 1, circuit RCD23D (WH/BN), wiring harness side.

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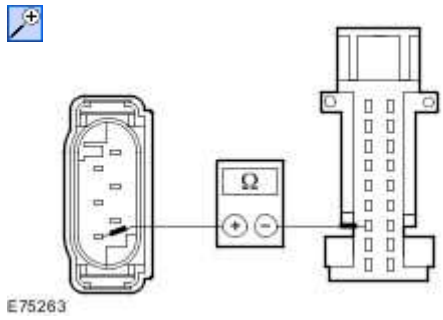


Is a resistance of less than 2 Ohms registered?

Yes

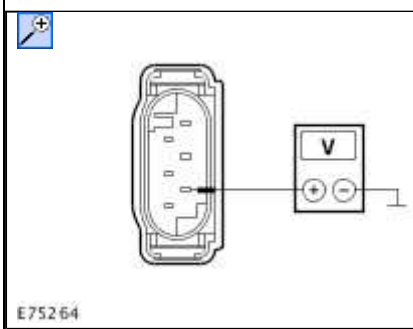
RENEW the adaptive front lighting module. CHECK the operation of the system.

No

LOCATE and RECTIFY break in circuit between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.

B19: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND FRONT HEADLAMP LEVELLING SENSOR FOR SHORT CIRCUIT TO BATTERY VOLTAGE

1 Ignition switch in position II.



2 Measure the voltage between front headlamp levelling sensor, connector C5CD07, pin 4, circuit VCD10B (BN), wiring harness side and ground.

Does the meter display battery voltage?

Yes

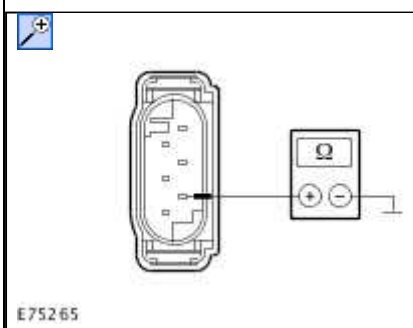
LOCATE and RECTIFY the short to battery voltage in circuit(s) between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.

No

GO to B20.

B20: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND FRONT HEADLAMP LEVELLING SENSOR FOR SHORT CIRCUIT TO GROUND

1 Ignition switch in position 0.



2 Measure the resistance between front headlamp levelling sensor, connector C5CD07, pin 4, circuit VCD10B (BN), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

Yes

GO to B21.

No

LOCATE and RECTIFY the short to ground in circuit (s) between adaptive front lighting module and

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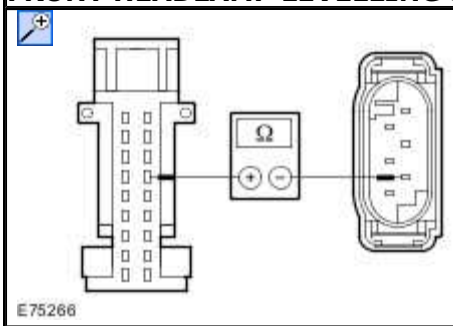
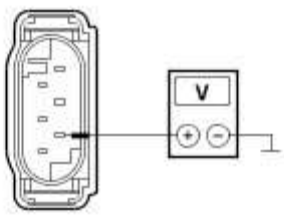
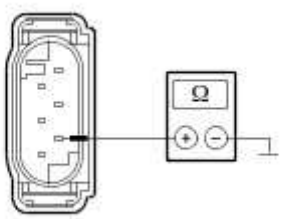
	headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.
B21: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND FRONT HEADLAMP LEVELLING SENSOR FOR OPEN CIRCUIT	
 E75266	1 Measure the resistance between the front headlamp levelling sensor, connector C5CD07, pin 4, circuit VCD10B (BN), wiring harness side and adaptive front lighting module, connector C2LF23A, pin 15, circuit VCD10D (BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B22. **No** LOCATE and RECTIFY break in circuit(s) between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.
B22: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND REAR HEADLAMP LEVELLING SENSOR FOR SHORT CIRCUIT TO BATTERY VOLTAGE	
	1 Ignition switch in position II.
 E75264	2 Measure the voltage between rear headlamp levelling sensor, connector C7CD12, pin 4, circuit VCD12B (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the short to battery voltage in circuit(s) between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system. **No** GO to B23.
B23: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND REAR HEADLAMP LEVELLING SENSOR FOR SHORT CIRCUIT TO GROUND	
 E75265	1 Measure the resistance between rear headlamp levelling sensor, connector C7CD12, pin 4, circuit VCD12B (VT/WH), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to B24. **No**

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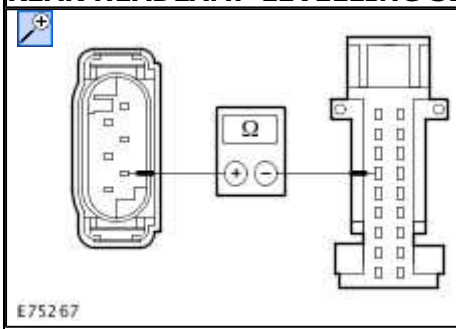
	LOCATE and RECTIFY the short to ground in circuit (s) between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.
B24: CHECK SIGNAL CIRCUIT BETWEEN ADAPTIVE FRONT LIGHTING MODULE AND REAR HEADLAMP LEVELLING SENSOR FOR OPEN CIRCUIT	
	1 Measure the resistance between the rear headlamp levelling sensor, connector C7CD12, pin 4, circuit VCD12B (VT/WH), wiring harness side and adaptive front lighting module, connector C2LF23A, pin 6, circuit VCD12C (VT/WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW the adaptive front lighting module. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit(s) between adaptive front lighting module and headlamp levelling sensor using the Wiring Diagrams. CHECK the operation of the system.
B25: CHECK VOLTAGE SUPPLY OF LEFT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand headlamp from connector C1LF08.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
	5 Measure the voltage between left-hand headlamp, connector C1LF08, pin 13, circuit CBB39E (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B26. **No** LOCATE and RECTIFY break in circuit between soldered connection SP172 and headlamp using the Wiring Diagrams. CHECK the operation of the system.
B26: CHECK GROUND CONNECTION OF LEFT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand headlamp, connector C1LF08, pin 11, circuit GD130AE (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B27. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP371 using the Wiring Diagrams. CHECK the operation of the system.
B27: CHECK LIN DATABUS CONNECTION BETWEEN ADAPTIVE FRONT LIGHTING	

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MODULE AND LEFT-HAND HEADLAMP FOR OPEN CIRCUIT	
	1 Disconnect Right-hand headlamp from connector C1LF09.
	2 Measure resistance between left-hand headlamp, connector C1LF08, pin 14, circuit VLF32A (YE), wiring harness side and right-hand headlamp, connector C1LF09, pin 14, circuit VLF32C (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK headlamp levelling motor. CHECK the operation of the system. If the concern persists, RENEW the headlamp. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit between left-hand headlamp and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.
B28: CHECK VOLTAGE SUPPLY OF RIGHT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Right-hand headlamp from connector C1LF09.
	3 Ignition switch in position II.
	4 SWITCH ON dipped beam.
	5 Measure the voltage between right-hand headlamp, connector C1LF09, pin 13, circuit CBB39F (VT/WH), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B29. **No** LOCATE and RECTIFY break in circuit between soldered connection SP172 and headlamp using the Wiring Diagrams. CHECK the operation of the system.
B29: CHECK GROUND CONNECTION OF RIGHT-HAND HEADLAMP LEVELLING MOTOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand headlamp, connector C1LF09, pin 11, circuit GD132W (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B30. **No** LOCATE and RECTIFY the break in the circuit between the headlamp and soldered connection SP380 using the Wiring Diagrams. CHECK the operation of the system.
B30: CHECK THE LIN DATABUS CONNECTION FOR OPEN CIRCUIT	
	1 Disconnect Left-hand headlamp from connector C1LF08.
	2 Measure resistance between left-hand headlamp, connector C1LF08, pin 14, circuit VLF32A (YE), wiring harness side and right-hand headlamp, connector C1LF09, pin 14, circuit VLF32C (YE),

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	wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK headlamp levelling motor. CHECK the operation of the system. If the concern persists, RENEW the headlamp. CHECK the operation of the system. **No** LOCATE and RECTIFY break in circuit between right-hand headlamp and intermediate connector C21A/B using the Wiring Diagrams. CHECK the operation of the system.

Component checks

HEADLAMP LEVELLING SENSOR

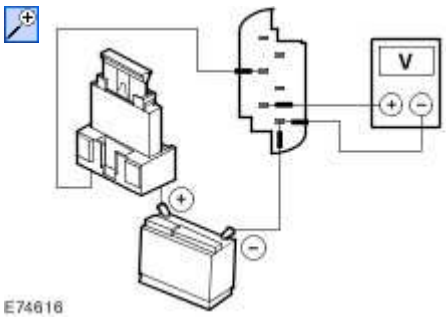
CAUTIONS:

Electronic modules are sensitive to electrical charge. If exposed to these charges, damage may result.

Be sure, that the headlamp levelling sensor is supplied with exactly 5 volts.
NOTE: Check the headlamp levelling sensor when installed.

- Switch off the ignition.
- Disconnect the electrical connector.
- Using an external 5 volts DC supply.
- Using a digital multimeter.
- Using a test cable, set up the test as in the following description.

1. **1.** Check headlamp levelling sensor, front/rear.



- Connect the positive terminal of the voltage supply with fused cable (5 A) to pin 5 of the headlamp levelling sensor and the negative terminal to pin 1.
- To measure the voltage at the sensor, connect the positive terminal of the Digital Multimeter to pin 4 and the negative terminal to pin 1.
- Change the vehicle load during the measurement.

Measure the voltage.

Is the range of values at the digital multimeter between 2.0 - 2.7 volts?

If yes, the headlamp levelling sensor is OK.

If no, RENEW the headlamp levelling sensor.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: A new GEM needs to be configured after installation. For this purpose, the vehicle-specific data are read out of the module to be changed using WDS and is transferred to the new module. REFER to:
Module Configuration (418-01 Module Configuration, General Procedures),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and WDS can communicate correctly.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Connector • Switch • Wiring loom

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
All parking lamps inoperative	* Fuse(s) * Circuit(s) * Ignition switch * LCM (Lights Control Module) * Central Junction Box (CJB)	* GO to Pinpoint Test A.

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One parking, rear or license lamp(s) is inoperative	* Fuse(s) * Circuit(s) * LCM (Lights Control Module) * License plate lamp * Rear lamp unit * Conventional Headlamps * Xenon headlamp * Central Junction Box (CJB)	* GO to Pinpoint Test B.
All or one parking lamp(s), tail lamp(s) or licence plate lamp(s) is/are permanently lit	* Circuit(s) * LCM (Lights Control Module) * Trailer socket * Central Junction Box (CJB)	* GO to Pinpoint Test C.

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : ALL PARKING LAMPS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FUSE F17 (60 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F17 (60 A) (EJB).
	3 CHECK fuse F17 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A2. **No** RENEW fuse F17 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A2: CHECK FUSE F18 (60 A) (EJB)	
	1 Disconnect fuse F18 (60 A) (EJB).
	2 CHECK fuse F18 (60 A) (EJB).
	Is the fuse OK.? **Yes** GO to A3. **No** RENEW fuse F18 (60 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
A3: CHECK THE GROUND CONNECTION OF THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2LF23D from lighting control module.
	3 Measure the resistance between the lights control module, connector C2LF23D, pin 5, circuit GD133BT (BK), wiring harness side and ground.

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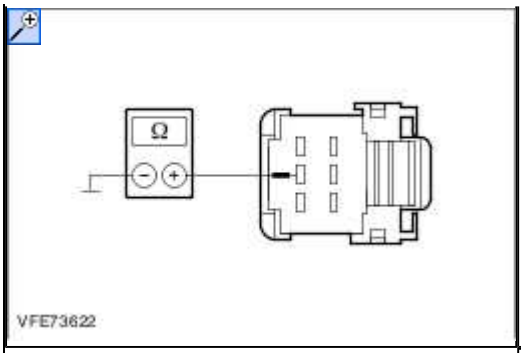
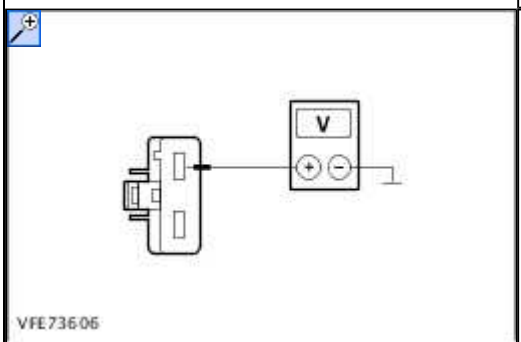
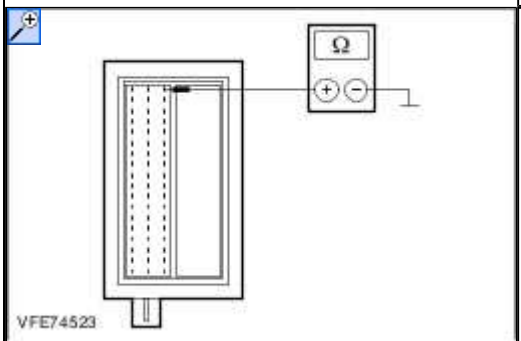
	
	Is a resistance of less than 2 Ohm registered? **Yes** GO to A4. **No** LOCATE AND RECTIFY the break in the circuits between the lights control module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK system operates correctly
A4: CHECK THE VOLTAGE SUPPLY TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02G.
	3 Measure the voltage between the Smart Junction Box, connector C1BP02G, pin 1, circuit SBB17A (RD), wiring harness side and ground.
	4 Ignition switch in position II.
	Does the meter display battery voltage? **Yes** GO to A5. **No** LOCATE and RECTIFY the break in the circuits between fuse F17 (60 A) (EJB) and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly
A5: CHECK THE GROUND CONNECTION TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 54, circuit GD123F (BK/GY), wiring harness side and ground.

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	Is a resistance of less than 2 Ohm registered? **Yes** GO to A6. **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G1D132B with the aid of the Wiring Diagrams. CHECK system operates correctly
A6: RULE OUT THE LIGHTS CONTROL MODULE AS A POSSIBLE CAUSE OF THE FAULT	
	1 Connect Smart Junction Box from connector C1BP02A.
	2 Connect Smart Junction Box from connector C1BP02G.
	Are all parking lamps lit? **Yes** INSTALL A NEW lights control module. CHECK system operates correctly **No** CHECK the Smart Junction Box with the aid of the diagnostic unit and INSTALL a new one if necessary. CHECK system operates correctly

PINPOINT TEST B : ONE PARKING, REAR OR LICENSE LAMP(S) IS INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 SWITCH ON the parking lamps.
	2 CHECK parking lamps and license plate lamps.
	Are both parking lamps inoperative? **Yes** GO to Pinpoint Test A. **No** - Both license plate lamps inoperative: GO to B2. - One license plate lamp inoperative: GO to B4. - Front left parking lamp inoperative: GO to B6. - Front right parking lamp inoperative: GO to B9. - Both rear lamps on the left-hand side inoperative: GO to B12. - Rear lamp (rear lamp assembly) on the left-hand side inoperative: GO to B14. - Rear lamp (tailgate) on the left-hand side inoperative: GO to B15. - Both rear lamps on the right-hand side inoperative: GO to B17. - Rear lamp (rear lamp assembly) on the right-hand side inoperative: GO to B18. - Rear lamp (tailgate) on the right-hand side inoperative: GO to B20.
B2: CHECK THE COMMON POWER SUPPLY OF THE LICENSE PLATE LAMPS FOR OPEN	
	1 Ignition switch in position 0.
	2 Disconnect left-hand license plate lamp from connector C4LS04.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the left-hand license plate lamp, connector C4LS04, pin 1, circuit CLS04C (YE/VT), wiring harness side and ground.
	Does the meter display battery voltage?

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	Yes LOCATE and RECTIFY the break in the circuits between soldered connection SP534 and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK system operates correctly **No** GO to B3.
B3: CHECK THE COMMON POWER SUPPLY OF THE LICENSE PLATE LAMPS FOR OPEN	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 52, circuit CLS04B (YE/VT), wiring harness side and the left-hand license plate lamp, connector C4LS04, pin 1, circuit CLS04C (YE/VT), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and soldered connection SP400 with the aid of the Wiring Diagrams. CHECK system operates correctly
B4: CHECK THE POWER SUPPLY TO THE LICENSE PLATE LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect License plate lamp. • left: from connector C4LS04 • right: from connector C4LS05
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between license plate lamp: • left: Connector C4LS04, pin 1, circuit CLS04C (YE/VT), wiring harness side and ground. • right: Connector C4LS05, pin 1, circuit CLS04D (YE/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B5. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP400 and the license plate lamp with the aid of the Wiring Diagrams. CHECK system operates correctly
B5: CHECK THE GROUND CONNECTION OF THE LICENSE PLATE LAMP FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the license plate lamp: • left: connector C4LS04, pin 2, circuit GD150M (BK/WH), wiring harness side and ground.

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	• right: connector C4LS05, pin 2, circuit GD150U (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** RENEW the license plate lamp. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the license plate lamp and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly
B6: CHECK THE VOLTAGE SUPPLY TO THE FRONT LEFT-HAND PARKING LIGHT FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand front fog lamp unit from connector C1LS06.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the left-hand parking lamp, connector C1LS06, pin 1: • Vehicles with body code vehicle identification number (VIN) S: circuit CLS13B (YE/BU), wiring harness side and ground. • All other vehicles: circuit CLS13C (YE/BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B8. **No** GO to B7.
B7: CHECK THE VOLTAGE SUPPLY TO THE FRONT LEFT-HAND PARKING LIGHT FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02A, pin 39, circuit CLS13B (YE/BU), wiring harness side and the front fog lamp unit C1LS06, pin 1: • Vehicles with body code vehicle identification number (VIN) S: circuit CLS13B (YE/BU), wiring harness side and ground. • All other vehicles: circuit CLS13C (YE/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and the front fog lamp unit with the aid of the Wiring Diagrams. CHECK system operates correctly

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B8: CHECK THE GROUND CONNECTION OF THE LEFT-HAND FRONT PARKING LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Measure the resistance between the parking lamp, connector C1LS06, pin 2: • Vehicles with body code vehicle identification number (VIN) S: circuit GD130AR (BK/YE), wiring harness side and ground. • All other vehicles: circuit GD130AT (BK/YE), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** CHECK and RENEW the front fog lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the front fog lamp unit and soldered connection SP371 with the aid of the Wiring Diagrams. CHECK system operates correctly

B9: CHECK THE VOLTAGE SUPPLY TO THE RIGHT-HAND FRONT PARKING LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Right-hand front fog lamp unit from connector C1LS07.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the right-hand parking lamp, connector C1LS07, pin 1, circuit CLS07B (BN/YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B11. **No** GO to B10.

B10: CHECK THE VOLTAGE SUPPLY TO THE RIGHT-HAND FRONT PARKING LAMP FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02A.
	3 Measure the resistance between the parking lamp, connector C1LS07, pin 1, circuit CLS07B (BN/YE), wiring harness side and the Smart Junction Box, connector C1BP02A, pin 40, circuit CLS07B (BN/YE), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and the front fog lamp unit with the aid of the Wiring Diagrams. CHECK system operates correctly

B11: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND FRONT PARKING LIGHT FOR OPEN CIRCUIT

	1 Ignition switch in position 0.

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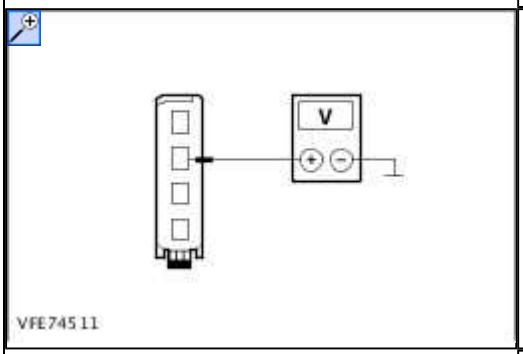
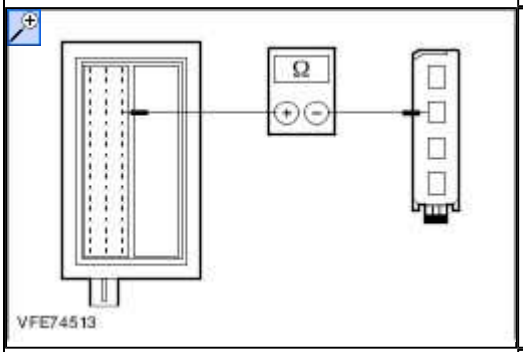
	2 Measure the resistance between the parking lamp, connector C1LS07, pin 2, circuit GD132S (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** CHECK and RENEW the front fog lamp unit. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the front fog lamp unit and soldered connection SP380 with the aid of the Wiring Diagrams. CHECK system operates correctly
B12: CHECK THE SHARED VOLTAGE SUPPLY OF THE LEFT-HAND REAR PARKING LAMPS FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Left-hand rear lamp assembly from connector C4LS18A.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the left-hand rear lamp assembly, connector C4LS18A, pin 2, circuit CLS08A (VT/GN)/CLS08C (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the break in the circuits between soldered connection SP549 and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK system operates correctly **No** GO to B13.
B13: CHECK THE SHARED VOLTAGE SUPPLY OF THE LEFT-HAND REAR PARKING LAMPS FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the left-hand rear lamp assembly, connector C4LS18A, pin 2, circuit CLS08A (VT/GN)/CLS08C (VT/GN), wiring harness side and the Smart Junction Box, connector C1BP02B, pin 50, circuit CLS08A (VT/GN), wiring harness side.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No**

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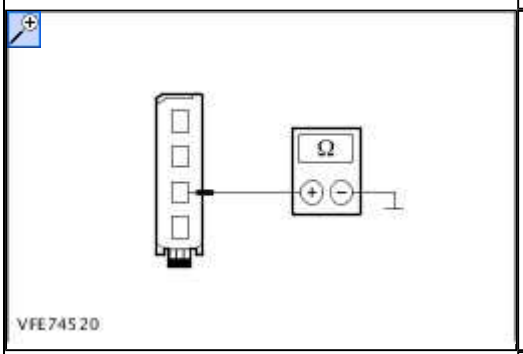
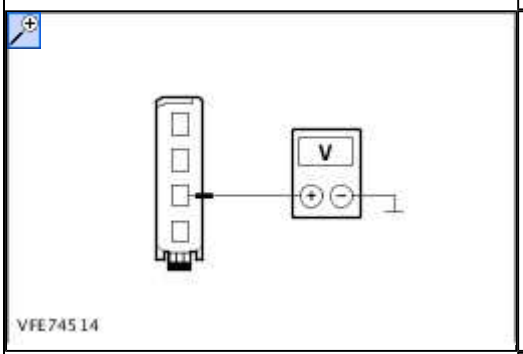
	LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and the rear lamp assembly with the aid of the Wiring Diagrams. CHECK system operates correctly
B14: CHECK THE GROUND CONNECTION OF THE LEFT-HAND REAR LAMP (LAMP ASSEMBLY) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Rear lamp (lamp assembly) from connector C4LS18A.
	3 Measure the resistance between the left-hand rear lamp (lamp assembly), connector C4LS18A, pin 3, circuit GD150C (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW rear lamp (lamp assembly). CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the rear lamp (lamp assembly) and soldered connection SP549 with the aid of the Wiring Diagrams. CHECK system operates correctly
B15: CHECK THE VOLTAGE SUPPLY OF THE LEFT-HAND REAR LAMP (TAILGATE) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Rear lamp (tailgate) from connector C4LS35.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the left-hand rear lamp (tailgate), connector C4LS35, pin 3, circuit CLS08B (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B16. **No** LOCATE and RECTIFY the break in the circuits between the rear lamp (lamp assembly) and the rear lamp (tailgate) with the aid of the Wiring Diagrams. CHECK system operates correctly
B16: CHECK THE GROUND CONNECTION OF THE LEFT-HAND REAR LAMP (TAILGATE) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left-hand rear

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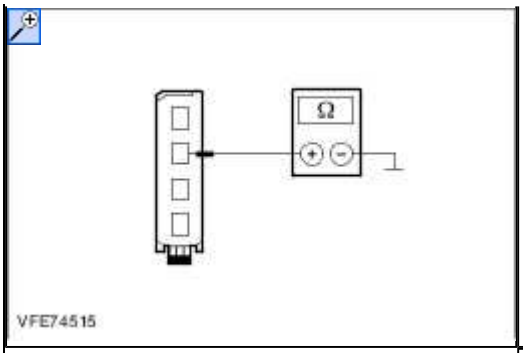
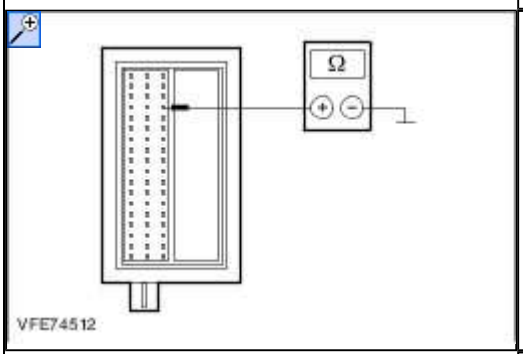
	lamp (tailgate), connector C4LS35, pin 2, circuit GD150P (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW rear lamp (tailgate). CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the rear lamp (tailgate) and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly
B17: CHECK THE SHARED VOLTAGE SUPPLY OF THE RIGHT-HAND REAR LAMPS FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 51, circuit CLS09A (WH/OG), wiring harness side and ground.
	Is a resistance of less than 10,000 Ohm registered? **Yes** INSTALL A NEW Smart Junction Box. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and soldered connection SP568 with the aid of the Wiring Diagrams. CHECK system operates correctly
B18: CHECK THE VOLTAGE SUPPLY TO THE RIGHT-HAND REAR LAMP (LAMP ASSEMBLY) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Rear lamp (lamp assembly) from connector C4LS19A.
	3 Ignition switch in position II.
	4 SWITCH ON the parking lamps.
	5 Measure the voltage between the rear lamp unit (lamp assembly), connector C4LS19A, pin 2, circuit CLS09B (WH/OG), wiring harness side and ground.

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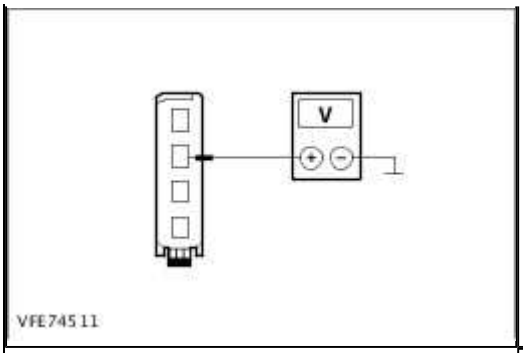


Does the meter display battery voltage?

Yes

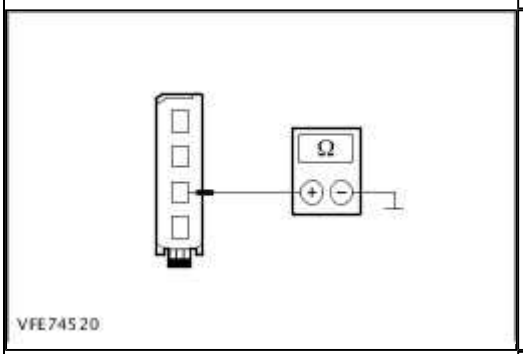
GO to B19.

No

LOCATE and RECTIFY the break in the circuit between soldered connection SP568 and the rear lamp unit (lamp assembly) with the aid of the Wiring Diagrams. CHECK system operates correctly

B19: CHECK THE GROUND CONNECTION OF THE RIGHT-HAND REAR LAMP (LAMP ASSEMBLY) FOR OPEN CIRCUIT

1. Ignition switch in position 0.



2. Measure the resistance between the right-hand rear lamp unit (lamp assembly), connector C4LS19A, pin 3, circuit GD152A (BK/BU), wiring harness side and ground.

Is a resistance of less than 2 Ohm registered?

Yes

INSTALL A NEW rear lamp unit (lamp assembly). CHECK system operates correctly

No

LOCATE and RECTIFY the break in the circuits between the rear lamp unit (lamp assembly) and soldered connection SP600 with the aid of the Wiring Diagrams. CHECK system operates correctly

B20: CHECK THE VOLTAGE SUPPLY TO THE RIGHT-HAND REAR LAMP (TAILGATE) FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect Rear lamp unit (tailgate) from connector C4LS36.
3. Ignition switch in position II.
4. SWITCH ON the parking lamps.
5. Measure the voltage between the right-hand rear lamp unit (tailgate), connector C4LS36, pin 3, circuit CLS09F (WH/OG), wiring harness side and ground.

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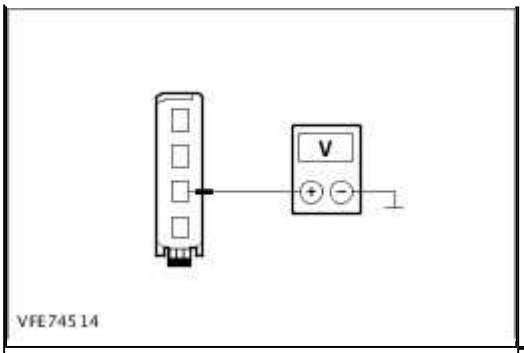
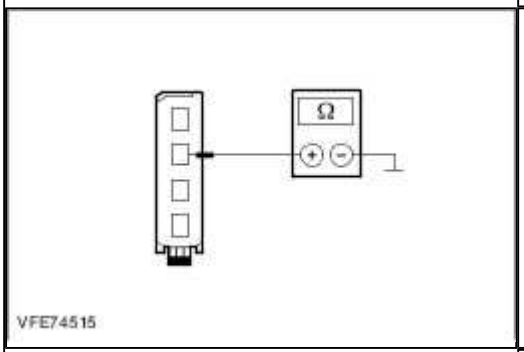
	
	Does the meter display battery voltage? **Yes** GO to B21. **No** LOCATE and RECTIFY the break in the circuits between soldered connection SP568 and the rear lamp unit (tailgate) with the aid of the Wiring Diagrams. CHECK system operates correctly
B21: CHECK THE GROUND CONNECTION AT THE RIGHT-HAND REAR LAMP (TAILGATE) FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right-hand rear lamp unit (tailgate), connector C4LS36, pin 2, circuit GD150W (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** INSTALL A NEW rear lamp unit (tailgate). CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between the rear lamp unit (tailgate) and soldered connection SP534 with the aid of the Wiring Diagrams. CHECK system operates correctly

PINPOINT TEST C : ALL OR ONE PARKING LAMP(S), TAIL LAMP(S) OR LICENCE PLATE LAMP(S) IS/ARE PERMANENTLY LIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: DETERMINE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position II.
	2 CHECK the parking lamps.
	Are all parking lamps permanently lit? **Yes** GO to C2. **No** - Left-hand front parking lamp permanently lit: GO to C10. - Right-hand front parking lamp permanently lit: GO to C10. - Left-hand rear parking lamps permanently lit: GO to C11.

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	- Right-hand rear parking lamps permanently lit: GO to C11. - License plate lamps permanently lit: GO to C12.
C2: DETERMINE VEHICLE EQUIPMENT LEVEL	
	1 Find out whether the vehicle is fitted with the daytime running lamps (DRL) option.
	Does the vehicle have daytime running lamps (DRL)? **Yes** CHECK the software configuration of the GEM with the aid of WDS, and update it if necessary. CHECK system operates correctly If the concern persists: GO to C3. **No** GO to C3.
C3: CHECK FUSE F33 (5 A) (EJB)	
	1 Ignition switch in position 0.
	2 Disconnect fuse F33 (5 A) (EJB).
	3 CHECK fuse F33 (5 A) (EJB).
	Is the fuse OK.? **Yes** GO to C4. **No** RENEW fuse F33 (5 A) (EJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly
C4: CHECK THE VOLTAGE SUPPLY TO FUSE F17 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 Measure the voltage between fuse F17 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to C5. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F17 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
C5: CHECK THE VOLTAGE SUPPLY TO FUSE F18 (60 A) (EJB) FOR OPEN CIRCUIT	
	1 Ignition switch in position II.
	2 Measure the voltage between fuse F18 (60 A) (EJB) and ground.
	Does the meter display battery voltage? **Yes** GO to C6. **No** LOCATE AND RECTIFY the break in the voltage supply of fuse F18 (60 A) (EJB) with the aid of the wiring diagrams. CHECK system operates correctly
C6: CHECK THE VOLTAGE SUPPLY TO THE LIGHTS CONTROL MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Lights control module from connector C2LF23D.
	3 Measure the voltage between the lights control module, connector C2LF23D, pin 1, circuit SBB33B (RD), wiring harness side and ground.

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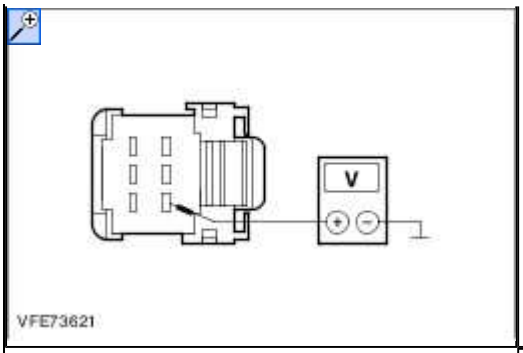

	4 Ignition switch in position II.
	Does the meter display battery voltage? **Yes** GO to C7. **No** LOCATE and RECTIFY the break in the circuits between fuse F33 (5 A) (EJB) and the lights control module with the aid of the wiring diagrams. CHECK system operates correctly
C7: CHECK THE GROUND CONNECTION TO THE SMART JUNCTION BOX FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Measure the resistance between the Smart Junction Box, connector C1BP02B, pin 65: • LHD: circuit GD140J (BK/GN), wiring harness side and ground. • RHD: circuit GD134U (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohm registered? **Yes** GO to C8. **No** - LHD: LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G3D138 with the aid of the Wiring Diagrams. CHECK system operates correctly - RHD: LOCATE and RECTIFY the break in the circuits between the Smart Junction Box and ground connection G3D133 with the aid of the Wiring Diagrams. CHECK system operates correctly
C8: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR SHORT CIRCUIT TO BATTERY VOLTAGE	
	1 Disconnect Smart Junction Box from connector C1BP02C.
	2 Disconnect Lights control module from connector C2LF23D.
	3 Ignition switch in position II.
	4 Measure the voltage between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.

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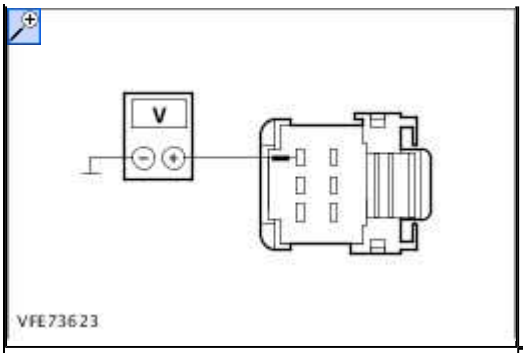


Does the meter display battery voltage?

Yes

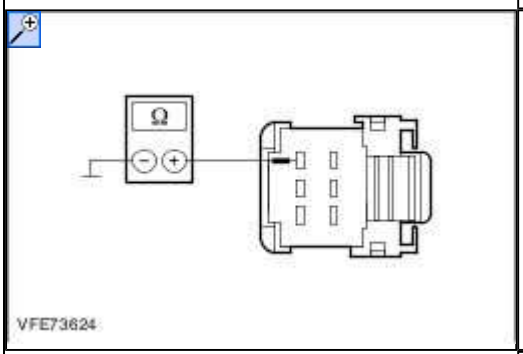
LOCATE and RECTIFY the short to battery voltage in the circuits between the lights control module and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly

No

GO to C9.

C9: CHECK THE LIN DATA BUS CONNECTION BETWEEN THE LIGHTS CONTROL MODULE AND THE SMART JUNCTION BOX FOR SHORT CIRCUIT TO GROUND

1. Ignition switch in position 0.



2. Measure the resistance between the lights control module, connector C2LF23D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

Yes

INSTALL A NEW lights control module. CHECK system operates correctly

No

LOCATE and RECTIFY the short to ground in the circuits between the lights control module and the Smart Junction Box with the aid of the wiring diagrams. CHECK system operates correctly

C10: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE FRONT FOG LAMP UNIT FOR SHORT TO BATTERY VOLTAGE

1. Ignition switch in position 0.
2. Disconnect Smart Junction Box from connector C1BP02A.
3. Ignition switch in position II.
4. CHECK the parking lamps.

Is one of the front parking lamps permanently lit?

Yes

- Left-hand parking lamp permanently lit: Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in circuits connected to the Smart Junction Box, connector C1BP02A, pin 39. CHECK system operates correctly
- Right-hand parking lamp permanently lit: Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in circuits connected to the

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	Smart Junction Box, connector C1BP02A, pin 40. CHECK system operates correctly **No** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly
C11: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE REAR PARKING LAMPS FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 CHECK the parking lamps.
	Are the rear parking lamps permanently lit on one side? **Yes** - Left-hand rear parking lamp permanently lit: Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in circuits connected to the Smart Junction Box, connector C1BP02B, pin 50. CHECK system operates correctly - Right-hand rear parking lamp permanently lit: Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in circuits connected to the Smart Junction Box, connector C1BP02B, pin 51. CHECK system operates correctly **No** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
C12: CHECK THE CIRCUITS BETWEEN THE SMART JUNCTION BOX AND THE LICENSE PLATE LAMPS FOR SHORT TO BATTERY VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Smart Junction Box from connector C1BP02B.
	3 Ignition switch in position II.
	4 CHECK the license plate lamps.
	Do the license plate lamps illuminate continuously? **Yes** Use the Wiring Diagrams to LOCATE and RECTIFY the short to battery voltage in circuits connected to the Smart Junction Box, connector C1BP02B, pin 52. CHECK system operates correctly **No** CHECK the Smart Junction Box and INSTALL A NEW ONE if required. CHECK system operates correctly If the concern persists: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-01, for schematic and connector information.

Special Tool(s)

	Terminal Probe Kit 29-011A

Inspection and Testing

NOTE: The generic electronic module (GEM) is part of the central junction box (CJB).
NOTE: A new generic electronic module (GEM) always needs to be configured after installation. For this purpose, the vehicle-specific data are read out of the module to be changed using the diagnostic unit and transferred to the new module.
NOTE: Before reading out the vehicle-specific data make sure that all electrical connections in the vehicle are reconnected so that the module and the diagnostic unit can communicate correctly.
NOTE: Ensure correct engagement of the wiring harness connectors.
NOTE: The maximum output voltage at the trailer socket is 13 Volt.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Bulb(s) • Connector • Trailer socket • Trailer Lamps • Wiring loom

3. **3.** Resolve any obvious causes for a concern found during the visual inspection before carrying out any further tests.

4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis on the generic electronic module (GEM) using the diagnostic unit and RESOLVE the fault(s) displayed according to the fault description. CHECK system operates correctly

5. **5.** On a vehicle without stored fault(s), continue according to the Symptom Chart and the corresponding symptom.

6. **6.** After checking or rectifying the fault(s) and finishing the work, READ OUT the fault memory in the generic electronic module (GEM) and DELETE any saved faults. After performing a road test and CHECKING the system, READ OUT the fault memories again.

Diagnostic Trouble Code (DTC) Table - Generic Electronic Module (GEM)

DTC	Description	Action

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C111B-11	Short circuit in stoplamps circuit (short to ground)	GO to Pinpoint Test A.
C111B-12	Short circuit in stoplamps circuit (short to battery positive)	GO to Pinpoint Test C.
C1120-11	Short circuit in stoplamps circuit (short to ground)	GO to Pinpoint Test A.
C1120-12	Short circuit in backup lamps circuit (short to battery positive)	GO to Pinpoint Test C.
C1126-11	Short circuit in clearance lamps circuit (short to ground)	GO to Pinpoint Test A.
C1126-12	Short circuit in clearance lamps circuit (short to battery positive)	GO to Pinpoint Test C.
B1102-62	Conflicting stoplamp input signals at the trailer module (TRM) (CAN bus and circuit)	GO to Pinpoint Test A.
B1A79-11	Short circuit in rear fog lamp circuit (short to ground)	GO to Pinpoint Test A.
B1A79-12	Short circuit in rear fog lamp circuit (short to battery positive)	GO to Pinpoint Test C.
B1D06-11	Short circuit in left-hand turn signal lamp circuit (short to ground)	GO to Pinpoint Test B.
B1D06-12	Short circuit in left-hand turn signal lamp circuit (short to battery positive)	GO to Pinpoint Test C.
B1D07-11	Short circuit in right-hand turn signal lamp circuit (short to ground)	GO to Pinpoint Test B.
B1D07-12	Short circuit in right-hand turn signal lamp circuit (short to battery positive)	GO to Pinpoint Test C.
U0010-00	Communication fault in the MS CAN bus	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0140-00	No communications between the GEM and the trailer module (TRM)	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U1300-00	Trailer module (TRM) and software (CAN bus) not compatible	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
U2100-00	Trailer module (TRM) not configured	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
U2101-00	Trailer module (TRM) incorrectly configured	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
U3000-42	Internal module fault - general memory fault	INSTALL A NEW trailer module (TRM)
U3000-51	Module programming fault - not programmed	REFER to: Module Configuration (418-01 Module Configuration, General Procedures).
U3003-62	Fault in the power supply to the trailer module (TRM	GO to Pinpoint Test A.

Symptom Chart

Symptom	Possible Sources	Action
Trailer lamps inoperative, OK on vehicle	* Fuse * Circuit(s) in vehicle * Circuit(s) in trailer * Trailer module (TRM) * Trailer socket	* GO to Pinpoint Test A.
The individual trailer lamp is inoperative	* Circuit(s) in vehicle * Circuit(s) in trailer * Trailer module (TRM) * Trailer socket	* GO to Pinpoint Test B.

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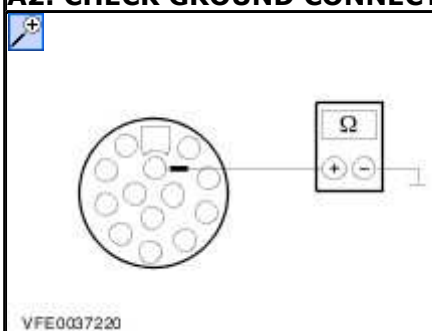
The trailer lamps are on continuously	* Circuit(s) in vehicle * Circuit(s) in trailer * Trailer module (TRM) * Trailer socket	* GO to Pinpoint Test C.

Pinpoint test

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : TRAILER LAMPS INOPERATIVE, LAMPS ON VEHICLE OK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 CHECK the trailer lamps after every step.
	3 APPLY the brakes.
	4 Switch on the dipped beam.
	5 SWITCH ON the rear fog lamps.
	6 SWITCH ON the left-hand turn signal.
	7 Switch on the RIGHT-HAND TURN SIGNAL.
	8 ENGAGE reverse gear.
	Are all trailer lamps inoperative? **Yes** GO to A2. **No** - Both trailer stoplamps inoperative: GO to A7. - Both trailer rear lamps inoperative: GO to A17. - Trailer rear fog lamp inoperative: GO to A11. - Both trailer turn signal lamps inoperative: INSTALL A NEW TRM. CHECK system operates correctly - Trailer backup lamp inoperative: GO to A14. - Stoplamps functioning and clearance lamps permanently lit: REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
A2: CHECK GROUND CONNECTION OF TRAILER SOCKET FOR OPEN CIRCUIT	
	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 3, circuit GD160A(B) (BR/WH) and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A3. **No** LOCATE and RECTIFY the break in the circuit between the trailer socket and ground connection G4D151 with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

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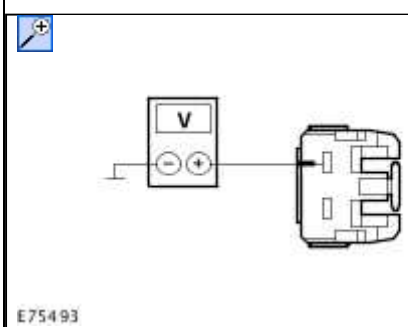
A3: CHECK FUSE FA11 (40 A) (RJB)

	1 Ignition switch in position 0.
	2 Disconnect Fuse FA11 (40 A) (RJB) .
	3 CHECK Fuse FA11 (40 A) (RJB) .
	Is the fuse in order? **Yes** GO to A4. **No** RENEW fuse FA11 (40 A) (RJB) and CHECK the operation of the system. If the fuse blows again, LOCATE and RECTIFY the short to ground using the Wiring Diagrams. CHECK system operates correctly

A4: CHECK THE VOLTAGE SUPPLY TO FUSE FA11 (40 A) (RJB) FOR OPEN CIRCUIT

	1 Connect Fuse FA11 (40 A) (RJB) .
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FA11 (40 A) (RJB) and ground.
	Does meter display battery voltage? **Yes** GO to A5. **No** LOCATE and RECTIFY the break in the voltage supply of fuse FA11 (40 A) (RJB) with the aid of the Wiring Diagrams. CHECK system operates correctly

A5: CHECK THE VOLTAGE SUPPLY OF THE TRAILER MODULE (TRM) FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-B.
	3 Ignition switch in position II.
	4 Measure the voltage between the TRM, connector C4AT23-B, pin 2, circuit SBR11A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** LOCATE and RECTIFY the break in the circuit between fuse FA11 (40 A) (RJB) and the TRM. CHECK system operates correctly INSTALL A NEW RJB if required. CHECK system operates correctly

A6: CHECK THE GROUND CONNECTION OF THE TRAILER MODULE (TRM) FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-C.
	3 Measure the resistance between the TRM, connector C4AT23-C, pin 4, circuit GD152C (BK/BU), wiring harness side and ground.

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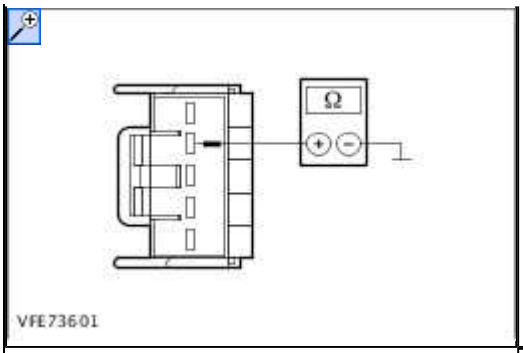


Is a resistance of less than 2 Ohms registered?

Yes

INSTALL A NEW TRM. CHECK system operates correctly

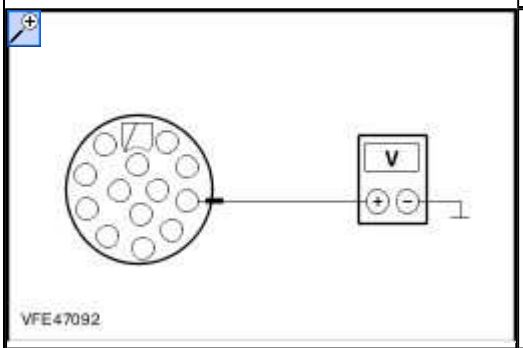
No

LOCATE and RECTIFY the break in the circuit between the TRM and soldered connection SP600 with the aid of the Wiring Diagrams. CHECK system operates correctly

A7: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE STOP LAMPS SWITCHED ON

NOTE: Keep the brake pedal depressed during the following measurement.

1. Ignition switch in position II.
2. APPLY the brakes.
3. Measure the voltage between the trailer socket, connector C4AT23-D, pin 6, circuit CAT19A (VT) and ground.



Does the meter display battery voltage?

Yes

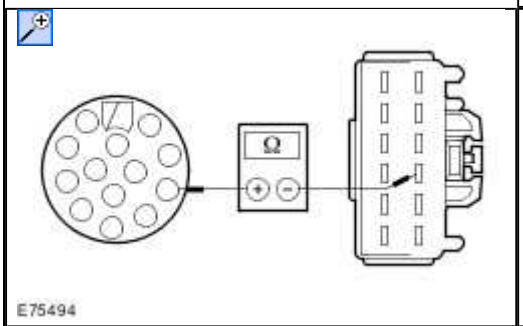
Continue fault finding on the trailer.

No

GO to A8.

A8: CHECK CIRCUIT CAT19A (VT) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR OPEN CIRCUIT

1. Ignition switch in position 0.
2. Disconnect TRM from connector C4AT23-A.
3. Measure the resistance between the TRM, connector C4AT23-A, pin 3, circuit CAT19A (VT), wiring harness side and the trailer socket, connector C4AT23-D, pin 6, circuit CAT19A (VT), wiring harness side.



Is a resistance of less than 2 Ohms registered?

Yes

GO to A9.

No

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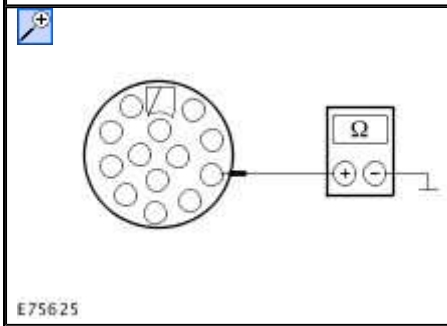
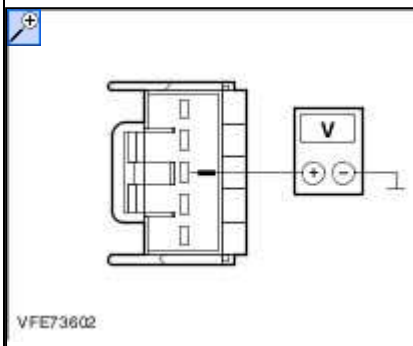
	LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A9: CHECK CIRCUIT CAT19A (VT) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND	
	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 6, circuit CAT19A (VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to A10. **No** LOCATE and RECTIFY the short to ground in the circuit between the TRM and the trailer socket with the aid of the wiring diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A10: CHECK THE CIRCUIT BETWEEN THE SMART JUNCTION BOX AND THE TRAILER MODULE (TRM) FOR OPEN CIRCUIT	
NOTE: Keep the brake pedal depressed during the following measurement.	
	1 Disconnect TRM from connector C4AT23-C.
	2 Ignition switch in position II.
	3 APPLY the brakes.
	4 Measure the voltage between the TRM, connector C4AT23-C, pin 3, circuit CLS44E (VT/BN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** INSTALL A NEW TRM. CHECK system operates correctly **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP451 and the TRM with the aid of the Wiring Diagrams. CHECK system operates correctly
A11: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE REAR FOG LAMPS SWITCHED ON	
	1 Ignition switch in position II.
	2 Switch on the REAR FOG LAMPS.
	3 Switch on the dipped beam.
	4 Measure the voltage between the trailer socket,

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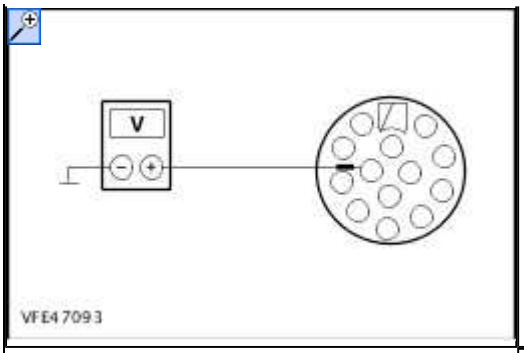
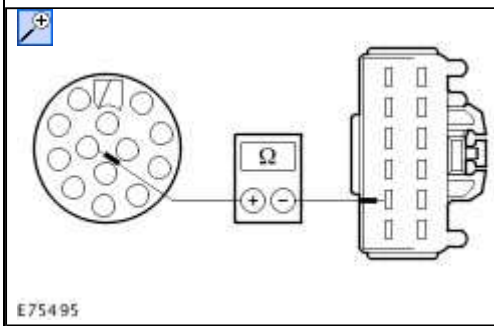
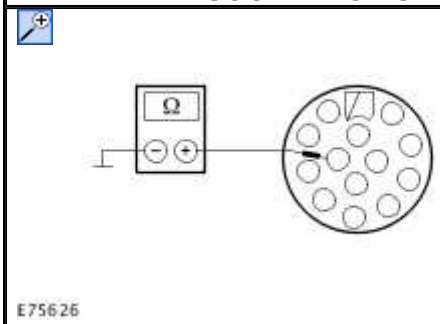
	connector C4AT23-D, pin 2, circuit CAT07A (RD/YE) and ground.
	Does the meter display battery voltage? **Yes** Continue fault finding on the trailer. **No** GO to A12.
A12: CHECK CIRCUIT CAT07A (RD/YE) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-A.
	3 Measure the resistance between the TRM, connector C4AT23-A, pin 8, circuit CAT07A (RD/YE), wiring harness side and the trailer socket, connector C4AT23-D, pin 2, circuit CAT07A (RD/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A13. **No** LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A13: CHECK CIRCUIT CAT07A (RD/YE) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND	
	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 2, circuit CAT07A (RD/YE), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** INSTALL A NEW TRM. CHECK system operates correctly **No** LOCATE and RECTIFY the short to ground in the circuit between the TRM and the trailer socket with the aid of the wiring diagrams. CHECK system

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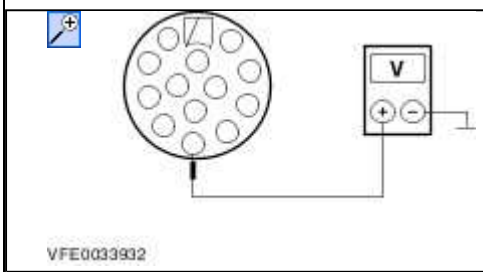
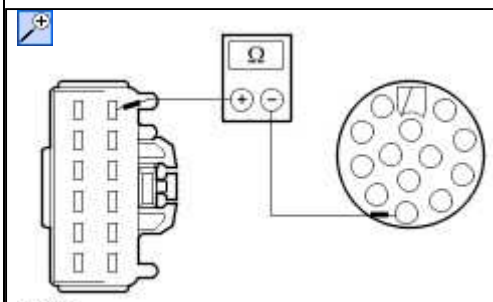
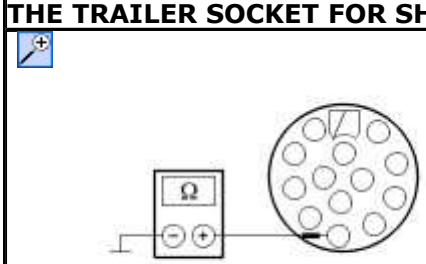
	operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A14: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE REVERSING LAMPS SWITCHED ON	
	1 Ignition switch in position II.
	2 ENGAGE the reverse gear.
 VFE0033932	3 Measure the voltage between the trailer socket C4AT23-D, pin 8, circuit CAT03A (VT/OG) and ground.
	Does the meter display battery voltage? **Yes** Continue fault finding on the trailer. **No** GO to A15.
A15: CHECK CIRCUIT CAT03A (VT/OG) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-A.
 E75496	3 Measure the resistance between the TRM, connector C4AT23-A, pin 6, circuit CAT03A (VT/OG), wiring harness side and the trailer socket, connector C4AT23-D, pin 8, circuit CAT03A (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A16. **No** LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A16: CHECK CIRCUIT CAT03A (VT/OG) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND	
 E75627	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 8, circuit CAT03A (VT/OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** INSTALL A NEW TRM. CHECK system operates correctly

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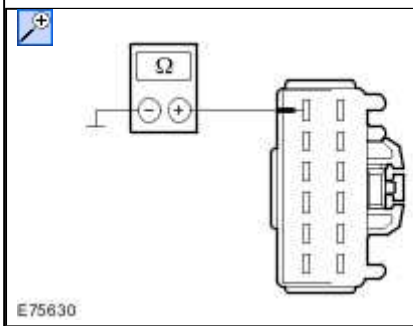
	No LOCATE and RECTIFY the short to ground in the circuit between the TRM and the trailer socket with the aid of the wiring diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
A17: CHECK CIRCUITS CAT11A/B (OG) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-A.
	3 Measure the resistance between the TRM, connector C4AT23-A, pin 12, circuit CAT11A/B (OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** INSTALL A NEW TRM. CHECK system operates correctly **No** LOCATE and RECTIFY the short to ground in the circuits connected to the TRM, connector C4AT23-A, pin 12 with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

PINPOINT TEST B : INDIVIDUAL TRAILER LAMPS INOPERATIVE, LAMPS ON VEHICLE OK	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DETERMINE THE CAUSE OF THE FAULT	
	1 Ignition switch in position II.
	2 CHECK the trailer lamps after every step.
	3 APPLY the brakes.
	4 SWITCH ON the left-hand turn signal.
	5 SWITCH ON the right-hand turn signal.
	6 SWITCH ON the dipped beam.
	Is the left-hand turn signal lamp on the trailer inoperative? **Yes** GO to B2. **No** - One trailer stoplamp inoperative: LOCATE and RECTIFY the break in the circuits on the trailer with the aid of the wiring diagrams. CHECK system operates correctly - Right-hand trailer turn signal lamp inoperative: GO to B5. - Left-hand rear trailer rear lamp inoperative: GO to B8. - Right-hand rear trailer lamp inoperative: GO to B9.
B2: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE LEFT-HAND TURN	

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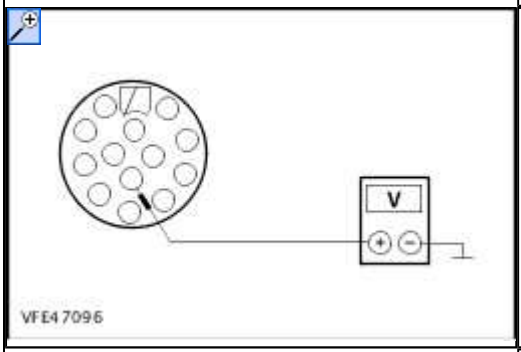
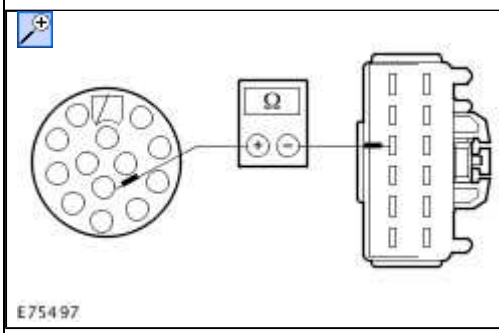
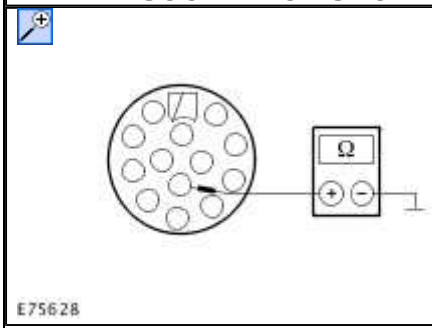
SIGNAL SWITCHED ON

	1 Ignition switch in position II.
	2 SWITCH ON the left-hand turn signal.
	3 Measure the voltage between the trailer socket, connector C4AT23-D, pin 1, circuit CAT06A (BU) and ground.
	Does the voltage alternate between 0 V and battery voltage? **Yes** Continue fault finding on the trailer. **No** GO to B3.

B3: CHECK CIRCUIT CAT06A (BU) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR OPEN CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-A.
	3 Measure the resistance between the TRM, connector C4AT23-A, pin 10, circuit CAT06A (BU), wiring harness side and the trailer socket, connector C4AT23-D, pin 1, circuit CAT06A (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B4. **No** LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

B4: CHECK CIRCUIT CAT06A (BU) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND

	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 1, circuit CAT06A (BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** INSTALL A NEW TRM. CHECK system operates correctly

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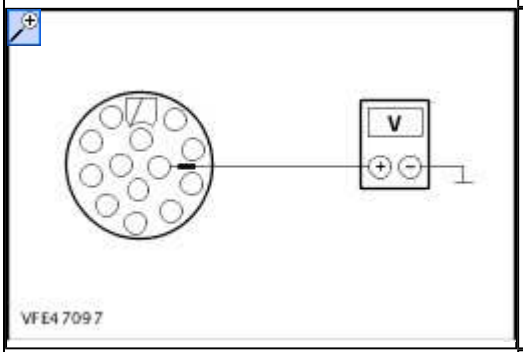
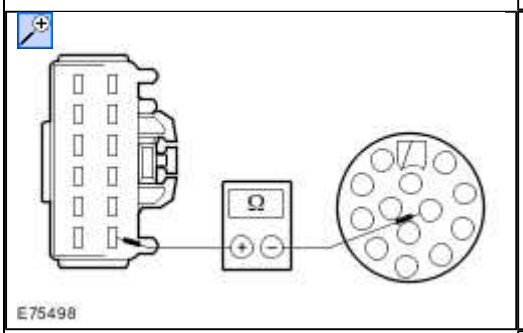
	No LOCATE and RECTIFY the short to ground in the circuit between the TRM and the trailer socket with the aid of the wiring diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
B5: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE RIGHT-HAND TURN SIGNAL SWITCHED ON	
	1 Ignition switch in position II.
	2 SWITCH ON the right-hand turn signal.
	3 Measure the voltage between the trailer socket, connector C4AT23-D, pin 4, circuit CAT09A (BU) and ground.
	Does the voltage alternate between 0 V and battery voltage? **Yes** Continue fault finding on the trailer. **No** GO to B6.
B6: CHECK CIRCUIT CAT09A (BU/RD) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect TRM from connector C4AT23-A.
	3 Measure the resistance between the TRM, connector C4AT23-A, pin 1, circuit CAT09A (BU/RD), wiring harness side and the trailer socket, connector C4AT23-D, pin 4, circuit CAT09A (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B7. **No** LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly
B7: CHECK CIRCUIT CAT09A (BU/RD) BETWEEN THE TRAILER MODULE (TRM) AND THE TRAILER SOCKET FOR SHORT TO GROUND	
	1 Measure the resistance between the trailer socket, connector C4AT23-D, pin 4, circuit CAT09A (BU/RD), wiring harness side and ground.

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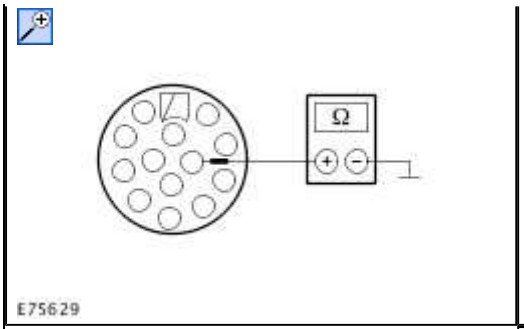


Is a resistance of more than 10,000 Ohm measured?

Yes

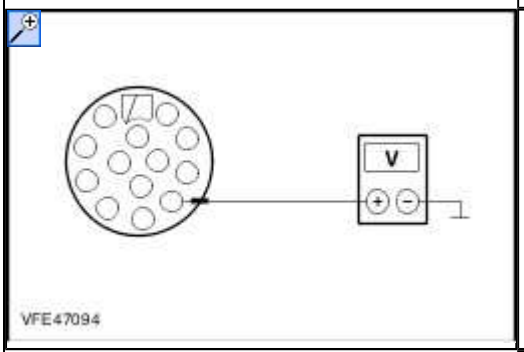
INSTALL A NEW TRM. CHECK system operates correctly

No

LOCATE and RECTIFY the short to ground in the circuit between the TRM and the trailer socket with the aid of the wiring diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

B8: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE SIDE LIGHTS SWITCHED ON

1 Switch on side light.



2 Measure the voltage between the trailer socket, connector C4AT23-D, pin 7, circuit CAT11A (OG) and ground.

Does the meter display battery voltage?

Yes

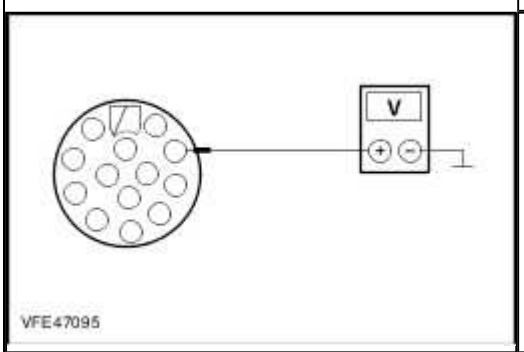
Continue fault finding on the trailer.

No

LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

B9: CHECK THE VOLTAGE AT THE TRAILER SOCKET WITH THE SIDE LIGHTS SWITCHED ON

1 Switch on side light.



2 Measure the voltage between the trailer socket, connector C4AT23-D, pin 5, circuit CAT11B (OG) and ground.

Does the meter display battery voltage?

Yes

Continue fault finding on the trailer.

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	No LOCATE and RECTIFY the break in the circuit between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly

PINPOINT TEST C : THE TRAILER LAMPS ARE ON CONTINUOUSLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: DETERMINE THE FAULT CONDITION	
NOTE: Ensure that no adapter or trailer is connected to the trailer coupling socket.	
	1 Ignition switch in position II. 2 CHECK the stop lamps at the vehicle. Are the stoplamps on the vehicle permanently lit? **Yes** REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing). **No** GO to C2.
C2: RULE OUT THE TRAILER MODULE (TRM) AS THE CAUSE OF THE FAULT	
	1 Connect a test adapter or trailer to the trailer coupling socket. 2 Ignition switch in position 0. 3 Disconnect Fuse FA11 (40 A) (RJB) . 4 Ignition switch in position II. 5 CHECK the trailer lamps. Are there any lamps on the trailer which are permanently lit? **Yes** - Left-hand trailer turn signal lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CAT06A (BU) between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly - Right-hand trailer turn signal lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CAT09A (BU/RD) between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly - Trailer stoplamps permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CAT19A (VT) between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly - Trailer backup lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CAT03A (VT/OG) between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly - Rear trailer fog lamp permanently lit: LOCATE and RECTIFY the short to battery voltage in circuit CAT07A (RD/YE) between the TRM and the trailer socket with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly - Rear trailer lamps permanently lit: LOCATE and RECTIFY the short to battery voltage in the circuits connected to the TRM, connector C4AT23-A, pin 12 with the aid of the Wiring Diagrams. CHECK system operates correctly If necessary RENEW the trailer socket. CHECK system operates correctly **No**

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	INSTALL A NEW TRM. CHECK system operates correctly If the concern persists, continue fault finding on the trailer. CHECK system operates correctly

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General Procedures

General Equipment

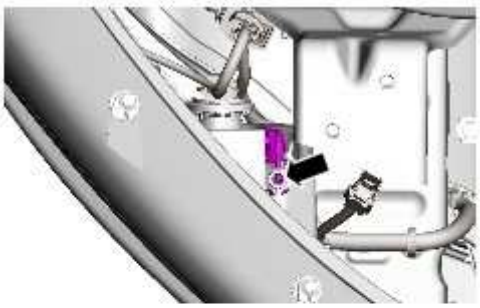
Headlamp beam setter

All vehicles

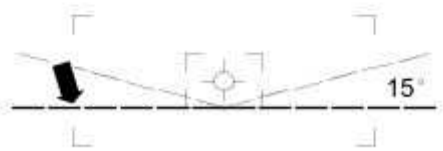
1. Place the vehicle on a level surface.
2. Ensure that the tire pressures are to specification and that the vehicle is not overloaded.
3. Switch on the front fog lamps.
4. Set the measuring screen of the beam setting equipment to the correct front fog lamp adjustment setting.

   General Equipment: Headlamp beam setter

Vehicle with chassis code (type plate): M



5. Adjust the fog lamp so that the light/dark boundary touches the horizontal line.



E72341

Vehicle with chassis code (type plate): S

E72354

6.

7. Adjust the fog lamp so that the light/dark boundary touches the horizontal line.

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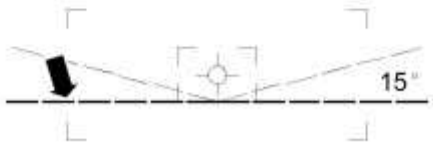
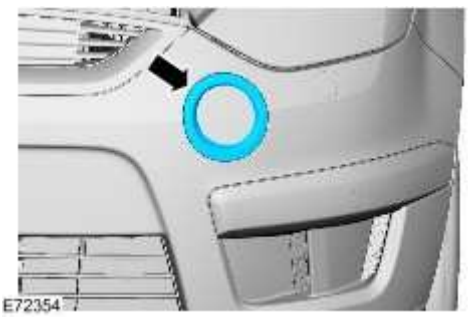


E72342



E72354

8.

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General Procedures

General Equipment

Headlamp beam setter

All vehicles

1. Place the vehicle on a level surface.
2. Ensure that the tire pressures are to specification and that the vehicle is not overloaded.

Vehicles with conventional headlamps

3. Repeatedly operate the headlamp leveling switch and then set it to "0".

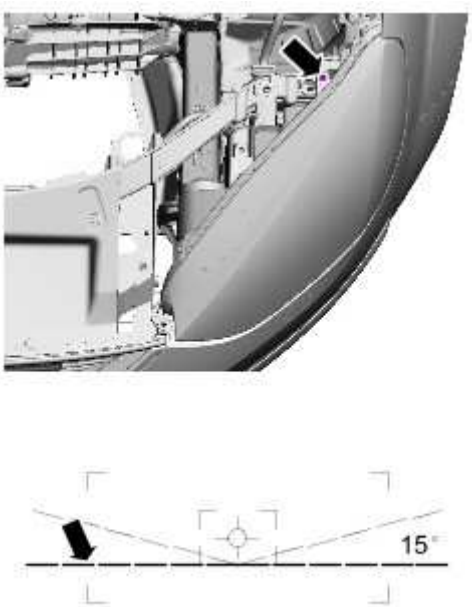
Vehicles with adaptive front lighting

4. Use WDS to make certain that the front wheels are in the straight ahead position.

All vehicles

5. Switch on dipped beam.
6. Set the measuring screen of the beam setting equipment to the correct headlamp adjustment setting.

   Refer to: Specifications (417-01 Exterior Lighting, Specifications).
   General Equipment: Headlamp beam setter



E72339

7. Adjust the dipped beams so that the light/dark boundary touches the horizontal line.
8. NOTE: Some scattered light from the low beam may lie above the 15 degree line.
   Adjust the headlamps so that the rising line of the boundary line lies at the intersection of horizontal line and the 15 degree line (left-hand drive vehicle shown).

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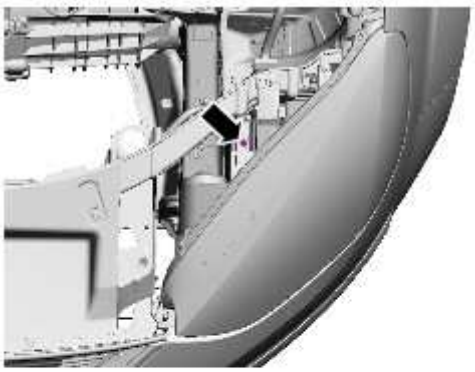

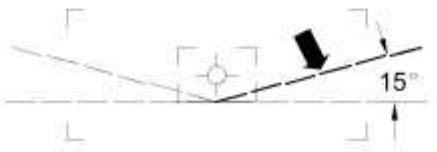

E72340

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Print

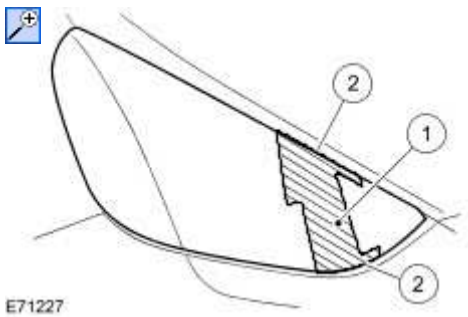
General Procedures

All vehicles

1. Print out the corresponding templates at the end of this operation.
2. Measure dimension X on the printout of the template.
3. Calculate the enlargement/reduction factor Y for the photocopier using the following formula: Y=Z÷X×100.
4.
   - X = measurement on the printout of the template in mm
   - Y = enlargement/reduction factor in %
   - Z = original dimension in mm = 100
5. Enlarge/reduce the printout with a photocopier by the calculated percentage.
6. Compare dimension X on the photocopy with the original dimension.
7. Cut out the prepared template for the headlamp.

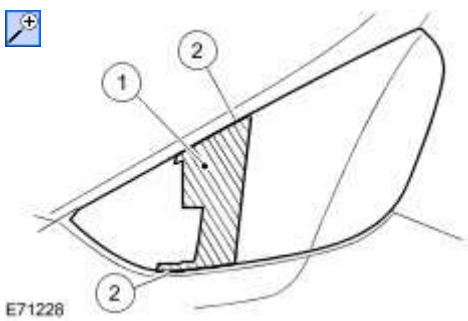
LHD Vehicles

8. Align the template on the lens of the headlamp.
9.
   1. Template
   2. Alignment edges on the headlamp lens



E71227

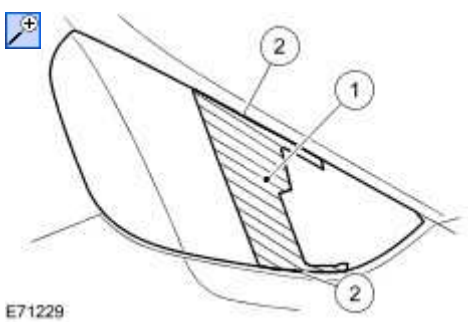
10. Align the template on the lens of the headlamp.
11.
    1. Template
    2. Alignment edges on the headlamp lens



E71228

Right-hand drive vehicles

12. Align the template on the lens of the headlamp.
13.
    1. Template
    2. Alignment edges on the headlamp lens



E71229

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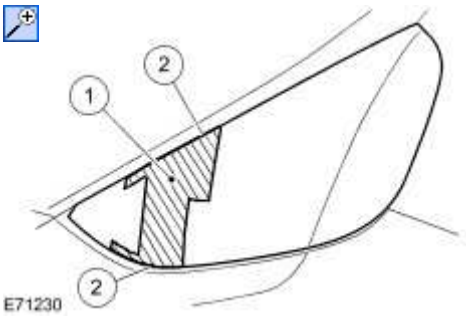

14. Align the template on the lens of the headlamp.
15.
    1. Template
    2. Alignment edges on the headlamp lens

All vehicles

16. CAUTION: Take extra care not to scratch the headlamp lens.
    Copy the outline of the template with a suitable pen onto the headlamp lens.
17. Remove the template.
18. Mask the marked area with opaque black adhesive tape.
19. Repeat steps 16 to 18 for the headlamp on the other side.
20. Template for LHD vehicles, right-hand headlamp

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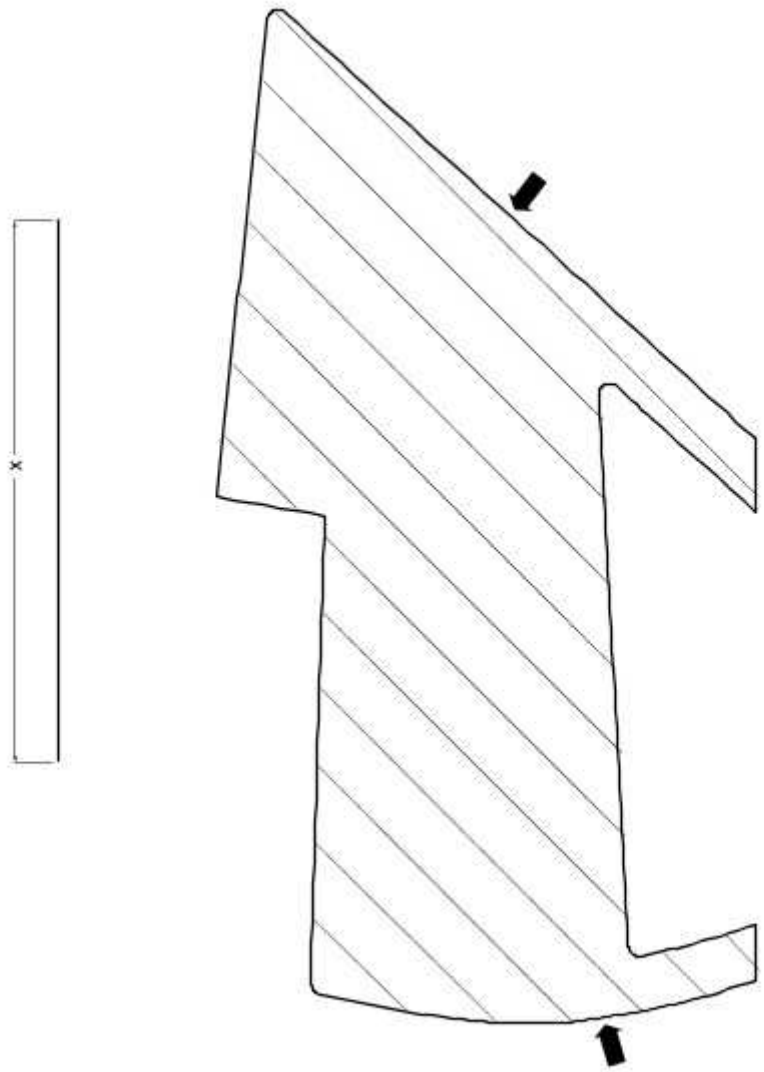

E71231

21. Template for LHD vehicles, left-hand headlamp

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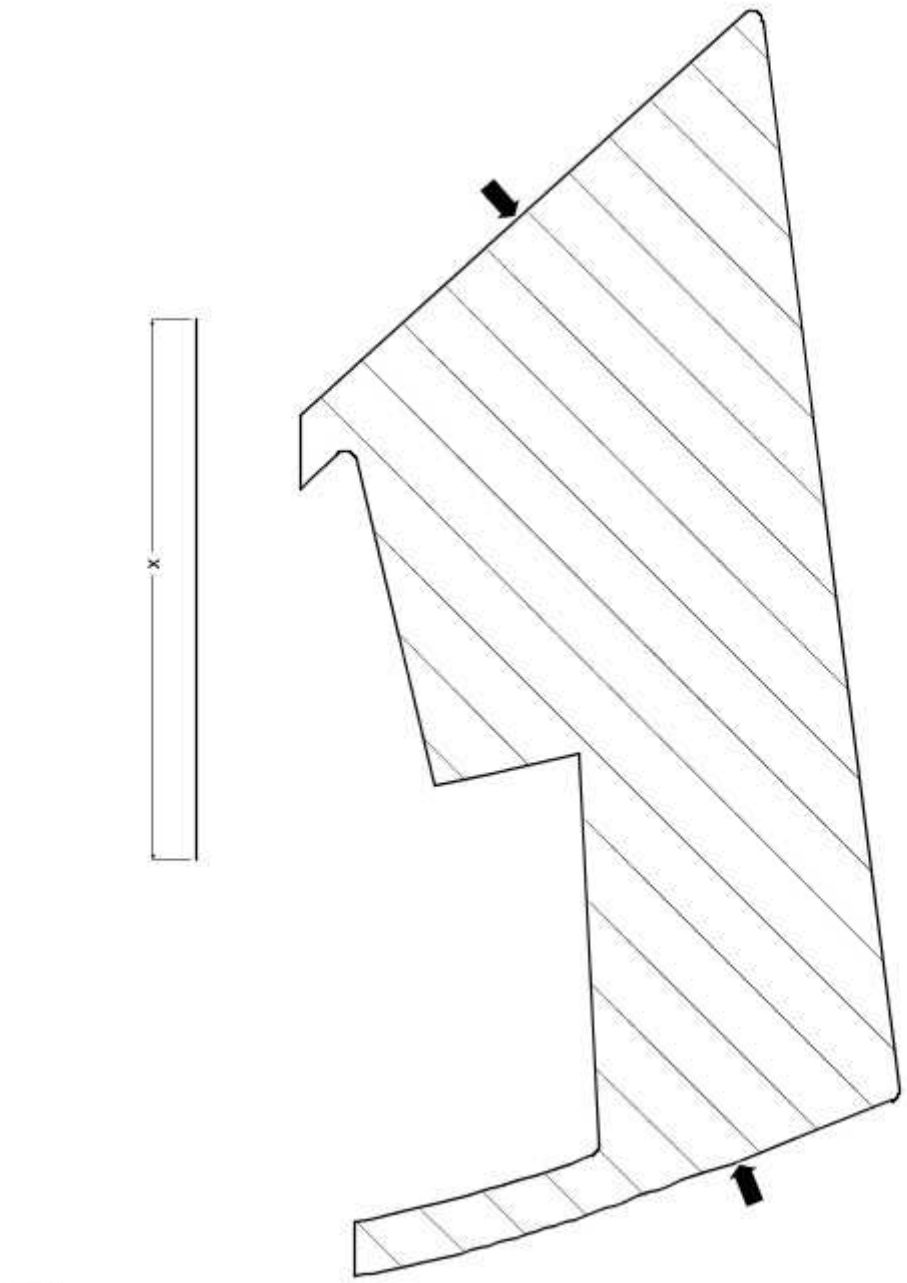

E71232

22. Template for RHD vehicles, right-hand headlamp

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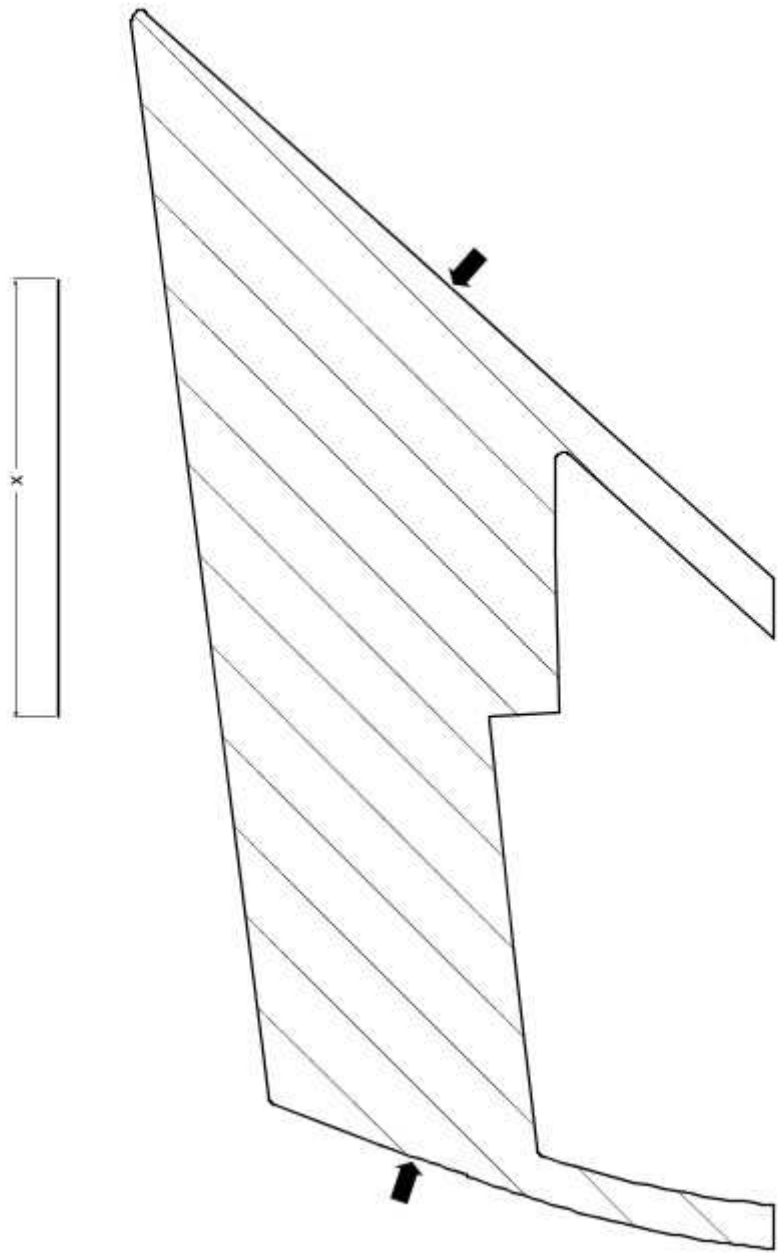

E71233

23. Template for RHD vehicles, left-hand headlamp

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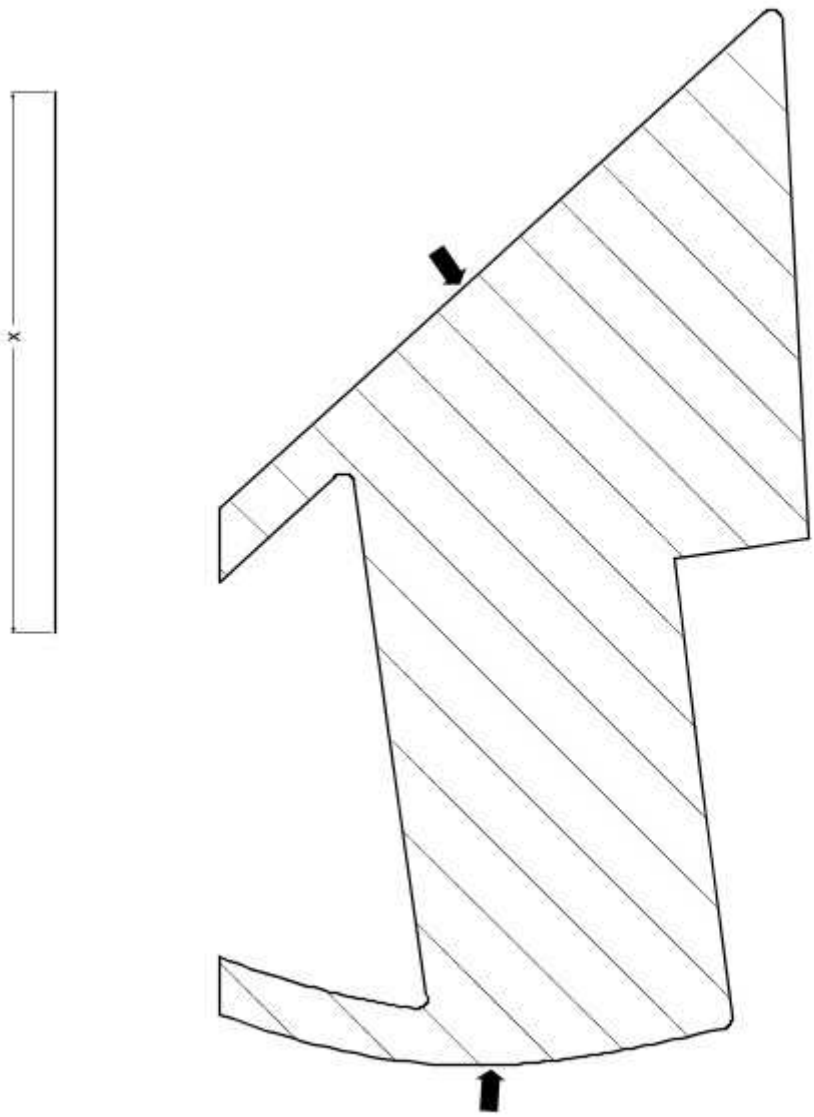

E71234

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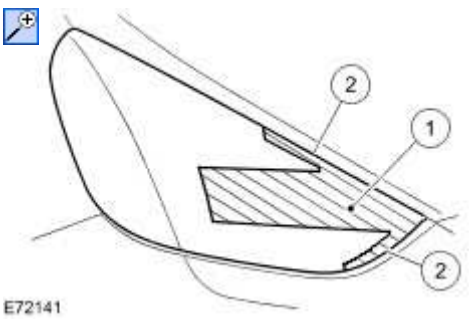
Print

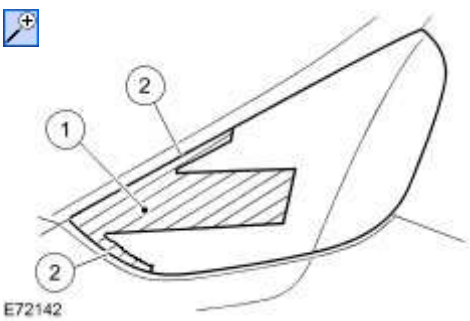
General Procedures

1. Print out the corresponding templates at the end of this operation.
2. Measure dimension X on the printout of the template.
3. Calculate the enlargement/reduction factor Y for the photocopier using the following formula: Y=Z÷X×100.
4.
   - X = measurement on the printout of the template in mm
   - Y = enlargement/reduction factor in %
   - Z = original dimension in mm = 100
5. Enlarge/reduce the printout with a photocopier by the calculated percentage.
6. Compare dimension X on the photocopy with the original dimension.
7. Cut out the prepared template for the headlamp.
8. Align the template on the lens of the headlamp.



E72141

9.
   1. Template
   2. Alignment edges on the headlamp lens



E72142

10. Align the template on the lens of the headlamp.
11.
    1. Template
    2. Alignment edges on the headlamp lens
12. CAUTION: Take extra care not to scratch the headlamp lens.
    Copy the outline of the template with a suitable pen onto the headlamp lens.
13. Remove the template.
14. Mask the marked area with opaque black adhesive tape.
15. Repeat steps 12 to 14 for the headlamp on the other side.
16. Template for the

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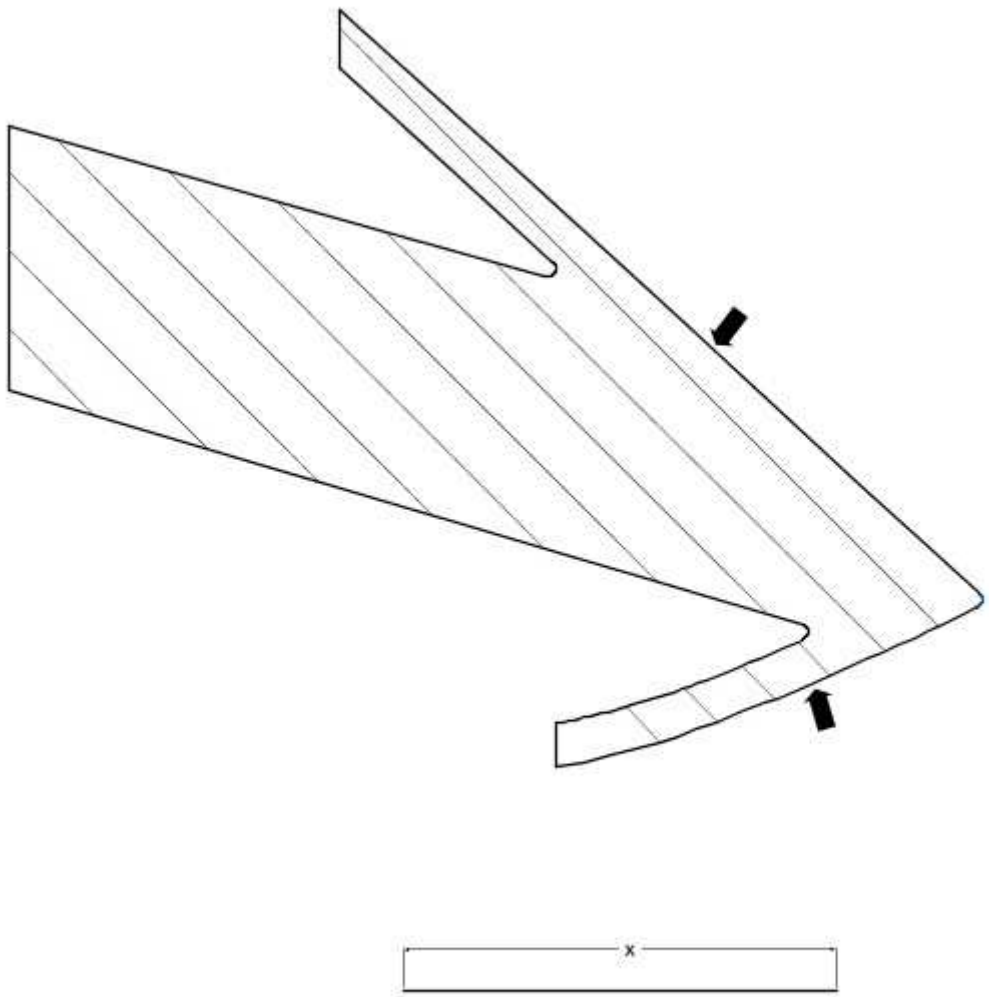
right-hand headlamp



E72143

17. Template for the left-hand headlamp

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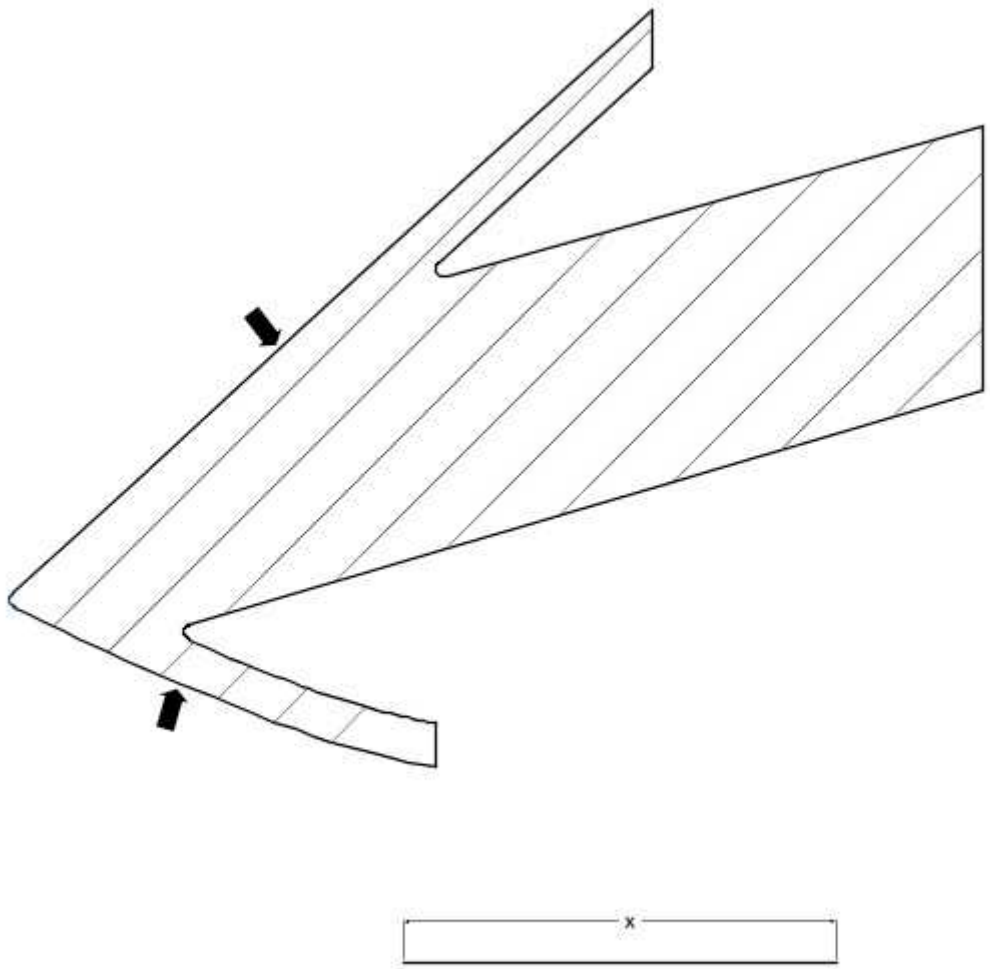

E72144

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Removal and Installation

Removal

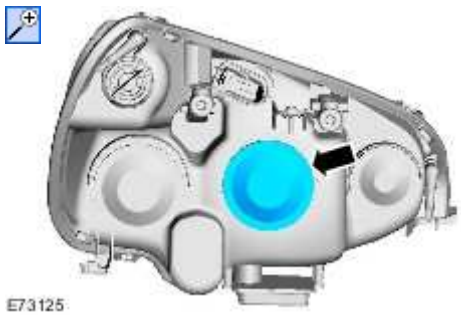
WARNING: High voltage.

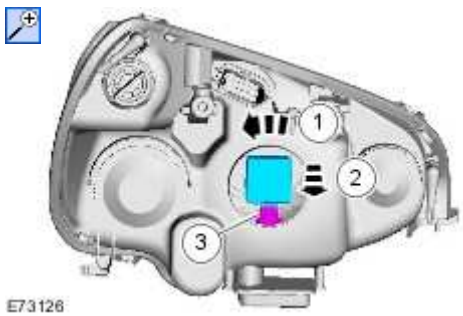
CAUTION: Make sure that the headlamps are not switched on with the headlamp bulb electrical connectors disconnected.

1. Remove headlamp.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

2.





3. WARNING: Safety goggles and gloves must be worn.

Installation

WARNING: Safety goggles and gloves must be worn.

1. Install the components in reverse order.

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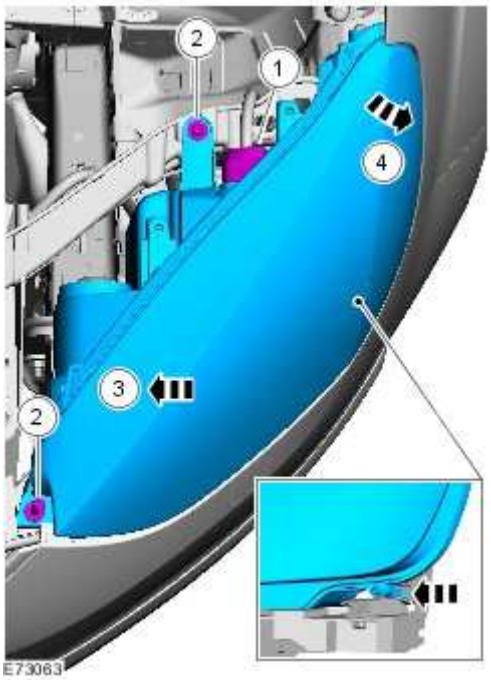
Removal and Installation

Removal

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



1.
    2. *Torque:* 4 Nm

Installation

1. To install, reverse the removal procedure.
2. Align headlamp beams.

   Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

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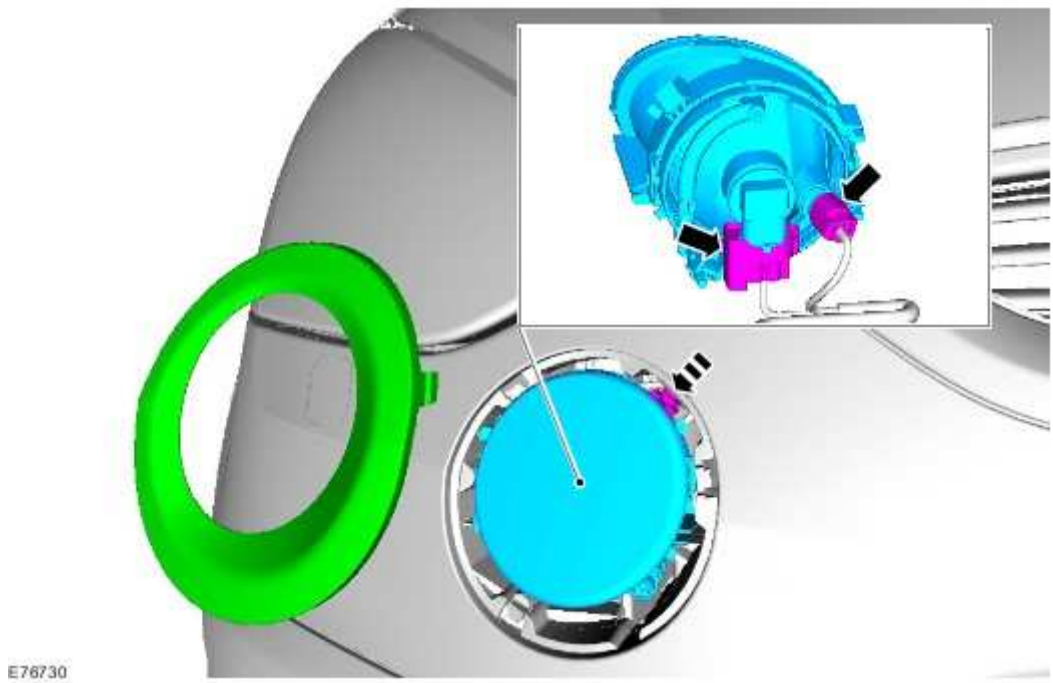
Removal and Installation

General Equipment

Headlamp beam setter

Removal



1.

Installation

1. Install the components in reverse order.
2. Adjust the fog lamp beam alignment.

   Refer to: Front Fog Lamp Adjustment (417-01 Exterior Lighting, General Procedures).
   General Equipment: Headlamp beam setter

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Removal and Installation

General Equipment

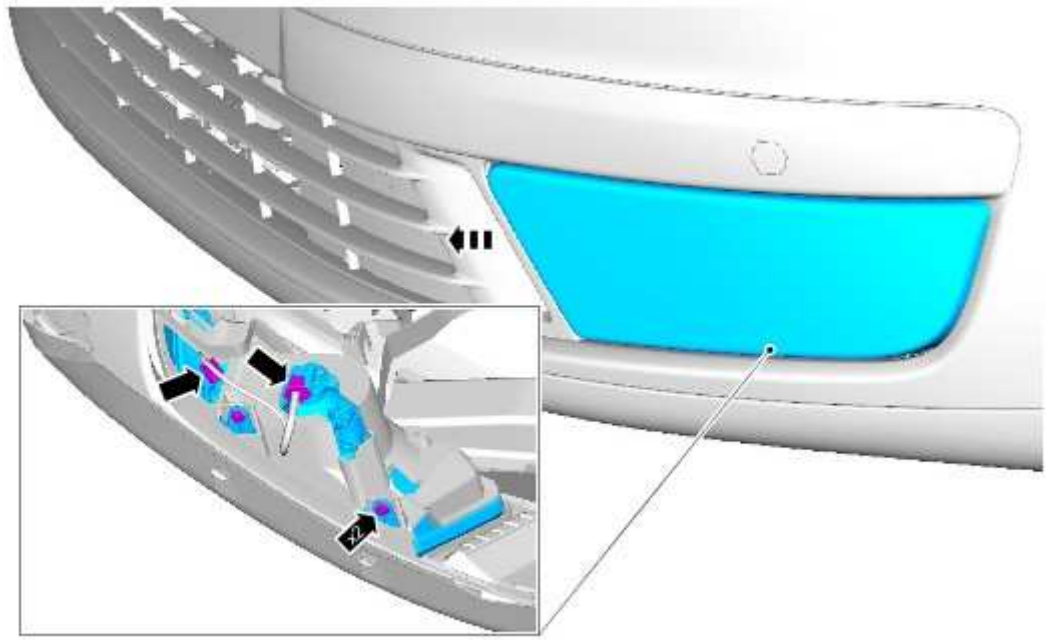
Headlamp beam setter

Removal

1. Raise vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

2.



E76729

Installation

1. To install, reverse the removal procedure.
2. Adjust the front fog lamps.

   Refer to: Front Fog Lamp Adjustment (417-01 Exterior Lighting, General Procedures).
   General Equipment: Headlamp beam setter

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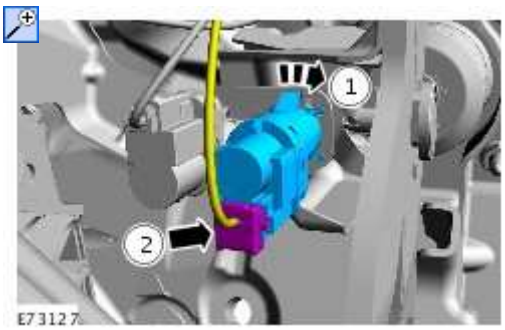
Removal and Installation

Removal

CAUTION: The brake pedal must remain in the rest position.



1.

Installation

CAUTION: The brake pedal must remain in the rest position.

1. To install, reverse the removal procedure.

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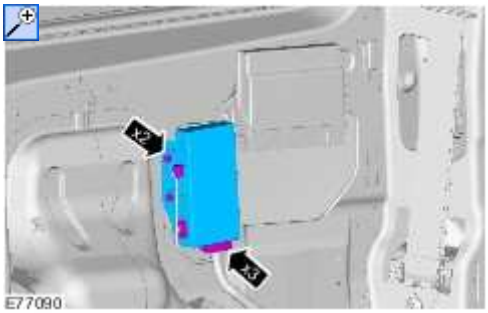
Removal and Installation

Removal

1. Remove the luggage compartment right-hand side trim.

   Refer to: Verkleidung - Laderaum (501-05, Removal and Installation).



2.

Installation

1. Install the components in reverse order.

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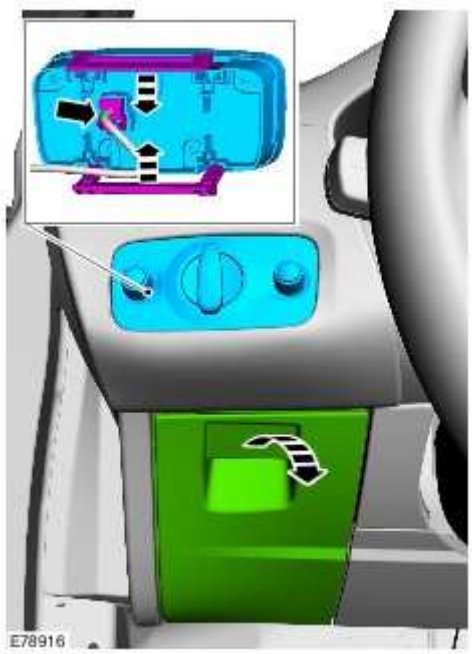
Removal and Installation

Removal



1.

Installation

1. Install the components in reverse order.

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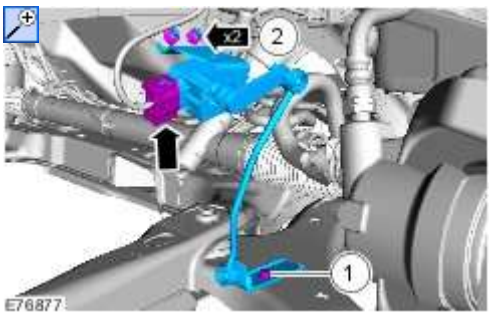
Removal and Installation

Removal

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

1. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2.
   1. *Torque:* 8 Nm
   2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Following installation of the front headlamp leveling sensor, calibrate the headlamp leveling system using WDS.
3. Check the aim of the dip beam headlamps.

   Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

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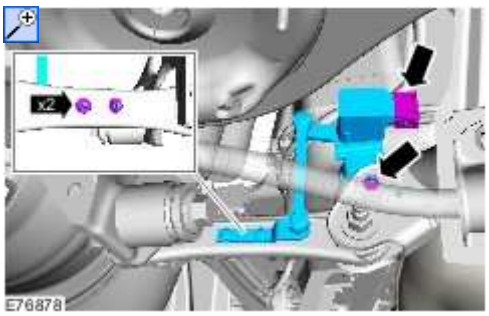
Removal and Installation

Removal

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



1. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Following installation of the rear headlamp leveling sensor, calibrate the headlamp leveling system using WDS.
3. Check the aim of the dip beam headlamps.

   Refer to: Headlamp Adjustment (417-01 Exterior Lighting, General Procedures).

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-02, for schematic and connector information.

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

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

Visual Inspection Chart

Electrical
• Bulb(s) • Fuse(s) • Switch(es) • Wiring harness • Electrical connector(s) • Interior lamp(s) • Battery saver relay • Central junction box (CJB)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The front interior lamp is inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Front interior lamp. * Battery saver relay. * CJB.	* GO to Pinpoint Test A.
The middle interior lamp is inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Middle interior lamp. * Battery saver relay. * CJB.	* GO to Pinpoint Test B.
The rear interior lamp is inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Rear interior lamp. * Battery saver relay. * CJB.	* GO to Pinpoint Test C.
The luggage compartment lamp is inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Luggage compartment	* GO to Pinpoint Test D.

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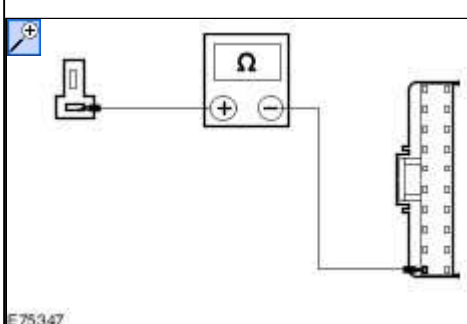
	lamp. * Liftgate latch motor. * CJB.	
The glove compartment lamp is inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Glove compartment lamp. * CJB. * Battery saver relay.	* GO to Pinpoint Test E.
The front footwell lamp(s) are inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Front footwell lamp(s). * CJB. * Battery saver relay.	* GO to Pinpoint Test F.
The vanity mirror lamp(s) are inoperative	* Fuse(s). * Bulb(s). * Circuit(s). * Vanity mirror lamp(s). * CJB. * Battery saver relay.	* GO to Pinpoint Test G.
The battery saver is inoperative/does not operate correctly	* Circuit(s). * Door module(s). * Door ajar switch(es). * CJB.	* Refer to the WDS.

Pinpoint Tests

NOTE: Use a digital multimeter for all electrical measurements.

PINPOINT TEST A : THE FRONT INTERIOR LAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK OPERATION OF THE INTERIOR LAMP	
	1 Check for operation of the interior lamp in both the ON and DOOR OPEN positions.
	Is the interior lamp inoperative in both positions? **Yes** GO to A3. **No** If the interior lamp is inoperative in the ON position. GO to A5. If the interior lamp is inoperative in the DOOR OPEN position. GO to A2.
A2: CHECK CIRCUIT CLN27G (WH/BN) AND CIRCUIT CLN27B (WH/BN) FOR OPEN CIRCUIT	
	1 Disconnect Front Interior Lamp C9LN28-B.
	2 Disconnect CJB C1BP02-H.
	3 Measure the resistance between the front interior lamp C9LN28-B pin 1, circuit CLN27G (WH/BN), harness side and the CJB C1BP02-H pin 20, circuit CLN27B (WH/BN), harness side .
	Is the resistance less than 1 ohm? **Yes**

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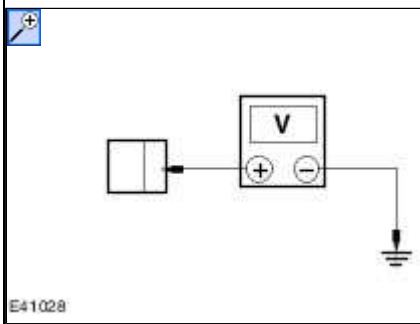
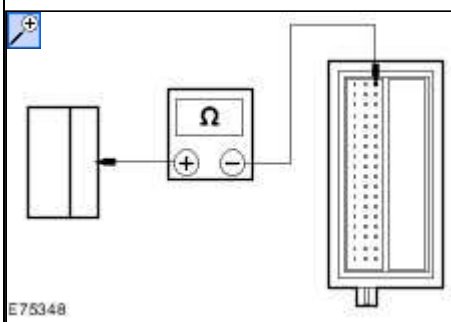
	INSTALL a new front interior lamp. TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new CJB. TEST the system for normal operation.
A3: CHECK CIRCUIT CBP17A (BN/GN) FOR VOLTAGE	
	1 Disconnect Front Interior Lamp C9LN28-A.
	2 Measure the voltage between the front interior lamp C9LN28-A pin 1, circuit CBP17A (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new front interior lamp. TEST the system for normal operation. If the concern persists, GO to Pinpoint Test H. **No** GO to A4.
A4: CHECK FRONT INTERIOR LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the front interior lamp C9LN28-A pin 1, circuit CBP17A (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CBP17A (BN/GN) or circuit CBP17R (BN/GN) as necessary . TEST the system for normal operation.
A5: CHECK CIRCUIT GD138R (BK/WH) FOR GROUND	
	1 Disconnect the battery ground cable. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
	2 Disconnect Front Interior Lamp C9LN28-B.
	3 Measure the resistance between the front interior lamp C9LN28-B pin 2, circuit GD138R (BK/WH), harness side and ground.

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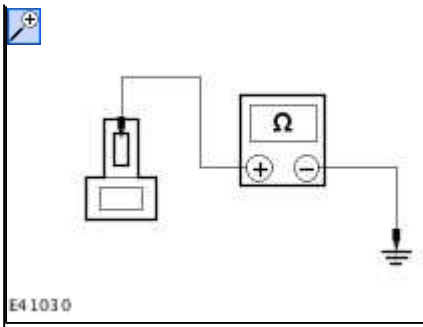


Is the resistance less than 1 ohm?

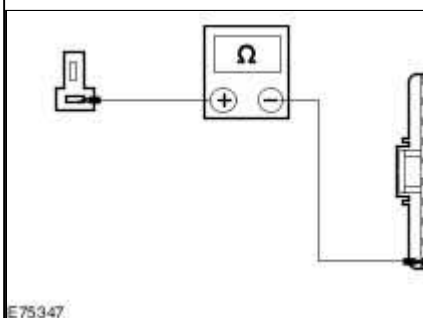
Yes

INSTALL a new front interior lamp. TEST the system for normal operation.

No

REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST B : THE MIDDLE INTERIOR LAMP IS INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK OPERATION OF THE MIDDLE INTERIOR LAMP	
	1 Check for operation of the middle interior lamp in both the ON and DOOR OPEN positions.
	Is the middle interior lamp inoperative in both positions? **Yes** GO to B3. **No** If the middle interior lamp is inoperative in the ON position. GO to B5. If the middle interior lamp is inoperative in the DOOR OPEN position. GO to B2.
B2: CHECK CIRCUIT CLN27H (WH/BN) AND CIRCUIT CLN27B (WH/BN) FOR OPEN CIRCUIT	
	1 Disconnect Middle Interior Lamp C9LN14-B.
	2 Disconnect CJB C1BP02-H.
	3 Measure the resistance between the middle interior lamp C9LN14-B pin 1, circuit CLN27H (WH/BN), harness side and the CJB C1BP02-H pin 20, circuit CLN27B (WH/BN), harness side .
	Is the resistance less than 1 ohm? **Yes** INSTALL a new middle interior lamp. TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new CJB. TEST the system for normal operation.
B3: CHECK CIRCUIT CBP17B (BN/GN) FOR VOLTAGE	
	1 Disconnect Middle Interior Lamp C9LN14-A.
	2 Measure the voltage between the middle interior lamp C9LN14-A pin 1, circuit CBP17B (BN/GN), harness side and ground.

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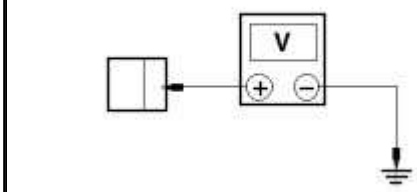


Is the voltage greater than 10 volts?

Yes

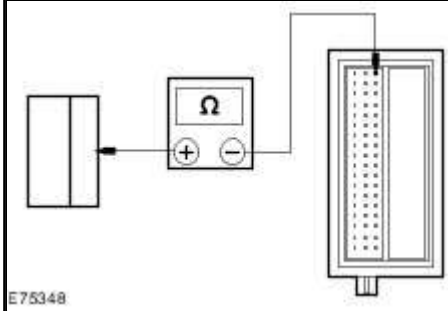
INSTALL a new middle interior lamp. TEST the system for normal operation. If the concern persists, GO to Pinpoint Test H.

No

GO to B4.

B4: CHECK MIDDLE INTERIOR LAMP POWER CIRCUIT FOR OPEN CIRCUIT

1 Disconnect CJB C1BP02-C.



2 Measure the resistance between the middle interior lamp C9LN14-A pin 1, circuit CBP17B (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.

Is the resistance less than 1 ohm?

Yes

GO to Pinpoint Test H.

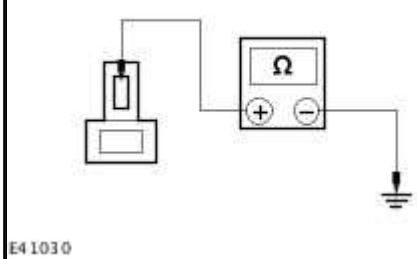
No

REPAIR circuit CBP17B (BN/GN) or circuit CBP17R (BN/GN) as necessary . TEST the system for normal operation.

B5: CHECK CIRCUIT GD138X (BK/WH) FOR GROUND

1 Disconnect the battery ground cable.
REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2 Disconnect Middle Interior Lamp C9LN14-B.



3 Measure the resistance between the middle interior lamp C9LN14-B pin 2, circuit GD138X (BK/WH), harness side and ground.

Is the resistance less than 1 ohm?

Yes

INSTALL a new middle interior lamp. TEST the system for normal operation.

No

REPAIR the circuit. TEST the system for normal operation.

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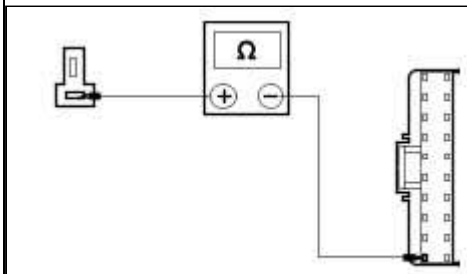
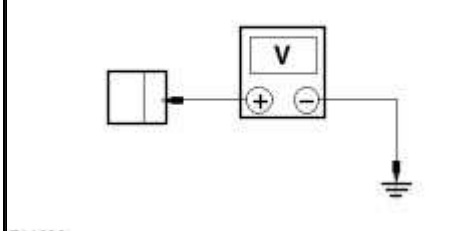
PINPOINT TEST C : THE REAR INTERIOR LAMP IS INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK OPERATION OF THE REAR INTERIOR LAMP	
	1 Check for operation of the rear interior lamp in both the ON and DOOR OPEN positions.
	Is the rear interior lamp inoperative in both positions? **Yes** GO to C3. **No** If the rear interior lamp is inoperative in the ON position. GO to C5. If the rear interior lamp is inoperative in the DOOR OPEN position. GO to C2.
C2: CHECK CIRCUIT CLN27F (WH/BN) AND CIRCUIT CLN27B (WH/BN) FOR OPEN CIRCUIT	
	1 Disconnect Rear Interior Lamp C9LN14-D.
	2 Disconnect CJB C1BP02-H.
 E75347	3 Measure the resistance between the rear interior lamp C9LN14-D pin 1, circuit CLN27F (WH/BN), harness side and the CJB C1BP02-H pin 20, circuit CLN27B (WH/BN), harness side .
	Is the resistance less than 1 ohm? **Yes** INSTALL a new rear interior lamp. TEST the system for normal operation. **No** REPAIR the circuit(s) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new CJB. TEST the system for normal operation.
C3: CHECK CIRCUIT CBP17C (BN/GN) FOR VOLTAGE	
	1 Disconnect Rear Interior Lamp C9LN14-C.
 E41028	2 Measure the voltage between the rear interior lamp C9LN14-C pin 1, circuit CBP17C (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new rear interior lamp. TEST the system for normal operation. If the concern persists, GO to Pinpoint Test H. **No** GO to C4.
C4: CHECK REAR INTERIOR LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the rear interior

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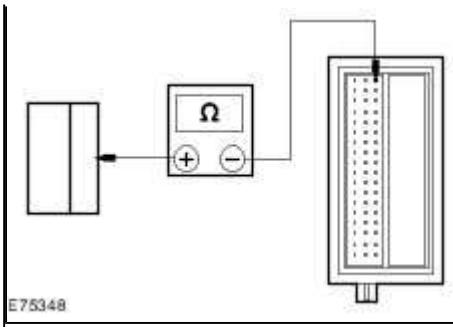
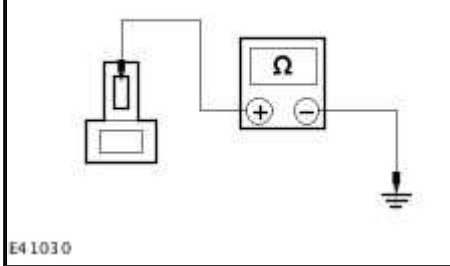
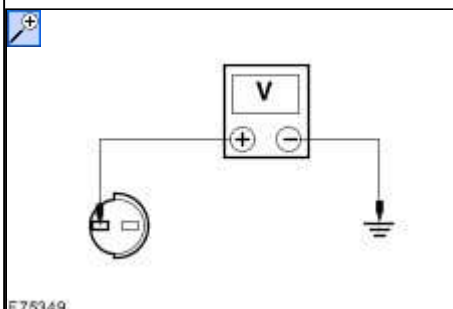
	lamp C9LN14-C pin 1, circuit CBP17C (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CBP17C (BN/GN) or circuit CBP17R (BN/GN) as necessary . TEST the system for normal operation.
C5: CHECK CIRCUIT GD138M (BK/WH) FOR GROUND	
	1 Disconnect the battery ground cable. REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
	2 Disconnect Rear Interior Lamp C9LN14-D.
	3 Measure the resistance between the rear interior lamp C9LN14-D pin 2, circuit GD138M (BK/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new rear interior lamp. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST D : THE LUGGAGE COMPARTMENT LAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK CIRCUIT CBP17B (BN/GN) FOR VOLTAGE	
	1 Ignition switch in position 0.
	2 Disconnect Luggage Compartment Lamp C4LN13-B.
	3 Measure the voltage between the luggage compartment lamp C4LN13-B pin 1, circuit CBP17B (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D3. **No**

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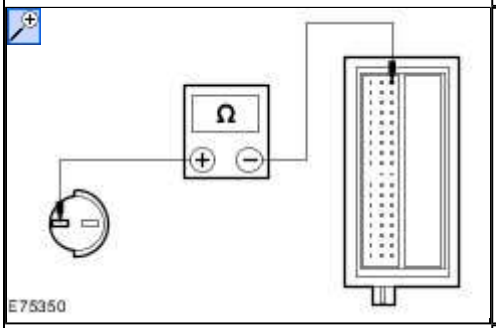
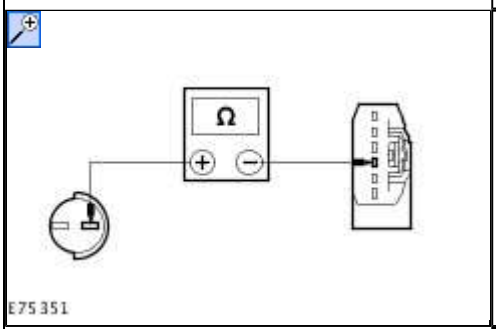
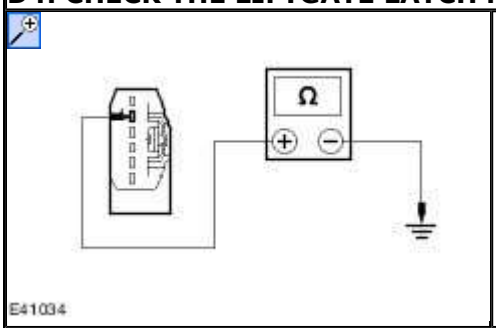
	GO to D2.
D2: CHECK LUGGAGE COMPARTMENT LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-B.
	2 Measure the resistance between the luggage compartment lamp C4LN13-B pin 1, circuit CBP17B (BN/GN), harness side and the CJB C1BP02-B pin 56, circuit A_CBP17A (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CBP17B (BN/GN) or circuit A_CBP17A (BN/GN) as necessary . TEST the system for normal operation.
D3: CHECK THE SWITCHED SIGNAL TO THE LUGGAGE COMPARTMENT LAMP	
	1 Disconnect Liftgate Latch Motor C4PL17.
	2 Measure the resistance between the luggage compartment lamp C4LN13-B pin 2, circuit CLN13B (WH/BU), harness side and the liftgate latch motor C4PL17 pin 4, circuit CLN13C (WH/BU), harness side.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new luggage compartment lamp. TEST the system for normal operation. If the concern persists, GO to D4. **No** REPAIR circuit CLN13B (WH/BU) or circuit CLN13C (WH/BU) as necessary . TEST the system for normal operation.
D4: CHECK THE LIFTGATE LATCH MOTOR FOR GROUND	
	1 Measure the resistance between the liftgate latch motor C4PL17 pin 2, circuit GD150Y (BK/WH), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new liftgate latch motor. REFER to: Liftgate Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation). TEST the system for normal operation.

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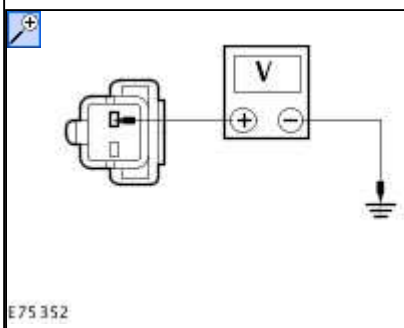
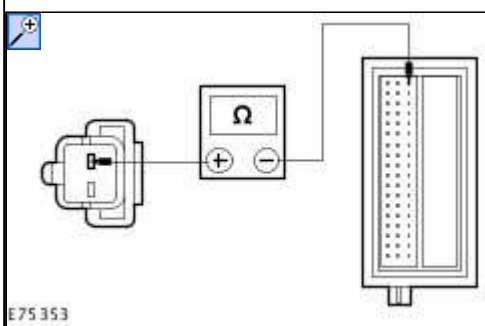
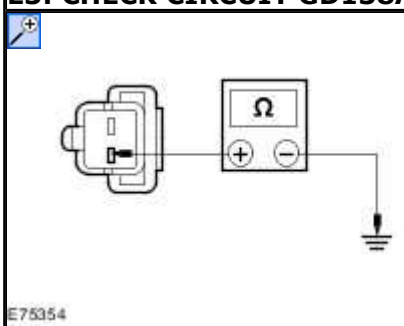
	No REPAIR the circuit GD150Y (BK/WH). TEST the system for normal operation.

PINPOINT TEST E : THE GLOVE COMPARTMENT LAMP IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK CIRCUIT CBP17N (BN/GN) FOR VOLTAGE	
	1 Disconnect Glove Compartment Lamp C2LN15.
 E75352	2 Measure the voltage between the glove compartment lamp C2LN15 pin 1, circuit CBP17N (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to E3. **No** GO to E2.
E2: CHECK THE GLOVE COMPARTMENT LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
 E75353	2 Measure the resistance between the glove compartment lamp C2LN15 pin 1, circuit CBP17N (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CLN15 pin 1, circuit CBP17N (BN/GN) or circuit CBP17R (BN/GN) as necessary. TEST the system for normal operation.
E3: CHECK CIRCUIT GD138AU (BK/WH) FOR GROUND	
 E75354	1 Measure the resistance between the glove compartment lamp C2LN15 pin 2, circuit GD138AU (BK/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new glove compartment lamp. TEST the system for normal operation. **No**

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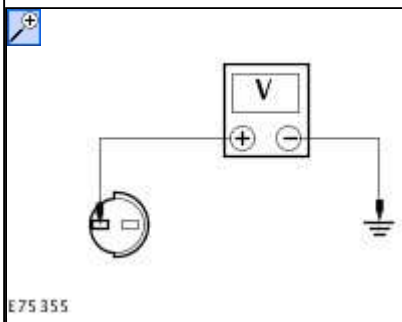
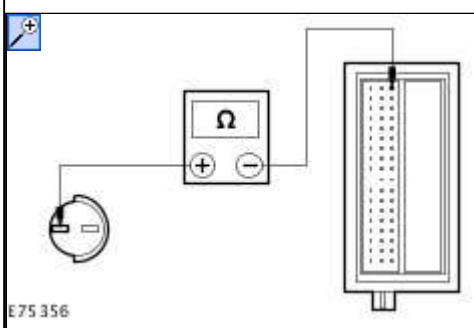
	REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST F : THE FRONT FOOTWELL LAMP(S) ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK OPERATION OF THE FOOTWELL LAMPS	
	1 Check for operation of the front footwell lamp(s).
	Are both the front footwell lamp(s) inoperative? **Yes** GO to F3. **No** If the right-hand side front footwell lamp is inoperative. GO to F5. If the left-hand side front footwell lamp is inoperative. GO to F2.
F2: CHECK CIRCUIT CBP17H (BN/WH) FOR VOLTAGE	
	1 Disconnect Left-hand Front Footwell Lamp C3LN38.
	2 Measure the voltage between the left-hand front footwell lamp C3LN38 pin 1, circuit CBP17H (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to F4. **No** GO to F3.
F3: CHECK THE LEFT-HAND FRONT FOOTWELL LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the left-hand front footwell lamp C3LN38 pin 1, circuit CBP17H (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CBP17H (BN/GN) or circuit CBP17R (BN/GN) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new left-hand front footwell lamp. TEST the system for normal operation.
F4: CHECK CIRCUIT CLN38A (BU/GY) FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-B.
	2 Measure the resistance between the left-hand front footwell lamp C3LN38 pin 2, circuit CLN38A (BU/GY),

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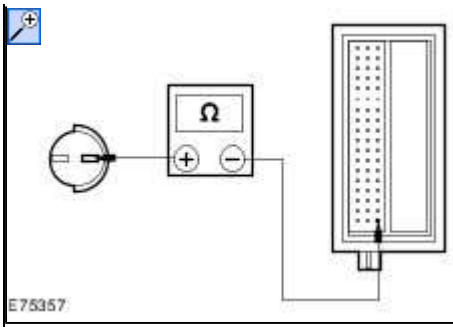
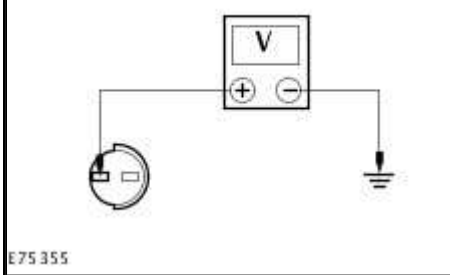
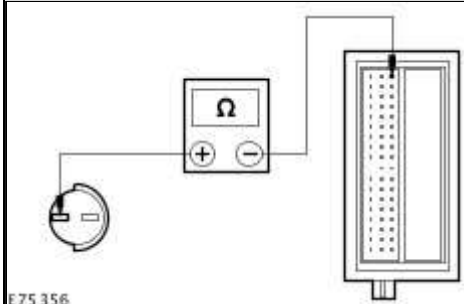
	harness side and the CJB C1BP02_B pin 37, circuit CLN38A (BU/GY), harness side.
	Is the resistance less than 1 ohm? **Yes** REFER to the WDS. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new left-hand front footwell lamp. TEST the system for normal operation.
F5: CHECK CIRCUIT CBP17L (BN/GN) FOR VOLTAGE	
	1 Disconnect Right-hand Front Footwell Lamp C3LN39.
	2 Measure the voltage between the right-hand front footwell lamp C3LN39 pin 1, circuit CBP17L (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to F7. **No** GO to F6.
F6: CHECK THE RIGHT-HAND FRONT FOOTWELL LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the right-hand front footwell lamp C3LN39 pin 1, circuit CBP17L (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** REFER to the WDS. **No** REPAIR circuit CBP17L (BN/GN) or circuit CBP17R (BN/GN) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new right-hand front footwell lamp. TEST the system for normal operation.
F7: CHECK CIRCUIT CLN38C (BU/WH) FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.

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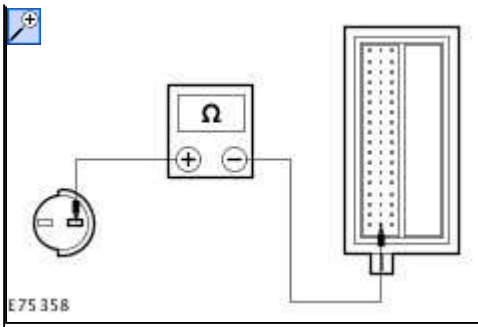
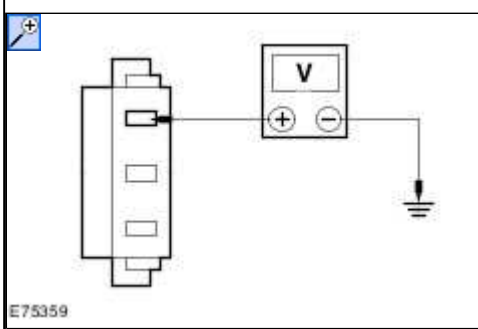
	2 Measure the resistance between the right-hand front footwell lamp C3LN39 pin 2, circuit CLN38C (BU/WH), harness side and the CJB C1BP02-C pin 19, circuit CLN38C (BU/WH), harness side.
	Is the resistance less than 1 ohm? **Yes** REFER to the WDS. **No** REPAIR the circuit. TEST the system for normal operation. If the concern persists, INSTALL a new right-hand front footwell lamp. TEST the system for normal operation.

PINPOINT TEST G : THE VANITY MIRROR LAMP(S) ARE INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK OPERATION OF THE VANITY MIRROR LAMP	
	1 Check for operation of the vanity mirror lamp(s).
	Are both the vanity mirror lamp(s) inoperative? **Yes** GO to G6. **No** If the driver side vanity mirror lamp is inoperative. GO to G2. If the passenger side vanity mirror lamp is inoperative. GO to G5.
G2: CHECK CIRCUIT CBP17D (BN/GN) FOR VOLTAGE	
	1 Disconnect Driver Side Vanity Mirror Lamp C5LN23.
	2 Measure the voltage between the driver side vanity mirror lamp C5LN23 pin 1, circuit CBP17D (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to G4. **No** GO to G3.
G3: CHECK THE DRIVER SIDE VANITY MIRROR LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the driver side vanity mirror lamp C5LN23 pin 1, circuit CBP17D (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.

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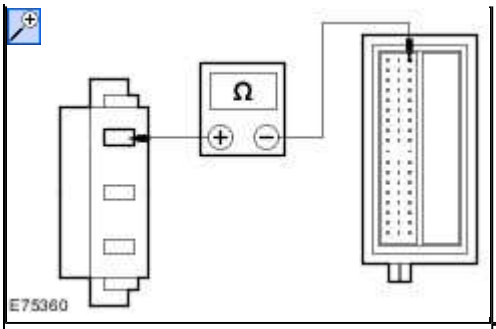
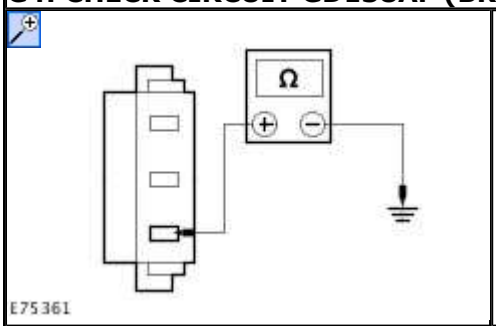
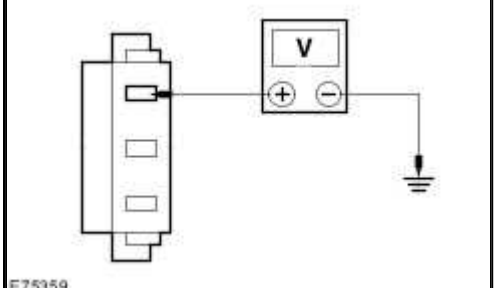
	
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR circuit CBP17D (BN/GN) or circuit CBP17R (BN/GN) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new driver side vanity mirror lamp. TEST the system for normal operation.
G4: CHECK CIRCUIT GD138AF (BK/WH) FOR GROUND	
	1 Measure the resistance between the driver side vanity mirror lamp C5LN23 pin 3, circuit GD138AF (BK/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new driver side vanity mirror lamp. TEST the system for normal operation **No** REPAIR the circuit. TEST the system for normal operation.
G5: CHECK CIRCUIT CBP17F (BN/GN) FOR VOLTAGE	
	1 Disconnect Passenger Side Vanity Mirror Lamp C6LN24.
	2 Measure the voltage between the passenger side vanity mirror lamp C6LN24 pin 1, circuit CBP17F (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to G7. **No** GO to G6.
G6: CHECK THE PASSENGER SIDE VANITY MIRROR LAMP POWER CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect CJB C1BP02-C.
	2 Measure the resistance between the passenger side

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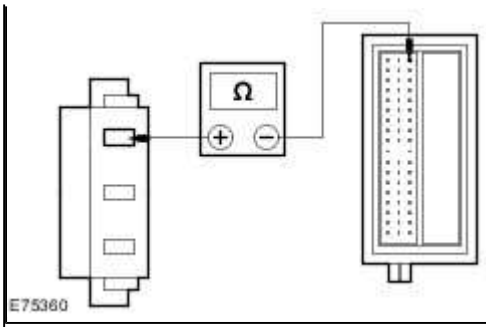
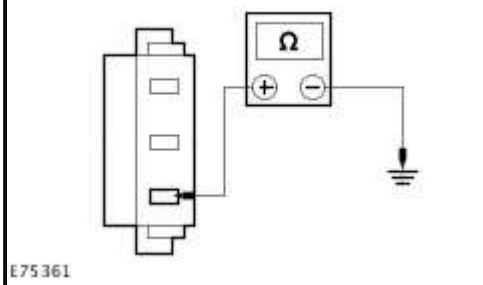
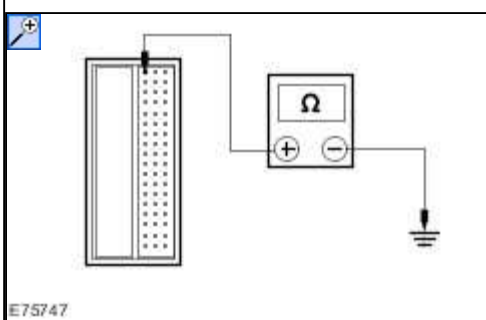
	vanity mirror lamp C6LN24 pin 1, circuit CBP17F (BN/GN), harness side and the CJB C1BP02-C pin 67, circuit CBP17R (BN/GN), harness side.
	Is the resistance less than 1 ohm? **Yes** GO to Pinpoint Test H. **No** REPAIR the circuit CBP17F (BN/GN) or circuit CBP17R (BN/GN) as necessary. TEST the system for normal operation. If the concern persists, INSTALL a new passenger side vanity mirror lamp. TEST the system for normal operation.
G7: CHECK CIRCUIT GD138AH (BK/WH) FOR GROUND	
	1 Measure the resistance between the passenger side vanity mirror lamp C6LN24 pin 3, circuit GD138AH (BK/WH), harness side and ground.
	Is the resistance less than 1 ohm? **Yes** INSTALL a new passenger side vanity mirror lamp. TEST the system for normal operation **No** REPAIR the circuit. TEST the system for normal operation.

PINPOINT TEST H : BATTERY SAVER RELAY TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE BATTERY SAVER RELAY	
	1 Disconnect CJB C1BP02-C.
	2 Ignition switch in position II.
	3 Measure the voltage between the CJB C1BP02-C pin 67, component side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to H2. **No** INSTALL a new CJB. TEST the system for normal operation.

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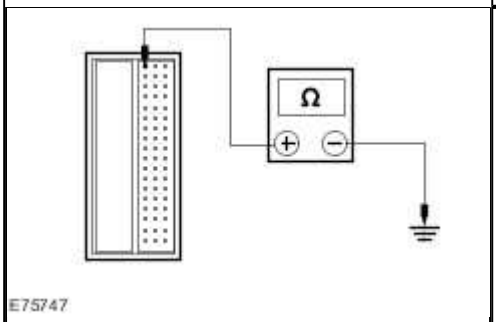
H2: CHECK THE BATTERY SAVER RELAY DISCHARGE

	1 Ignition switch in position 0.
	2 WAIT for 35 minutes.
 E75747	**3** Measure the voltage between the CJB C1BP02-C pin 67, component side and ground.
	Is the voltage 0 volts? **Yes** CONNECT the CJB C1BP02-C. TEST the system for normal operation. If the concern persists, INSTALL a new CJB. TEST the system for normal operation. **No** INSTALL a new CJB. TEST the system for normal operation.

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Description and Operation

In areas in which daytime running lamps (DRL) are required by law the generic electronic module (GEM) switches on the dipped beam headlamps and the side lights whenever the ignition is in position "II" or "III".

The configuration in the GEM can be changed using the Worldwide Diagnosis System (WDS). This makes aftermarket configuration of vehicles with DRL possible (e.g. on customer request or in response to changes in the law).

Vehicles with DRL can be combined with autolamps.

On vehicles with conventional filament bulbs the GEM switches on the dipped beam headlamps and the side lights in light switch position "0", whereby the dipped beam headlamps are limited via pulse-width-modulation (PWM) to around 11.5V and therefore only operate at 90 % of their normal brightness.

On vehicles with gas discharge headlamps the PWM control is not active - the dipped beam headlamps come on with normal intensity.

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Diagnosis and Testing

Refer to Wiring Diagrams Section 417-04, for schematic and connector information.

Operation

The daytime running lamps (DRL) system is designed to turn the dipped beam headlamps, parking lamps and licence plate lamps ON automatically as soon as engine is running.

The instrument cluster illumination is not switched on in this mode so as to make the driver aware that he has not switched on the normal dipped beam.

To increase the service life of conventional filament bulbs, the bulbs are operated at a reduced voltage of 11.5 volts maximum when the daytime running lamps (DRL) are switched on; this also reduces the brightness of the lamps. By contrast, xenon headlamps are also operated at a reduced voltage in daytime running lamp (DRL) mode, but they operate at normal brightness.

Vehicles with and without daytime running lamps are no longer distinguished from each other by their different headlamp connections; instead, they have different software configurations in the GEM.

The daytime running lamps (DRL) are ON under the following conditions:

- Ignition switch in position RUN **and**
- Headlight switch in position OFF **or**
- Headlight switch in automatic headlamps position if light conditions are sufficient.

The daytime running lamps (DRL) are OFF under the following conditions:

- The ignition switch is in any position except RUN **or**
- Headlight switch in parking light position **or**
- Headlight switch in dipped beam position **or**
- Headlight switch in automatic headlamps position and light conditions are not sufficient.

Inspection and Testing

NOTE: Before reading out the vehicle-specific data, remake all the separated electrical connections in the vehicle, so that communication between the module and WDS is ensured.
NOTE: The generic electronic module (GEM) forms part of the central junction box (CJB).
NOTE: If the generic electronic module (GEM) is changed, the new one must be reinitialized. For this purpose, the vehicle-specific data is read out of the module to be replaced using WDS and is transferred to the new module. REFER to:
Communications Network (418-00 Module Communications Network, Diagnosis and Testing),
Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of electrical or mechanical damage.

Visual Inspection Chart

Electrical
• Fuse(s)

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- Bulb(s)
- Electrical connector(s)
- Wiring loom
- Light switch

3. **3.** Resolve any obvious causes or concerns found during the visual inspection before carrying out any further tests.

4. **4.** If the cause of the concern cannot be found by visual inspection, continue with the symptom chart.

Symptom chart

Symptom chart

Symptom	Possible Sources	Action
The daytime running lamps are inoperative	* Fuse(s) * Circuit(s) * Light switch * Central Junction Box (CJB) * Generic electronic module (GEM)	* REFER to: Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
The parking, rear and/or license lamps are inoperative with the daytime running lamps ON.	* Circuit(s) * Central Junction Box (CJB) * Generic electronic module (GEM)	* REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

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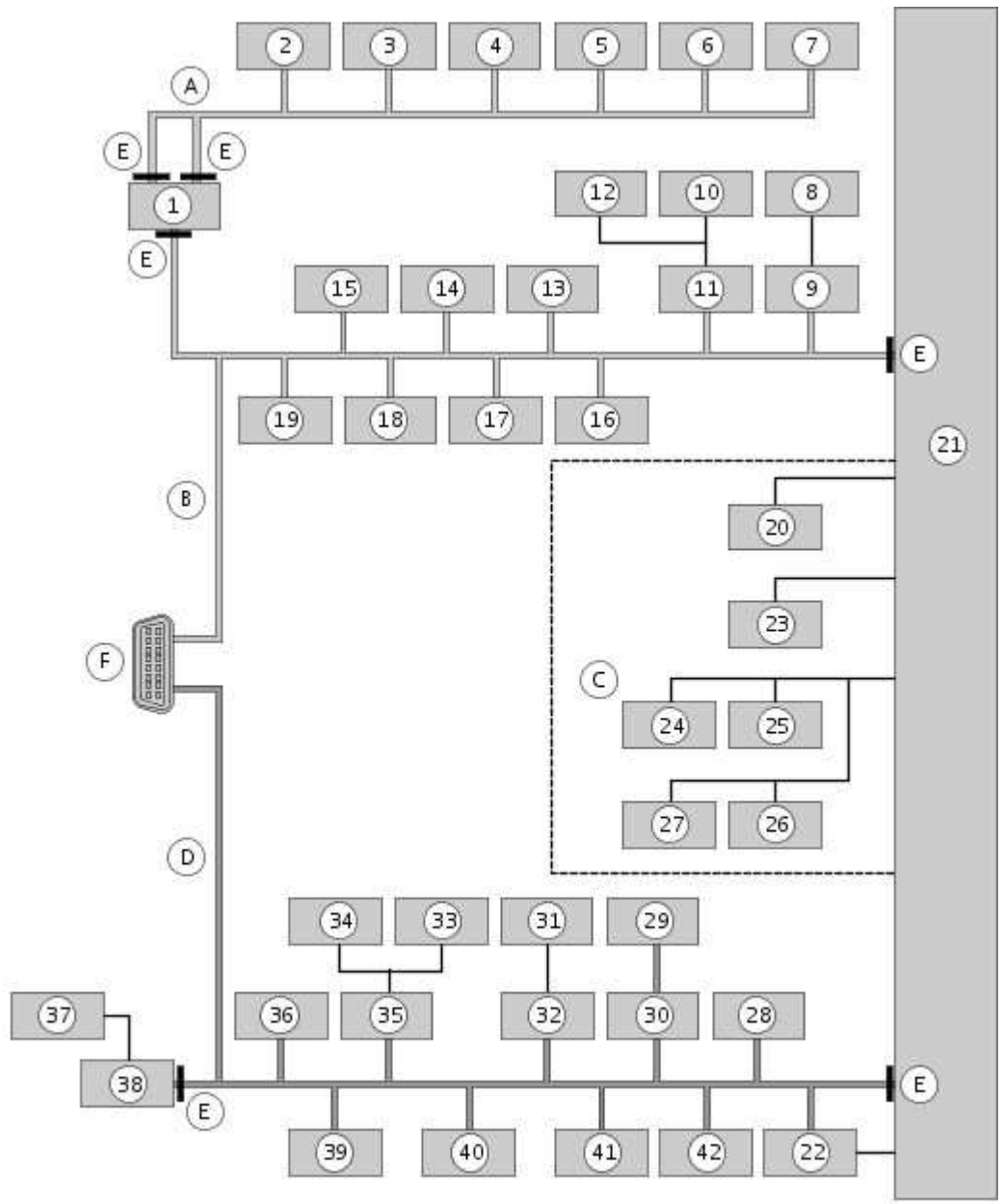
Description and Operation



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Item	Part Number	Description
A	-	MM CAN bus (Infotainment)
B	-	MS CAN bus
C	-	LIN bus (directly to the GEM)
D	-	HS CAN bus
E	-	Terminating resistors
F	-	DLC
1	-	Electronic instrument cluster
2	-	Audio unit

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3		CD changer
	4 -	Navigation system module not communicating with the diagnostic tester - vehicles equipped with DVD navigation system with touch screen
5	-	Navigation system display not communicating with the diagnostic tester - vehicles equipped with DVD navigation system with touch screen
6	-	Handsfree module / Bluetooth module / voice activation module
7	-	Rear seat entertainment system module
8	-	Door module on the rear passenger side (via LIN bus)
9	-	Door module on the front passenger side
10	-	Door module on the rear driver's side (via LIN bus)
11	-	Door module on the front driver's side
12	-	Switch unit on the front driver's side (via LIN bus)
13	-	Restraints control module
14	-	Electronic automatic temperature control (EATC) module
15	-	Rear A/C module
16	-	Parking aid module
17	-	Driver seat module
18	-	Fuel fired booster heater /programmable fuel fired booster heater
19	-	Trailer Module
20	-	Receiver module for the remote control / tire pressure monitoring (via LIN bus)
21	-	Generic electronics module (GEM)
22	-	Steering wheel module (via LIN bus and HS CAN bus)
23	-	Light switch unit (via LIN bus)
24	-	Battery-buffered signal horn – anti-theft alarm system (BBS) (via LIN bus)
25	-	Interior monitoring sensors (via LIN bus)
26	-	Wiper motor (front left) (via LIN bus)
27	-	Light/rain sensor (via LIN bus)
28	-	Shock absorber control module
29	-	Collision warning radar unit (via private CAN bus)
30	-	Collision warning module
31	-	Gear lever (automatic transmission only) (via LIN bus)
32	-	Transmission Control Module
33	-	Gas discharge headlamp, right (via LIN bus / PWM)
34	-	Gas discharge headlamp, left (via LIN bus / PWM)
35	-	Gas discharge headlamp module
36	-	ABS module or ESP module
37	-	Alternator (via LIN bus)
38	-	Powertrain control module (PCM)
39	-	Yaw rate / lateral acceleration sensor
40	-	Electric handbrake module
	-	

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41		Electro-hydraulic power-assisted steering module
	42 -	Steering wheel rotation sensor

Network components

Dependent on the vehicle accessories version, two data bus systems are used:

- Controller Area Network (CAN) bus
- Local Interconnect Network (LIN) bus

Due to the increased number of modules and the resulting continued increase in data transfer, three different CAN bus systems are used. Essentially, they only differ in terms of their data transmission rates and application areas. In order to be able to distinguish between the individual CAN bus systems, the CAN bus system with the higher data transfer rate is referred to as the high-speed (HS) CAN bus, the CAN bus system(s) with the lower data transfer rate as the mid-speed (MS) CAN bus or multimedia (MM) CAN bus. The latter operate at a slower speed and are used primarily for communications in the areas of comfort electronics and multimedia systems. Two interfaces (gateways) are used in order to exchange data between the HS CAN bus, MS CAN bus and the MM CAN bus. The provide the connection between the three CAN databus systems and are installed in the GEM and in the electronic instrument cluster.

The number of modules which are connected to the three databus systems depends on the equipment level of the vehicle.

Controller area network (CAN)

General

In the past, a separate cable was needed for every command and every message. The use of networks has enabled an increase in functionality without additional cables.

The demand for greater functionality in vehicles, both due to legal requirements and in order to meet customer demands, results in increasing complexity of vehicle systems.

The Controller Area Network (CAN) was developed as part of the effort to achieve greater flexibility of the electrical systems. It allows a large number of different control commands and messages to be sent and received on the same cable system.

The number of control commands and messages which can be processed by a network depends on factors like the data transfer rate and the length of the messages. The SMAX/Galaxy network, which is based on a Controller Area Network (CAN), is capable of transferring over 500 different signals and approx. 100 messages. These messages are also described as transmission blocks and may contain several signals.

Advantages of a network

Easy integration of additional functions and accessories

As the control modules in the network are already connected to each other and can easily accept further information, only the following steps are necessary:

- Connection of the sensors to the nearest control module
- Connection of the component which is to be actuated to the nearest control module
- Software-based adaptation of the module configuration

This means that the overall length of cabling and the number of components in a vehicle are reduced compared to before.

One example of this is the integration of the speed control system.

Before the introduction of the network, control modules, switches, vacuum pumps, vacuum servos, hoses and wiring harnesses were needed for this system.

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Following introduction of the network, only one switch and the software for adaptation of the vehicle configuration are required.

Easier to introduce logical functions

The term "logical functions" is used to describe the concept whereby certain events trigger certain responses. For example, the system is programmed in such a way that if a tail lamp fails a message is sent via the Controller Area Network (CAN) to the electronic instrument cluster to warn the driver.

A logical function can be introduced by merely reprogramming the affected control modules. In the above case this would be the generic electronic module (GEM) and the electronic instrument cluster. The number of components and cables remains the same.

Simple adaptation of systems to customer demands and market requirements

Vehicle functions can be adapted to customer demands and market requirements, e.g. in the case of the rear fog lamps. In some countries two rear fog lamps are used, whereas in other countries only one fog lamp is used on the driver's side. In the past it was necessary to stock different spare parts for different markets. Now a single part is sufficient to cover all markets - it just needs to be programmed for the specific market.

Use of similar basic systems for entire series

Similar networks (hardware) can be used for a wide variety of different vehicles.

The vehicles only differ in terms of:

- The individual components (modules, sensors, actuated components etc.) which are connected to the system.
- The task(s) of the components.
- The definition of the components as standard/optional/accessories.
- The configuration/programming of the system.

The layout of the network.

General

The network is made up of a range of control modules (these are also referred to as nodes) which are connected to each other via two communication cables. Each module has its own voltage supply and ground connection and receives messages and control commands via both communication cables.

In the event of a break in the circuit, the modules beyond the break cannot communicate with other parts of the network.

Network areas with high and low data transfer rates

The network consists of two parts. The area with the higher data transfer rate (HS CAN bus) transmits signals and messages between the generic electronic module (GEM) and control modules which are mostly located in the engine compartment. The area with the lower data transfer rate (MS/MM CAN bus) transmits signals and messages between the generic electronic module (GEM) and the control modules in the passenger compartment and in the luggage compartment.

The generic electronic module (GEM) represents the interface between the two areas and converts the data transfer rate up or down to allow the two areas of the network to communicate with each other.

Data transfer rates

The Controller Area Network (CAN) uses two data transfer rates.

- The HS CAN bus (high data transfer rate) transfers data at a rate of 500 kBit/s.
- The MS/MM CAN bus (low data transfer rate) transfers data at a rate of 125 kBit/s. 1

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kBit/s = 1024 Bit per second (1 Byte = 8 Bit).

Terminating resistor

In order to avoid reflections and interferences in the CAN bus network, a terminating resistor is provided for bridging purposes at both ends of the CAN. Each terminating resistor has a resistance value of 120 Ohm.

- For the HS CAN bus, the terminating resistors are located in the generic electronic module (GEM) and in the powertrain control module (PCM).
- For the MS/MM CAN bus, the terminating resistors are located in the generic electronic module (GEM) and in the electronic instrument cluster.

The two resistors are connected in parallel. The resistance values are as follows:

- When the CAN bus is intact, the resistance is approx. 60 Ohm in both areas of the network.
- In the event of a short circuit between the communication lines the resistance is approx. 0 Ohm.

Controller Area Network (CAN) Standard

General

The CAN bus is a standardized system for multiplex communication. This means that multiple control modules can use the same wires for communication without causing interference between the different signals.

The Controller Area Network (CAN) Standard specifies the following:

- The use of two wires (CAN H and CAN L)
- The voltage amplitudes
- The structure of the messages
- The way in which transmission faults are handled

The lines CAN H and CAN L

The lines CAN H and CAN L must not be confused with the different data transfer rates HS CAN bus and HS CAN bus. The lines CAN H and CAN L are the paths on which signals are transmitted within the multiplex communication system.

Communications take place at different voltages via two separate wires which are twisted in pairs. As a result, the network is less susceptible to interference.

The same message is put out at the same time on both wires with different voltages.

- Binary signal 0 = 2.5V on CAN H and on CAN L
- Binary signal 1 = 4V on CAN H and 1V on CAN L

The average potential difference between CAN L and ground is approx. 2.3V, or approx. 2.8V between CAN H and ground.

These measured values refer to "normal" communications in the Controller Area Network (CAN), i.e. cases in which no faults have occurred which would cause the modules to send out error messages.

NOTE: Certain modules, such as the restraints control module (the module for the SRS system) and the ABS module or ESP module communicate with their relevant sensors via a so-called internal CAN bus. The internal CAN bus systems have nothing to do with the communications on the general CAN bus. Instead, they are only used for the purpose of transmitting data between sensors and associated modules.

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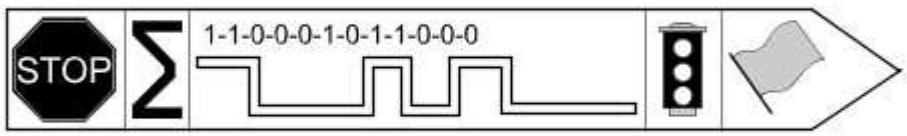
Messages in the Controller Area Network (CAN)



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A message comprises the following parts:

- An identifier which indicates the identity and priority of the message
- Information data (value, information etc.)
- A check sum which is used to check whether the message is received in full
- And end signal which signals the end of the message

A complete CAN message is referred to as a signal frame.

Priority

Conflicts may arise in a network if several control modules try to send messages at the same time as each other. This could for example be the case if the driver applied the brakes while the front passenger adjusted the A/C settings and a rear passenger operated the electric rear window regulators. The messages need to be prioritized so that safe operation can be ensured. In addition, any delays arising as a result of the prioritization process must be kept within limits so that the customer preferably does not notice them at all.

In order to avoid conflicts and delays and to ensure perfect operation of the systems, a fixed ranking order applies to the messages.

The priority of a message is defined by the number of zeros at the start of the message; the more zeros, the higher the priority.

Prioritization takes place as follows:

- If the network is available, all modules waiting to send a message deliver the first bit of their message.
- All modules register the signals sent out on the network.
- If a zero is sent out by a module then the modules which sent out a "1" wait until the network is available again.
- The modules with a zero then send the second bit of their message.
- If a zero is sent out by a module as its second bit then the modules with a "1" wait until the network is available again. This process is repeated.

The message with the highest priority, i.e. the message with the largest number of zeros at the start, is sent first.

The end of a message is made up of seven zeros. It shows the modules that the network is free again and that messages can be sent out again according to their priority.

Two message types

Two types of message are sent in the system:

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- Periodic signal frames are sent regularly to indicate the current status of a parameter. They are used for types of information which change frequently, e.g. vehicle speed signals.
- Event-related signal frames are only sent if certain conditions are met. They are used for types of information which occur more rarely, e.g. the opening or closing of a window.

The messages may also incorporate an update bit which shows how "new" the message is.

The system always assumes that the messages reach the intended recipient, so no receipt acknowledgement signals are sent out. Replies are only sent in response to direct queries from other modules.

However, a receiver module also knows how often it should receive a particular status message. If the message is not received then the receiver module can launch an emergency running program and/or set a trouble code (DTC).

Compatibility

The modules must all speak the same language and be compatible with each other. As a result, a standardized communication protocol is used.

The language of the modules is contained in the signal configuration. If the signal configuration of a module does not match the configuration of the other modules than the module cannot communicate with them. This means that all modules must have a compatible signal configuration.

In order to check this, the generic electronic module (GEM) sends out an identification number for its signal configuration via the Controller Area Network (CAN). The other modules compare this number to their own number. If the identification does not match then the module stores a trouble code (DTC). The signal configuration is changed occasionally, so that new messages are added and old ones are removed.

Configurations

The following information is downloaded when a system is configured:

- Type of control modules contained (e.g. generic electronic module (GEM)) - task assignments for the individual modules (e.g. this is the module for the driver's door))
- Functions contained (e.g. alarm function on or off)
- Connected components (e.g. whether or not the inclination sensor is relevant for the alarm function)
- Output an input messages for each module
- Storage locations for various data

The configuration needs to be adapted for any accessories which are installed and needs to be downloaded again if a module is replaced. The diagnostic unit is used for adaptation and downloading.

NOTE: Two vehicles which otherwise appear identical may behave differently if they have different configurations. Parameters may have been changed by the customer or by the workshop.
Error management in the Controller Area Network (CAN)

General

The Controller Area Network (CAN) is monitored by the generic electronic module (GEM). If the GEM detects a fault in the CAN bus then a trouble code (DTC) is stored in the GEM. There are different types of DTC according to the fault type:

- No communications from the module
- Faulty communications

No communications from the module

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The generic electronic module (GEM) knows which modules are in the Controller Area Network (CAN) and checks whether all modules are communicating. If a module is not communicating a trouble code (DTC) is set in the GEM. There is a trouble code (DTC) for every module.

Faulty communications

If the Controller Area Network (CAN) is in operation then the generic electronic module (GEM) continuously monitors the flow of information in the network. If the GEM determines that, for some reason, the communications in the CAN bus are interrupted, it can set a trouble code (DTC). The GEM has trouble codes for all parts of the CAN bus (one each for the HS CAN bus and the MS/MM CAN bus).

With the exception of the GEM, which only knows one type of DTC, each module uses two types of DTC in relation to communication faults. These are:

- Faulty messages
- Faulty configuration

As the GEM is the main module in the network, it does not have a DTC for faulty configuration.

Faulty messages

The control modules continuously monitor the flow of information in the Controller Area Network (CAN). If a module receives a message it cannot interpret it sends a fault message via the CAN bus. The modules also have function which allows them to detect any faulty messages they generate themselves. This prevents interference on the CAN bus. If there is a lot of interference in the network then any modules which cannot communicate properly can switch themselves off. This status is referred to as "databus OFF" - the module can no longer send or receive information.

To prevent the vehicle from coming to a sudden standstill or suffering a total loss of particular functions if a fault occurs in the CAN bus, certain modules have an emergency running mode. This means that modules which are required for driving or for safety aspects (e.g. the powertrain control module (PCM) or the transmission control module (TCM)) can maintain a restricted functionality on the basis of predefined or estimated data. For example, if communications to the transmission control module (TCM) are interrupted then the transmission will use a preselected gear which will enable the customer to at least drive to the nearest workshop. A module remains in "databus OFF" mode until the power supply to the module is switched off. If the power supply is reconnected the module attempts to re-establish communications.

Faulty configuration

The generic electronic module (GEM) transmits its configuration ID within the messages it sends out to other modules. To enable the modules in the Controller Area Network (CAN) to communicate with each other they must have the same configuration ID, as modules only look at messages carrying their own configuration ID. If the signal configuration of a module does not match the signal configuration of the GEM then a trouble code (DTC) is stored in the module with the faulty configuration.

NOTE: A module will save a trouble code (DTC) if it does not receive any messages from the generic electronic module (GEM). This also applies if there are any software errors in the module. If the circuit in the Controller Area Network (CAN) is interrupted then certain modules will also not receive any messages from the GEM.

Local Interconnect Network (LIN)

The Local Interconnect Network (LIN) bus is a standard which has been developed for cost-effective communications between intelligent sensors and actuators in motor vehicles. LIN is used wherever the bandwidth and versatility of CAN is not required.

The LIN specification comprises the LIN protocol, a standard format for describing a

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complete LIN network and the interface between a LIN network and the application.

A LIN network is made up of a LIN master and one or more LIN slaves.

The LIN network utilizes the master/slave principle for the purpose of bus access control. This has the significant advantage that few resources (CPU performance, ROM, RAM) are required for bus management in the slave module. The master is implemented in a control module or a gateway which has the necessary resources. All communication is initiated by the master. Consequently, a message always consists of a header, which is generated by the master, and a response from the slave.

The data transfer rate is in the region of up to 20 Kbit/s.

The LIN master knows the time sequence of all data which are to be transmitted. These data are transmitted by the corresponding LIN slaves (e.g. ultrasonic sensors) when requested to do so by the LIN master.

LIN is a single-wire bus, i.e. the data are transmitted across a single-stranded cable. Usually the same cable is also used to provide the supply voltage. The ground connection of the supply voltage also acts as the ground connection of the data transmission. No terminating resistors are used in the LIN network.

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Print

Diagnosis and Testing

Special Tool(s)

	Terminal Probe Kit 29-011A

General Equipment

Digital Multimeter
Ford approved diagnostic tool

Inspection and Testing

1. **1.** CHECK the concern.

2. **2.** Visually CHECK for any obvious mechanical or electrical damage.

Visual Inspection

Electrical
• Fuse(s). • Wiring harness. • Electrical connectors.

3. **3.** RECTIFY any obvious causes for a concern found during the visual inspection before performing any further tests. CHECK the operation of the system.

4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis with the Ford approved diagnostic tool and RECTIFY any displayed faults in accordance with the displayed fault description. CHECK the operation of the system.

5. **5.** On a vehicle without stored fault(s), PROCEED according to the Symptom Chart and the corresponding symptom.

6. **6.** After testing or rectifying the fault and after completion of operations, READ OUT the fault memories of all vehicle modules and DELETE any stored faults. READ OUT all fault memories again after a road test.

Diagnostic Trouble Code (DTC) Table - Generic Electronic Module (GEM)

DTC	Description	Action
B1131-88	No communications possible with the wiper motor module.	GO to Pinpoint Test T.
U0155-00	No communications possible with the instrument cluster.	GO to Pinpoint Test AH.
U0129-00	No communication with the anti-block brake system module.	GO to Pinpoint Test AC.
U0100-00	No communications possible with the powertrain control module (PCM).	GO to Pinpoint Test AG.
B112B-88	No communications possible with the steering wheel module.	GO to Pinpoint Test O.
B112C-88	No communications possible with the interior monitoring sensor.	GO to Pinpoint Test AA.

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B1D17-88	No communications possible with the anti-theft alarm signal horn with integrated battery.	GO to Pinpoint Test Z.
U0231-00	No communications possible with the rain sensor/light sensor.	GO to Pinpoint Test S.
B1130-88	No communications possible with the light switch unit.	GO to Pinpoint Test U.
U0214-00	No communications possible with the keyless vehicle module.	GO to Pinpoint Test J.
U0104-00	No communications possible with the collision warning module.	GO to Pinpoint Test P.
U0001-00	No communications possible via the HS CAN bus.	GO to Pinpoint Test AK.
U0010-00	No communications possible via the MS CAN bus.	GO to Pinpoint Test AJ.

Symptom Chart

Symptom	Possible Sources	Action
Driver's side door module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Driver's side door module	* GO to Pinpoint Test A.
Passenger side door module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Passenger's side door module	* GO to Pinpoint Test B.
Navigation system touch screen not communicating with the Ford approved diagnostic tool - vehicles equipped with DVD navigation system with touch screen	* Fuse(s) * Circuit(s) * Navigation system touch screen	* GO to Pinpoint Test G.
DVD drive not communicating with the Ford approved diagnostic tool - vehicles equipped with DVD navigation system with touch screen	* Fuse(s) * Circuit(s) * DVD drive	* GO to Pinpoint Test H.
Fuel-fired booster heater/programmable fuel-fired booster heater not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Fuel fired booster heater /programmable fuel fired booster heater	* GO to Pinpoint Test I.
Keyless vehicle module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Keyless vehicle module	* GO to Pinpoint Test J.
Auxiliary climate control module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Auxiliary climate control module	* GO to Pinpoint Test K.
Rain sensor/light sensor not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Rain sensor/light sensor	* GO to Pinpoint Test S.
Wiper motor module not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Wiper motor module	* GO to Pinpoint Test T.
Light switch unit not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Light switch unit	* GO to Pinpoint Test U.
Remote control/tire pressure monitoring receiver module not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Remote control/tire pressure monitoring receiver module	* GO to Pinpoint Test V.
Driver's side rear door module not communicating with the driver's side door module	* Fuse(s) * Circuit(s) * Driver's side rear door module	* GO to Pinpoint Test W.

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Passenger side rear door module not communicating with the passenger side door module	* Fuse(s) * Circuit(s) * Passenger's side door module	* GO to Pinpoint Test X.
Gear lever module not communicating with the transmission control unit (TCM)	* Fuse(s) * Circuit(s) * Gear lever module	* GO to Pinpoint Test Y.
Anti-theft alarm signal horn with integrated battery not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Anti-theft alarm horn with integral battery	* GO to Pinpoint Test Z.
Interior monitoring sensor not communicating with the generic electronic module (GEM)	* Fuse(s) * Circuit(s) * Interior scanning sensor	* GO to Pinpoint Test AA.
Trailer coupling module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Trailer coupling module	* GO to Pinpoint Test L.
Lights control module (LCM) not communicating with the Ford approved diagnostic tool - vehicles with gas discharge lamps and vehicles with adaptive front lighting	* Fuse(s) * Circuit(s) * Lights control module (LCM)	* GO to Pinpoint Test M.
Shock absorber control module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Shock absorber control module	* GO to Pinpoint Test N.
Steering wheel module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Steering wheel module	* GO to Pinpoint Test O.
Collision warning module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Collision warning module	* GO to Pinpoint Test P.
Yaw rate/lateral acceleration sensor not communicating with the Ford approved diagnostic tool.	* Fuse(s) * Circuit(s) * Yaw rate / lateral acceleration sensor	* GO to Pinpoint Test Q.
CD changer not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * CD changer	* GO to Pinpoint Test R.
Parking brake module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Parking brake module	* GO to Pinpoint Test AE.
Bluetooth/voice control module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Bluetooth/voice control module	* GO to Pinpoint Test D.
Generic electronic module (GEM) not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Generic Electronic Module (GEM)	* GO to Pinpoint Test AF.
ESP module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Stability assist module	* GO to Pinpoint Test AC.
Parking aid module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Parking aid module	* GO to Pinpoint Test C.
Electronic automatic temperature control (EATC) module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Electronic automatic temperature control (EATC)	* GO to Pinpoint Test E.

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	module	
Powertrain control module (PCM) not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * PCM	* GO to Pinpoint Test AG.
Supplemental restraint control module (RCM) not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Supplemental restraint control module (RCM)	* GO to Pinpoint Test AB.
Audio system control panel not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Audio system control panel	* GO to Pinpoint Test F.
Power steering pump module not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Power steering pump module	* GO to Pinpoint Test AD.
Instrument cluster not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * Instrument cluster	* GO to Pinpoint Test AH.
Transmission control module (TCM) not communicating with the Ford approved diagnostic tool	* Fuse(s) * Circuit(s) * TCM	* GO to Pinpoint Test AI.
Faulty communications between the modules (MM CAN bus)	* Circuit(s) * Instrument cluster * Audio system control panel * Bluetooth/voice control module * CD changer * DVD drive * Navigation system touch screen	* GO to Pinpoint Test AL.
Faulty communications between the modules (HS CAN bus)	* Circuit(s) * ABS module or ESP module * Transmission control unit (TCM) - vehicles with automatic transmission * Power steering pump module * Parking brake module * Yaw rate / lateral acceleration sensor * Lights control module (LCM) * Collision warning module * Generic Electronic Module (GEM) * Steering wheel module * Shock absorber control module * Powertrain control module (PCM)	* GO to Pinpoint Test AK.
Faulty communications between the modules (MS CAN bus)	* Circuit(s) * Instrument cluster * Electronic automatic temperature control (EATC) module * Supplemental restraint control module (RCM) * Parking aid module * Trailer coupling module * Auxiliary climate control module * Fuel fired booster	* GO to Pinpoint Test AJ.

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	heater /programmable fuel fired booster heater * Keyless vehicle module * Passenger's side door module * Driver's side door module * Generic Electronic Module (GEM)	

Pinpoint Tests

PINPOINT TEST A : DRIVER'S SIDE DOOR MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to A2. **No** GO to Pinpoint Test AJ.
A2: CHECK FUSE FA1	
	1 Ignition switch in position 0.
	2 CHECK Fuse FA1 (RJB).
	Is the fuse OK? **Yes** GO to A3. **No** RENEW fuse FA1 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A3: CHECK THE VOLTAGE AT FUSE FA1	
	1 Connect Fuse FA1 (RJB).
	2 Measure the voltage between fuse FA1 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A4. **No** REPAIR the voltage supply to fuse FA1 with the aid of the wiring diagrams. CHECK the operation of the system.
A4: CHECK THE VOLTAGE AT THE DRIVER'S SIDE DOOR MODULE	
	1 Disconnect Connector C5PL01-A from the driver's side door module.
	2 Measure the voltage between the driver's side door module, connector C5PL01-A, pin 2, circuit SBR01A (RD), wiring harness side and ground.

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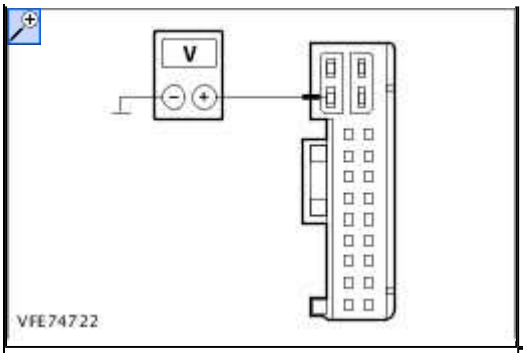


Does the meter display battery voltage?

Yes

GO to A6.

No

GO to A5.

A5: CHECK THE CIRCUIT BETWEEN THE DRIVER'S SIDE DOOR MODULE AND THE RJB FOR OPEN CIRCUIT

1 Disconnect Connector C4BR02-A from the RJB.

2 Measure the resistance between the driver's side door module, connector C5PL01-A, pin 2, circuit SBR01A (RD), wiring harness side and the RJB, connector C4BR02-A, pin 102, circuit SBR01B (RD), wiring harness side.

Is a resistance of less than 2 Ohms registered?

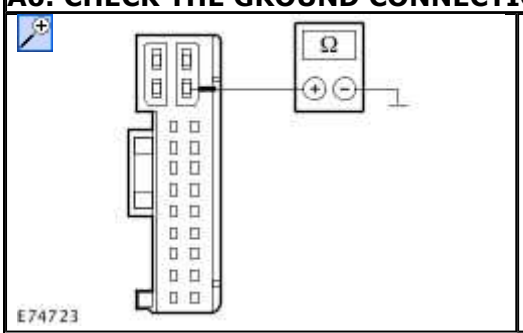
Yes

CHECK and RENEW the RJB if necessary. CHECK the operation of the system.

No

LOCATE and REPAIR the break in the circuit between the driver's side door module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

A6: CHECK THE GROUND CONNECTION OF THE DRIVER'S SIDE DOOR MODULE



1 Measure the resistance between the driver's side door module, connector C5PL01-A, pin 13, circuit GD134H (BK/VT), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

GO to A7.

No

LOCATE and REPAIR the break in the circuit between the driver's side door module and soldered connection SP386 with the aid of the Wiring Diagrams. CHECK the operation of the system.

A7: CHECK FOR OPEN CIRCUIT BETWEEN THE DRIVER'S SIDE DOOR MODULE AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

1 Disconnect Connector C5PL01-B from the driver's

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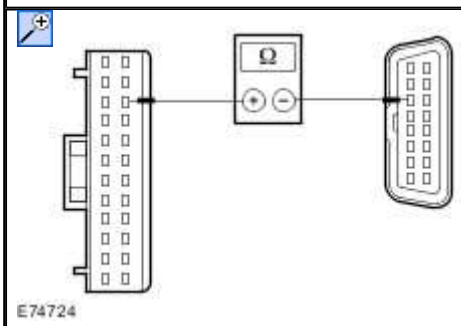
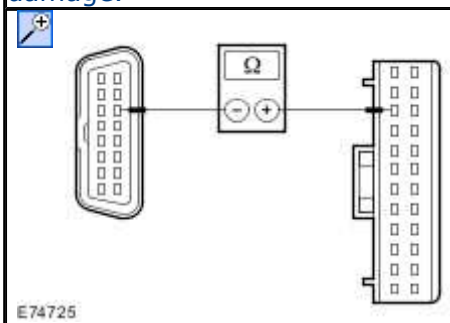
	side door module.
	2 Measure the resistance between the driver's side door module, connector C5PL01-B, pin 15, circuit VDB07L (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to A8. **No** LOCATE and RECTIFY the break in the circuit between the driver's side door module and soldered connection SP286 (RHD vehicles: soldered connection SP284) with the aid of the Wiring Diagrams. CHECK the operation of the system.
A8: CHECK THE CIRCUIT BETWEEN THE DRIVER'S SIDE DOOR MODULE AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the driver's side door module, connector C5PL01-B, pin 3, circuit VDB06C (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the driver's side door module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the driver's side door module and soldered connection SP293 (RHD vehicles: soldered connection SP293) with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : PASSENGER SIDE DOOR MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes**

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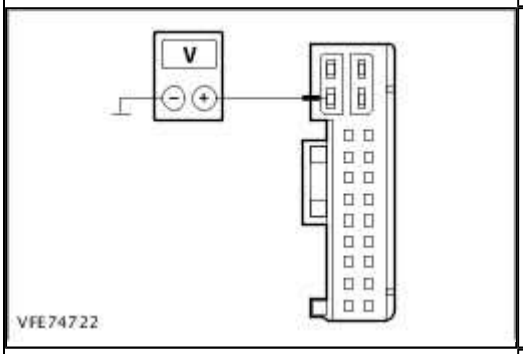
	GO to B2. **No** GO to Pinpoint Test AJ.
B2: CHECK FUSE FA2	
	1 Ignition switch in position 0. 2 CHECK Fuse FA2 (RJB). Is the fuse OK? **Yes** GO to B3. **No** RENEW fuse FA2 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
B3: CHECK THE VOLTAGE AT FUSE FA2	
	1 Connect Fuse FA2 (RJB). 2 Measure the voltage between fuse FA2 (25 A) and ground. Does the meter display battery voltage? **Yes** GO to B4. **No** REPAIR the voltage supply to fuse FA2 with the aid of the wiring diagrams. CHECK the operation of the system.
B4: CHECK THE VOLTAGE AT THE PASSENGER SIDE DOOR MODULE	
	1 Disconnect Connector C6PL01-A from the passenger side door module.
	2 Measure the voltage between the passenger side door module, connector C6PL01-A, pin 2, circuit SBR02A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to B6. **No** GO to B5.
B5: CHECK THE CIRCUIT BETWEEN THE PASSENGER SIDE DOOR MODULE AND THE CENTRAL JUNCTION BOX (RJB) FOR OPEN CIRCUIT	
	1 Disconnect Connector C4BR02-A from the RJB. 2 Measure the resistance between the passenger side door module, connector C6PL01-A, pin 2, circuit SBR02A (YE/RD), wiring harness side and the RJB, connector C4BR02-A, pin 103, circuit SBR02B (YE/RD), wiring harness side. Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the passenger side door module and the RJB with the aid of the Wiring Diagrams. CHECK

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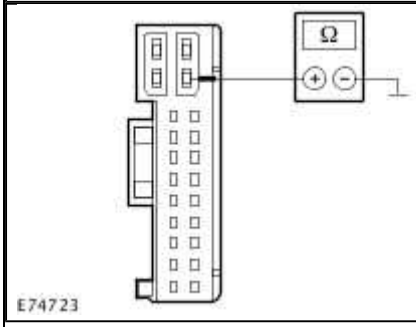
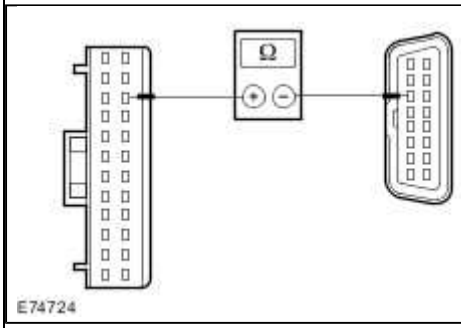
	the operation of the system.
B6: CHECK THE GROUND CONNECTION OF THE PASSENGER SIDE DOOR MODULE	
	1 Measure the resistance between the passenger side door module, connector C6PL01-A, pin 13, circuit GD140D (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B7. **No** LOCATE and REPAIR the break in the circuit between the passenger side door module and soldered connection SP392 with the aid of the Wiring Diagrams. CHECK the operation of the system.
B7: CHECK FOR OPEN CIRCUIT BETWEEN THE PASSENGER SIDE DOOR MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C6PL01-B from the passenger side door module.
	2 Measure the resistance between the passenger side door module, connector C6PL01-B, pin 15, circuit VDB07X (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to B8. **No** LOCATE and RECTIFY the break in the circuit between the passenger side door module and soldered connection SP284 (RHD vehicles: soldered connection SP286) with the aid of the Wiring Diagrams. CHECK the operation of the system.
B8: CHECK THE CIRCUIT BETWEEN THE PASSENGER SIDE DOOR MODULE AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the passenger side door module, connector C6PL01-B, pin 3, circuit VDB06P (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.

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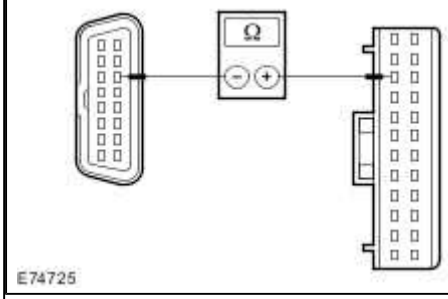

Is a resistance of less than 2 Ohms registered?

Yes

CHECK and if necessary RENEW the passenger side door module. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the passenger side door module and soldered connection SP294 (RHD vehicles: soldered connection SP293) with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST C : PARKING AID MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to C2. **No** GO to Pinpoint Test AJ.
C2: CHECK FUSE FB1	
	1 Ignition switch in position 0.
	2 CHECK Fuse FB1 (RJB).
	Is the fuse OK? **Yes** GO to C3. **No** RENEW fuse FB1 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
C3: CHECK THE VOLTAGE AT FUSE FB1	
	1 Connect Fuse FB1 (RJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FB1 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to C4. **No** REPAIR the voltage supply to fuse FB1 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C4: CHECK THE VOLTAGE AT THE PARKING AID MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4MP01-A from the parking aid module.

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	3 Ignition switch in position II.
	4 Measure the voltage between the parking aid module, connector C4MP01-A, pin 1, circuit CBR01A (BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to C6. **No** GO to C5.
C5: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE PARKING AID MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4BR02-B from the RJB.
	3 Measure the resistance between the RJB, connector C4BR02-B, pin 202, circuit CBR01A (BU), wiring harness side and the parking aid module, connector C4MP01-A, pin 1, circuit CBR01A (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CBR01A (BU) between the parking aid module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
C6: CHECK THE GROUND CONNECTION OF THE PARKING AID MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the parking aid module, connector C4MP01-A, pin 8, circuit GND52N (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C7. **No** LOCATE and RECTIFY the break in the circuit between the parking aid module and ground connection G4D151 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C7: CHECK FOR OPEN CIRCUIT BETWEEN THE PARKING AID MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the parking aid module, connector C4MP01-A, pin 14, circuit VDB06G (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to C8. **No** LOCATE and RECTIFY the break in the circuit between the parking aid module and soldered connection SP296 with the aid of the Wiring Diagrams. CHECK the operation of the system.
C8: CHECK FOR OPEN CIRCUIT BETWEEN THE PARKING AID MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the parking aid module, connector C4MP01-A, pin 7, circuit VDB07R (VT/OG), wiring harness side and the

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	DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the parking aid module if necessary INSTALL a new one. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the parking aid module and soldered connection SP287 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST D : BLUETOOTH/VOICE CONTROL MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK COMMUNICATION WITH THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.
	Is it possible to establish communication with the instrument cluster? **Yes** GO to D2. **No** GO to Pinpoint Test AH.
D2: CHECK FUSE F6	
	1 Ignition switch in position 0.
	2 CHECK Fuse F6 (CJB).
	Is the fuse OK? **Yes** GO to D3. **No** RENEW fuse F6 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
D3: CHECK THE VOLTAGE AT FUSE F6	
	1 Connect Fuse F6 (CJB).
	2 Measure the voltage between fuse F6 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to D4. **No** REPAIR the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D4: CHECK THE VOLTAGE AT THE BLUETOOTH/VOICE CONTROL MODULE	
	1 Disconnect Connector C2MM01-A from Bluetooth/voice control module.
	2 Measure the voltage between the Bluetooth/voice control module, connector C2MM01, pin 17, circuit SBP06H (BN/RD), wiring harness side and ground.

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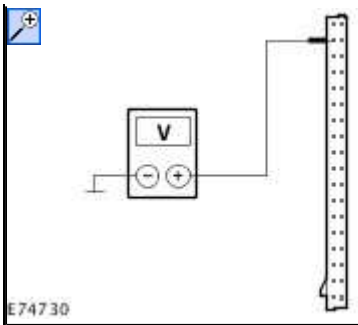
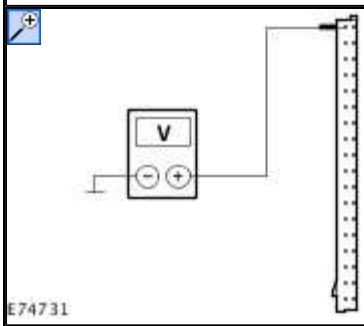
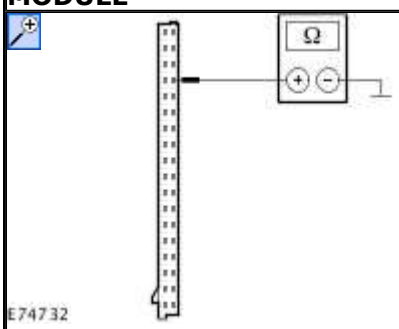
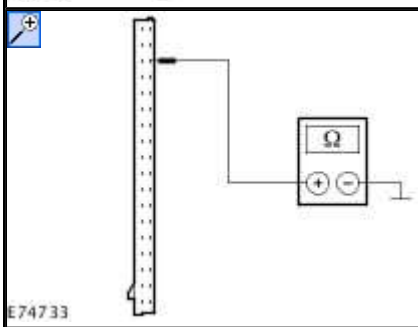
 E74730	
 E74731	3 Measure the voltage between the Bluetooth/voice control module, connector C2MM01, pin 18, circuit SBP06G (BN/RD), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to D5. **No** - If battery voltage is not measured during one measurement:LOCATE and RECTIFY the break in the affected circuit between the Bluetooth/voice control module and soldered connection SP558 with the aid of the Wiring Diagrams. CHECK the operation of the system. - If battery voltage is not measured during both measurements: LOCATE and RECTIFY the break in the circuit between soldered connection SP558 and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
D5: CHECK THE GROUND CONNECTION AT THE BLUETOOTH/VOICE CONTROL MODULE	
 E74732	1 Measure the resistance between the Bluetooth/voice control module, connector C2MM01, pin 33, circuit GD138BE (BK/WH), wiring harness side and ground.
 E74733	2 Measure the resistance between the Bluetooth/voice control module, connector C2MM01, pin 34, circuit GD138BD (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm measured in both cases?

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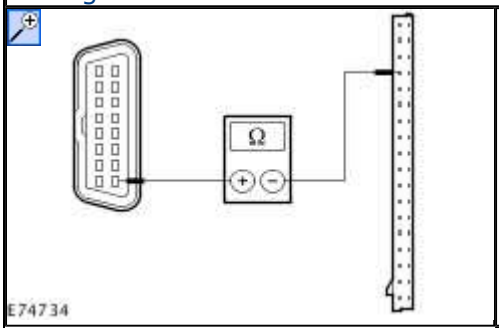
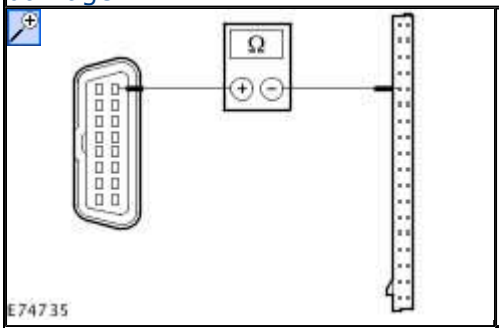
	Yes GO to D6. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and RECTIFY the break in the affected circuit between the Bluetooth/voice control module and soldered connection SP196 with the aid of the Wiring Diagrams. CHECK the operation of the system. - If a resistance greater than 2 Ohm is measured in both cases:LOCATE and RECTIFY the open circuit in the relevant circuit between soldered connection SP196 and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D6: CHECK FOR OPEN CIRCUIT BETWEEN THE BLUETOOTH/VOICE CONTROL MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the Bluetooth/voice control module, connector C2MM01-A, pin 15, circuit VDB14J (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to D7. **No** LOCATE and REPAIR the break in circuit VDB14J (VT/GY) between the Bluetooth/voice control module and soldered connection SP352 with the aid of the Wiring Diagrams. CHECK the operation of the system.
D7: CHECK FOR OPEN CIRCUIT BETWEEN THE BLUETOOTH/VOICE CONTROL MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the Bluetooth/voice control module, connector C2MM01-A, pin 14, circuit VDB13G (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the Bluetooth/voice

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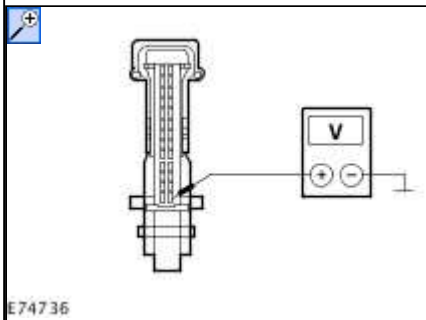
	control module. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VDB13G (BU/GY) between the Bluetooth/voice control module and soldered connection SP347 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST E : ELECTRONIC AUTOMATIC TEMPERATURE CONTROL (EATC) MODULE NOT COMMUNICATING WITH FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0. 2 Connect the diagnostic tool. 3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to E2. **No** GO to Pinpoint Test AJ.
E2: CHECK FUSE F27	
	1 Ignition switch in position 0. 2 CHECK Fuse F27 (CJB).
	Is the fuse OK? **Yes** GO to E3. **No** RENEW fuse F27 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
E3: CHECK THE VOLTAGE AT FUSE F27	
	1 Connect Fuse F27 (CJB). 2 Measure the voltage between fuse F27 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to E4. **No** REPAIR the voltage supply to fuse F27 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E4: CHECK VOLTAGE AT THE EATC MODULE	
	1 Ignition switch in position 0. 2 Disconnect Connector C2H101-B from the EATC module.
	3 Measure the voltage between the EATC module, connector C2H101-B, pin 14, circuit SBP27B (BU/RD), wiring harness side and ground.

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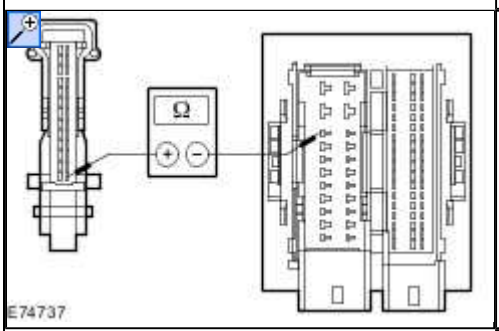
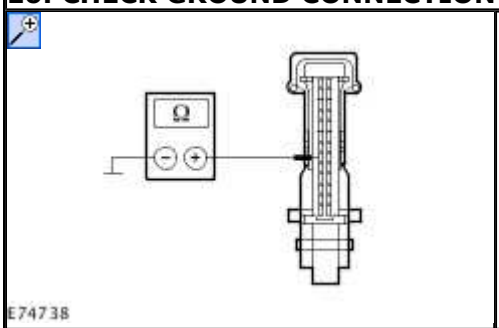
	Does the meter display battery voltage? **Yes** GO to E6. **No** GO to E5.
E5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE EATC MODULE FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-C, pin 74, circuit SBP27B (BU/RD), wiring harness side and the EATC module, connector C2H101-B, pin 14, circuit SBP27B (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP27B (BU/RD) between the EATC module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
E6: CHECK GROUND CONNECTION OF THE EATC MODULE	
	1 Measure the resistance between the EATC module, connector C2H101-B, pin 6, circuit GD133BE (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to E7. **No** LOCATE and REPAIR the break in the relevant circuit between the EATC module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E7: CHECK FOR OPEN CIRCUIT BETWEEN THE EATC MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the EATC module, connector C2H101-B, pin 19, circuit VDB07B (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.

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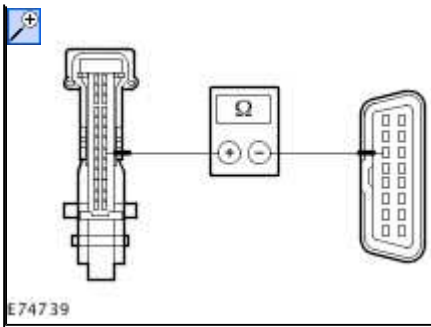
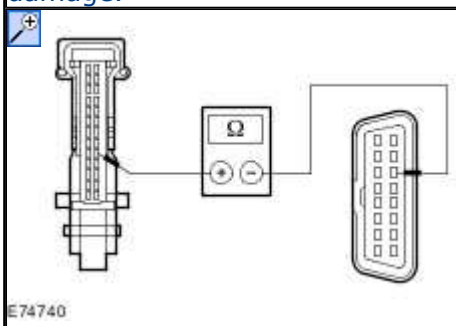
 E74739	
	Is a resistance of less than 2 Ohms registered? **Yes** GO to E8. **No** LOCATE and RECTIFY the break in circuit VDB07B (VT/OG) between the EATC module and soldered connection SP285 with the aid of the Wiring Diagrams. CHECK the operation of the system.
E8: CHECK FOR OPEN CIRCUIT BETWEEN THE EATC MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
 E74740	1 Measure the resistance between the EATC module, connector C2H101-B, pin 18, circuit VDB06M (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EATC module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit VDB06M (GY/OG) between the EATC module and soldered connection SP295 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST F : AUDIO SYSTEM CONTROL PANEL NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK COMMUNICATION WITH THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.
	Is it possible to establish communication with the instrument cluster? **Yes** GO to F2. **No** GO to Pinpoint Test AH.
F2: CHECK FUSE F6	

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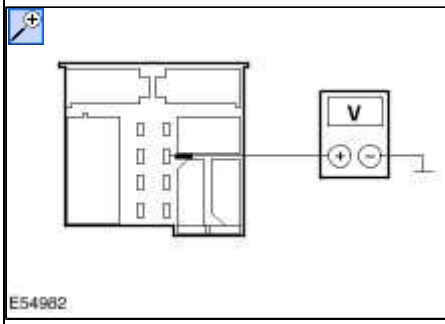
	1 CHECK Fuse F6 (CJB).
	Is the fuse OK? **Yes** GO to F3. **No** RENEW fuse F6 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
F3: CHECK THE VOLTAGE AT FUSE F6	
	1 Connect Fuse F6 (CJB).
	2 Measure the voltage between fuse F6 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to F4. **No** REPAIR the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F4: CHECK VOLTAGE AT AUDIO SYSTEM CONTROL PANEL	
	1 Disconnect Connector C2ME03-A from the audio system control panel.
	2 Measure the voltage between the audio system control panel, connector C2ME03-A, pin 15, circuit SBP06D (BN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to F6. **No** GO to F5.
F5: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE AUDIO SYSTEM CONTROL PANEL	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-C, pin 64, circuit SBP06E (BN/RD), wiring harness side and the audio system control panel, connector C2ME03-A, pin 15, circuit SBP06D (BN/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open circuit between the audio system control panel and the CJB using the Wiring Diagrams. CHECK the operation of the system.
F6: CHECK VOLTAGE AT AUDIO SYSTEM CONTROL PANEL	
	1 Ignition switch in position I.
	2 Measure the voltage between the audio system

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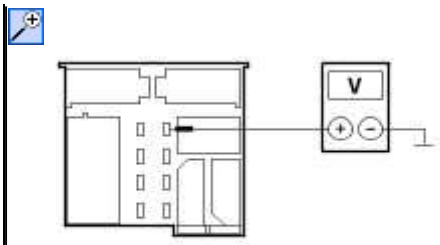
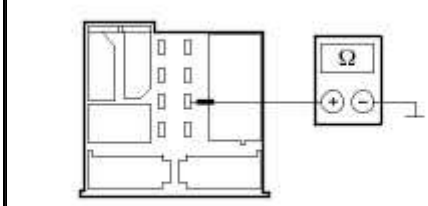
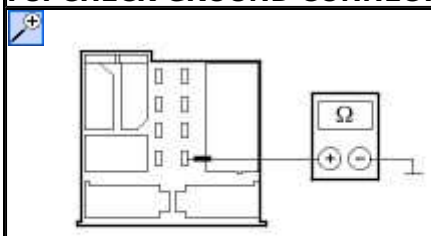
 E54983	control panel, connector C2ME03-A, pin 16, circuit CDC33C (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to F7. **No** LOCATE and REPAIR the break in the circuit between the audio system control panel and the ignition switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
F7: CHECK GROUND CONNECTION OF AUDIO SYSTEM CONTROL PANEL	
	1 Ignition switch in position 0.
 E61594	2 Measure the resistance between the audio system control panel, connector C2ME03-A, pin 11, circuit GD103C (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to F8. **No** LOCATE and RECTIFY the open circuit between the audio system control panel and ground connection G2D114 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F8: CHECK GROUND CONNECTION OF AUDIO SYSTEM CONTROL PANEL	
 E54984	1 Measure the resistance between the audio system control panel, connector C2ME03-A, pin 12, circuit GD103A (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to F9. **No** LOCATE and RECTIFY the open circuit between the audio system control panel and ground connection G2D114 with the aid of the Wiring Diagrams. CHECK the operation of the system.
F9: CHECK FOR OPEN CIRCUIT BETWEEN THE AUDIO SYSTEM CONTROL PANEL AND THE DLC	

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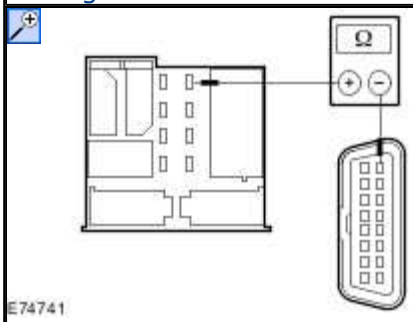
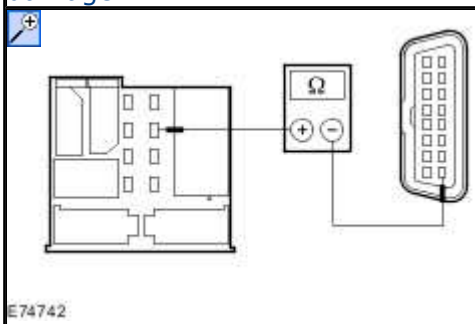
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the audio system control panel, connector C2ME03-A, pin 9, circuit VDB13J (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to F10. **No** LOCATE and REPAIR the open circuit between the audio system control panel and soldered connection SP349 using the Wiring Diagrams. CHECK the operation of the system.

F10: CHECK FOR OPEN CIRCUIT BETWEEN THE AUDIO SYSTEM CONTROL PANEL AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the audio system control panel, connector C2ME03-A, pin 10, circuit VDB14H (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the audio system control panel. CHECK the operation of the system. **No** LOCATE and REPAIR the open circuit between the audio system control panel and soldered connection SP355 using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST G : NAVIGATION SYSTEM TOUCH SCREEN NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL - VEHICLES EQUIPPED WITH DVD NAVIGATION SYSTEM WITH TOUCH SCREEN

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: CHECK COMMUNICATION WITH THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.

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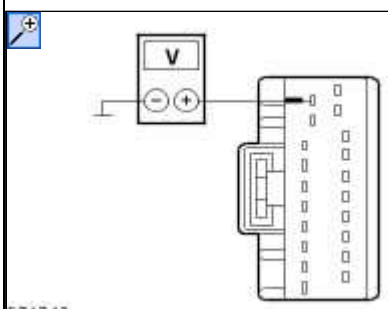
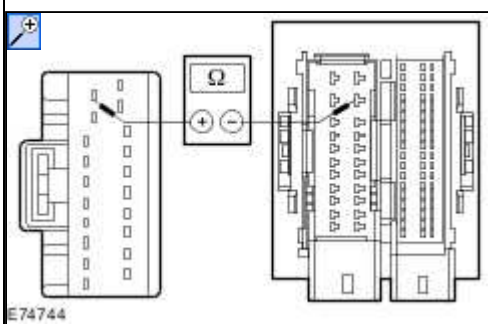
	Is it possible to establish communication with the instrument cluster? **Yes** GO to G2. **No** GO to Pinpoint Test AH.
G2: CHECK FUSE F6	
	1 Ignition switch in position 0.
	2 CHECK Fuse F6 (CJB).
	Is the fuse OK? **Yes** GO to G3. **No** RENEW fuse F6 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
G3: CHECK THE VOLTAGE AT FUSE F6	
	1 Connect Fuse F6 (CJB).
	2 Measure the voltage between fuse F6 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to G4. **No** REPAIR the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK the operation of the system.
G4: CHECK THE VOLTAGE AT THE NAVIGATION SYSTEM TOUCH SCREEN	
	1 Disconnect Connector C2ME03-F from the navigation system touch screen.
	2 Measure the voltage between the navigation system touch screen, connector C2ME03-F, pin 1, circuit SBP06J (BN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to G6. **No** GO to G5.
G5: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE NAVIGATION SYSTEM TOUCH SCREEN	
	1 Disconnect Connector C1BP02-C from the CJB.
	2 Measure the resistance between the CJB, connector C1BP02-C, pin 64, circuit SBP06E (BN/RD), wiring harness side and the navigation system touch screen, connector C2ME03-F, pin 1, circuit SBP06JD (BN/RD), wiring harness side.

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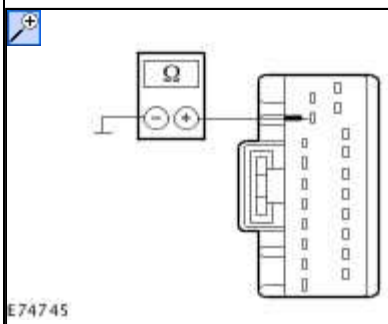
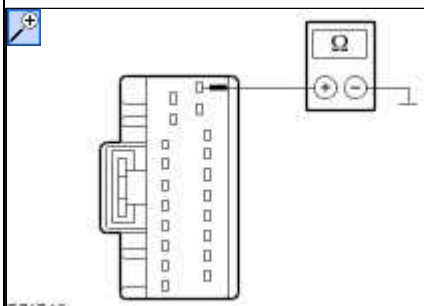
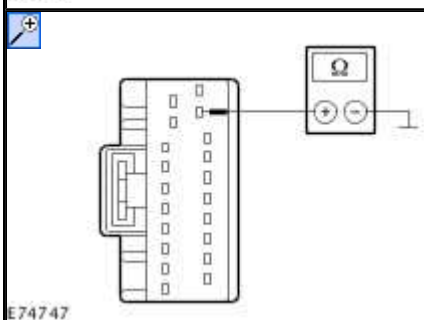
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the navigation system touch screen and the CJB using the Wiring Diagrams. CHECK the operation of the system.
G6: CHECK THE VOLTAGE AT THE NAVIGATION SYSTEM TOUCH SCREEN	
	1 Ignition switch in position I.
	2 Measure the voltage between the navigation system touch screen, connector C2ME03-F, pin 2, circuit CDC33D (VT/GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to G7. **No** LOCATE and RECTIFY the break in the circuit between the navigation system touch screen and the ignition switch with the aid of the Wiring Diagrams. CHECK the operation of the system.
G7: CHECK THE GROUND CONNECTION OF THE NAVIGATION SYSTEM TOUCH SCREEN	
	1 Ignition switch in position 0.
	2 Measure the resistance between the navigation system touch screen, connector C2ME03-F, pin 11, circuit GD138BF (BK/WH), wiring harness side and ground.
	3 Measure the resistance between the navigation system touch screen, connector C2ME03-F, pin 12, circuit GD138BG (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohm measured in both cases? **Yes** GO to G8. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the affected circuit between the navigation

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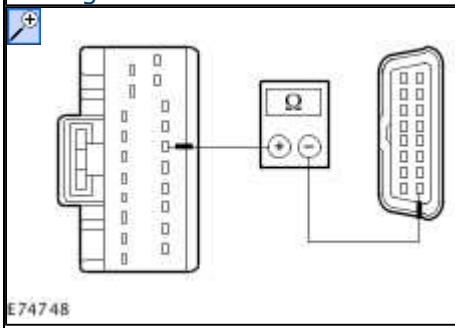
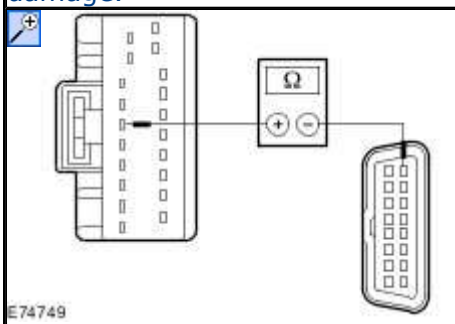
	system touch screen and soldered connection SP196 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in both of the measurements:LOCATE and RECTIFY the open circuit in the circuit between soldered connection SP196 and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
G8: CHECK FOR OPEN CIRCUIT BETWEEN THE NAVIGATION SYSTEM TOUCH SCREEN AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the navigation system touch screen, connector C2ME03-F, pin 15, circuit VDB14G (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to G9. **No** LOCATE and RECTIFY the break in circuit VDB14G (VT/GY) between the navigation system touch screen and soldered connection SP350 with the aid of the Wiring Diagrams. CHECK the operation of the system.
G9: CHECK FOR OPEN CIRCUIT BETWEEN THE NAVIGATION SYSTEM TOUCH SCREEN AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the navigation system touch screen, connector C2ME03-F, pin 5, circuit VDB13H (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the navigation system touch screen. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit VDB13H (BU/GY) between the navigation system touch screen and soldered connection SP345 with the aid of the

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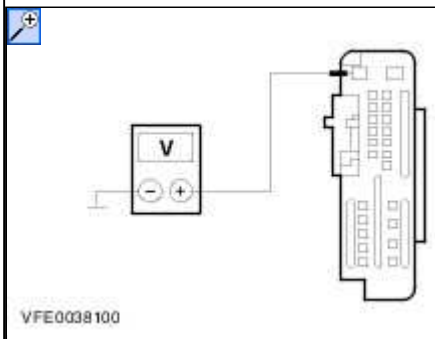
	Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST H : DVD DRIVE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL - VEHICLES EQUIPPED WITH DVD NAVIGATION SYSTEM WITH TOUCH SCREEN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK COMMUNICATION WITH THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.
	Is it possible to establish communication with the instrument cluster? **Yes** GO to H2. **No** GO to Pinpoint Test AH.
H2: CHECK FUSE F6	
	1 Ignition switch in position 0.
	2 CHECK Fuse F6 (CJB).
	Is the fuse OK? **Yes** GO to H3. **No** RENEW fuse F6 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
H3: CHECK THE VOLTAGE AT FUSE F6	
	1 Connect Fuse F6 (CJB).
	2 Measure the voltage between fuse F6 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to H4. **No** REPAIR the voltage supply to fuse F6 with the aid of the Wiring Diagrams. CHECK the operation of the system.
H4: CHECK THE VOLTAGE AT THE DVD DRIVE	
	1 Disconnect Connector C2ME04 from the DVD drive.
	2 Measure the voltage between the DVD drive, connector C2ME04, pin 1, circuit SBP06F (BN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to H6. **No** GO to H5.
H5: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE DVD DRIVE.	

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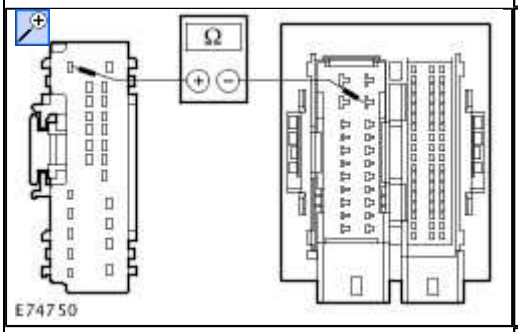
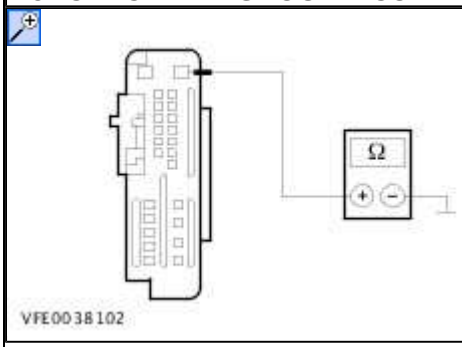
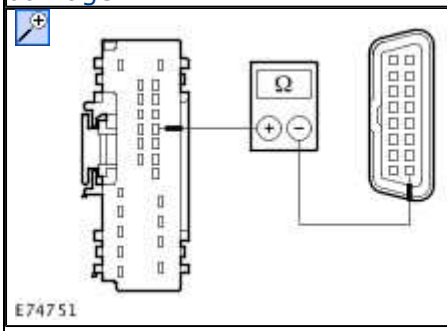
	1 Disconnect Connector C1BP02-C from the CJB.
	2 Measure the resistance between the CJB, connector C1BP02-C, pin 64, circuit SBP06E (BN/RD), wiring harness side and the DVD drive, connector C2ME04, pin 1, circuit SBP06F (BN/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the DVD drive and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
H6: CHECK THE GROUND CONNECTION OF THE DVD DRIVE	
	1 Measure the resistance between the DVD drive, connector C2ME04, pin 13, circuit GD138BH (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to H7. **No** LOCATE and RECTIFY the break in the relevant circuit between the DVD drive and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
H7: CHECK FOR OPEN CIRCUIT BETWEEN THE DVD DRIVE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the DVD drive, connector C2ME04, pin 17, circuit VDB14E (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to H8. **No**

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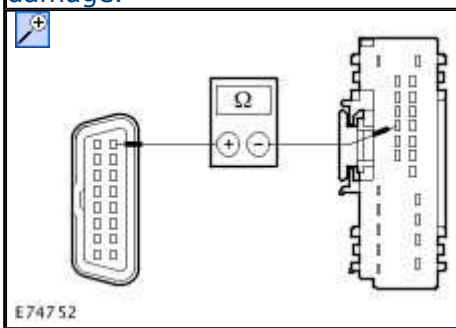
	LOCATE and RECTIFY the break in the circuit between the DVD drive and soldered connection SP354 with the aid of the Wiring Diagrams. CHECK the operation of the system.

H8: CHECK FOR OPEN CIRCUIT BETWEEN THE DVD DRIVE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the DVD drive, connector C2ME04, pin 5, circuit VDB13E (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the DVD drive and RENEW it if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the DVD drive and soldered connection SP344 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST I : FUEL-FIRED BOOSTER HEATER/PROGRAMMABLE FUEL-FIRED BOOSTER HEATER NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to I2. **No** GO to Pinpoint Test AF.
I2: CHECK FUSE F27	
	1 Ignition switch in position 0.
	2 CHECK Fuse F27 (EJB).
	Is the fuse OK? **Yes** GO to I3. **No** RENEW fuse F27 (30 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
I3: CHECK THE VOLTAGE AT FUSE F27	
	1 Connect Fuse F27 (EJB).
	2 Measure the voltage between fuse F27 (30 A) and ground.

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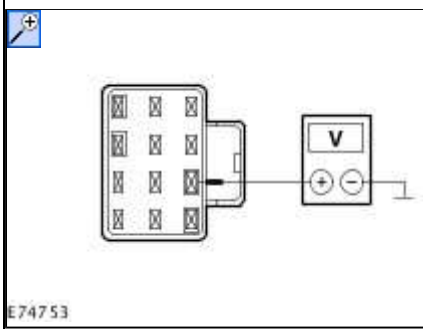
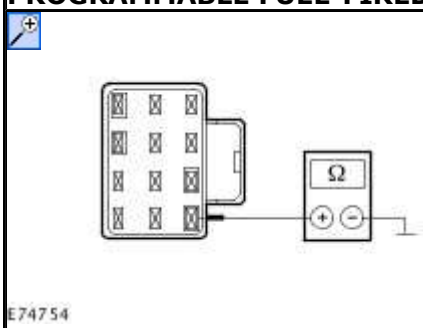
	Does the meter display battery voltage? **Yes** GO to I4. **No** REPAIR the voltage supply to fuse F27 with the aid of the Wiring Diagrams. CHECK the operation of the system.
I4: CHECK THE VOLTAGE AT THE FUEL-FIRED BOOSTER HEATER / PROGRAMMABLE FUEL-FIRED BOOSTER HEATER	
	1 Disconnect Connector C1HF01-C from the fuel-fired booster heater / programmable fuel-fired booster heater.
 E74753	2 Measure the voltage between the fuel-fired booster heater / programmable fuel-fired booster heater, connector C1HF01-C, pin 3, circuit SBB27A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to I5. **No** LOCATE and RECTIFY the break in circuit SBB27A (BU/RD) between the fuel-fired booster heater / programmable fuel-fired booster heater and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
I5: CHECK THE GROUND CONNECTION OF THE FUEL-FIRED BOOSTER HEATER / PROGRAMMABLE FUEL-FIRED BOOSTER HEATER	
 E74754	1 Measure the resistance between the fuel-fired booster heater / programmable fuel-fired booster heater, connector C1HF01-C, pin 4, circuit GD132L (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to I6. **No** LOCATE and RECTIFY the open circuit between the fuel-fired booster heater / programmable fuel-fired booster heater and soldered connection SP380 with the aid of the Wiring Diagrams. CHECK the operation of the system.
I6: CHECK FOR OPEN CIRCUIT BETWEEN THE FUEL-FIRED BOOSTER HEATER / PROGRAMMABLE FUEL-FIRED BOOSTER HEATER AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	

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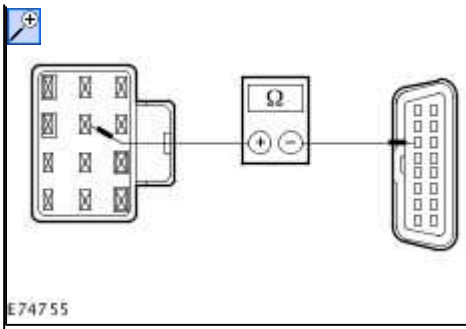
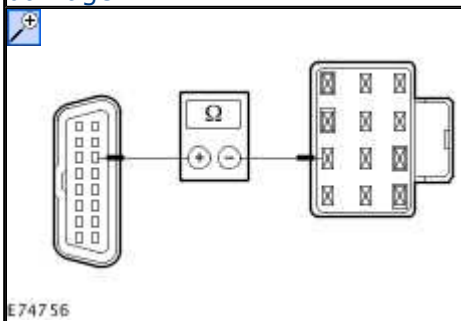


	1 Measure the resistance between the fuel-fired booster heater / programmable fuel-fired booster heater, connector C1HF01-C, pin 6, circuit VDB07F (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to I7. **No** LOCATE and RECTIFY the open circuit between the fuel-fired booster heater / programmable fuel-fired booster heater and soldered connection SP282 with the aid of the Wiring Diagrams. CHECK the operation of the system.

I7: CHECK FOR OPEN CIRCUIT BETWEEN THE FUEL-FIRED BOOSTER HEATER / PROGRAMMABLE FUEL-FIRED BOOSTER HEATER AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



	1 Measure the resistance between the fuel-fired booster heater / programmable fuel-fired booster heater, connector C1HF01-C, pin 11, circuit VDB06Z (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the fuel-fired booster heater / programmable fuel-fired booster heater. CHECK the operation of the system. **No** LOCATE and RECTIFY the open circuit between the fuel-fired booster heater / programmable fuel-fired booster heater and soldered connection SP290 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST J : KEYLESS VEHICLE MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to J2.

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	No GO to Pinpoint Test AF.
J2: CHECK FUSE FC8	
	1 Ignition switch in position 0.
	2 CHECK Fuse FC8 (RJB).
	Is the fuse OK? **Yes** GO to J3. **No** INSTALL A NEW fuse FC8 (20 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
J3: CHECK THE VOLTAGE AT FUSE FC8	
	1 Connect Fuse FC8 (RJB).
	2 Measure the voltage between fuse FC8 (20 A) and ground.
	Does the meter display battery voltage? **Yes** GO to J4. **No** REPAIR the voltage supply to fuse FC8 with the aid of the Wiring Diagrams. CHECK the operation of the system.
J4: CHECK THE VOLTAGE AT THE KEYLESS VEHICLE MODULE	
	1 Disconnect Connector C2PK28-C from the keyless vehicle module.
	2 Measure the voltage between the keyless vehicle module, connector C2PK28-C, pin 5, circuit SBR08A (VT/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to J6. **No** GO to J5.
J5: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE KEYLESS VEHICLE MODULE	
	1 Disconnect Connector C4BR02-C from the RJB.
	2 Measure the resistance between the RJB, connector C4BR02-C, pin 317, circuit SBR08A (VT/RD), wiring harness side and the keyless vehicle module, connector C2PK28-C, pin 5, circuit SBR08A (VT/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBR08A (VT/RD) between the keyless vehicle module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
J6: CHECK THE GROUND CONNECTION OF THE KEYLESS VEHICLE MODULE	
	1 Measure the resistance between the keyless vehicle module, connector C2PK28-C, pin 4, circuit GD151H (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to J7. **No** LOCATE and RECTIFY the break in the circuit between the keyless vehicle module and ground connection G3D127 with the aid of the Wiring Diagrams. CHECK the operation of the system.
J7: CHECK FOR OPEN CIRCUIT BETWEEN THE KEYLESS VEHICLE MODULE AND THE DATA LINK CONNECTOR (DLC)	

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CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C2PK28-D from the keyless vehicle module.
	2 Measure the resistance between the keyless vehicle module, connector C2PK28-D, pin 4, circuit VDB07CA (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to J8. **No** LOCATE and RECTIFY the break in the circuit between the keyless vehicle module and soldered connection SP287 with the aid of the Wiring Diagrams. CHECK the operation of the system.

J8: CHECK FOR OPEN CIRCUIT BETWEEN THE KEYLESS VEHICLE MODULE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the keyless vehicle module, connector C2PK28-D, pin 3, circuit VDB06CA (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the keyless vehicle module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the keyless vehicle module and soldered connection SP296 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST K : AUXILIARY CLIMATE CONTROL MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to K2. **No** GO to Pinpoint Test AF.
K2: CHECK FUSE FC4	
	1 Ignition switch in position 0.
	2 CHECK Fuse FC4 (RJB).
	Is the fuse OK? **Yes** GO to K3. **No** INSTALL A NEW fuse FC4 (10 A). CHECK the operation of the system. If the fuse blows again,

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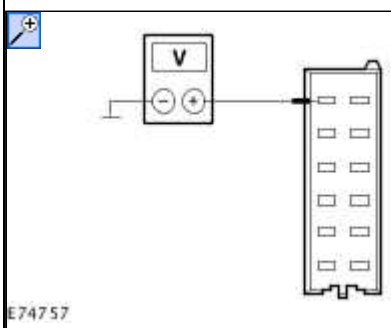
	LOCATE and REPAIR the short using the Wiring Diagrams.
K3: CHECK THE VOLTAGE AT FUSE FC4	
	1 Connect Fuse FC4 (RJB). 2 Measure the voltage between fuse FC4 (10 A) and ground. Does the meter display battery voltage? **Yes** GO to K4. **No** REPAIR the voltage supply to fuse FC4 with the aid of the Wiring Diagrams. CHECK the operation of the system.
K4: CHECK FUSE FB6	
	1 CHECK Fuse FB6 (RJB). Is the fuse OK? **Yes** GO to K5. **No** RENEW fuse FB6 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
K5: CHECK THE VOLTAGE AT FUSE FB6	
	1 Connect Fuse FB6 (RJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse FB6 (10 A) and ground. Does the meter display battery voltage? **Yes** GO to K6. **No** REPAIR the voltage supply to fuse FB6 with the aid of the Wiring Diagrams. CHECK the operation of the system.
K6: CHECK THE VOLTAGE AT THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Ignition switch in position 0. 2 Disconnect Connector C3H101-A from the auxiliary climate control module.
	3 Measure the voltage between the auxiliary climate control module, connector C3H101-A, pin 1, circuit SBR04A (GN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to K8. **No** GO to K7.
K7: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Disconnect Connector C4BR02-C from the RJB. 2 Measure the resistance between the RJB, connector

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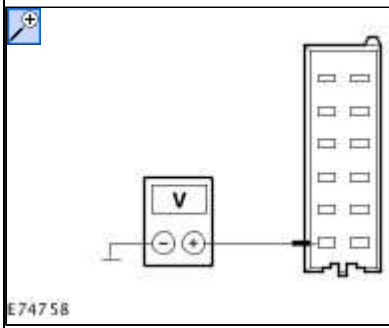
	C4BR02-C, pin 305, circuit SBR04A (GN/RD), wiring harness side and the auxiliary climate control module, connector C3H101-A, pin 1, circuit SBR04A (GN/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBR04A (GN/RD) between the auxiliary climate control module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
K8: CHECK THE VOLTAGE AT THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Ignition switch in position II.
	2 Measure the voltage between the auxiliary climate control module, connector C3H101-A, pin 6, circuit CBR06B (WH/BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to K10. **No** GO to K9.
K9: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4BR02-B from the RJB.
	3 Measure the resistance between the RJB, connector C4BR02-B, pin 221, circuit CBR06B (WH/BU), wiring harness side and the auxiliary climate control module, connector C3H101-A, pin 6, circuit CBR06B (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CBR06B (WH/BU) between the auxiliary climate control module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
K10: CHECK THE GROUND CONNECTION OF THE AUXILIARY CLIMATE CONTROL MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the auxiliary climate control module, connector C3H101-A, pin 10, circuit GD150L (BK/WH), wiring harness side and ground.

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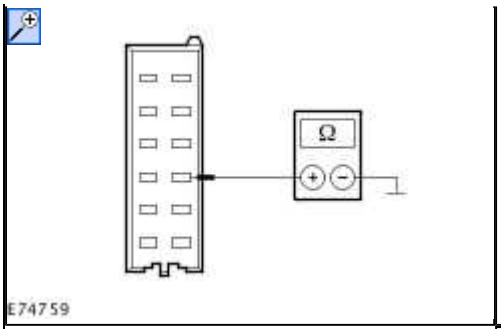


Is a resistance of less than 2 Ohms registered?

Yes

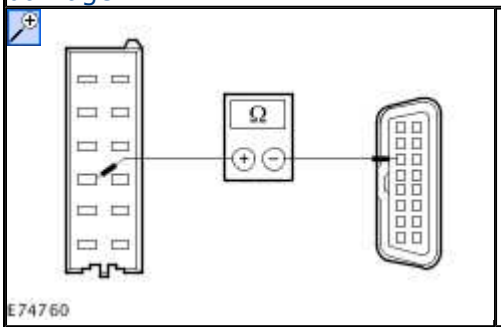
GO to K11.

No

LOCATE and RECTIFY the break in the circuit between the auxiliary climate control module and ground connection G4D149 with the aid of the Wiring Diagrams. CHECK the operation of the system.

K11: CHECK FOR OPEN CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL MODULE AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the auxiliary climate control module, connector C3H101-A, pin 4, circuit VDB07T ((VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

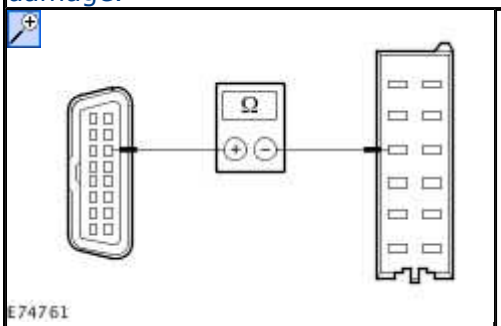
GO to K12.

No

LOCATE and RECTIFY the break in the circuit between the auxiliary climate control module and soldered connection SP278 with the aid of the Wiring Diagrams. CHECK the operation of the system.

K12: CHECK FOR OPEN CIRCUIT BETWEEN THE AUXILIARY CLIMATE CONTROL MODULE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the auxiliary climate control module, connector C3H101-A, pin 3, circuit VDB06J (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.

Is a resistance of less than 2 Ohms registered?

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	Yes CHECK and if necessary RENEW the auxiliary climate control module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the auxiliary climate control module and soldered connection SP279 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST L : TRAILER COUPLING MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to L2. **No** GO to Pinpoint Test AF.
L2: CHECK FUSE FA11	
	1 Ignition switch in position 0.
	2 CHECK Fuse FA11 (RJB).
	Is the fuse OK? **Yes** GO to L3. **No** RENEW fuse FA11 (40 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
L3: CHECK THE VOLTAGE AT FUSE FA11	
	1 Connect Fuse FA11 (RJB).
	2 Measure the voltage between fuse FA11 (40 A) and ground.
	Does the meter display battery voltage? **Yes** GO to L4. **No** REPAIR the voltage supply to fuse FA11 with the aid of the wiring diagrams. CHECK the operation of the system.
L4: CHECK THE VOLTAGE AT THE TRAILER COUPLING MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4AT23-B from the trailer coupling module.
	3 Measure the voltage between the trailer coupling module, connector C4AT23-B, pin 2, circuit SBR11A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to L6. **No** GO to L5.
L5: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE TRAILER COUPLING MODULE	
	1 Disconnect Connector C4BR02-A from the RJB.
	2 Measure the resistance between the RJB, connector C4BR02-A, pin 108, circuit SBR11A (BU/RD), wiring harness side and the trailer coupling module, connector C4AT23-B, pin 2, circuit SBR11A (BU/RD), wiring

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	harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBR11A (BU/RD) between the trailer coupling module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
L6: CHECK THE GROUND CONNECTION OF THE TRAILER COUPLING MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the trailer coupling module, connector C4AT23-C, pin 4, circuit GD152C (BK/BU), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to L7. **No** LOCATE and RECTIFY the break in the circuit between the trailer coupling module and ground connection G4D151 with the aid of the Wiring Diagrams. CHECK the operation of the system.
L7: CHECK FOR OPEN CIRCUIT BETWEEN THE TRAILER COUPLING MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the trailer coupling module, connector C4AT23-C, pin 2, circuit VDB07V ((VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to L8. **No** LOCATE and RECTIFY the break in the circuit between the trailer coupling module and soldered connection SP287 with the aid of the Wiring Diagrams. CHECK the operation of the system.
L8: CHECK FOR OPEN CIRCUIT BETWEEN THE TRAILER COUPLING MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the trailer coupling module, connector C4AT23-C, pin 1, circuit VDB06L (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the trailer coupling module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the trailer coupling module and soldered connection SP296 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST M : LIGHTS CONTROL MODULE (LCM) NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL -

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VEHICLES WITH GAS DISCHARGE LAMPS AND VEHICLES WITH ADAPTIVE FRONT LIGHTING

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to M2. **No** GO to Pinpoint Test AK.
M2: CHECK FUSE F39	
	1 Ignition switch in position 0.
	2 CHECK Fuse F39 (EJB).
	Is the fuse OK? **Yes** GO to M3. **No** RENEW fuse F39 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
M3: CHECK THE VOLTAGE AT FUSE F39	
	1 Connect Fuse F39 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F39 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to M4. **No** REPAIR the voltage supply to fuse F39 with the aid of the Wiring Diagrams. CHECK the operation of the system.
M4: CHECK THE VOLTAGE AT THE LCM	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2LF23-B from the LCM.
	3 Ignition switch in position II.
	4 Measure the voltage between the LCM, connector C2LF23-B, pin 1, circuit CBB39D (VT/WH), wiring harness side and ground.
	5 Measure the voltage between the LCM, connector C2LF23-B, pin 2, circuit CBB39G (VT/WH), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to M6. **No** If battery voltage is not measured during one measurement:LOCATE and RECTIFY the break in the circuit between soldered connection SP174 and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system. If battery voltage is not measured during either measurement:GO to M5.

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M5: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE LCM

1 Ignition switch in position 0.

2 Disconnect Connector C1BB01-A from the EJB.

3 Measure the resistance between the EJB, connector C1BB01-A, pin 124, circuit CBB39A (VT/WH), wiring harness side and the LCM, connector C2LF23-B, pin 2, circuit CBB39G (VT/WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK and if necessary RENEW the EJB. CHECK the operation of the system.

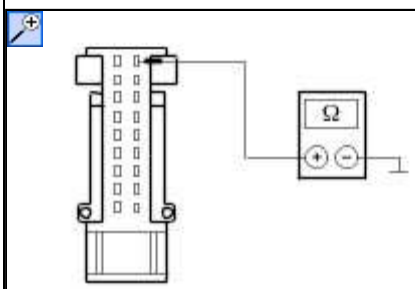
No

LOCATE and REPAIR the break in the circuit between the LCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

M6: CHECK THE GROUND CONNECTION OF THE LCM

1 Ignition switch in position 0.

2 Disconnect Connector C2LF23-A from the LCM.



3 Measure the resistance between the LCM, connector C2LF23-A, pin 1, circuit GD138BU (BK/WH), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

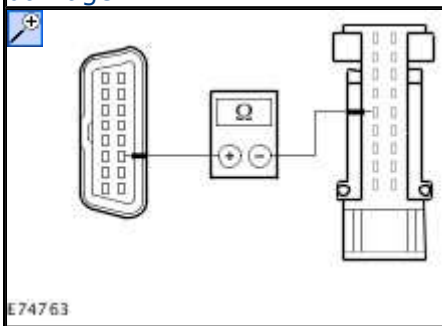
GO to M7.

No

LOCATE and REPAIR the open circuit between the LCM and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.

M7: CHECK FOR OPEN CIRCUIT BETWEEN THE LCM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the LCM, connector C2LF23-A, pin 13, circuit VDB05AK (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to M8.

No

LOCATE and REPAIR the break in the circuit between the LCM and soldered connection SP541 with the aid

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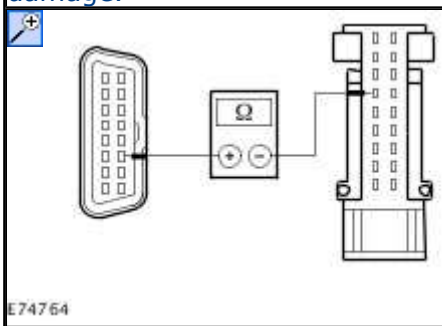
	of the Wiring Diagrams. CHECK the operation of the system.

M8: CHECK FOR OPEN CIRCUIT BETWEEN THE LCM AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the LCM, connector C2LF23-A, pin 14, circuit VDB04AG (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the LCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the LCM and soldered connection SP340 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST N : SHOCK ABSORBER CONTROL MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
N1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to N2. **No** GO to Pinpoint Test AK.
N2: CHECK FUSE FB2	
	1 Ignition switch in position 0.
	2 CHECK Fuse FB2 (RJB).
	Is the fuse OK? **Yes** GO to N3. **No** RENEW fuse FB2 (15 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
N3: CHECK THE VOLTAGE AT FUSE FB2	
	1 Connect Fuse FB2 (RJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse FB2 (15 A) and ground.
	Does the meter display battery voltage? **Yes** GO to N4.

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No
REPAIR the voltage supply to fuse FB2 with the aid of the Wiring Diagrams. CHECK the operation of the system.

N4: CHECK THE VOLTAGE AT THE SHOCK ABSORBER CONTROL MODULE

1. Ignition switch in position 0.
2. Disconnect Connector C4CD01-A from the shock absorber control module.
3. Ignition switch in position II.
4. Measure the voltage between the shock absorber control module, connector C4CD01-A, pin 1, circuit CBR02A (GN), harness side and ground.

Does the meter display battery voltage?

Yes
GO to N6.

No
GO to N5.

N5: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE SHOCK ABSORBER CONTROL MODULE

1. Ignition switch in position 0.
2. Disconnect Connector C4BR02-B from the RJB.
3. Measure the resistance between the RJB, connector C4BR02-B, pin 203, circuit CBR02A (GN), wiring harness side and the shock absorber control module, connector C4CD01-A, pin 1, circuit CBR02A (GN), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes
CHECK and RENEW the RJB if necessary. CHECK the operation of the system.

No
LOCATE and RECTIFY the break in circuit CBR02A (GN) between the shock absorber control module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

N6: CHECK THE GROUND CONNECTION OF THE SHOCK ABSORBER CONTROL MODULE

1. Ignition switch in position 0.
2. Measure the resistance between the shock absorber control module, connector C4CD01-A, pin 2, circuit GD15ON (BK/BU), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes
GO to N7.

No
LOCATE and RECTIFY the break in the circuit between the shock absorber control module and ground connection G4D151 with the aid of the Wiring Diagrams. CHECK the operation of the system.

N7: CHECK FOR OPEN CIRCUIT BETWEEN THE SHOCK ABSORBER CONTROL MODULE AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

1. Disconnect Connector C4CD01-B from the shock absorber control module.
2. Measure the resistance between the shock absorber control module, connector C4CD01-B, pin 15, circuit VDB05J (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes
GO to N8.

No

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	LOCATE and RECTIFY the break in the circuit between the shock absorber control module and soldered connection SP333 with the aid of the Wiring Diagrams. CHECK the operation of the system.

N8: CHECK FOR OPEN CIRCUIT BETWEEN THE SHOCK ABSORBER CONTROL MODULE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the shock absorber control module, connector C4CD01-B, pin 16, circuit VDB04C (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the shock absorber control module. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the shock absorber control module and soldered connection SP330 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST O : STEERING WHEEL MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
O1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to O2. **No** GO to Pinpoint Test AK.
O2: CHECK FUSE F7	
	1 Ignition switch in position 0.
	2 CHECK Fuse F7 (CJB).
	Is the fuse OK? **Yes** GO to O3. **No** RENEW fuse F7 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
O3: CHECK THE VOLTAGE AT FUSE F7	
	1 Connect Fuse F7 (PJB).
	2 Measure the voltage between fuse F7 (7.5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to O4. **No** REPAIR the voltage supply to fuse F7 with the aid of the Wiring Diagrams. CHECK the operation of the system.
O4: CHECK THE VOLTAGE AT THE STEERING WHEEL MODULE	
	1

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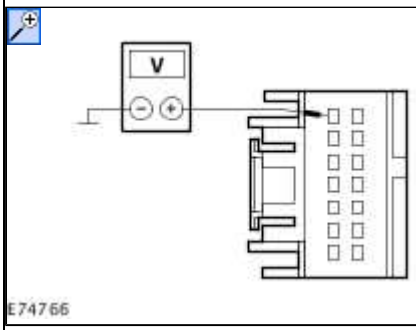
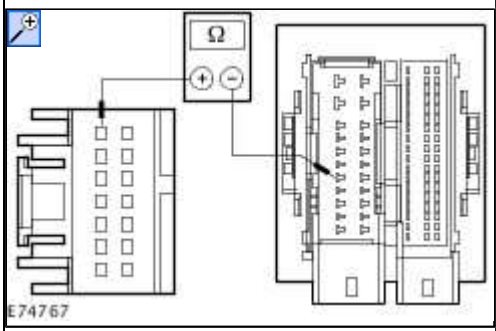
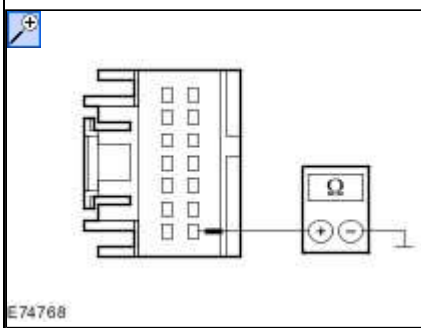
	1 Disconnect Connector C2LS41 from the steering wheel.
	2 Measure the voltage between the steering wheel module, connector C2LS41, pin 1, circuit SBP07A (WH/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to O6. **No** GO to O5.
O5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE STEERING WHEEL MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-C from the PJB.
	2 Measure the resistance between the CJB, connector C1BP02-C, pin 70, circuit SBP07A (WH/RD), wiring harness side and the steering wheel module, connector C2LS41, pin 1, circuit SBP07A (WH/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP07A (WH/RD) between the steering wheel module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
O6: CHECK THE GROUND CONNECTION OF THE STEERING WHEEL MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the steering wheel module, connector C2LS41, pin 14, circuit GD138AY (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to O7. **No** LOCATE and RECTIFY the break in the circuit between the steering wheel module and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.

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O7: CHECK THE GROUND CONNECTION OF THE STEERING WHEEL MODULE

1 Disconnect Connector C2R115-A from the steering wheel.

2 Measure the resistance between the steering wheel module, connector C2R115-A, pin 7, circuit GD133CJ (BK), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

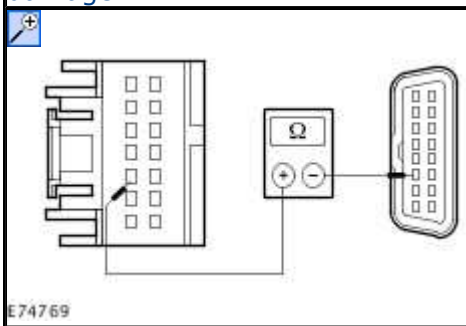
GO to O8.

No

LOCATE and RECTIFY the break in the circuit between the steering wheel module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.

O8: CHECK FOR OPEN CIRCUIT BETWEEN THE STEERING WHEEL MODULE AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the steering wheel module, connector C2LS41, pin 5, circuit VDB05AA (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

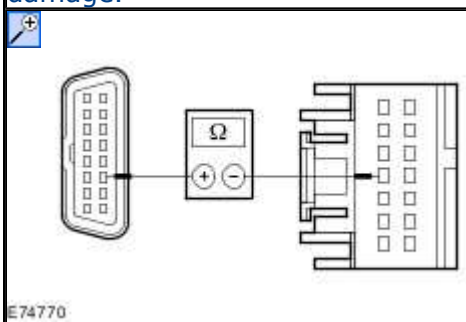
GO to O9.

No

LOCATE and RECTIFY the break in the circuit between the steering wheel module and soldered connection SP594 with the aid of the Wiring Diagrams. CHECK the operation of the system.

O9: CHECK FOR OPEN CIRCUIT BETWEEN THE STEERING WHEEL MODULE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the steering wheel module, connector C2LS41, pin 4, circuit VDB04T (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK and if necessary RENEW the steering wheel module. CHECK the operation of the system.

No

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	LOCATE and RECTIFY the break in the circuit between the steering wheel module and soldered connection SP336 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST P : COLLISION WARNING MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to P2. **No** GO to Pinpoint Test AK.
P2: CHECK FUSE F15	
	1 Ignition switch in position 0.
	2 CHECK Fuse F15 (CJB).
	Is the fuse OK? **Yes** GO to P3. **No** RENEW fuse F15 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
P3: CHECK THE VOLTAGE AT FUSE F15	
	1 Connect Fuse F15 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F15 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to P4. **No** REPAIR the voltage supply to fuse F15 with the aid of the Wiring Diagrams. CHECK the operation of the system.
P4: CHECK THE VOLTAGE AT THE COLLISION WARNING MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C2MF01 from the collision warning module.
	3 Ignition switch in position II.
	4 Measure the voltage between the collision warning module, connector C2MF01, pin 15, circuit CBP15A (BN/BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to O6. **No** GO to O5.
P5: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE COLLISION WARNING MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-C, pin 55, circuit CBP15A (BN/BU), wiring harness side and the collision warning module, connector C2MF01, pin 15, circuit CBP15A (BN/BU), wiring harness

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	side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CBP15A (BN/BU) between the collision warning module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
P6: CHECK THE GROUND CONNECTION OF THE COLLISION WARNING MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the collision warning module, connector C2MF01, pin 12, circuit GD133BL (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to P7. **No** LOCATE and REPAIR the open circuit between the collision warning module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
P7: CHECK FOR OPEN CIRCUIT BETWEEN THE COLLISION WARNING MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the collision warning module, connector C2MF01, pin 8, circuit VDB05AC (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to P8. **No** LOCATE and REPAIR the break in the circuit between the collision warning module and soldered connection SP540 with the aid of the Wiring Diagrams. CHECK the operation of the system.
P8: CHECK FOR OPEN CIRCUIT BETWEEN THE COLLISION WARNING MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the collision warning module, connector C2MF01, pin 9, circuit VDB04Z (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the collision warning module. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the collision warning module and soldered connection SP339 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST Q : YAW RATE/LATERAL ACCELERATION SENSOR NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	

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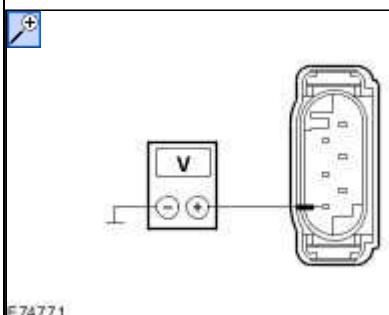
	1 Ignition switch in position 0. 2 Connect the diagnostic tool. 3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool. Is it possible to establish communications with the PCM? **Yes** GO to Q2. **No** GO to Pinpoint Test AK.
Q2: CHECK FUSE F3	
	1 Ignition switch in position 0. 2 CHECK Fuse F3 (CJB). Is the fuse OK? **Yes** GO to Q3. **No** RENEW fuse F3 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
Q3: CHECK THE VOLTAGE AT FUSE F3	
	1 Connect Fuse F3 (CJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse F3 (5 A) and ground. Does the meter display battery voltage? **Yes** GO to Q4. **No** REPAIR the voltage supply to fuse F3 with the aid of the Wiring Diagrams. CHECK the operation of the system.
Q4: CHECK THE VOLTAGE AT THE YAW RATE/LATERAL ACCELERATION SENSOR	
	1 Ignition switch in position 0. 2 Disconnect Connector C3CA09 from the yaw rate/lateral acceleration sensor. 3 Ignition switch in position II.
	4 Measure the voltage between the yaw rate/lateral acceleration sensor, connector C3CA09, pin 1, circuit CBP03A (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to Q6. **No** GO to Q5.
Q5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE YAW RATE/LATERAL ACCELERATION SENSOR FOR OPEN CIRCUIT	
	1 Ignition switch in position 0. 2 Disconnect Connector C1BP02-B from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-B, pin 58, circuit CBP03C (GY), wiring

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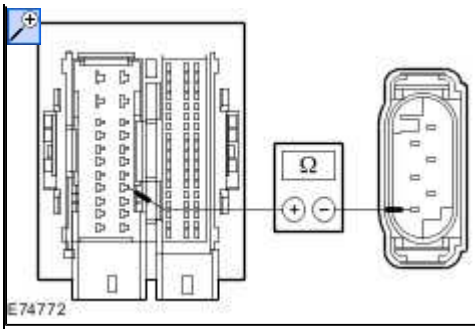


harness side and the yaw rate/lateral acceleration sensor, connector C3CA09, pin 1, circuit CBP03A (GY), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

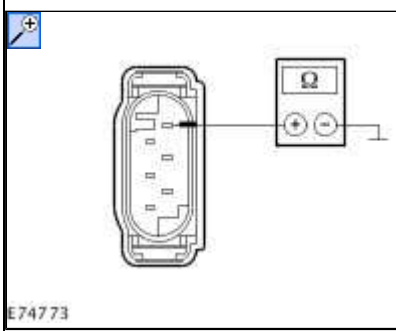
CHECK the CJB and RENEW as necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the yaw rate/lateral acceleration sensor and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

Q6: CHECK THE GROUND CONNECTION AT THE YAW RATE/LATERAL ACCELERATION SENSOR

1 Ignition switch in position 0.



2 Measure the resistance between the yaw rate/lateral acceleration sensor, connector C3CA09, pin 6, circuit GD135L (BK/GY),wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

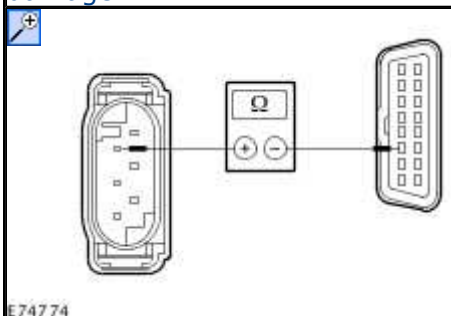
GO to Q7.

No

LOCATE and RECTIFY the break in the circuit between the yaw rate/lateral acceleration sensor and ground connection G3D135 with the aid of the Wiring Diagrams. CHECK the operation of the system.

Q7: CHECK FOR OPEN CIRCUIT BETWEEN THE YAW RATE/LATERAL ACCELERATION SENSOR AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the yaw rate/lateral acceleration sensor, connector C3CA09, pin 3, circuit VDB05V (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to Q8.

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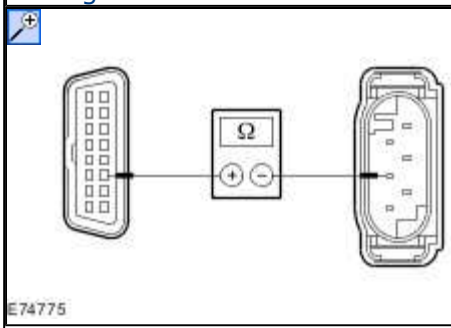
	No LOCATE and RECTIFY the break in the circuit between the yaw rate/lateral acceleration sensor and soldered connection SP276 with the aid of the Wiring Diagrams. CHECK the operation of the system.

Q8: CHECK FOR OPEN CIRCUIT BETWEEN THE YAW RATE/LATERAL ACCELERATION SENSOR AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the yaw rate/lateral acceleration sensor, connector C3CA09, pin 2, circuit VDB04X (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the yaw rate/lateral acceleration sensor. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the yaw rate/lateral acceleration sensor and soldered connection SP277 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST R : CD CHANGER NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
R1: CHECK COMMUNICATION WITH THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.
	Is it possible to establish communication with the instrument cluster? **Yes** GO to R2. **No** GO to Pinpoint Test AH.
R2: CHECK FUSE FC5	
	1 Ignition switch in position 0.
	2 CHECK Fuse FC5 (RJB).
	Is the fuse OK? **Yes** GO to R3. **No** RENEW fuse FC5 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
R3: CHECK THE VOLTAGE AT FUSE FC5	
	1 Connect Fuse FC5 (RJB).
	2 Measure the voltage between fuse FC5 (7.5 A) and ground.

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	Does the meter display battery voltage? **Yes** GO to R6. **No** GO to R4.
R4: CHECK FUSE F20	
	1 CHECK Fuse F20 (EJB).
	Is the fuse OK? **Yes** GO to R5. **No** RENEW fuse F20 (60 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
R5: CHECK THE VOLTAGE AT FUSE F20	
	1 Connect Fuse F20 (EJB).
	2 Measure the voltage between fuse F20 (60 A) and ground.
	Does the meter display battery voltage? **Yes** LOCATE and RECTIFY the break in the circuit between the EJB and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** REPAIR the voltage supply to fuse F20 with the aid of the Wiring Diagrams. CHECK the operation of the system.
R6: CHECK VOLTAGE AT CD CHANGER	
	1 Disconnect Connector C2ME27 from the CD changer.
	2 Measure the voltage between the CD changer, connector C2ME27, pin 1, circuit SBR05A (GY/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to R8. **No** GO to R7.
R7: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE CD CHANGER	
	1 Disconnect Connector C4BR2-C from the RJB.
	2 Measure the resistance between the RJB, connector C4BR2-C, pin 323, circuit SBR05A (GN/RD), wiring harness side and the CD changer, connector C2ME27, pin 1, circuit SBR05A (GY/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBR05A (GY/RD) between the CD changer and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
R8: CHECK THE GROUND CONNECTION OF THE CD CHANGER	
	1 Measure the resistance between the CD changer, connector C2ME27, pin 6, circuit GD135M (BK/GY), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to R9. **No** LOCATE and RECTIFY the open circuit between the CD changer and ground connection G3D135 using the Wiring Diagrams. CHECK the operation of the system.
R9: CHECK FOR OPEN CIRCUIT BETWEEN THE CD CHANGER AND THE DATA LINK CONNECTOR (DLC)	

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CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the CD changer, connector C2ME27, pin 5, circuit VDB13C (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to R10. **No** LOCATE and RECTIFY the break in circuit VDB13C (BU/GY) between the CD changer and soldered connection SP346 with the aid of the Wiring Diagrams. CHECK the operation of the system.

R10: CHECK FOR OPEN CIRCUIT BETWEEN THE CD CHANGER AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the CD changer, connector C2ME27, pin 10, circuit VDB14C (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW CD changer. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit VDB14C (VT/GY) between the CD changer and soldered connection SP351 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST S : RAIN SENSOR/LIGHT SENSOR NOT COMMUNICATING WITH THE GENERIC ELECTRONIC MODULE (GEM)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to S2. **No** GO to Pinpoint Test AF.
S2: CHECK FUSE F1	
	1 Ignition switch in position 0.
	2 CHECK Fuse F1 (CJB).
	Is the fuse OK? **Yes** GO to S3. **No** RENEW fuse F1 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
S3: CHECK THE VOLTAGE AT FUSE F1	
	1 Connect Fuse F1 (CJB).
	2 Measure the voltage between fuse F1 (5 A) and

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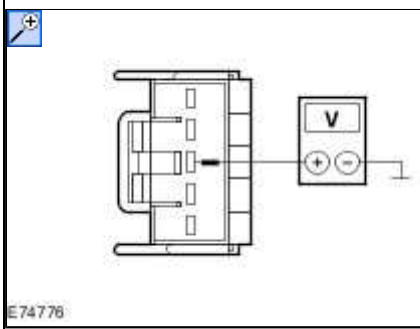
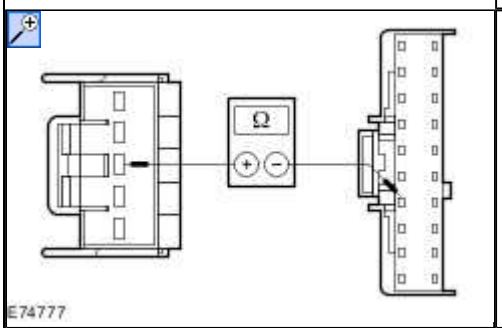
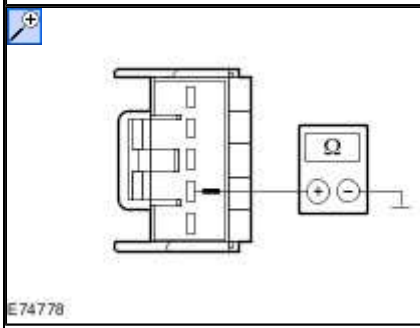
	ground.
	Does the meter display battery voltage? **Yes** GO to S4. **No** REPAIR the voltage supply to fuse F1 with the aid of the Wiring Diagrams. CHECK the operation of the system.
S4: CHECK THE VOLTAGE AT THE RAIN SENSOR/LIGHT SENSOR	
	1 Disconnect Pump Pulley Replacer.
 E74776	2 Measure the voltage between the rain sensor/light sensor, connector C9RW06, pin 3, circuit CBP01B (BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to S6. **No** GO to S5.
S5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE RAIN SENSOR/LIGHT SENSOR FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-H from the CJB.
 E74777	2 Measure the resistance between the CJB, connector C1BP02-H, pin 17, circuit CBP01B (BU), wiring harness side and the rain sensor/light sensor, connector C9RW06, pin 3, circuit CBP01B (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the rain sensor/light sensor and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
S6: CHECK THE GROUND CONNECTION OF THE RAIN SENSOR/LIGHT SENSOR	
 E74778	1 Measure the resistance between the rain sensor/light sensor, connector C9RW0, pin 2, circuit GD138V (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered?

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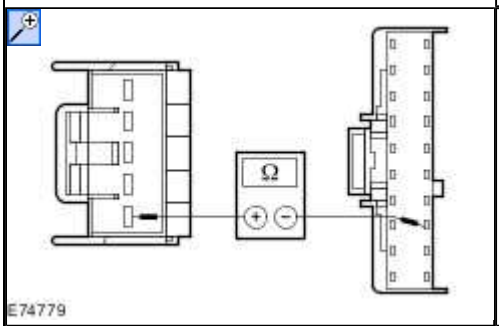
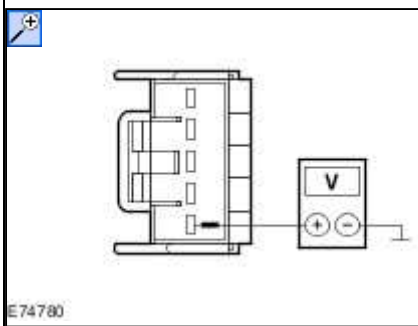
	Yes GO to S7. **No** LOCATE and RECTIFY the break in the circuit between the rain sensor/light sensor and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.

S7: CHECK THE CIRCUIT BETWEEN THE RAIN SENSOR/LIGHT SENSOR AND THE GEM FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1BP02-H from the GEM.
	2 Measure the resistance between the rain sensor/light sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side and the GEM, connector C1BP02-H, pin 8, circuit VRW26A (BN/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to S8. **No** LOCATE and RECTIFY the break in the circuit between the rain sensor/light sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

S8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY

	1 Ignition switch in position II.
	2 Measure the voltage between the rain sensor/light sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in the circuit between the rain sensor/light sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to S9.

S9: CHECK THE LIN BUS FOR A SHORT TO GROUND

	1 Ignition switch in position 0.
	2 Measure the resistance between the rain sensor/light sensor, connector C9RW06, pin 1, circuit VRW26A (BN/YE), wiring harness side and ground.

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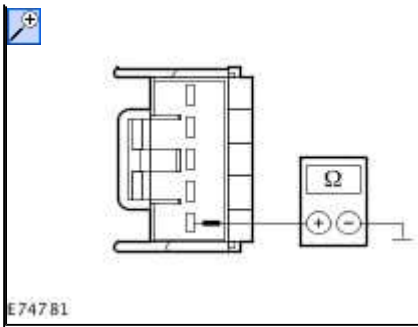

	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the rain sensor/light sensor. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in the circuit between the rain sensor/light sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST T : WIPER MOTOR MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
T1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to T2. **No** GO to Pinpoint Test AF.
T2: CHECK FUSE F22	
	1 Ignition switch in position 0.
	2 CHECK Fuse F22 (EJB).
	Is the fuse OK? **Yes** GO to T3. **No** RENEW fuse F22 (30 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
T3: CHECK THE VOLTAGE AT FUSE F22	
	1 Connect Fuse F22 (EJB).
	2 Measure the voltage between fuse F22 (30 A) and ground.
	Does the meter display battery voltage? **Yes** GO to T4. **No** REPAIR the voltage supply to fuse F22 with the aid of the Wiring Diagrams. CHECK the operation of the system.
T4: CHECK THE VOLTAGE AT THE WIPER MOTOR MODULE	
	1 Disconnect Connector C1RW01-B from the wiper motor module.
	2 Measure the voltage between the wiper motor module, connector C1RW01-B, pin 1, circuit SBB22A (BN/RD), wiring harness side and ground.
	Does the meter display battery voltage?

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Yes
GO to T6.
No
GO to T5.

T5: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE WIPER MOTOR MODULE

1 Disconnect Connector C1BB01-A from the EJB.

2 Measure the resistance between the EJB, connector C1BB01-A, pin 74, circuit SBB22A (BN/RD), wiring harness side and the wiper motor module, connector C1RW01-B, pin 1, circuit SBB22A (BN/RD), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
No
LOCATE and RECTIFY the break in circuit SBB22A (BN/RD) between the wiper motor module and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

T6: CHECK THE GROUND CONNECTION OF THE WIPER MOTOR MODULE

1 Measure the resistance between the wiper motor module, connector C1RW01-B, pin 2, circuit GD131H (BK/GY), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?
Yes
GO to T7.
No
LOCATE and RECTIFY the break in the circuit between the wiper motor module and ground connection G1D130D with the aid of the Wiring Diagrams. CHECK the operation of the system.

T7: CHECK FOR OPEN CIRCUIT BETWEEN THE WIPER MOTOR MODULE AND THE GEM

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

1 Disconnect Connector C1BP02-A from the GEM.

2 Measure the resistance between the wiper motor module, connector C1RW01-B, pin 4, circuit VRW27A (YE/BU), wiring harness side and the GEM, connector C1BP02-A, pin 36, circuit VRW27A (YE/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
GO to T8.
No
LOCATE and RECTIFY the break in circuit VRW27A (YE/BU) between the wiper motor module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

T8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY

1 Ignition switch in position II.

2 Measure the voltage between the wiper motor module, connector C1RW01-B, pin 4, circuit VRW27A (YE/BU), wiring harness side and ground.

Is a voltage measured?
Yes
LOCATE and RECTIFY the short to voltage in the circuit between the wiper motor module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
No
GO to T9.

T9: CHECK THE LIN BUS FOR A SHORT TO GROUND

1 Ignition switch in position 0.

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	2 Measure the resistance between the wiper motor module, connector C1RW01-B, pin 4, circuit VRW27A (YE/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the wiper motor module. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in the circuit between the wiper motor module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST U : LIGHT SWITCH UNIT NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to U2. **No** GO to Pinpoint Test AF.
U2: CHECK FUSE F33	
	1 Ignition switch in position 0.
	2 CHECK Fuse F33 (EJB).
	Is the fuse OK? **Yes** GO to U3. **No** RENEW fuse F33 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
U3: CHECK THE VOLTAGE AT FUSE F33	
	1 Connect Fuse F33 (EJB).
	2 Measure the voltage between fuse F33 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to U4. **No** REPAIR the voltage supply to fuse F33 with the aid of the Wiring Diagrams. CHECK the operation of the system.
U4: CHECK THE VOLTAGE AT THE LIGHT SWITCH UNIT	
	1 Disconnect Connector C2LF23-D from the light switch unit.
	2 Measure the voltage between the light switch unit, connector C2LF23-D, pin 1, circuit SBB33B (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to U6. **No** GO to U5.
U5: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE LIGHT SWITCH UNIT	
	1 Disconnect Connector C1BB01-A from the EJB.
	2 Measure the resistance between the EJB, connector C1BB01-A, pin 92, circuit SBB33D (RD), wiring harness side and the light switch unit,

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	connector C2LF23-D, pin 1, circuit SBB33B (RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB22A (BN/RD) between the light switch unit and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
U6: CHECK THE GROUND CONNECTION OF THE LIGHT SWITCH UNIT	
	1 Measure the resistance between the light switch unit, connector C2LF23-D, pin 5, circuit GD133BT (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to U7. **No** LOCATE and REPAIR the open circuit between the light switch unit and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
U7: CHECK THE CIRCUIT BETWEEN THE LIGHT SWITCH UNIT AND THE GEM FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1BP02-C from the GEM.
	2 Measure the resistance between the light switch unit, connector C2LF23-D, pin 6, circuit VLF25A (GN/VT), wiring harness side and the GEM, connector C1BP02-C, pin 52, circuit VLF25A (GN/VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to U8. **No** LOCATE and RECTIFY the break in circuit VLF25A (GN/VT) between the light switch unit and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
U8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the light switch unit, connector C2LF23-D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in circuit VLF25A (GN/VT) between the light switch unit and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to U9.
U9: CHECK THE LIN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the light switch unit, connector C2LF23-D, pin 6, circuit VLF25A (GN/VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the light switch unit. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit VLF25A (GN/VT) between the light switch unit and the GEM with the aid of the Wiring

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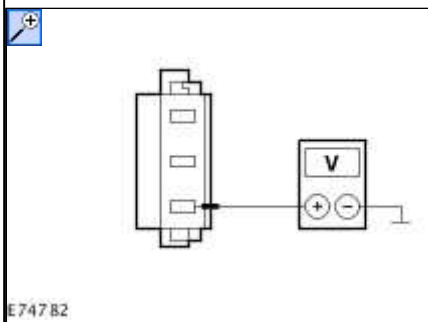
	Diagrams. CHECK the operation of the system.

PINPOINT TEST V : REMOTE CONTROL/TIRE PRESSURE MONITORING RECEIVER MODULE NOT COMMUNICATING WITH THE GENERIC ELECTRONIC MODULE (GEM)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
V1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0. 2 Connect the diagnostic tool. 3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool. Is it possible to establish communications with the GEM? **Yes** GO to V2. **No** GO to Pinpoint Test AF.
V2: CHECK FUSE F21	
	1 Ignition switch in position 0. 2 CHECK Fuse F21 (CJB). Is the fuse OK? **Yes** GO to V3. **No** RENEW fuse F21 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
V3: CHECK THE VOLTAGE AT FUSE F21	
	1 Connect Fuse F21 (CJB). 2 Measure the voltage between fuse F21 (5 A) and ground. Does the meter display battery voltage? **Yes** GO to V4. **No** REPAIR the voltage supply to fuse F21 with the aid of the Wiring Diagrams. CHECK the operation of the system.
V4: CHECK THE VOLTAGE AT THE REMOTE CONTROL/TIRE PRESSURE MONITORING RECEIVER MODULE	
	1 Disconnect Connector C3PL56 from the remote control/tire pressure monitoring receiver module.
	2 Measure the voltage between the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 3, circuit SBP21A (GY/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to V6. **No** GO to V5.
V5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE REMOTE CONTROL/TIRE	

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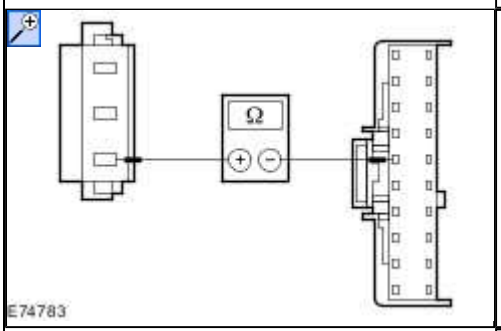
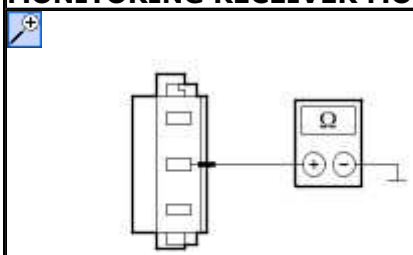
PRESSURE MONITORING RECEIVER MODULE FOR OPEN CIRCUIT

	1 Disconnect Connector C1BP02-H from the CJB.
 E74783	2 Measure the resistance between the CJB, connector C1BP02-H, pin 15, circuit SBP21A (GY/RD), wiring harness side and the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 3, circuit SBP21A (GY/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP21A (GY/RD) between the remote control/tire pressure monitoring receiver module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

V6: CHECK THE GROUND CONNECTION OF THE REMOTE CONTROL/TIRE PRESSURE MONITORING RECEIVER MODULE

 E74784	1 Measure the resistance between the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 2, circuit GD138AD (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to V7. **No** LOCATE and RECTIFY the open circuit in the circuit between the remote control/tire pressure monitoring receiver module and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.

V7: CHECK THE CIRCUIT BETWEEN THE REMOTE CONTROL/TIRE PRESSURE MONITORING RECEIVER MODULE AND THE GEM FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1BP02-H from the GEM.
	2 Measure the resistance between the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 1, circuit VRT22A (GN/BN), wiring harness side and the GEM, connector C1BP02-H, pin 5, circuit VRT22A (GN/BN), wiring harness side.

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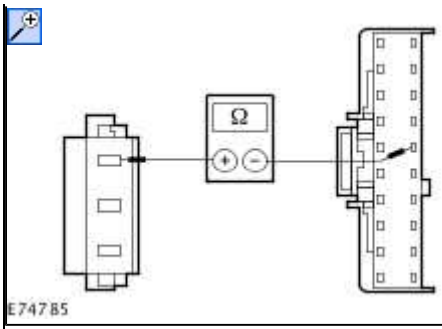
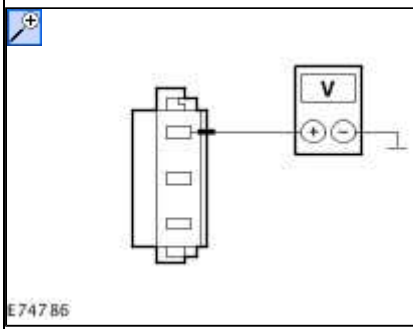
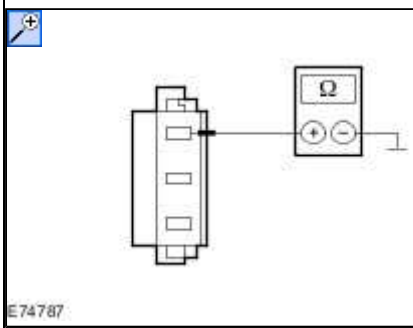
	
	Is a resistance of less than 2 Ohms registered? **Yes** GO to V8. **No** LOCATE and RECTIFY the break in circuit VRT22A (GN/BN) between the remote control/tire pressure monitoring receiver module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
V8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 1, circuit VRT22A (GN/BN), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in circuit VRT22A (GN/BN) between the remote control/tire pressure monitoring receiver module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to V9.
V9: CHECK THE LIN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the remote control/tire pressure monitoring receiver module, connector C3PL56, pin 1, circuit VRT22A (GN/BN), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the remote control/tire pressure monitoring receiver module. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in circuit

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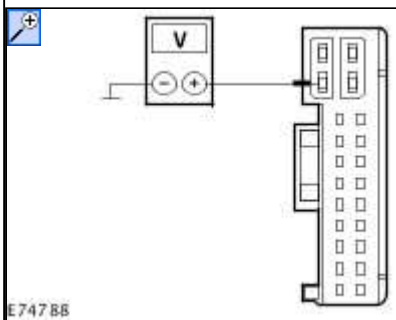
	VRT22A (GN/BN) between the remote control/tire pressure monitoring receiver module and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST W : DRIVER'S SIDE REAR DOOR MODULE NOT COMMUNICATING WITH THE DRIVER'S SIDE DOOR MODULE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
W1: CHECK THE COMMUNICATIONS WITH THE DOOR MODULE ON THE DRIVER'S SIDE	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the driver's side door module with the Ford approved diagnostic tool.
	Is it possible to establish communications with the driver's side door module? **Yes** GO to W2. **No** GO to Pinpoint Test A.
W2: CHECK FUSE FA3	
	1 Ignition switch in position 0.
	2 CHECK Fuse FA3 (RJB).
	Is the fuse OK? **Yes** GO to W3. **No** RENEW fuse FA3 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
W3: CHECK THE VOLTAGE AT FUSE FA3	
	1 Connect Fuse FA3 (RJB).
	2 Measure the voltage between fuse FA3 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to W4. **No** REPAIR the voltage supply to fuse FA3 with the aid of the Wiring Diagrams. CHECK the operation of the system.
W4: CHECK THE VOLTAGE AT THE DRIVER'S SIDE REAR DOOR MODULE	
	1 Disconnect Connector C7PL01 from the driver's side rear door module.
	2 Measure the voltage between the driver's side rear door module, connector C7PL01, pin 2, circuit SBR03A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to W6. **No**

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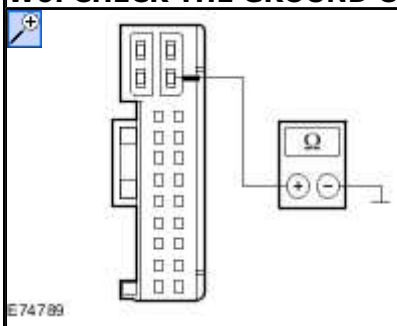
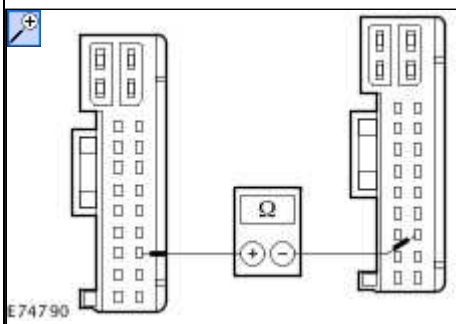
	GO to W5.
W5: CHECK THE CIRCUIT BETWEEN THE RJB AND THE DRIVER'S SIDE REAR DOOR MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C4BR02-A from the RJB.
	2 Measure the resistance between the RJB, connector C4BR02-A, pin 104, circuit SBR03B (BU/RD), wiring harness side and the driver's side rear door module, connector C7PL01, pin 2, circuit SBR03A (BU/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the driver's side rear door module and the RJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
W6: CHECK THE GROUND CONNECTION OF THE DRIVER'S SIDE REAR DOOR MODULE	
	1 Measure the resistance between the driver's side rear door module, connector C7PL01, pin 13, circuit GD134B (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to W7. **No** LOCATE and RECTIFY the break in the circuit between the driver's side rear door module and ground connection G3D133 with the aid of the Wiring Diagrams. CHECK the operation of the system.
W7: CHECK FOR OPEN CIRCUIT BETWEEN THE DRIVER'S SIDE REAR DOOR MODULE AND THE DRIVER'S SIDE DOOR MODULE	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C5PL01-A from the driver's side door module.
	2 Measure the resistance between the driver's side rear door module, connector C7PL01, pin 20, circuit VPW32C (GY/BU), wiring harness side and the driver's side door module, connector C5PL01-A, pin 20, circuit VPW32A (GY/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to W8. **No**

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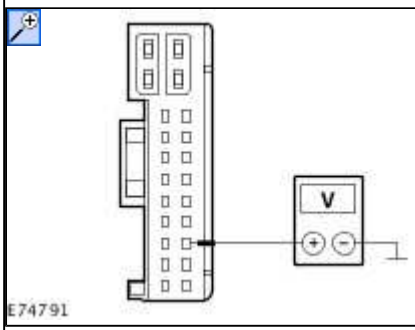
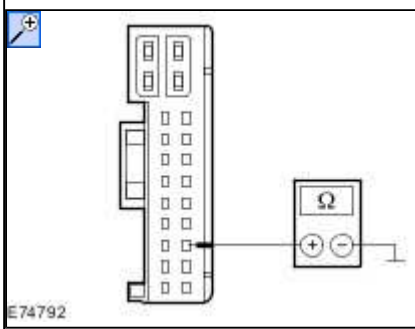
	LOCATE and REPAIR the break in the circuit between the driver's side rear door module and the driver's side door module with the aid of the Wiring Diagrams. CHECK the operation of the system.
W8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the driver's side rear door module, connector C7PL01, pin 20, circuit VPW32C (GY/BU), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the driver's side rear door module and the driver's side door module with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to W9.
W9: CHECK THE LIN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the driver's side rear door module, connector C7PL01, pin 20, circuit VPW32C (GY/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the driver's side rear door module. CHECK the operation of the system. **No** LOCATE and REPAIR the short to ground in the circuit between the driver's side rear door module and the driver's side door module with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST X : PASSENGER SIDE REAR DOOR MODULE NOT COMMUNICATING WITH THE PASSENGER SIDE DOOR MODULE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK THE COMMUNICATIONS WITH THE DOOR MODULE ON THE PASSENGER SIDE	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the passenger side door module with the Ford approved diagnostic tool.
	Is it possible to establish communications with the passenger side door module?

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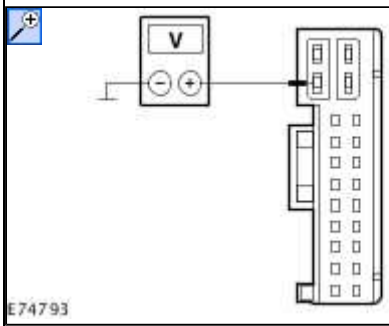
	Yes GO to X2. **No** GO to Pinpoint Test B.
X2: CHECK FUSE FA4	
	1 Ignition switch in position 0.
	2 CHECK Fuse FA4 (RJB).
	Is the fuse OK? **Yes** GO to X3. **No** RENEW fuse FA4 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
X3: CHECK THE VOLTAGE AT FUSE FA4	
	1 Connect Fuse FA4 (RJB).
	2 Measure the voltage between fuse FA4 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to X4. **No** REPAIR the voltage supply to fuse FA4 with the aid of the Wiring Diagrams. CHECK the operation of the system.
X4: CHECK THE VOLTAGE AT THE PASSENGER SIDE REAR DOOR MODULE	
	1 Disconnect Connector C8PL01 from the passenger side rear door module.
	2 Measure the voltage between the passenger side rear door module, connector C8PL01, pin 2, circuit SBR04B (GN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to X6. **No** GO to X5.
X5: CHECK THE CIRCUIT BETWEEN THE RJB AND THE PASSENGER SIDE REAR DOOR MODULE FOR OPEN CIRCUIT	
	1 Disconnect Connector C4BR02-A from the RJB.
	2 Measure the resistance between the RJB, connector C4BR02-A, pin 105, circuit SBR04A (GN/RD), wiring harness side and the passenger side rear door module, connector C8PL01, pin 2, circuit SBR04B (GN/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the passenger side rear door module and the RJB

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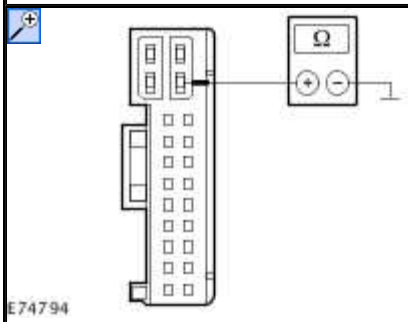
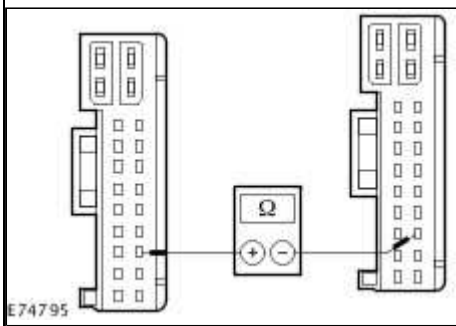
	with the aid of the Wiring Diagrams. CHECK the operation of the system.
X6: CHECK THE GROUND CONNECTION OF THE PASSENGER SIDE REAR DOOR MODULE	
	1 Measure the resistance between the passenger side rear door module, connector C8PL01, pin 13, circuit GD140F (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to X7. **No** LOCATE and RECTIFY the break in the circuit between the passenger side rear door module and ground connection G3D138 with the aid of the Wiring Diagrams. CHECK the operation of the system.
X7: CHECK FOR OPEN CIRCUIT BETWEEN THE PASSENGER SIDE REAR DOOR MODULE AND THE PASSENGER SIDE DOOR MODULE	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C6PL01-A from the passenger side door module.
	2 Measure the resistance between the passenger side rear door module, connector C8PL01, pin 20, circuit VPW33C (VT/BN), wiring harness side and the passenger side door module, connector C6PL01-A, pin 20, circuit VPW33A (VT/BN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to X8. **No** LOCATE and REPAIR the break in the circuit between the passenger side rear door module and the passenger side door module with the aid of the Wiring Diagrams. CHECK the operation of the system.
X8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the passenger side rear door module, connector C8PL01, pin 20, circuit VPW33C (VT/BN), wiring harness side and ground.

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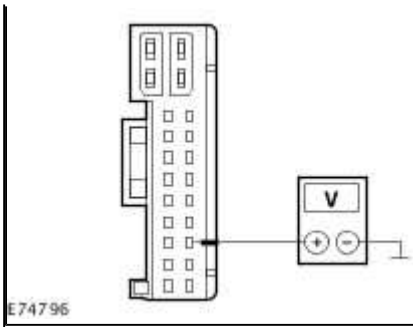


Is a voltage measured?

Yes

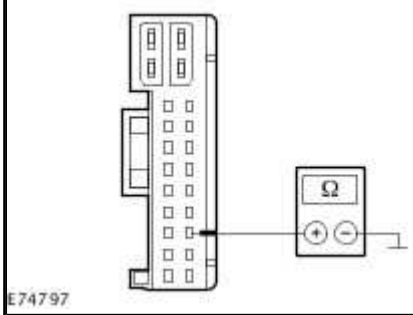
LOCATE and REPAIR the short to voltage in the circuit between the passenger side rear door module and the passenger side door module with the aid of the Wiring Diagrams. CHECK the operation of the system.

No

GO to X9.

X9: CHECK THE LIN BUS FOR A SHORT TO GROUND

1 Ignition switch in position 0.



2 Measure the resistance between the passenger side rear door module, connector C8PL01, pin 20, circuit VPW33C (VT/BN), wiring harness side and ground.

Is a resistance of more than 10,000 Ohm measured?

Yes

CHECK and if necessary RENEW the passenger side rear door module. CHECK the operation of the system.

No

LOCATE and REPAIR the short to ground in the circuit between the passenger side rear door module and the passenger side door module with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST Y : GEAR LEVER MODULE NOT COMMUNICATING WITH THE TRANSMISSION CONTROL UNIT (TCM)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
Y1: CHECK THE COMMUNICATIONS WITH THE TRANSMISSION CONTROL MODULE (TCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the transmission control module (TCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the transmission control module (TCM)? **Yes** GO to Y2. **No** GO to Pinpoint Test AI.

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Y2: CHECK THE VOLTAGE AT THE GEAR LEVER MODULE

1 Disconnect Connector C3ET42 from the gear lever module.

2 Measure the voltage between the gear lever module, connector C3ET42, pin 1, circuit CET39A (BU/GY), wiring harness side and ground.

Does the meter display battery voltage?

Yes

GO to Y4.

No

GO to Y3.

Y3: CHECK THE CIRCUIT BETWEEN THE TRANSMISSION CONTROL MODULE (TCM) AND THE GEAR LEVER MODULE FOR OPEN CIRCUIT

1 Disconnect Connector C1ET34 from the transmission control module (TCM).

2 Measure the resistance between the transmission control module (TCM), connector C1ET34, pin 16, circuit CET39C (BU/GY), wiring harness side and the gear lever module, connector C3ET42, pin 1, circuit CET39A (BU/GY), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the transmission control module (TCM) and RENEW as required. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in the circuit between the rear gear lever module and the transmission control module (TCM) with the aid of the Wiring Diagrams. CHECK the operation of the system.

Y4: CHECK THE GROUND CONNECTION OF THE REAR GEAR LEVER MODULE

1 Measure the resistance between the gear lever module, connector C3ET42, pin 6, circuit GD133AX (BK), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

GO to Y5.

No

LOCATE and RECTIFY the break in the circuit between the gear lever module and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.

Y5: CHECK THE CIRCUIT BETWEEN THE GEAR LEVER MODULE AND THE TRANSMISSION CONTROL MODULE (TCM) FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

1 Disconnect Connector C1ET34 from the transmission control module (TCM).

2 Measure the resistance between the gear lever module, connector C3ET42, pin 2, circuit VET54A (BU/OG), wiring harness side and the transmission control module (TCM), connector C1ET34, pin 7, circuit VET54C (BN/VT), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to Y6.

No

LOCATE and RECTIFY the break in the circuit between the gear lever module and the transmission control module (TCM) with the aid of the Wiring Diagrams. CHECK the operation of the system.

Y6: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY

1 Ignition switch in position II.

2 Measure the voltage between the gear lever module, connector C3ET42, pin 2, circuit VET54A (BU/OG), wiring harness side and ground.

Is a voltage measured?

Yes

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	LOCATE and RECTIFY the short to voltage in the circuit between the gear lever module and the transmission control module (TCM) with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to Y7.
Y7: CHECK THE LIN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the gear lever module, connector C3ET42, pin 2, circuit VET54A (BU/OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the gear lever module. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in the circuit between the gear lever module and the transmission control module (TCM) with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST Z : ANTI-THEFT ALARM SIGNAL HORN WITH INTEGRATED BATTERY NOT COMMUNICATING WITH THE GENERIC ELECTRONIC MODULE (GEM)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
Z1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to Z2. **No** GO to Pinpoint Test AF.
Z2: CHECK FUSE F26	
	1 Ignition switch in position 0.
	2 CHECK Fuse F26 (CJB).
	Is the fuse OK? **Yes** GO to Z3. **No** RENEW fuse F26 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
Z3: CHECK THE VOLTAGE AT FUSE F26	
	1 Connect Fuse F26 (CJB).
	2 Measure the voltage between fuse F26 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to Z4. **No** REPAIR the voltage supply to fuse F26 with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z4: CHECK THE VOLTAGE AT THE ANTI-THEFT ALARM SIGNAL HORN WITH INTEGRATED BATTERY	
	1 Disconnect Connector C1RT16 from the anti-theft alarm signal horn with integrated battery.

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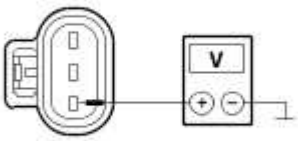
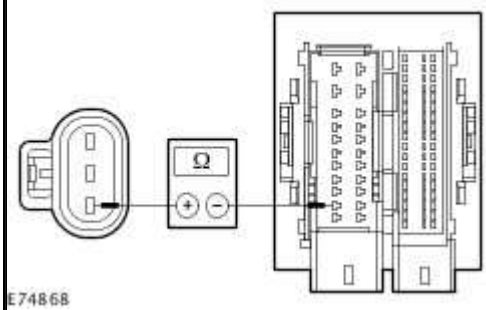
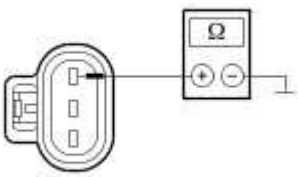
 E74867	2 Measure the voltage between the anti-theft alarm signal horn with integrated battery, connector C1RT16 , pin 3, circuit SBP26B (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to Z6. **No** GO to Z5.
Z5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE ANTI-THEFT ALARM SIGNAL HORN WITH INTEGRATED BATTERY FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-A from the CJB.
 E74868	2 Measure the resistance between the CJB, connector C1BP02-A, pin 67, circuit SBP26A (YE/RD), wiring harness side and the anti-theft alarm signal horn with integrated battery, connector C1RT16, pin 3, circuit SBP26B (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the anti-theft alarm signal horn with integrated battery and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
Z6: CHECK THE GROUND CONNECTION OF THE ANTI-THEFT ALARM SIGNAL HORN WITH INTEGRATED BATTERY	
 E74869	1 Measure the resistance between the anti-theft alarm signal horn with integrated battery, connector C1RT16, pin 1, circuit GD120N (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to Z7. **No** LOCATE and RECTIFY the break in the circuit between the anti-theft alarm signal horn with integrated battery and ground connection G1D130B with the aid of the Wiring Diagrams. CHECK the operation of the system.

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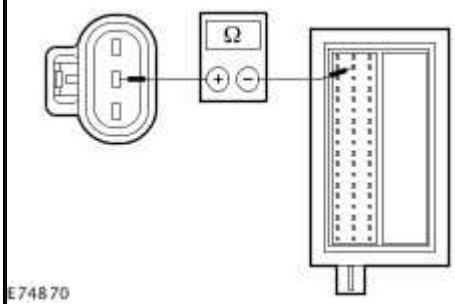
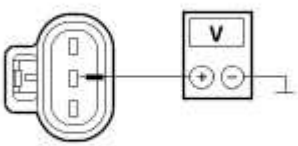
Z7: CHECK THE CIRCUIT BETWEEN THE ANTI-THEFT ALARM SIGNAL HORN WITH INTEGRATED BATTERY AND THE GEM FOR OPEN CIRCUIT

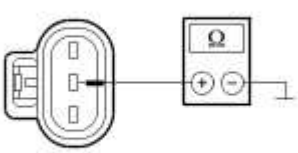
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1BP02-A from the GEM.
 E74870	2 Measure the resistance between the anti-theft alarm signal horn with integrated battery, connector C1RT16, pin 2, circuit VRT27B (BN/BU), wiring harness side and the GEM, connector C1BP02-A, pin 35, circuit VRT27A (BN/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to Z8. **No** LOCATE and RECTIFY the break in the circuit between the anti-theft alarm signal horn with integrated battery and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

Z8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY

	1 Ignition switch in position II.
 E74871	2 Measure the voltage between the anti-theft alarm signal horn with integrated battery, connector C1RT16 , pin 2, circuit VRT27B (BN/BU), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in the circuit between the anti-theft alarm signal horn with integrated battery and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to Z9.

Z9: CHECK THE LIN BUS FOR A SHORT TO GROUND

	1 Ignition switch in position 0.
 E74872	

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	2 Measure the resistance between the anti-theft alarm signal horn with integrated battery, connector C1RT16 , pin 2, circuit VRT27B (BN/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the anti-theft alarm signal horn with integrated battery. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in the circuit between the anti-theft alarm signal horn with integrated battery and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AA : INTERIOR MONITORING SENSOR NOT COMMUNICATING WITH THE GENERIC ELECTRONIC MODULE (GEM)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AA1: CHECK COMMUNICATION WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to AA2. , **No** GO to Pinpoint Test AF.
AA2: CHECK FUSE F21	
	1 Ignition switch in position 0.
	2 CHECK Fuse F21 (CJB).
	Is the fuse OK? **Yes** GO to AA3. **No** RENEW fuse F21 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AA3: CHECK THE VOLTAGE AT FUSE F21	
	1 Connect Fuse F21 (CJB).
	2 Measure the voltage between fuse F21 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AA4. **No** REPAIR the voltage supply to fuse F21 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AA4: CHECK THE VOLTAGE AT THE INTERIOR MONITORING SENSOR	
	1 Disconnect Connector C3RT03 from the interior monitoring sensor.
	2 Measure the voltage between the interior monitoring sensor, connector C3RT03, pin 3, circuit SBP21A (GY/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AA6. **No** GO to AA5.

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AA5: CHECK THE CIRCUIT BETWEEN THE CJB AND THE INTERIOR MONITORING SENSOR FOR OPEN CIRCUIT	
	1 Disconnect Connector C1BP02-H from the CJB.
	2 Measure the resistance between the CJB, connector C1BP02-H, pin 16, circuit SBP21A (GY/RD), wiring harness side and the interior monitoring sensor, connector C3RT03, pin 3, circuit SBP21A (GY/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the interior monitoring sensor and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AA6: CHECK THE GROUND CONNECTION OF THE INTERIOR MONITORING SENSOR	
	1 Measure the resistance between the interior monitoring sensor, connector C3RT03, pin 1, circuit GD138T (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AA7. **No** LOCATE and REPAIR the break in the circuit between the interior monitoring sensor and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AA7: CHECK THE CIRCUIT BETWEEN THE INTERIOR MONITORING SENSOR AND THE GEM FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1BP02-H from the GEM.
	2 Measure the resistance between the interior monitoring sensor, connector C3RT03, pin 2, circuit VRT26A (VT), wiring harness side and the GEM, connector C1BP02-H, pin 7, circuit VRT26A (VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AA8. **No** LOCATE and REPAIR the break in the circuit between the interior monitoring sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.
AA8: CHECK THE LIN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the interior monitoring sensor, connector C3RT03, pin 2, circuit VRT26A (VT), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage in the circuit between the interior monitoring sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to AA9.
AA9: CHECK THE LIN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the interior monitoring sensor, connector C3RT03, pin 2, circuit VRT26A (VT), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured?

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	Yes CHECK and if necessary RENEW the interior monitoring sensor. CHECK the operation of the system. **No** LOCATE and RECTIFY the short to ground in the circuit between the interior monitoring sensor and the GEM with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AB : RESTRAINTS CONTROL MODULE (RCM) NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

WARNINGS:

The backup power supply must be depleted to prevent the risk of accidental airbag deployment. After disconnecting the battery, wait at least 1 minute before starting work on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

In order to prevent the risk of accidental deployment, do not program any keycodes while working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.

Only test the connectors of airbags or other supplemental restraint systems using the correct test probe adapter. Failure to follow this instruction may result in personal injury.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AB1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to AB2. **No** GO to Pinpoint Test AJ.
AB2: CHECK FUSE F2	
	1 Ignition switch in position 0.
	2 CHECK Fuse F2 (CJB).
	Is the fuse OK? **Yes** GO to AB3. **No** RENEW fuse F2 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AB3: CHECK THE VOLTAGE AT FUSE F2	
	1 Connect Fuse F2 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F2 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AB4. **No** REPAIR the voltage supply to fuse F2 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB4: CHECK THE VOLTAGE AT THE SAFETY RESTRAINT CONTROL MODULE (RCM)	
	1

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	1 Ignition switch in position 0. 2 Disconnect the ground cable from the battery. 3 Disconnect connector C2R114-A from restraints control module (RCM). 4 Connect the ground cable to the battery. 5 Ignition switch in position II. 6 Measure the voltage between the restraints control module (RCM), connector C2R114-A, pin 24, circuit CBP02A (GN), harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AB6. **No** GO to AB5.
AB5: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE RESTRAINTS CONTROL MODULE (RCM)	
	1 Ignition switch in position 0. 2 Disconnect Connector C1BP02-C from the CJB. 3 Measure the resistance between the CJB, connector C1BP02-C, pin 66, circuit CBP02A (GN), wiring harness side and the restraints control module (RCM), connector C2R114-A, pin 24, circuit CBP02A (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CBP02A (GN) between the restraints control module (RCM) and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB6: CHECK FOR OPEN CIRCUIT BETWEEN THE RESTRAINTS CONTROL MODULE (RCM) AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side and the restraints control module (RCM), connector C2R114-A, pin 20, circuit VDB07H (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AB7. **No** LOCATE and RECTIFY the break in circuit VDB07H (VT/OG) between the restraints control module (RCM) and soldered connection SP280 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AB7: CHECK FOR OPEN CIRCUIT BETWEEN THE RESTRAINTS CONTROL MODULE (RCM) AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side and the restraints control module (RCM), connector C2R114-A, pin 19, circuit VDB06AB (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered?

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	Yes CHECK and if necessary RENEW the safety restraint control module (RCM). CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit VDB06AB (GY//OG) between the restraints control module (RCM) and soldered connection SP297 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AC : ESP MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to AC2. **No** GO to Pinpoint Test AK.
AC2: CHECK FUSE F25	
	1 Ignition switch in position 0.
	2 CHECK Fuse F25 (EJB).
	Is the fuse OK? **Yes** GO to AC3. **No** RENEW fuse F25 (30 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AC3: CHECK THE VOLTAGE AT FUSE F25	
	1 Connect Fuse F25 (EJB).
	2 Measure the voltage between fuse F25 (30 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AC4. **No** GO to AC18.
AC4: CHECK FUSE F26	
	1 Ignition switch in position 0.
	2 CHECK fuse F26 (BJB).
	Is the fuse OK? **Yes** GO to AC5. **No** RENEW fuse F26 (40 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AC5: CHECK THE VOLTAGE AT FUSE F26	
	1 Connect Fuse F26 (EJB).
	2 Measure the voltage between fuse F26 (40 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AC6.

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	No REPAIR the voltage supply to fuse F26 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC6: CHECK FUSE F36	
	1 CHECK Fuse F36 (EJB).
	Is the fuse OK? **Yes** GO to AC7. **No** RENEW fuse F36 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AC7: CHECK THE VOLTAGE AT FUSE F36	
	1 Connect Fuse F36 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F36 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AC8. **No** REPAIR the voltage supply to fuse F36 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC8: CHECK FUSE F3	
	1 CHECK Fuse F3 (CJB).
	Is the fuse OK? **Yes** GO to AC9. **No** RENEW fuse F3 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AC9: CHECK THE VOLTAGE AT FUSE F3	
	1 Connect Fuse F3 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F3 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AC19. **No** GO to AC10.
AC10: CHECK FUSE F41	
	1 CHECK Fuse F41 (EJB).
	Is the fuse OK? **Yes** GO to AC11. **No** RENEW fuse F41 (20 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AC11: CHECK THE VOLTAGE AT FUSE F41	
	1 Connect Fuse F41 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F41 (20 A) and

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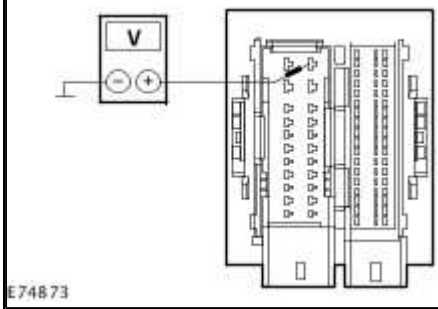
	ground.
	Does the meter display battery voltage? **Yes** GO to AC12. **No** GO to AC14.
AC12: CHECK THE VOLTAGE AT THE CJB	
	1 Ignition switch in position 0.
	2 Disconnect CJB from socket C1BP02-A.
	3 Measure the voltage between the CJB, socket C1BP02-A, pin 65, circuit CBB41A (VT/GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** GO to AC13.
AC13: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the CJB, connector C1BP02-A, pin 65, circuit CBB41A (VT/GY), wiring harness side and the EJB, connector C1BB01-A, pin 98, circuit CBB41A (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit CBB41A (VT/GY) between the electronic stability program module and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC14: CHECK THE VOLTAGE AT RELAY DC21	
	1 Ignition switch in position 0.
	2 Disconnect Relay DC21 from socket C1BB01-A.
	3 Measure the voltage between relay DC21, socket C1BB01-A, pin 1, circuit CDC01A (GN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AC15. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and the CJB using the Wiring Diagrams. CHECK the operation of the system.
AC15: CHECK THE VOLTAGE AT RELAY DC21	
	1 Measure the voltage between relay DC21, socket C1BB01-A, pin 3, circuit SDC02H (RD), wiring harness side and ground.

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	Does the meter display battery voltage? **Yes** GO to AC16. **No** CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
AC16: CHECK THE CIRCUIT BETWEEN RELAY DC21 AND FUSE F41 FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between relay DC21, socket C1BB01-A, pin 105, circuit CDC21F (GY/BN), wiring harness side and fuse F41.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AC17. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and fuse F41 using the Wiring Diagrams. CHECK the operation of the system.
AC17: CHECK THE GROUND CONNECTION OF DC21	
	1 Ignition switch in position 0.
	2 Measure the resistance between DC21, connector C1BB01-A, pin 106, circuit GD120P (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW relay DC21. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the corresponding circuit between DC21 and soldered connection SP358 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC18: CHECK THE VOLTAGE AT THE EJB	
	1 Disconnect Connector C1BB01-B from the EJB.
	2 Measure the voltage between the EJB, connector C1BB01-B, pin 1, circuit SDC02A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SDC02A (RD) between the EJB and the battery with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC19: CHECK THE VOLTAGE AT THE ESP MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1CA01 from the electronic stability program module.
	3 Measure the voltage between the ESP module, connector C1CA01, pin 1, circuit SBB26A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AC21. **No** GO to AC20.

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AC20: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE ESP MODULE	
	1 Disconnect Connector C1BB01-A from the EJB.
	2 Measure the resistance between the EJB, connector C1BB01-A, pin 112, circuit SBB26A (YE/RD), wiring harness side and the ESP module, connector C1CA01, pin 1, circuit SBB26A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB26A (YE/RD) between the ESP module and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AC21: CHECK THE VOLTAGE AT THE ESP MODULE	
	1 Measure the voltage between the ESP module, connector C1CA01, pin 25, circuit SBB25A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AC27. **No** GO to AC22.
AC22: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE ESP MODULE	
	1 Disconnect Connector C1BB01-A from the EJB.
	2 Measure the resistance between the EJB, connector C1BB01-A, pin 113, circuit SBB25AB (RD), wiring harness side and the ESP module, connector C1CA01, pin 25, circuit SBB25A (RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the electronic stability program module and the EJB using the Wiring Diagrams. CHECK the operation of the system.
AC23: CHECK THE VOLTAGE AT THE ESP MODULE	
	1 Measure the voltage between the ESP module, connector C1CA01, pin 7, circuit SBB36A (GN/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AC25. **No** GO to AC24.
AC24: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE ESP MODULE	
	1 Disconnect Connector C1BB01-A from the EJB.
	2 Measure the resistance between the EJB, connector C1BB01-A, pin 41, circuit SBB36AB (GN/RD), wiring harness side and the ESP module, connector C1CA01, pin 7, circuit SBB36A (GN/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered?

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	Yes CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the electronic stability program module and the EJB using the Wiring Diagrams. CHECK the operation of the system.
AC25: CHECK THE VOLTAGE AT THE ESP MODULE	
	1 Ignition switch in position II.
	2 Measure the voltage between the ESP module, connector C1CA01, pin 33, circuit CBP03A (GY), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AC27. **No** GO to AC26.
AC26: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE ESP MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-A from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-A, pin 55, circuit CBP03AB (GY), wiring harness side and the ESP module, connector C1CA01, pin 33, circuit CBP03A (GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the electronic stability program module and the CJB using the Wiring Diagrams. CHECK the operation of the system.
AC27: CHECK THE GROUND CONNECTION OF THE ELECTRONIC STABILITY PROGRAM MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the ESP module, connector C1CA01, pin 38, circuit GD122X (BK), wiring harness side and ground.
	3 Measure the resistance between the ESP module, connector C1CA01, pin 13, circuit GD122V (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohm measured in both cases? **Yes** GO to AC28. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the ESP module and soldered connection SP200 with the aid of the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in both of the measurements:LOCATE and REPAIR the break in circuit GD122Y (BK) between soldered connection SP200 and ground connection G1D130C

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	with the aid of the Wiring Diagrams. CHECK the operation of the system.

AC28: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC STABILITY PROGRAM MODULE AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the ESP module, connector C1CA01, pin 5, circuit VDB04S (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AC29. **No** LOCATE and REPAIR the break in the circuit between the ESP module and soldered connection SP335 with the aid of the Wiring Diagrams. CHECK the operation of the system.

AC29: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC STABILITY PROGRAM MODULE AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the ESP module, connector C1CA01, pin 6, circuit VDB05S (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the electronic stability program module. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the ESP module and soldered connection SP334 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AD : POWER STEERING PUMP MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL - VEHICLES WITH 2.0L DIESEL ENGINE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AD1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to AD2. **No** GO to Pinpoint Test AG.
AD2: CHECK FUSE F3	
	1 Ignition switch in position 0.

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	2 CHECK Fuse F3 (EJB).
	Is the fuse OK? **Yes** GO to AD3. **No** RENEW fuse F3 (80 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AD3: CHECK THE VOLTAGE AT FUSE F3	
	1 Connect Fuse F3 (EJB).
	2 Measure the voltage between fuse F3 (80 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AD4. **No** REPAIR the voltage supply to fuse F3 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AD4: CHECK FUSE F42	
	1 Ignition switch in position 0.
	2 CHECK Fuse F42 (EJB).
	Is the fuse OK? **Yes** GO to AD5. **No** RENEW fuse F42 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AD5: CHECK THE VOLTAGE AT FUSE F42	
	1 Connect Fuse F42 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F42 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AD6. **No** REPAIR the voltage supply to fuse F42 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AD6: CHECK THE VOLTAGE AT THE POWER STEERING PUMP MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1CS10 from the power steering pump module.
	3 Measure the voltage between the power steering pump module, connector C1CS10, pin 1, circuit SBB03A (BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AD8. **No** GO to AD7.
AD7: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE POWER STEERING PUMP MODULE	
	1 Disconnect Connector C1BB03-C from the EJB.
	2 Measure the resistance between the EJB, connector C1BB03-C, pin 1, circuit SBB03A (BU), wiring harness side and the power steering pump module, connector C1CS10, pin 1, circuit SBB03A (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No**

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	LOCATE and REPAIR the break in the circuit between the power steering pump module and the EJB using the Wiring Diagrams. CHECK the operation of the system.
AD8: CHECK THE VOLTAGE AT THE POWER STEERING PUMP MODULE	
	1 Disconnect Connector C1CS04 from the power steering pump module.
	2 Ignition switch in position II.
	3 Measure the voltage between the power steering pump module, connector C1CS04, pin 1, circuit CBB44A (VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AD10. **No** GO to AD9.
AD9: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE POWER STEERING PUMP MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Connector CBB01-A from the EJB.
	3 Measure the resistance between the EJB, connector CBB01-A, pin 101, circuit CBB44B (VT), wiring harness side and the power steering pump module, connector C1CS04, pin 1, circuit CBB44A (VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the power steering pump module and the EJB using the Wiring Diagrams. CHECK the operation of the system.
AD10: CHECK THE GROUND CONNECTION OF THE POWER STEERING PUMP MODULE	
	1 Ignition switch in position 0.
	2 Measure the resistance between the power steering pump module, connector C1CS10, pin 2, circuit GD120A (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AD11. **No** LOCATE and REPAIR the break in circuit GD120A (BK) between the power steering pump module and ground connection G1D108B with the aid of the Wiring Diagrams. CHECK the operation of the system.
AD11: CHECK FOR OPEN CIRCUIT BETWEEN THE POWER STEERING PUMP MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the power steering pump module, connector C1CS04, pin 3, circuit VDB04F (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AD12. **No** LOCATE and REPAIR the break in circuit VDB04F (WH/BU) between the power steering pump module and soldered connection SP328 using the Wiring Diagrams. CHECK the operation of the system.

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AD12: CHECK FOR OPEN CIRCUIT BETWEEN THE POWER STEERING PUMP MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the power steering pump module, connector C1CS04, pin 2, circuit VDB05M (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the power steering pump module. CHECK the operation of the system. **No** LOCATE and REPAIR the break in circuit VDB05M (WH) between the power steering pump module and soldered connection SP331 using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AE : PARKING BRAKE MODULE NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AE1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to AE2. **No** GO to Pinpoint Test AG.
AE2: CHECK FUSE FC2	
	1 Ignition switch in position 0.
	2 CHECK Fuse FC2 (RJB).
	Is the fuse OK? **Yes** GO to AE3. **No** RENEW fuse FC2 (30 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AE3: CHECK THE VOLTAGE AT FUSE FC2	
	1 Connect Fuse FC2 (RJB).
	2 Measure the voltage between fuse FC2 (30 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AE4. **No** REPAIR the voltage supply to fuse FC2 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AE4: CHECK FUSE FC3	
	1 CHECK Fuse FC3 (RJB).
	Is the fuse OK? **Yes** GO to AE5. **No**

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	RENEW fuse FC3 (30 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AE5: CHECK THE VOLTAGE AT FUSE FC3	
	1 Connect Fuse FC3 (RJB).
	2 Measure the voltage between fuse FC3 (30 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AE6. **No** REPAIR the voltage supply to fuse FC3 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AE6: CHECK FUSE F3	
	1 CHECK Fuse F3 (CJB).
	Is the fuse OK? **Yes** GO to AE7. **No** RENEW fuse F3 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AE7: CHECK THE VOLTAGE AT FUSE F3	
	1 Connect Fuse F3 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F3 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AE8. **No** REPAIR the voltage supply to fuse F3 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AE8: CHECK THE VOLTAGE AT THE PARKING BRAKE MODULE (TERMINAL 30)	
	1 Ignition switch in position 0.
	2 Disconnect Connector C4CB01 from the parking brake module.
	3 Measure the voltage between the parking brake module, connector C4CB01, pin 15, circuit SBR02A (YE/RD), wiring harness side and ground.
	Is battery voltage measured in both cases? **Yes** GO to AE10. **No** GO to AE9.
AE9: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE PARKING BRAKE MODULE	
	1 Disconnect Connector C4BR02-C from the RJB.
	2 Measure the resistance between the RJB, connector C4BR02-C, pin 303, circuit SBR02A (YE/RD), wiring harness side and the parking brake module, connector C4CB01, pin 15, circuit SBR02A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and RENEW the RJB if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the parking brake module and the RJB using the Wiring Diagrams. CHECK the operation of the system.
AE10: CHECK THE VOLTAGE AT THE PARKING BRAKE MODULE (TERMINAL 30)	
	1 Measure the voltage between the parking brake module, connector C4CB01, pin 13, circuit SBR03A (BU/RD), wiring harness side and ground.
	Does the meter display battery voltage?

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Yes
GO to AE12.
No
GO to AE11.

AE11: CHECK FOR OPEN CIRCUIT BETWEEN THE RJB AND THE PARKING BRAKE MODULE

1 Disconnect Connector C4BR02-C from the RJB.

2 Measure the resistance between the RJB, connector C4BR02-C, pin 304, circuit SBR03A (BU/RD), wiring harness side and the parking brake module, connector C4CB01, pin 13, circuit SBR03A (BU/RD), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
CHECK and RENEW the RJB if necessary. CHECK the operation of the system.
No
LOCATE and REPAIR the break in the circuit between the parking brake module and the RJB using the Wiring Diagrams. CHECK the operation of the system.

AE12: CHECK THE VOLTAGE AT THE PARKING BRAKE MODULE (TERMINAL 15)

1 Ignition switch in position II.

2 Measure the voltage between the parking brake module, connector C4CB01, pin 22, circuit CBP03B (GY), wiring harness side and ground.

Does the meter display battery voltage?
Yes
GO to AE14.
No
GO to AE13.

AE13: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE PARKING BRAKE MODULE.

1 Ignition switch in position 0.

2 Disconnect Connector C1BP02-B from the CJB.

3 Measure the resistance between the CJB, connector C1BP02-B, pin 58, circuit CBP03C (GY), wiring harness side and the parking brake module, connector C4CB01, pin 22, circuit CBP03B (GY), wiring harness side.

Is a resistance of less than 2 Ohms registered?
Yes
CHECK the CJB and RENEW as necessary. CHECK the operation of the system.
No
LOCATE and REPAIR the break in the circuit between the parking brake module and the CJB using the Wiring Diagrams. CHECK the operation of the system.

AE14: CHECK THE GROUND CONNECTION OF THE PARKING BRAKE MODULE

1 Ignition switch in position 0.

2 Measure the resistance between the parking brake module, connector C4CB01, pin 28, circuit GD147B (BK/VT), wiring harness side and ground.

3 Measure the resistance between the parking brake module, connector C4CB01, pin 30, circuit GD147A (BK/VT), wiring harness side and ground.

Is a resistance of less than 2 Ohms measured in both cases?
Yes
GO to AE15.
No
- If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the parking brake module and soldered connection SP551 using the Wiring Diagrams. CHECK the operation of the system.
- If a resistance greater than 2 Ohm is measured in both cases:LOCATE and

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	REPAIR the break in circuit GD147C (BK/VT) between soldered connection SP551 and ground connection G3D149 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AE15: CHECK FOR OPEN CIRCUIT BETWEEN THE PARKING BRAKE MODULE AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the parking brake module, connector C4CB01, pin 16, circuit VDB04N (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AE16. **No** LOCATE and RECTIFY the break in the circuit between the parking brake module and soldered connection SP343 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AE16: CHECK FOR OPEN CIRCUIT BETWEEN THE PARKING BRAKE MODULE AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the parking brake module, connector C4CB01, pin 17, circuit VDB05E (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the parking brake module. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the relevant circuit between the parking brake module and soldered connection SP342 using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AF : GENERIC ELECTRONIC MODULE (GEM) NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AF1: CHECK COMMUNICATION WITH THE POWERTRAIN CONTROL MODULE (PCM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to AF2. **No** GO to Pinpoint Test AG.
AF2: CHECK FUSE F17	
	1 Ignition switch in position 0.
	2 CHECK Fuse F17 (EJB).
	Is the fuse OK? **Yes** GO to AF3.

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	No RENEW fuse F17 (60 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AF3: CHECK THE VOLTAGE AT FUSE F17	
	1 Connect Fuse F17 (EJB).
	2 Measure the voltage between fuse F17 (60 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AF4. **No** REPAIR the voltage supply to fuse F17 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF4: CHECK FUSE F18	
	1 CHECK Fuse F18 (EJB).
	Is the fuse OK? **Yes** GO to AF5. **No** RENEW fuse F18 (60 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AF5: CHECK THE VOLTAGE AT FUSE F18	
	1 Connect Fuse F18 (EJB).
	2 Measure the voltage between fuse F18 (60 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AF6. **No** REPAIR the voltage supply to fuse F18 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF6: CHECK FUSE F41	
	1 CHECK Fuse F41 (EJB).
	Is the fuse OK? **Yes** GO to AF7. **No** RENEW fuse F41 (20 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AF7: CHECK THE VOLTAGE AT FUSE F41	
	1 Connect Fuse F41 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F41 (20 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AF12. **No** GO to AF8.
AF8: CHECK THE VOLTAGE AT RELAY DC21	
	1 Ignition switch in position 0.
	2 Disconnect Relay DC21 from socket C1BB01A.

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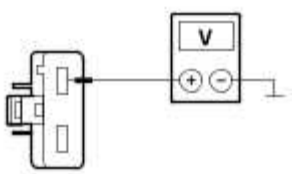
	3 Measure the voltage between relay DC21, socket C1BB01A pin 107, circuit CDC01A (GN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AF9. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and the CJB using the Wiring Diagrams. CHECK the operation of the system.
AF9: CHECK THE VOLTAGE AT RELAY DC21	
	1 Measure the voltage between relay DC21, socket C1BB01A, pin 104, circuit SDC02H (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AF10. **No** CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
AF10: CHECK THE CIRCUIT BETWEEN RELAY DC21 AND FUSE F41 FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between relay DC21, socket C1BB01A, pin 105, circuit CDC21F (GY/BN), wiring harness side and fuse F42.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF11. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and fuse F41 using the Wiring Diagrams. CHECK the operation of the system.
AF11: CHECK THE GROUND CONNECTION OF DC21	
	1 Ignition switch in position 0.
	2 Measure the resistance between DC21, connector C1BB01-A, pin 106, circuit GD120P (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW relay DC21. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the corresponding circuit between DC21 and soldered connection SP358 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF12: CHECK THE VOLTAGE AT THE GEM	
	1 Disconnect Connector C1BP02-G from the GEM.
 E74874	2 Measure the voltage between the GEM, connector C1BP02-G, pin 1, circuit SBB17A (RD), wiring harness side and ground.

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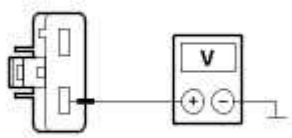
	Does the meter display battery voltage? **Yes** GO to AF14. **No** GO to AF13.
AF13: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE EJB	
	1 Disconnect Connector C1BB03-G from the EJB.
	2 Measure the resistance between the CJB, connector C1BP02-G, pin 1, circuit SBB17A (RD), wiring harness side and the EJB, connector C1BB03-G, pin 1, circuit SBB17A (RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB17A (RD) between the EJB and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF14: CHECK THE VOLTAGE AT THE GEM	
 E74875	1 Measure the voltage between the GEM, connector C1BP02-G, pin 2, circuit SBB18A (YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AF16. **No** GO to AF15.
AF15: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE EJB	
	1 Disconnect Connector C1BP03-H from the EJB.
	2 Measure the resistance between the CJB, connector C1BP02-G, pin 2, circuit SBB18A (YE), wiring harness side and the EJB, connector C1BB03-H, pin 1, circuit SBB18A (YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB18A (YE) between the GEM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF16: CHECK THE VOLTAGE AT THE GEM	
	1 Disconnect Connector C1BP02-A from the GEM.
	2 Ignition switch in position II.
	3 Measure the voltage between the GEM, connector C1BP02-A, pin 65, circuit CBB41A (BU), wiring harness side and ground.
	Does the meter display battery voltage?

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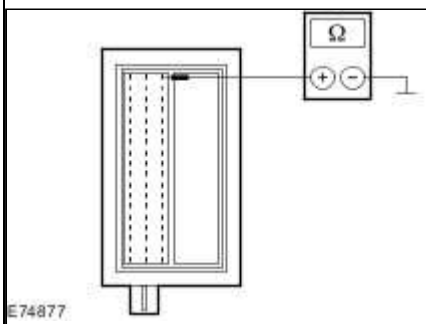
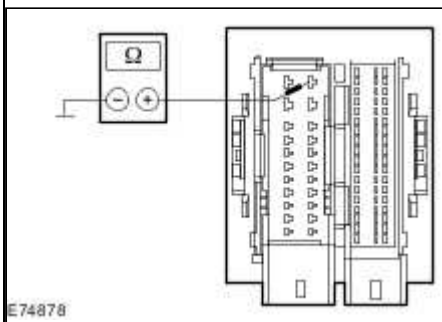
	Yes GO to AF18. **No** GO to AF17.
AF17: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the CJB, connector C1BP02-A, pin 65, circuit CBB41A (BU), wiring harness side and the EJB, connector C1BB01-A, pin 98, circuit CBB41A (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CBB41A (BU) between the EJB and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF18: TEST THE GEM GROUND CONNECTION	
	1 Ignition switch in position 0.
	2 Measure the resistance between the GEM, connector C1BP02-A, pin 54, circuit GD123F (BK/GY), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF19. **No** LOCATE and REPAIR the break in circuit GD123F (BK/GY) between the GEM and ground connection GD123 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AF19: TEST THE GEM GROUND CONNECTION	
	1 Disconnect Connector C1BP02-B from the GEM.
	2 Measure the resistance between the GEM, connector C1BP02-B, pin 65, circuit GD134U (BK/VT), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF20. **No** LOCATE and REPAIR the break in circuit GD134U (BK/VT) between the GEM and ground connection

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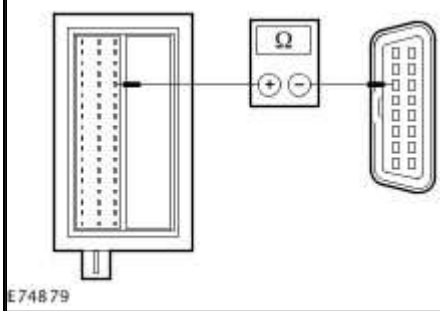
	GD134 with the aid of the Wiring Diagrams. CHECK the operation of the system.

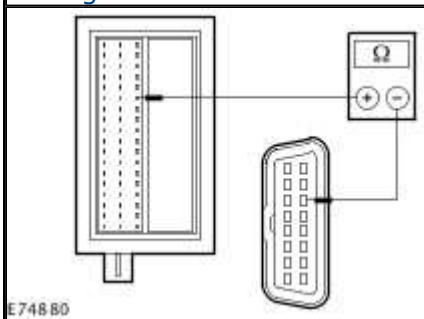
AF20: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the GEM, connector C1BP02-A, pin 50, circuit VDB07J (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF21. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AF21: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the GEM, connector C1BP02-A, pin 49, circuit VDB06AC (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF22. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AF22: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1BP02-C from the GEM.
	2 Measure the resistance between the GEM, connector C1BP02-C, pin 47, circuit VDB04Y (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.

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	Is a resistance of less than 2 Ohms registered? **Yes** GO to AF23. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AF23: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the GEM, connector C1BP02-C, pin 48, circuit VDB05AB (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the corresponding circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AG : POWERTRAIN CONTROL MODULE (PCM) NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AG1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the instrument cluster with the Ford approved diagnostic tool.
	Is it possible to establish communication with the instrument cluster? **Yes** - All except vehicles with a 2.0L engine:GO to AG2. - Vehicles with a 2.0L engine:GO to AG4. **No** GO to Pinpoint Test AK.
AG2: CHECK FUSE F10	
	1 Ignition switch in position 0.
	2 CHECK Fuse F10 (EJB).
	Is the fuse OK? **Yes** GO to AG3. **No** RENEW fuse F10 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AG3: CHECK THE VOLTAGE AT FUSE F10	
	1 Connect Fuse F10 (EJB).
	2 Measure the voltage between fuse F10 (10 A) and ground.
	Does the meter display battery voltage? **Yes**

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	GO to AG4. **No** GO to AG19.
AG4: CHECK FUSE F8	
	1 CHECK Fuse F8 (EJB).
	Is the fuse OK? **Yes** GO to AG5. **No** RENEW fuse F8 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AG5: CHECK THE VOLTAGE AT FUSE F8	
	1 Connect Fuse F8 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F8 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AG20. **No** GO to AG6.
AG6: CHECK FUSE F7	
	1 CHECK Fuse F7 (EJB).
	Is the fuse OK? **Yes** GO to AG7. **No** RENEW fuse F7 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AG7: CHECK THE VOLTAGE AT FUSE F7	
	1 Connect Fuse F7 (EJB).
	2 Measure the voltage between fuse F7 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AG8. **No** CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
AG8: CHECK THE VOLTAGE AT RELAY E612	
	1 Disconnect Relay E612 from socket C1BB03-A.
	2 Measure the voltage between relay E612, socket C1BB03-A, pin 10, circuit SBB07B (WH/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG9. **No** LOCATE and REPAIR the break in the circuit between relay E612 and fuse F7 using the Wiring Diagrams. CHECK the operation of the system.
AG9: CHECK THE VOLTAGE AT RELAY E612	
	1 Measure the voltage between relay E612, socket C1BB03-A, pin 7, circuit SDC02A (RD), wiring harness side and ground.

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	Does the meter display battery voltage? **Yes** GO to AG10. **No** CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
AG10: CHECK THE CIRCUIT BETWEEN RELAY E612 AND FUSE F8 FOR OPEN CIRCUIT	
	1 Ignition switch in position 0.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 37, circuit CE612J (GY/VT), wiring harness side and fuse F8.
	Is a resistance of less than 2 Ohms registered? **Yes** - Vehicles with a 2.0L diesel engine:GO to AG11. - Vehicles with a 2.0L engine:GO to AG12. - Vehicles with a 2.5L engine:GO to AG13. - Vehicles with a 1.8L diesel engine:GO to AG14. - Vehicles with a 1.6L Duratec-16V (Sigma) engine:GO to AG15. - Vehicles with a 3.0L Duratec-VE (VE6) engine:GO to AG16. - Vehicles with a 3.0L Duratec-VE (VE6) engine:GO to AG17. **No** LOCATE and REPAIR the break in the circuit between relay E612 and fuse F8 using the Wiring Diagrams. CHECK the operation of the system.
AG11: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E108-D from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302A (YE/BU), wiring harness side and the PCM, connector C1E108-D, pin C1, circuit CE302A (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG12: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E104-E from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302E (YE/BU), wiring harness side and the PCM, connector C1E104-E, pin G1, circuit CE302E (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG13: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E108-B from the PCM.

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	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302A (YE/BU), wiring harness side and the PCM, connector C1E108-B, pin 27, circuit CE302A (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG14: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E108-K from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03A, pin 9, circuit CE302B(YE/BU), wiring harness side and the PCM, connector C1E108-K, pin C1, circuit CE302BA (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG15: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E104-G from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302A (YE/BU), wiring harness side and the PCM, connector C1E104-G, pin B1, circuit CE302A (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG16: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	
	1 Disconnect Connector C1E109-B from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302A (YE/BU), wiring harness side and the PCM, connector C1E109-B, pin 27, circuit CE302A (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG17: CHECK THE CIRCUIT BETWEEN RELAY E612 AND THE PCM FOR CONTINUITY.	

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	1 Disconnect Connector C1E108-H from the PCM.
	2 Measure the resistance between relay E612, socket C1BB03-A, pin 9, circuit CE302A (YE/BU), wiring harness side and the PCM, connector C1E108-H, pin A3, circuit CE302A (YE/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG18. **No** LOCATE and REPAIR the break in the circuit between relay E612 and the PCM using the Wiring Diagrams. CHECK the operation of the system.
AG18: CHECK RELAY E612	
	1 Check relay E612 according to the component test at the end of this section.
	Is relay E612 OK? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** RENEW relay E612. CHECK the operation of the system.
AG19: CHECK THE VOLTAGE AT THE EJB	
	1 Disconnect Connector C1BB01-B from the EJB.
	2 Measure the voltage between the EJB, connector C1BB01-B, pin 1, circuit SDC02A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SDC02A (RD) between the EJB and the battery with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG20: CHECK FUSE F42	
	1 CHECK Fuse F42 (EJB).
	Is the fuse OK? **Yes** GO to AG21. **No** RENEW fuse F42 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AG21: CHECK THE VOLTAGE AT FUSE F42	
	1 Connect Fuse F42 (EJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F42 (10 A) and ground.
	Does the meter display battery voltage? **Yes** - Vehicles with a 2.0L diesel engine:GO to AG26. - Vehicles with a 2.0L engine:GO to AG35. - Vehicles with a 2.5L engine:GO to AG42. - Vehicles with a 1.8L diesel engine:GO to AG50.

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	- Vehicles with a 1.6L Duratec-16V (Sigma) engine:GO to AG59. - Vehicles with a 3.0L Duratec-VE (VE6) engine:GO to AG67. - Vehicles with a 2.2L diesel engine:GO to AG76. **No** GO to AG22.
AG22: CHECK THE VOLTAGE AT RELAY DC21	
	1 Ignition switch in position 0.
	2 Disconnect Relay DC21 from socket C1BB01-A.
	3 Measure the voltage between relay DC21, socket C1BB01-A, pin 107, circuit CDC01A (GN/VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG23. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and the CJB using the Wiring Diagrams. CHECK the operation of the system.
AG23: CHECK THE VOLTAGE AT RELAY DC21	
	1 Measure the voltage between relay DC21, socket C1BB01-A, pin 104, circuit SDC02H (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG24. **No** CHECK and if necessary RENEW the EJB. CHECK the operation of the system.
AG24: CHECK THE CIRCUIT BETWEEN RELAY DC21 AND FUSE F42 FOR OPEN CIRCUIT	
	1 Measure the resistance between relay DC21, socket C1BB01-A, pin 105, circuit CDC21F (GY/BN), wiring harness side and fuse F42.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG25. **No** LOCATE and REPAIR the break in the circuit between relay DC21 and fuse F42 using the Wiring Diagrams. CHECK the operation of the system.
AG25: CHECK THE GROUND CONNECTION OF DC21	
	1 Measure the resistance between DC21, connector C1BB01-A, pin 106, circuit GD120P (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** RENEW relay E612. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the corresponding circuit between DC21 and soldered connection SP358 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG26: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E108-C from the PCM.
	2 Measure the voltage between the PCM, connector

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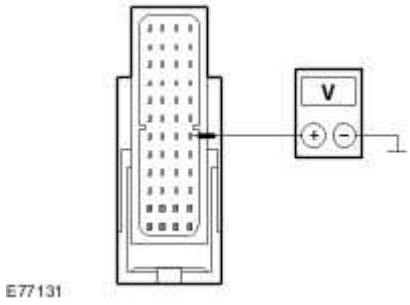
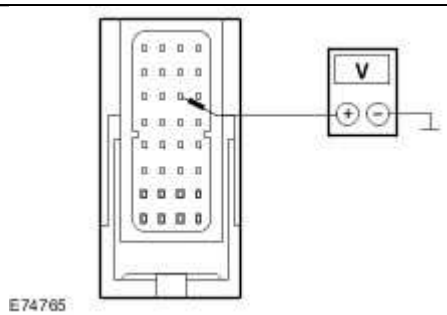
	C1E108-C, pin G4, circuit SBB10B (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG28. **No** GO to AG27.
AG27: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C4BR03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-C, pin G4, circuit SBB10B (YE/RD), wiring harness side and the RJB, connector C1BB03-A, pin 26, circuit SBB10B (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB10B (YE/RD) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG28: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E108-D from the PCM.
	2 Ignition switch in position II.
	3 Measure the voltage between the PCM, connector C1E108-D, pin C3, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG30. **No** GO to AG29.
AG29: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E108-D, pin C3, circuit CBB42A (GN), wiring harness side and the RJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.

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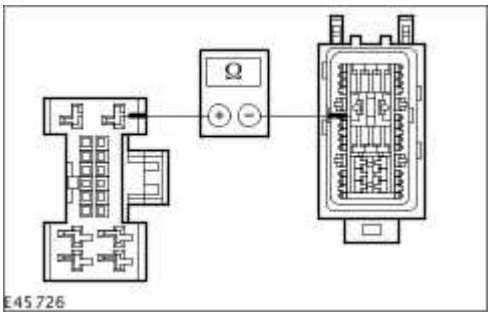


Is a resistance of less than 2 Ohms registered?

Yes

CHECK and if necessary RENEW the EJB. CHECK the operation of the system.

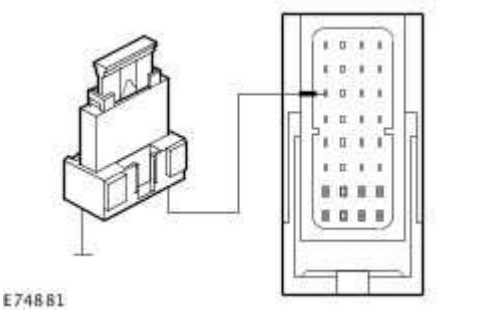
No

LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

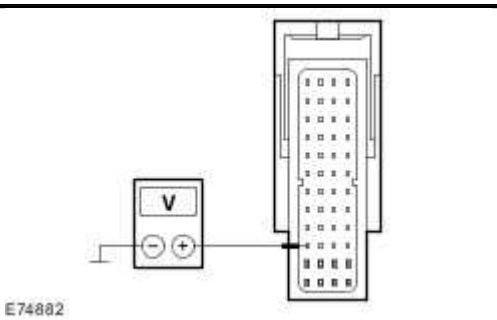
AG30: CHECK THE VOLTAGE AT THE PCM

1 Ignition switch in position 0.

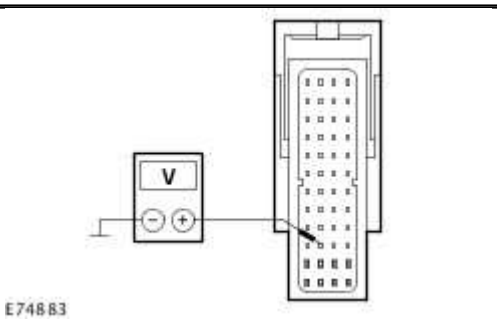
2 Disconnect Connector C1E108-E from the PCM.



3 Use a fused test lead (1 A) at the PCM to bridge connector C1E108-D, pin C1, circuit CE302A (YE/BU), wiring harness side and ground.



4 Measure the voltage between the PCM, connector C1E108-E, pin K1, circuit CBB08D (GY/YE), wiring harness side and ground.



5 Measure the voltage between the PCM, connector C1E108-E, pin K2, circuit CBB08C (GY/YE), wiring harness side and ground.

6 Measure the voltage between the PCM, connector C1E108-E, pin J1, circuit CBB08E (GY/YE), wiring harness side and ground.

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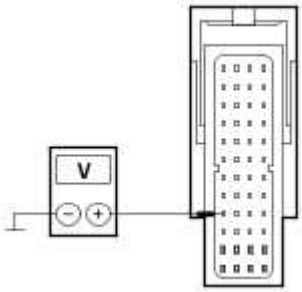


Is battery voltage measured in all cases?

Yes

GO to AG32.

No

- If no voltage is measured during a measurement:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP482 using the Wiring Diagrams. CHECK the operation of the system.
- If battery voltage is not measured during all measurements:GO to AG31.

AG31: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB

1 Disconnect Connector C1BB03-A from the EJB.

2 Measure the resistance between the PCM, connector C1E108-E, pin K1, circuit CBB08D (GY/YE), wiring harness side and the RJB, connector C1BB03-A, pin 16, circuit CBB08A (GY/YE), wiring harness side.

Is a resistance of less than 2 Ohms registered?

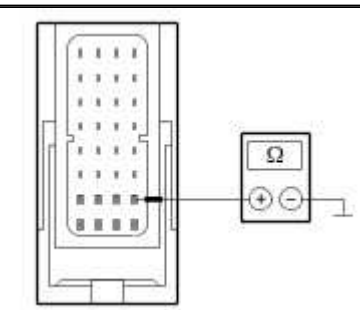
Yes

CHECK and if necessary RENEW the EJB. CHECK the operation of the system.

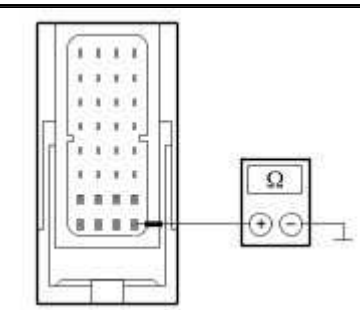
No

LOCATE and RECTIFY the break in circuit CBB08A (GY/YE) between soldered connection SP482 and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

AG32: CHECK THE GROUND CONNECTION OF THE PCM



1 Measure the resistance between the PCM, connector C1E108-D, pin G4, circuit GD120P (BK/GN), wiring harness side and ground.



2 Measure the resistance between the PCM, connector C1E108-D, pin H4, circuit GD120Y (BK/GN), wiring harness side and ground.

3 Measure the resistance between the PCM,

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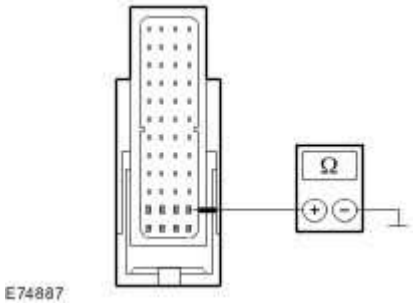
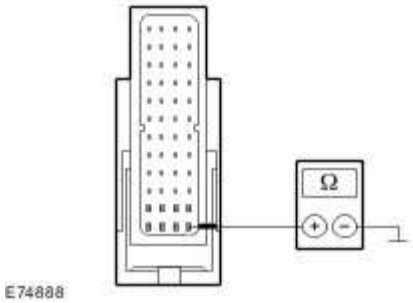
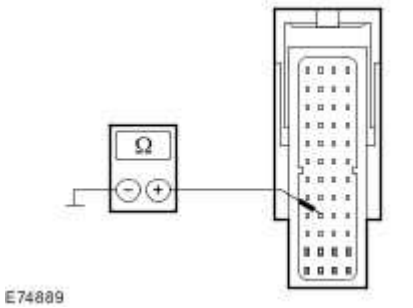
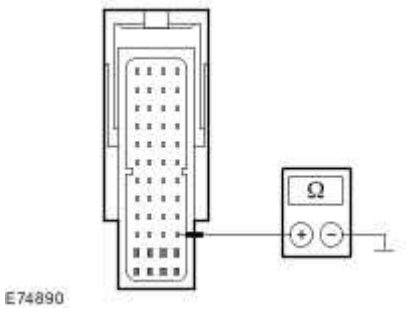
	connector C1E108-C, pin L4, circuit GD120W (BK/GN), wiring harness side and ground.
	**4** Measure the resistance between the PCM, connector C1E108-C, pin M4, circuit GD120R (BK/GN), wiring harness side and ground.
	**5** Measure the resistance between the PCM, connector C1E108-E, pin J2, circuit GD120AC (BK/GN), wiring harness side and ground.
	**6** Measure the resistance between the PCM, connector C1E108-E, pin K4, circuit GD120N (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG33. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP301 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP301 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG33: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	

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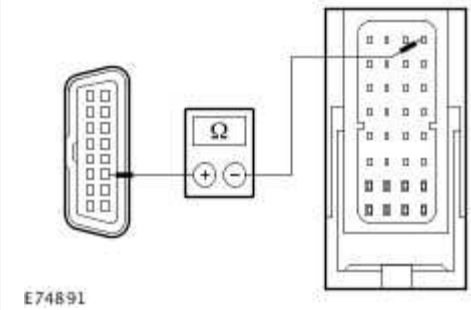
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the PCM, connector C1E108-D, pin A4, circuit VDB04E (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

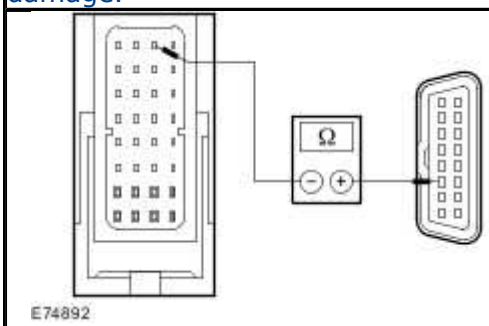
GO to AG34.

No

LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AG34: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the PCM, connector C1E108-D, pin A3, circuit VDB05L (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the PCM and RENEW if necessary. CHECK the operation of the system.

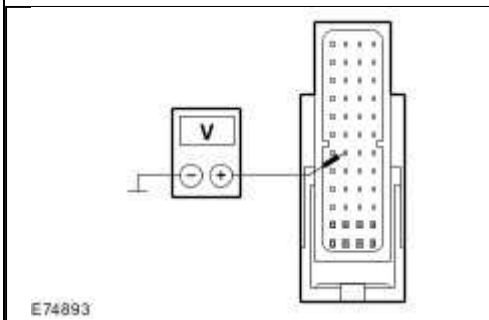
No

LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.

AG35: CHECK THE VOLTAGE AT THE PCM

1 Disconnect Connector C1E104-E from the PCM.

2 Ignition switch in position II.



3 Measure the voltage between the PCM, connector C1E108-E, pin G2, circuit CBB42A (GN), wiring harness side and ground.

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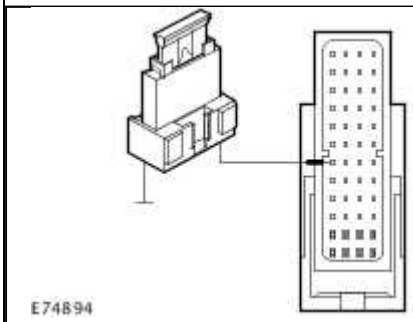
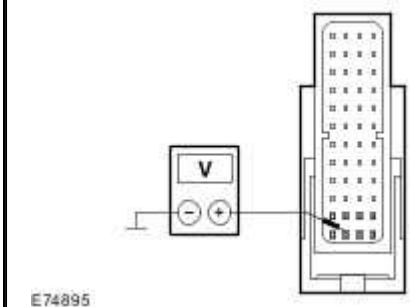
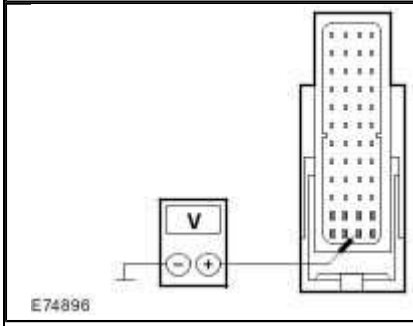
	Does the meter display battery voltage? **Yes** GO to AG37. **No** GO to AG36.
AG36: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E104-E, pin G2, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG37: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.
 E74894	**2** Use a fused test lead (1 A) at the PCM to bridge connector C1E104-ED, pin G1, circuit CE302E (YE/BU), wiring harness side and ground.
 E74895	**3** Measure the voltage between the PCM, connector C1E104-E, pin M2, circuit CBB08N (GY/YE), wiring harness side and ground.
 E74896	**4** Measure the voltage between the PCM, connector C1E104-E, pin M3, circuit CBB08L (GY/YE), wiring harness side and ground.
	Is battery voltage measured in all cases? **Yes** GO to AG38. **No** LOCATE and REPAIR the break in the relevant

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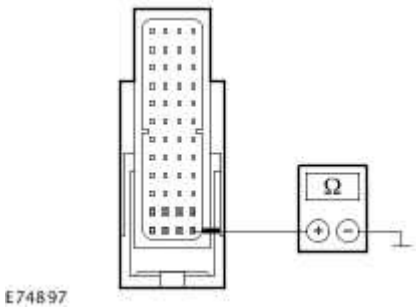
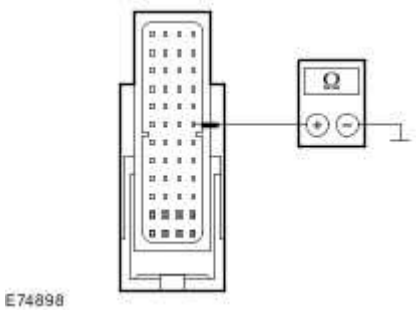
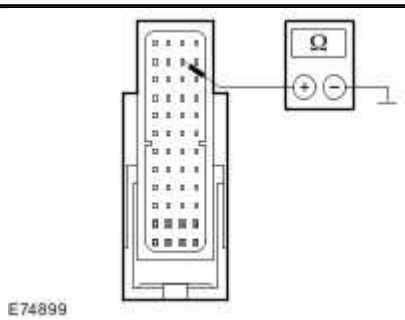
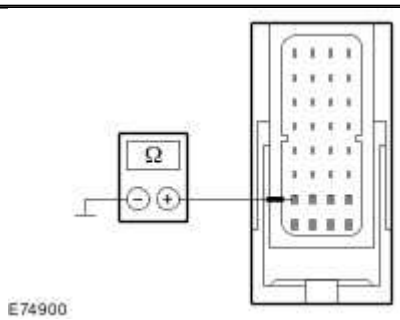
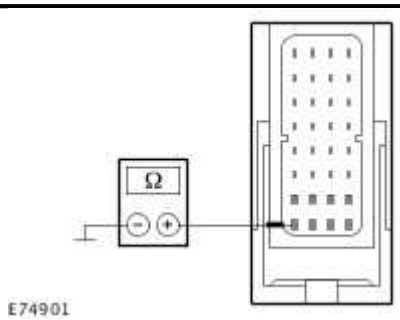
	circuit between the PCM and the EJB with the aid of the wiring diagrams. CHECK the operation of the system.
AG38: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Disconnect Connector C1E104-D from the PCM.
	2 Disconnect Connector C1E104-F from the PCM.
 E74897	**3** Measure the resistance between the PCM, connector C1E104-E, pin M4, circuit GD120BM (BK/GN), wiring harness side and ground.
 E74898	**4** Measure the resistance between the PCM, connector C1E104-E, pin F4, circuit GD120AK (BK/GN), wiring harness side and ground.
 E74899	**5** Measure the resistance between the PCM, connector C1E104-E, pin B3, circuit GD120AJ (BK/GN), wiring harness side and ground.
 E74900	**6** Measure the resistance between the PCM, connector C1E104-D, pin G1, circuit GD120AH (BK/GN), wiring harness side and ground.
 E74901	**7** Measure the resistance between the PCM, connector C1E104-F, pin H1, circuit GD120BN (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes**

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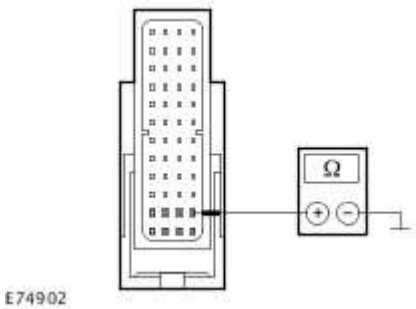
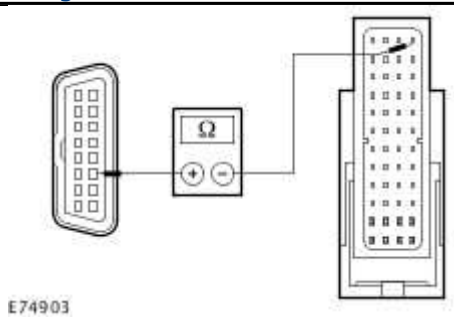
	GO to AG39. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP185 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP185 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG39: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Measure the resistance between the PCM, connector C1E104-E, pin L4, circuit GD120BL (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG40. **No** LOCATE and REPAIR the open circuit between the PCM and ground connection G1D108B using the Wiring Diagrams. CHECK the operation of the system.
AG40: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E104-E, pin A4, circuit VDB04AH (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG41. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AG41: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	

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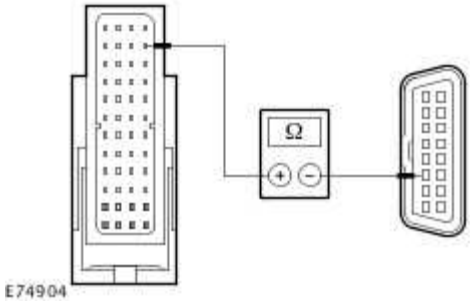
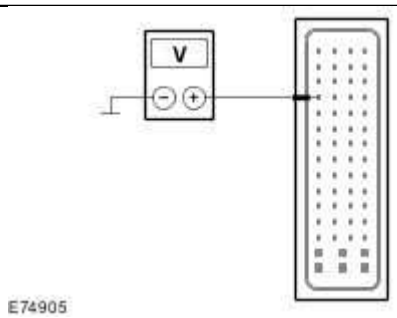
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the PCM, connector C1E104-E, pin B4, circuit VDB05AL (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AG42: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E108-B from the PCM.
	2 Measure the voltage between the PCM, connector C1E108-B, pin 16, circuit SBB10A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG46. **No** GO to AG43.
AG43: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C4BR03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-B, pin 16, circuit SBB10A (YE/RD), wiring harness side and the EJB, connector C1BB03-A, pin 26, circuit SBB10A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBB10A (YE/RD) between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG44: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position II.

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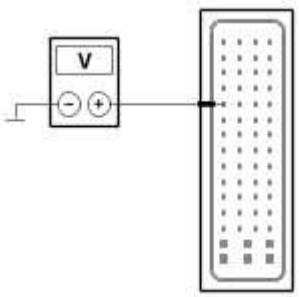
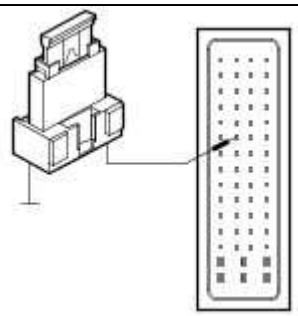
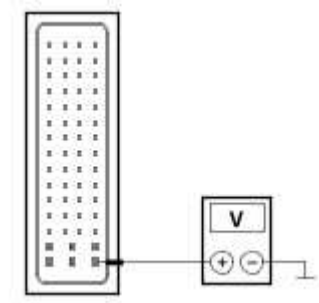
 E74906	2 Measure the voltage between the PCM, connector C1E108-B, pin 15, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG46. **No** GO to AG45.
AG45: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E108-B, pin 15, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG46: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.
 E74907	2 Use a fused test lead (1 A) at the PCM to bridge connector C1E108-B, pin 27, circuit CE302A (YE/BU), wiring harness side and ground.
 E74908	3 Measure the voltage between the PCM, connector C1E108-B, pin 5, circuit CBB08A (GY/YE), wiring harness side and ground.
	4 Measure the voltage between the PCM, connector C1E108-B, pin 3, circuit CBB08B (GY/YE), wiring harness side and ground.

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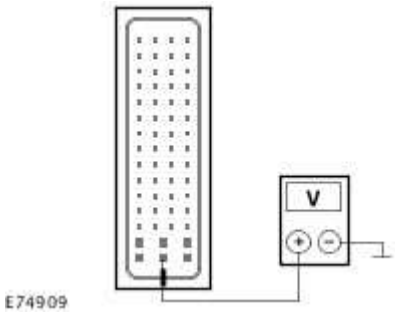
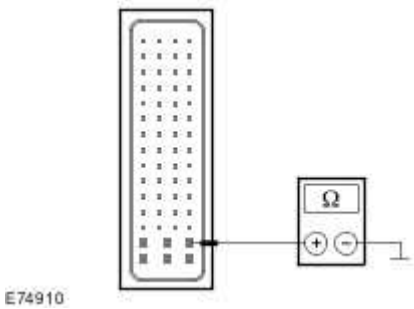
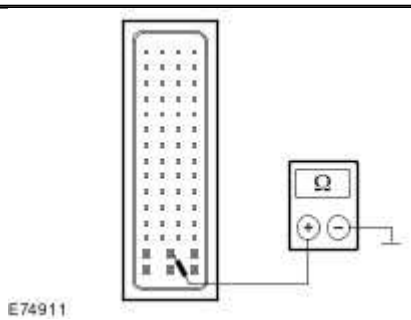
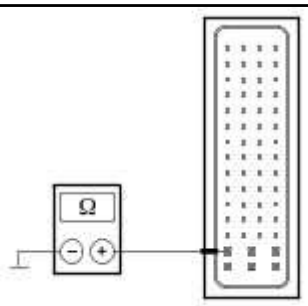
	
	Is battery voltage measured in all cases? **Yes** GO to AG47. **No** LOCATE and REPAIR the break in the relevant circuit between the PCM and the EJB with the aid of the wiring diagrams. CHECK the operation of the system.
AG47: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Measure the resistance between the PCM, connector C1E108-B, pin 6, circuit GD120AP (BK/GN), wiring harness side and ground.
	2 Measure the resistance between the PCM, connector C1E108-B, pin 4, circuit GD120U (BK/GN), wiring harness side and ground.
	3 Measure the resistance between the PCM, connector C1E108-B, pin 2, circuit GD120T (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG48. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP803 using the Wiring Diagrams. CHECK the operation of the system.

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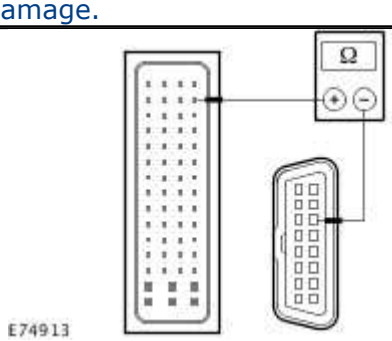
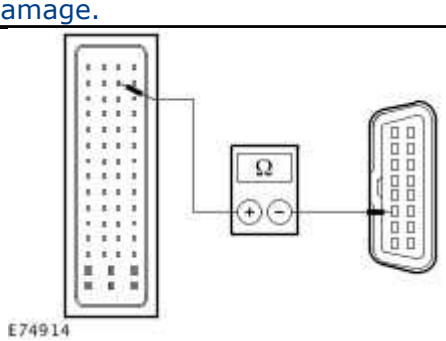
	- If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP803 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG48: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-B, pin 57, circuit VDB04AK (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG49. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AG49: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-B, pin 44, circuit VDB05A (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AG50: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E108-J from the PCM.
	2 Measure the voltage between the PCM, connector C1E108-J, pin G4, circuit SBB10C (YE/RD), wiring harness side and ground.

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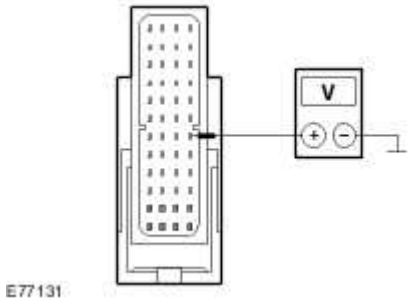	
	Does the meter display battery voltage? **Yes** GO to AG52. **No** GO to AG51.
AG51: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-J, pin G4, circuit SBB10C (YE/RD), wiring harness side and the EJB, connector C1BB03-A, pin 26, circuit SBB10B (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG52: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position II.
	2 Measure the voltage between the PCM, connector C1E108-J, pin C3, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG54. **No** GO to AG53.
AG53: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E108-J, pin C3, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

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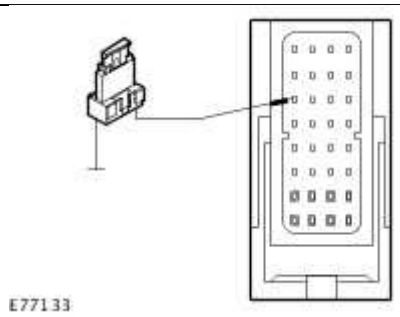
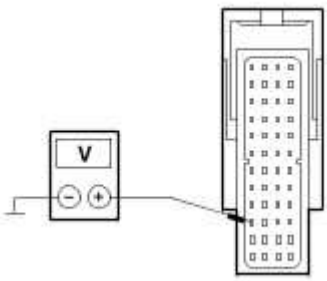
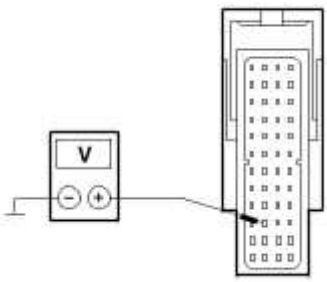
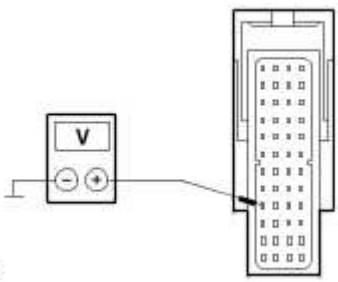
AG54: CHECK THE VOLTAGE AT THE PCM

	1 Ignition switch in position 0.
	2 Disconnect Connector C1E108-L from the PCM.
	3 Disconnect Connector C1E108-K from the PCM.
 E77133	4 Use a fused test lead (1 A) at the PCM to bridge connector C1E108-K, pin C1, circuit CE302B (YE/BU), wiring harness side and ground.
 E77191	5 Measure the voltage between the PCM, connector C1E108-L, pin K1, circuit CBB08D (GY/YE), wiring harness side and ground.
 E77192	6 Measure the voltage between the PCM, connector C1E108-L, pin K2, circuit CBB08C (GY/YE), wiring harness side and ground.
 E77193	7 Measure the voltage between the PCM, connector C1E108-L, pin J1, circuit CBB08E (GY/YE), wiring harness side and ground.
	Is battery voltage measured in all cases? **Yes** GO to AG56. **No** - If no voltage is measured during a measurement:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP482 using the Wiring Diagrams. CHECK the operation of the system. - If battery voltage is not measured during all measurements:GO to AG55.

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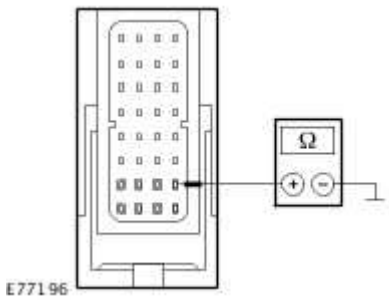
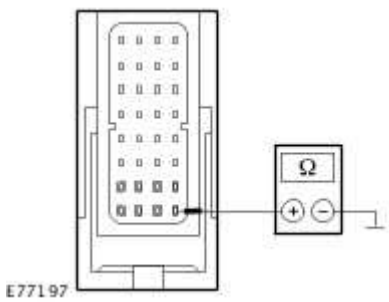
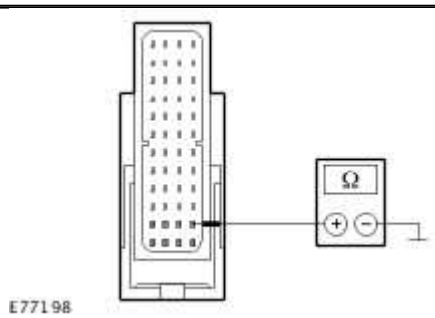
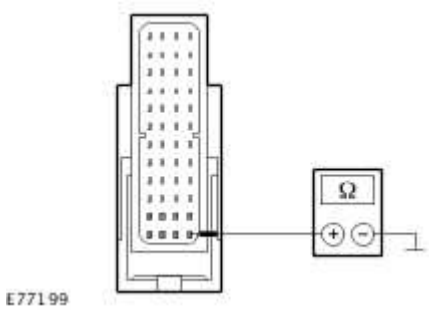
AG55: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-L, pin J1, circuit CBB08E (GY/YE), wiring harness side and the EJB, connector C1BB03-A, pin 16, circuit CBB08A (GY/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP482 and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG56: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Measure the resistance between the PCM, connector C1E108-K, pin G4, circuit GD120AD (BK/GN), wiring harness side and ground.
	2 Measure the resistance between the PCM, connector C1E108-K, pin H4, circuit GD120Y (BK/GN), wiring harness side and ground.
	3 Measure the resistance between the PCM, connector C1E108-J, pin L4, circuit GD120W (BK/GN), wiring harness side and ground.
	4 Measure the resistance between the PCM, connector C1E108-J, pin M4, circuit GD120AE (BK/GN), wiring harness side and ground.
	5 Measure the resistance between the PCM, connector C1E108-L, pin J2, circuit GD120AC

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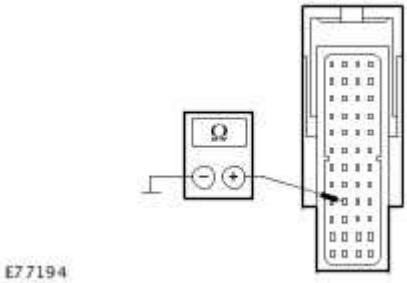
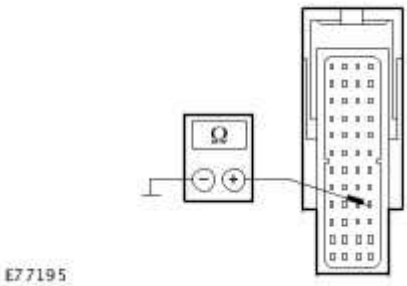
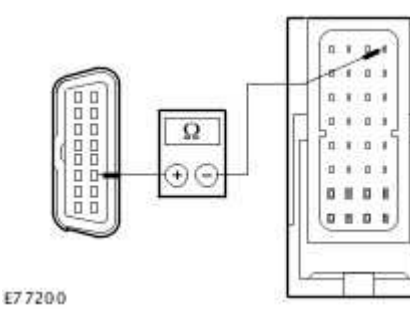
	(BK/GN), wiring harness side and ground.
	6 Measure the resistance between the PCM, connector C1E108-L, pin K4, circuit GD120AA (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG57. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP190 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP190 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG57: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-K, pin A4, circuit VDB04AE (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG58.

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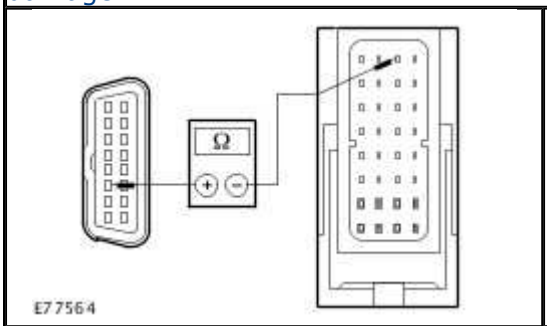
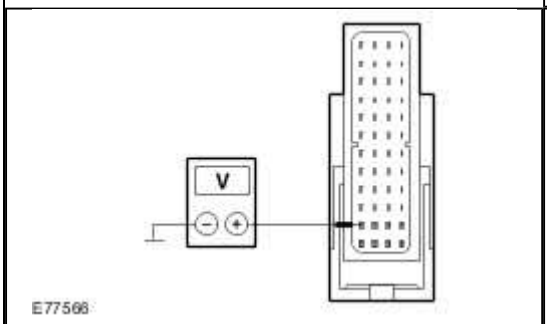
	No LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AG58: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-K, pin A3, circuit VDB05AH (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AG59: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E104-H from the PCM.
	2 Measure the voltage between the PCM, connector C1E104-H, pin L1, circuit SBB10A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG61. **No** GO to AG60.
AG60: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E104-H, pin L1, circuit SBB10A (YE/RD), wiring harness side and the EJB, connector C1BB03-A, pin 26, circuit SBB10B (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the

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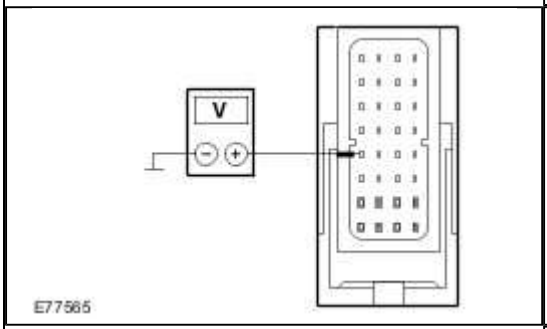
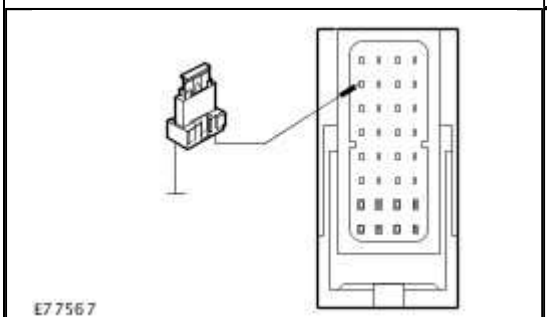
	Wiring Diagrams. CHECK the operation of the system.
AG61: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E104-G from the PCM.
	2 Ignition switch in position II.
	3 Measure the voltage between the PCM, connector C1E108-G, pin E1, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG63. **No** GO to AG62.
AG62: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E104-G, pin E1, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG63: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E104-J from the PCM.
	3 Use a fused test lead (1 A) at the PCM to bridge connector C1E104-G, pin B1, circuit CE302A (YE/BU), wiring harness side and ground.
	4 Measure the voltage between the PCM, connector C1E104-J, pin G1, circuit CBB08A (GY/YE), wiring harness side and ground.

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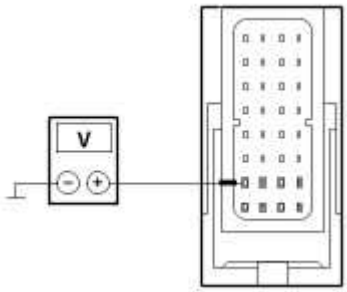
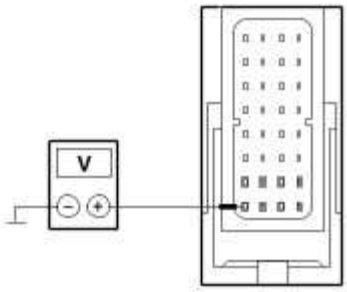
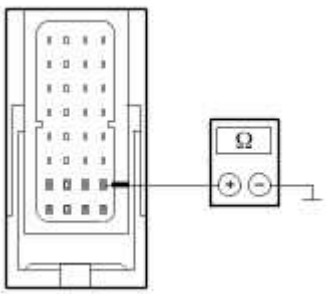
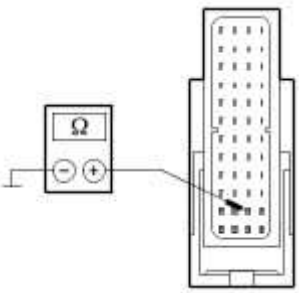
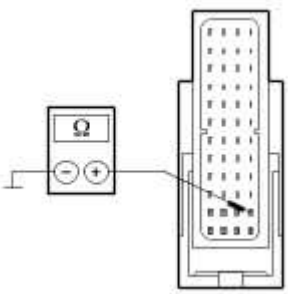
 E77568	
 E77569	**5** Measure the voltage between the PCM, connector C1E104-J, pin H1, circuit CBB08B (GY/YE), wiring harness side and ground.
	Is battery voltage measured in all cases? **Yes** GO to AG64. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG64: CHECK THE GROUND CONNECTION OF THE PCM	
 E77570	**1** Measure the resistance between the PCM, connector C1E104-J, pin G4, circuit GD120K (BK/GN), wiring harness side and ground.
 E77571	**2** Measure the resistance between the PCM, connector C1E104-H, pin L3, circuit GD120J (BK/GN), wiring harness side and ground.
 E77572	**3** Measure the resistance between the PCM, connector C1E104-H, pin L4, circuit GD120H (BK/GN), wiring harness side and ground.

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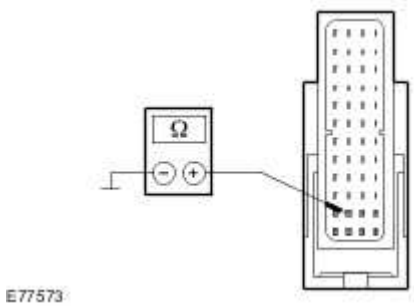
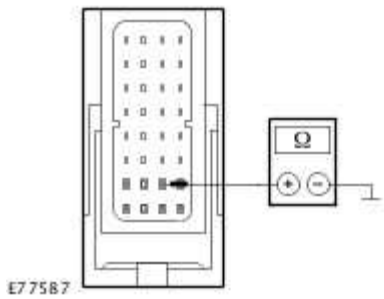
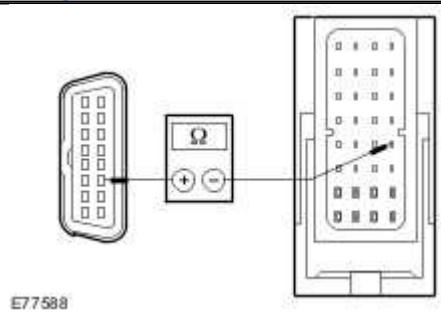
	4 Measure the resistance between the PCM, connector C1E104-H, pin L2, circuit GD120M (BK/GN), wiring harness side and ground.
	5 Measure the resistance between the PCM, connector C1E104-J, pin G3, circuit GD120L (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG65. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP918 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP918 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.

AG65: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the PCM, connector C1E104-J, pin D4, circuit VDB04AX (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG66. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams.

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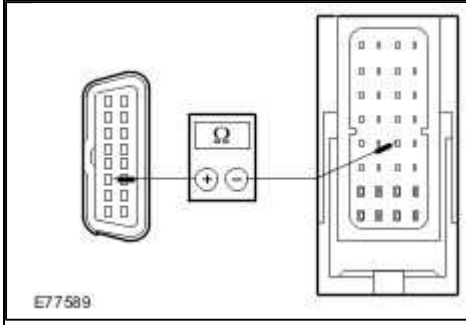
	CHECK the operation of the system.
AG66: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E104-J, pin E3, circuit VDB05BA (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AG67: CHECK THE VOLTAGE AT THE PCM	
	1 Disconnect Connector C1E109-B from the PCM.
	2 Measure the voltage between the PCM, connector C1E109-B, pin 16, circuit SBB10A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG69. **No** GO to AG68.
AG68: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E109-B, pin 16, circuit SBB10A (YE/RD), wiring harness side and the EJB, connector C1BB03-A, pin 26, circuit SBB10A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG69: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position II.
	2 Measure the voltage between the PCM, connector C1E109-B, pin 15, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes**

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	GO to AG69. **No** GO to AG70.
AG70: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E109-B, pin 15, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG71: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1E109-B from the PCM.
	3 Use a fused test lead (1 A) at the PCM to bridge connector C1E109-B, pin 27, circuit CE302A (YE/BU), wiring harness side and ground.
	4 Measure the voltage between the PCM, connector C1E109-A, pin 73, circuit CBB08A (GY/YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG73. **No** GO to AG72.
AG72: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the PCM, connector C1E109-A, pin 73, circuit CBB08A (GY/YE), wiring harness side and the EJB, connector C1BB03-A, pin 16, circuit CBB08A (GY/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG73: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Measure the resistance between the PCM, connector C1E109-B, pin 2, circuit GD120T (BK/GN), wiring harness side and ground.
	2 Measure the resistance between the PCM, connector C1E109-B, pin 4, circuit GD120U (BK/GN), wiring harness side and ground.
	3 Measure the resistance between the PCM,

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	connector C1E109-B, pin 6, circuit GD120AP (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG74. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP803 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP803 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG74: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E109-B, pin 54, circuit VDB04BC (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG75. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AG75: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E109-B, pin 41, circuit VDB05BC (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AG76: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.

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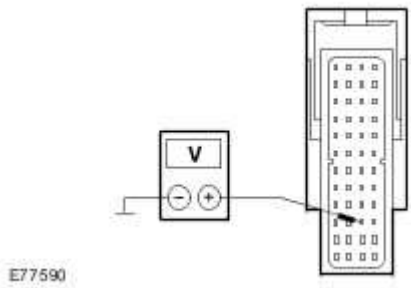
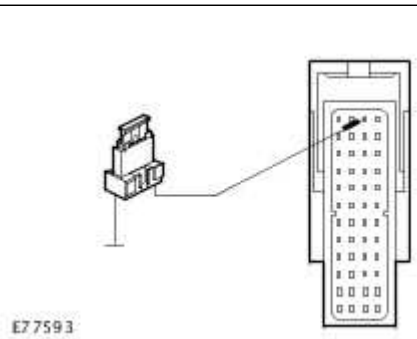
	2 Disconnect Connector C1E108-H from the PCM.
	3 Ignition switch in position II.
	4 Measure the voltage between the PCM, connector C1E108-H, pin K3, circuit CBB42A (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AG78. **No** GO to AG77.
AG77: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB01-A from the EJB.
	3 Measure the resistance between the PCM, connector C1E108-H, pin K3, circuit CBB42A (GN), wiring harness side and the EJB, connector C1BB01-A, pin 99, circuit CBB42B (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the PCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG78: CHECK THE VOLTAGE AT THE PCM	
	1 Ignition switch in position 0.
	2 Use a fused test lead (1 A) at the PCM to bridge connector C1E108-H, pin A3, circuit CE302A (YE/BU), wiring harness side and ground.
	3 Measure the voltage between the PCM, connector C1E108-H, pin L3, circuit CBB08H (GY/YE), wiring harness side and ground.

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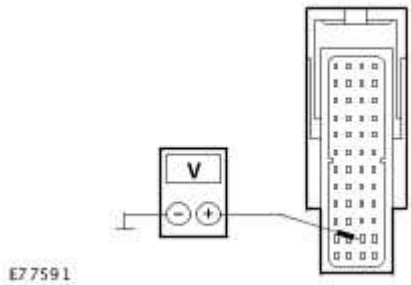	
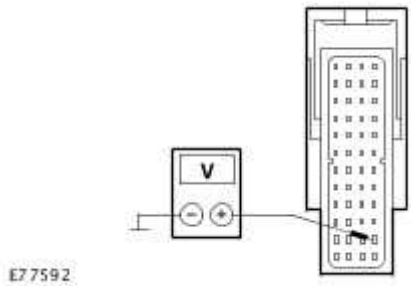	4 Measure the voltage between the PCM, connector C1E108-H, pin L4, circuit CBB08J (GY/YE), wiring harness side and ground.
	Is battery voltage measured in all cases? **Yes** GO to AG80. **No** - If no voltage is measured during a measurement:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP847 using the Wiring Diagrams. CHECK the operation of the system. - If battery voltage is not measured during all measurements:GO to AG79.
AG79: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE EJB	
	1 Disconnect Connector C1BB03A from the EJB.
	2 Measure the resistance between the PCM, connector C1E108-H, pin L4, circuit CBB08J (GY/YE), wiring harness side and the EJB, connector C1BB03-A, pin 16, circuit CBB08G (GY/YE), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between soldered connection SP847 and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG80: CHECK THE GROUND CONNECTION OF THE PCM	
	1 Measure the resistance between the PCM, connector C1E108-H, pin L1, circuit GD120D (BK/GN), wiring harness side and ground.

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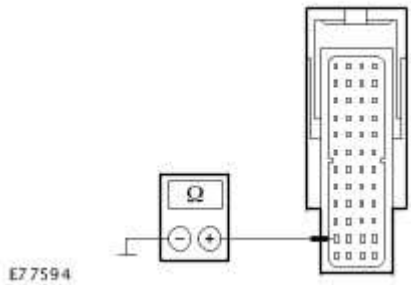
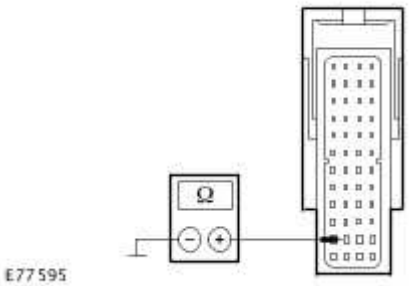
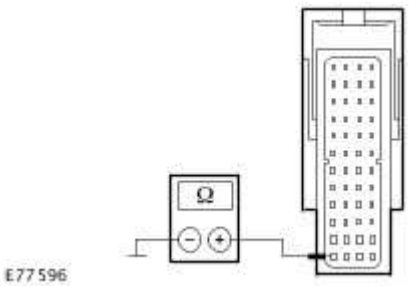
	
	**2** Measure the resistance between the PCM, connector C1E108-H, pin L2, circuit GD120B (BK/GN), wiring harness side and ground.
	**3** Measure the resistance between the PCM, connector C1E108-H, pin M1, circuit GD120C (BK/GN), wiring harness side and ground.
	Is a resistance of less than 2 Ohms measured in all of the cases? **Yes** GO to AG81. **No** - If a resistance of more than 2 Ohms is measured in one of the measurements:LOCATE and REPAIR the break in the relevant circuit between the PCM and soldered connection SP302 using the Wiring Diagrams. CHECK the operation of the system. - If a resistance of more than 2 Ohms is measured in all of the measurements:LOCATE and RECTIFY the open circuit in the corresponding circuit between soldered connection SP302 and ground connection G1D108D with the aid of the Wiring Diagrams. CHECK the operation of the system.
AG81: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM,

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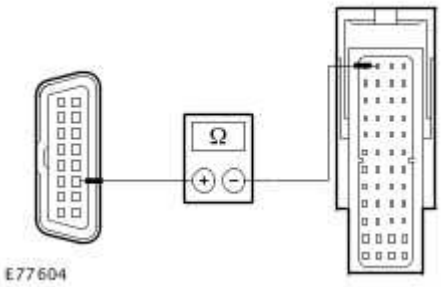
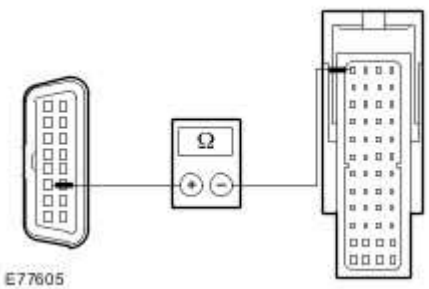
	connector C1E108-H, pin A2, circuit VDB04AV (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AG82. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AG82: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the PCM, connector C1E108-H, pin A1, circuit VDB05AW (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.

PINPOINT TEST AH : INSTRUMENT CLUSTER NOT COMMUNICATING WITH THE FORD APPROVED DIAGNOSTIC TOOL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AH1: CHECK COMMUNICATIONS WITH THE GENERIC ELECTRONIC MODULE (GEM)	
	1 Ignition switch in position 0.
	2 Connect the diagnostic tool.
	3 Select the generic electronic module (GEM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** GO to AH2. **No** GO to Pinpoint Test AF.

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AH2: CHECK FUSE F8

	1 Ignition switch in position 0.
	2 CHECK Fuse F8 (CJB).
	Is the fuse OK? **Yes** GO to AH3. **No** RENEW fuse F8 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.

AH3: CHECK THE VOLTAGE AT FUSE F8

	1 Connect Fuse F8 (CJB).
	2 Measure the voltage between fuse F8 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AH4. **No** REPAIR the voltage supply to fuse F8 with the aid of the Wiring Diagrams. CHECK the operation of the system.

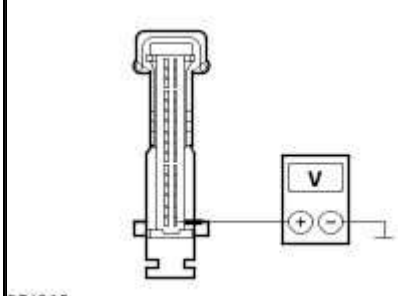
AH4: CHECK FUSE F4

	1 CHECK Fuse F4 (CJB).
	Is the fuse OK? **Yes** GO to AH5. **No** RENEW fuse F4 (7.5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.

AH5: CHECK THE VOLTAGE AT FUSE F4

	1 Connect Fuse F4 (CJB).
	2 Ignition switch in position II.
	3 Measure the voltage between fuse F4 (7.5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AH6. **No** REPAIR the voltage supply to fuse F4 with the aid of the Wiring Diagrams. CHECK the operation of the system.

AH6: CHECK THE VOLTAGE AT THE ICL

	1 Ignition switch in position 0.
	2 Disconnect Connector C2MC01 from the instrument cluster.
	3 Measure the voltage between the instrument cluster, connector C2MC01, pin 32, circuit SBP08A (VT/RD), wiring harness side and ground.
	Does the meter display battery voltage?

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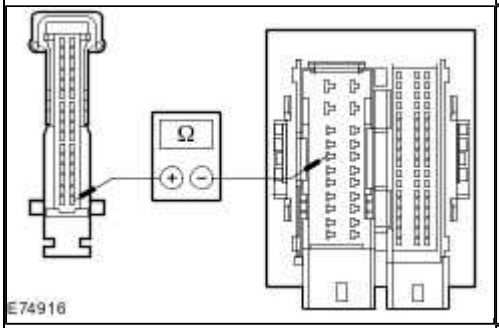
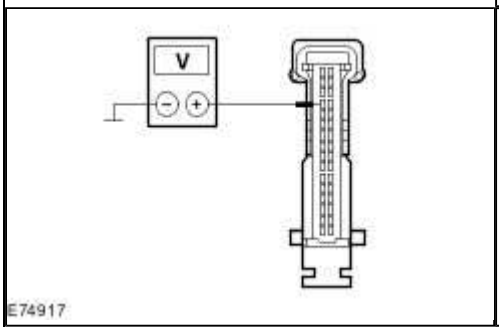
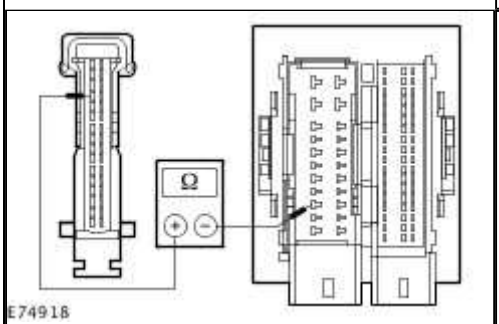
	Yes GO to AH8. **No** GO to AH7.
AH7: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE INSTRUMENT CLUSTER	
	1 Disconnect Connector C1BP02-C from the CJB.
	2 Measure the resistance between the CJB, connector C1BP02-C, pin 72, circuit SBP08A (VT/RD), wiring harness side and the instrument cluster, connector C2MC01, pin 32, circuit SBP08A (VT/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP08A (VT/RD) between the instrument cluster and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AH8: CHECK THE VOLTAGE AT THE ICL	
	1 Ignition switch in position II.
	2 Measure the voltage between the instrument cluster, connector C2MC01, pin 4, circuit CBP04X (VT), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AH10. **No** GO to AH9.
AH9: CHECK FOR OPEN CIRCUIT BETWEEN THE CJB AND THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0. 2 Disconnect Connector C1BP02-C from the CJB.
	3 Measure the resistance between the CJB, connector C1BP02-C, pin 68, circuit CBP04T (VT), wiring harness side and the instrument cluster, connector C2MC01, pin 4, circuit CBP04X (VT), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the

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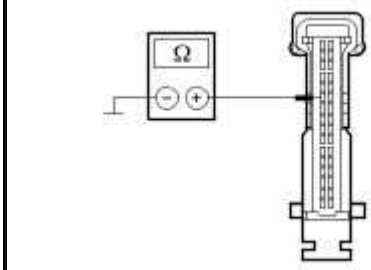
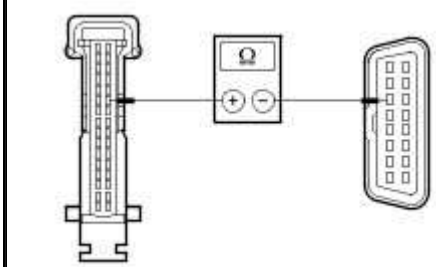
	operation of the system. **No** LOCATE and REPAIR the break in the circuit between the instrument cluster and the CJB using the Wiring Diagrams. CHECK the operation of the system.
AH10: CHECK THE GROUND CONNECTION OF THE INSTRUMENT CLUSTER	
	1 Ignition switch in position 0.
 E74919	2 Measure the resistance between the instrument cluster, connector C2MC01, pin 6, circuit GD138AP (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AH11. **No** LOCATE and REPAIR the open circuit between the instrument cluster and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AH11: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MS CAN BUS)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
 E74920	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 22, circuit VDB07A (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB7D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AH12. **No** LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AH12: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MS CAN BUS)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 23, circuit VDB06A (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB6X (GY/OG), wiring harness side.

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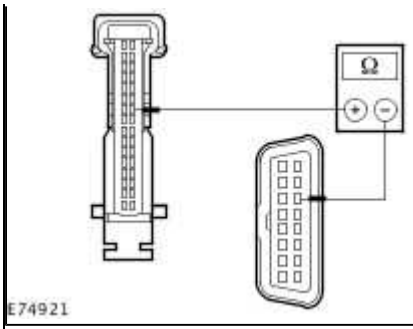


Is a resistance of less than 2 Ohms registered?

Yes

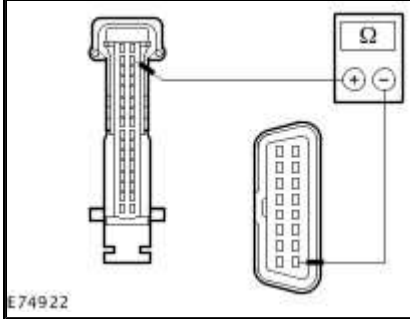
GO to AH13.

No

LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AH13: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MM CAN BUS)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the instrument cluster, connector C2MC01, pin 18, circuit VDB14X (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

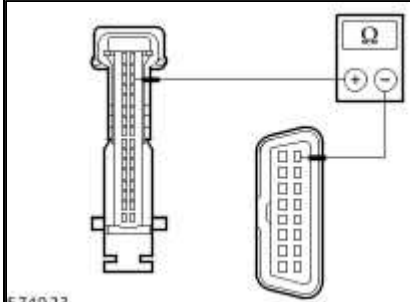
GO to AH14.

No

LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AH14: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MM CAN BUS)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the instrument cluster, connector C2MC01, pin 19, circuit VDB13X (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to AH15.

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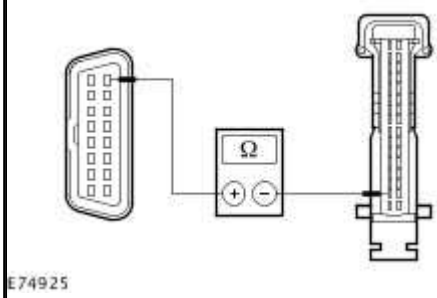
	No LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.

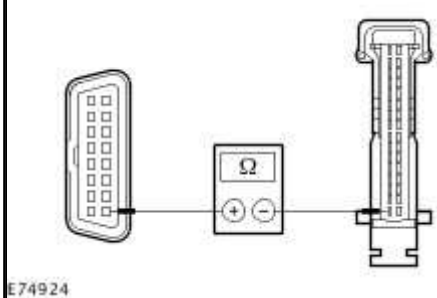
AH15: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MM CAN BUS)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 15, circuit VDB14L (VT/GY) (vehicles with CD changer: circuit VDB14M (VT/GY)), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AH16. **No** LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AH16: CHECK THE CIRCUIT BETWEEN THE INSTRUMENT CLUSTER AND THE DLC FOR OPEN CIRCUIT (MM CAN BUS)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 16, circuit VDB13L (BU/GY) (vehicles with CD changer: circuit VDB13M (BU/GY)), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the instrument cluster. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AI : TRANSMISSION CONTROL MODULE (TCM) NOT COMMUNICATING WITH FORD APPROVED DIAGNOSTIC TOOL - VEHICLES WITH AUTOMATIC CLUTCH AND GEARSHIFT ACTUATION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AI1: DETERMINE THE CONDITIONS UNDER WHICH THE FAULT OCCURS	

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	1 Ignition switch in position 0. 2 Connect the diagnostic tool. 3 Select the powertrain control module (PCM) with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** GO to AI2. **No** GO to Pinpoint Test AG.
AI2: CHECK FUSE F1	
	1 Ignition switch in position 0. 2 CHECK Fuse F1 (EJB).
	Is the fuse OK? **Yes** GO to AI3. **No** RENEW fuse F1 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AI3: CHECK THE VOLTAGE AT FUSE F1	
	1 Connect Fuse F1 (EJB). 2 Measure the voltage between fuse F1 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AI4. **No** REPAIR the voltage supply to fuse F1 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AI4: CHECK FUSE F42	
	1 CHECK Fuse F42 (EJB).
	Is the fuse OK? **Yes** GO to AI5. **No** RENEW fuse F42 (10 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AI5: CHECK THE VOLTAGE AT FUSE F42	
	1 Connect Fuse F42 (EJB). 2 Ignition switch in position II. 3 Measure the voltage between fuse F42 (10 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AI6. **No** REPAIR the voltage supply to fuse F42 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AI6: CHECK VOLTAGE AT TCM	
	1 Ignition switch in position 0. 2 Disconnect Connector C1ET34 from the TCM. 3 Measure the voltage between the TCM, connector C1ET34, pin 1, circuit CBB01A (BU), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AI8. **No** GO to AI7.
AI7: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE TCM	

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	1 Disconnect Connector C1BB03-A from the EJB.
	2 Measure the resistance between the EJB, connector C1BB03-A, pin 12, circuit CBB01A (BU), wiring harness side and the TCM, connector C1ET34, pin 1, circuit CBB01A (BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit CBB01A (BU) between the TCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AI8: CHECK VOLTAGE AT TCM	
	1 Ignition switch in position II.
	2 Measure the voltage between the TCM, connector C1ET34, pin 11, circuit CBB42D (GN), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AI10. **No** GO to AI9.
AI9: CHECK FOR OPEN CIRCUIT BETWEEN THE EJB AND THE TCM	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BB03A from the CJB.
	3 Measure the resistance between the EJB, connector C1BB03A, pin 99, circuit CBB42B (GN), wiring harness side and the TCM, connector C1ET34, pin 11, circuit CBB42D (GN), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the EJB. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the TCM and the EJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AI10: CHECK GROUND CONNECTION OF TCM	
	1 Ignition switch in position 0.
	2 Measure the resistance between the TCM, connector C1ET34, pin 9, circuit GD120T (BK/GN) (vehicles with IS6 engine: circuit GD120V (BK/GN)), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AI11. **No** Vehicles with DW12 engine:LOCATE and REPAIR the break in circuit GD120T (BK/GN) between the TCM and ground connection G1D108B with the aid of the Wiring Diagrams. CHECK the operation of the system. Vehicles with DW10 I4 engine:LOCATE and REPAIR the open circuit between the TCM and ground connection G1D108D using the Wiring Diagrams. CHECK the operation of the system. Vehicles with SI6 engine:LOCATE and REPAIR the break in circuit GD120V (BK/GN) between the TCM and ground connection G1D108B with the aid of the Wiring Diagrams. CHECK the operation of the system.
AI11: CHECK FOR OPEN CIRCUIT BETWEEN THE TCM AND THE DLC.	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PTCM, connector C1ET34, pin 14,

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	circuit VDB04BB (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AI12. **No** LOCATE and REPAIR the break in the circuit between the TCM and soldered connection SP329 with the aid of the Wiring Diagrams. CHECK the operation of the system.

AI12: CHECK FOR OPEN CIRCUIT BETWEEN THE TCM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the TCM, connector C1ET34, pin 6, circuit VDB05BB (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the TCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the TCM and soldered connection SP332 with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AJ : FAULTY COMMUNICATION BETWEEN THE MODULES - MS CAN BUS

CAUTION: The measurements below may only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

NOTE: Failure of the complete MS CAN bus system can be caused by incorrectly engaged wiring harness connectors at the CJB or in the A-pillar area. Ensure correct locking of wiring harness connector.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AJ1: CHECK FUSE F26	
	1 Ignition switch in position 0.
	2 CHECK Fuse F26 (CJB).
	Is the fuse OK? **Yes** GO to AJ2. **No** RENEW fuse F26 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AJ2: CHECK THE VOLTAGE AT FUSE F26	
	1 Connect Fuse F26 (CJB).
	2 Measure the voltage between fuse F26 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AJ3. **No** REPAIR the voltage supply to fuse F26 with the aid of the Wiring Diagrams. CHECK the operation of the system.

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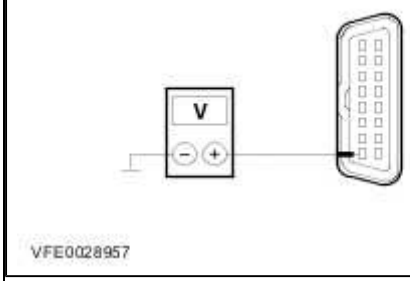
AJ3: CHECK THE VOLTAGE AT THE DATA LINK CONNECTOR (DLC)



1 Measure the voltage between the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side and ground.

Does the meter display battery voltage?

Yes

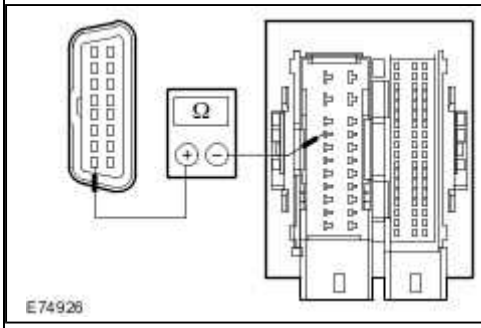
GO to AJ5.

No

GO to AJ4.

AJ4: CHECK THE CIRCUIT BETWEEN THE CJB AND THE DLC FOR CONTINUITY.

1 Disconnect Connector C1BP02-C from the CJB.



2 Measure the resistance between the CJB, connector C1BP02-C, pin 73, circuit SBP26A (YE/RD), wiring harness side and the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side.

Is a resistance of less than 2 Ohms registered?

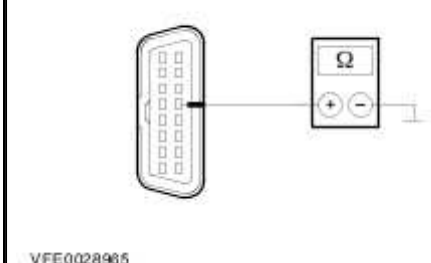
Yes

CHECK the CJB and RENEW as necessary. CHECK the operation of the system.

No

LOCATE and RECTIFY the break in circuit SBP26A (YE/RD) between the DLC and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.

AJ5: CHECK THE GROUND CONNECTION OF THE DLC - PIN 4



1 Measure the resistance between the DLC, connector C3DB04, pin 4, circuit GD138AS (BK/WH), wiring harness side and ground.

Is a resistance of less than 2 Ohms registered?

Yes

GO to AJ6.

No

LOCATE and REPAIR the open circuit between the DLC and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.

AJ6: CHECK THE GROUND CONNECTION OF THE DLC - PIN 5

1 Measure the resistance between the DLC,

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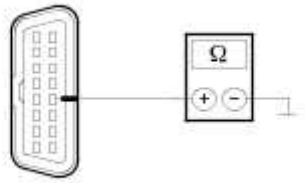
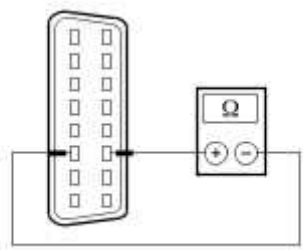
 VFE0028964	connector C3DB04, pin 5, circuit GD133BG (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AJ7. **No** LOCATE and REPAIR the break in circuit GD133BG (BK) between the DLC and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AJ7: CHECK THE MS CAN BUS FOR SHORT CIRCUIT	
	1 Disconnect the ground cable from the battery.
 E45952	2 Measure the resistance between the DLC, connector C3DB04, between pin 3, circuit VDB06X (GY/OG), wiring harness side and pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of between 55 and 65 Ohm measured? **Yes** GO to AJ8. **No** If a resistance between 115 and 120 Ohms is measured:GO to AJ12. If no resistance between 115 and 120 Ohms is measured:GO to AJ17.
AJ8: PERFORM NETWORK TEST (RESTRAINTS CONTROL MODULE (RCM))	
WARNINGS: The backup power supply must be depleted to prevent the risk of accidental airbag deployment. After disconnecting the battery, wait at least 1 minute before starting work on the supplemental restraint system (SRS). Failure to follow this instruction may result in personal injury.	
In order to prevent the risk of accidental deployment, do not program any keycodes while working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.	
Never use terminal probes to test any connectors of the airbag systems or of any other safety restraint systems. Failure to follow this instruction may result in personal injury.	
NOTE: After connecting the battery, initialize the power window motors.	
	1 Disconnect Connector C2R114-A the from restraints control module. 2 Connect ground cable from battery.

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	3 Connect the diagnostic tool.
	4 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** CHECK and if necessary RENEW the safety restraint control module. CHECK the operation of the system. **No** GO to AJ9.
AJ9: PERFORM NETWORK TEST	
NOTE: The number of modules connected to the MS CAN bus depends on the equipment levels of the vehicle. Therefore not every vehicle will have all the modules mentioned below.	
	1 Ignition switch in position 0.
	2 Disconnect a listed component, then proceed with the following test step: • Electronic automatic temperature control (EATC) module: C2H101 • Parking aid module: C4MP01-A • Trailer coupling module: C4AT23-C • Auxiliary climate control module: C3H101-A • Fuel fired booster heater /programmable fuel fired booster heater: C1HF01C • Keyless vehicle module: C2PK28-D • Passenger side door module: C6PL01-B • Driver's side door module: C5PL01-B • Electronic instrument cluster: C2MC01
	3 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** The component last disconnected is the cause of the concern; CHECK and if necessary RENEW the component. CHECK the operation of the system. **No** - If not all the listed components are disconnected:DISCONNECT the next component (go to test step 1). - If all the listed components are disconnected:GO to AJ10.
AJ10: CHECK THE MS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-A from the GEM.
	3 Ignition switch in position II.

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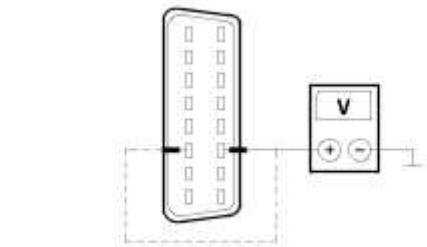
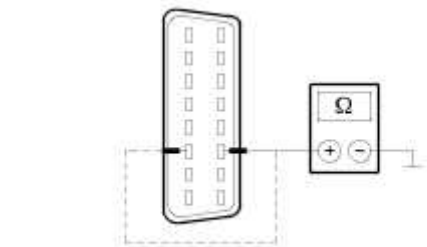
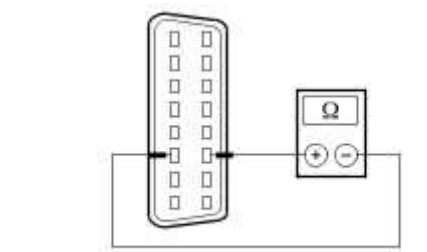
 VFE0038146	**4** Measure the voltage between the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side and ground.
	5 Measure the voltage between the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection SP292 using the Wiring Diagrams. CHECK the operation of the system. **No** GO to AJ11.
AJ11: CHECK THE MS CAN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
 VFE0038147	**2** Measure the resistance between the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side and ground.
	3 Measure the resistance between the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AJ12. **No** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection SP292 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AJ12: CHECK THE MS CAN BUS FOR SHORT CIRCUIT	
	1 Disconnect Connector C2MC01 from the electronic instrument cluster.
 E45952	**2** Measure the resistance between the DLC, connector C3DB04, between pin 3, circuit VDB06X (GY/OG), wiring harness side and pin 11, circuit VDB07D (VT/OG), wiring harness side.

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	Is a resistance of between 115 and 120 Ohm measured? **Yes** GO to AJ13. **No** GO to AJ15.
AJ13: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DATA LINK CONNECTOR (DLC)	
	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 22, circuit VDB07A (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AJ14. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AJ14: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DLC	
	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 23, circuit VDB06A (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK and if necessary RENEW the electronic instrument cluster. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AJ15: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC	
	1 Disconnect Connector C1BP02-A from the GEM.
	2 Measure the resistance between the GEM, connector C1BP02-A, pin 49, circuit VDB06AC (GY/OG), wiring harness side and the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AJ16. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AJ16: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC	
	1 Measure the resistance between the GEM, connector C1BP02-A, pin 50, circuit VDB07J (VT/OG), wiring harness side and the DLC, connector C3DB04, pin 11, circuit VDB07D (GY/OG), wiring harness side.
	Is a resistance of less than 2 Ohms registered?

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	Yes TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AJ17: PERFORM NETWORK TEST (RESTRAINTS CONTROL MODULE (RCM))	
WARNINGS: The backup power supply must be depleted to prevent the risk of accidental airbag deployment. After disconnecting the battery, wait at least 1 minute before starting work on the supplemental restraint system (SRS). Failure to follow this instruction may result in personal injury.	
In order to prevent the risk of accidental deployment, do not program any keycodes while working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.	
Never use terminal probes to test any connectors of the airbag systems or of any other safety restraint systems. Failure to follow this instruction may result in personal injury.	
NOTE: After connecting the battery, initialize the power window motors.	
	1 Disconnect Connector C2R114-A the from restraints control module.
	2 Connect ground cable from battery.
	3 Connect the diagnostic tool.
	4 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** CHECK and if necessary RENEW the safety restraint control module. CHECK the operation of the system. **No** GO to AJ18.
AJ18: PERFORM NETWORK TEST	
NOTE: The number of modules connected to the MS CAN bus depends on the equipment levels of the vehicle. Therefore not every vehicle will have all the modules mentioned below.	
	1 Disconnect a listed component, then proceed with the following test step: • Electronic automatic temperature control (EATC) module: C2H101 • Parking aid module: C4MP01-A • Trailer coupling module: C4AT23-C • Auxiliary climate control module: C3H101-A • Fuel fired booster heater /programmable fuel fired booster heater: C1HF01-C • Keyless vehicle module: C2PK28-D

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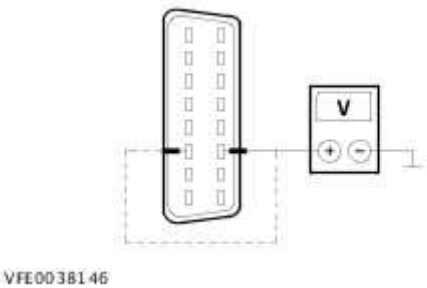
	• Passenger side door module: C6PL01-B • Driver's side door module: C5PL01-B • Electronic instrument cluster: C2MC01
	2 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** The component last disconnected is the cause of the concern; CHECK and if necessary RENEW the component. CHECK the operation of the system. **No** - If not all the listed components are disconnected:DISCONNECT the next component (go to test step 1). - If all the listed components are disconnected:GO to AJ19.
AJ19: CHECK THE MS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position 0.
	2 Disconnect Connector C1BP02-A from the GEM.
	3 Ignition switch in position II.
 VFE0038146	4 Measure the voltage between the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side and ground.
	5 Measure the voltage between the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection SP283 using the Wiring Diagrams. CHECK the operation of the system. **No** GO to AJ20.
AJ20: CHECK THE MS CAN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the DLC, connector C3DB04, pin 3, circuit VDB06X (GY/OG), wiring harness side and ground.

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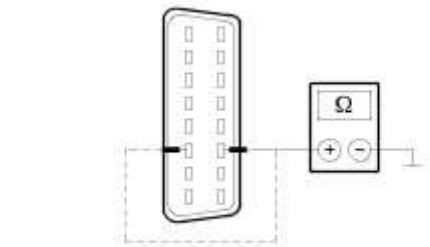

	3 Measure the resistance between the DLC, connector C3DB04, pin 11, circuit VDB07D (VT/OG), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AJ21. **No** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection SP292 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AJ21: CHECK THE MS CAN BUS FOR SHORT CIRCUIT	
	1 Measure the resistance between the DLC, connector C3DB04, between pin 3, circuit VDB06X (GY/OG), wiring harness side and pin 11, circuit VDB07D (VT/OG), wiring harness side.
	Is a resistance greater than 10,000 Ohms measured in both cases? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the short circuit in the MS CAN bus using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AK : FAULTY COMMUNICATION BETWEEN THE MODULES - HS CAN BUS

CAUTION: The measurements below may only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AK1: CHECK FUSE F26	
	1 Ignition switch in position 0.
	2 CHECK Fuse F26 (CJB).
	Is the fuse OK? **Yes** GO to AK2. **No** RENEW fuse F26 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AK2: CHECK THE VOLTAGE AT FUSE F26	
	1 Connect Fuse F26 (CJB).
	2 Measure the voltage between fuse F26 (5 A) and ground.

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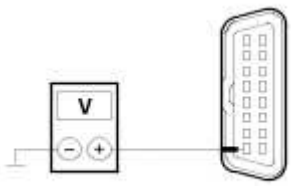
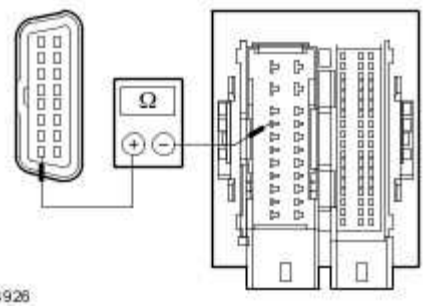
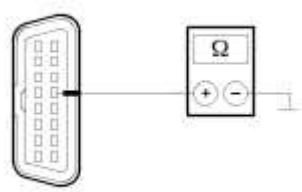
	Does the meter display battery voltage? **Yes** GO to AK3. **No** REPAIR the voltage supply to fuse F26 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK3: CHECK THE VOLTAGE AT THE DATA LINK CONNECTOR (DLC)	
 VFE0028957	1 Measure the voltage between the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** GO to AK5. **No** GO to AK4.
AK4: CHECK THE CIRCUIT BETWEEN THE CJB AND THE DLC FOR CONTINUITY.	
	1 Disconnect Connector C1BP02-C from the CJB.
 E74926	2 Measure the resistance between the CJB, connector C1BP02-C, pin 73, circuit SBP26A (YE/RD), wiring harness side and the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP26A (YE/RD) between the DLC and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK5: CHECK THE GROUND CONNECTION OF THE DLC - PIN 4	
 VFE0028965	1 Measure the resistance between the DLC, connector C3DB04, pin 4, circuit GD138AS (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK6.

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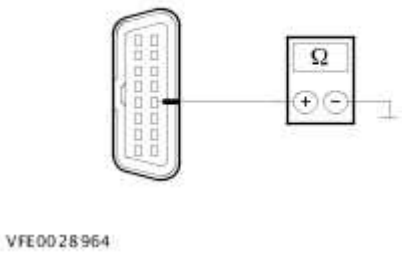
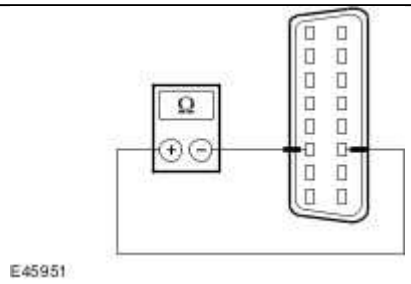
	No LOCATE and REPAIR the open circuit between the DLC and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK6: CHECK THE GROUND CONNECTION OF THE DLC - PIN 5	
	1 Measure the resistance between the DLC, connector C3DB04, pin 5, circuit GD133BG (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK7. **No** LOCATE and REPAIR the break in circuit GD133BG (BK) between the DLC and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK7: CHECK THE HS CAN BUS FOR SHORT CIRCUIT	
	1 Disconnect the ground cable from the battery.
	
	2 Measure the resistance between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of between 55 and 65 Ohm measured? **Yes** GO to AK8. **No** - If a resistance of between 115 and 125 Ohm is measured:GO to AK13. - If a resistance of between 115 and 125 Ohm is not measured:GO to AK30.
AK8: PERFORM NETWORK TEST	
NOTE: The number of modules connected to the CAN bus depends on the equipment levels of the vehicle. Therefore, not every vehicle will have all the modules mentioned below.	
	1 Connect the ground cable to the battery.
	2 Connect the diagnostic tool.
	3 Disconnect a listed component, then proceed with the following test step: • ESP module: C1CA01

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	• Power steering pump module: C1CS04 • Parking brake module: C4CB01 • Lights control module (LCM): C2LF23-A • Collision warning module: C2FM01 • Steering wheel module: C2LS41 • Shock absorber control module: C4CD01-B • Yaw rate / lateral acceleration sensor: C3CA09 • Transmission control unit (TCM) - vehicles with automatic transmission: C1ET34 • Generic Electronic Module (GEM): C1BP02-C
	4 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the PCM? **Yes** The component last disconnected is the cause of the concern; CHECK and if necessary RENEW the component. CHECK the operation of the system. **No** - If not all the listed components are disconnected:Key in OFF position. DISCONNECT the next component (go to test step 3). - If all the listed components are disconnected:GO to AK9.
AK9: CHECK THE HS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position 0.
	2 Disconnect - Vehicles with a 2.0L diesel engine: Connector C1E108-D from the PCM.
	3 Disconnect - Vehicles with a 2.0L engine: Connector C1E104-E from the PCM.
	4 Disconnect - Vehicles with a 2.5L engine: Connector C1E108-B from the PCM.
	5 Disconnect - Vehicles with a 1.8L diesel engine: Connector C1E108-K from the PCM.
	6 Disconnect - Vehicles with a 1.6L Duratec-16V (Sigma) engine: Connector C1E104-J from the PCM.
	7 Disconnect - Vehicles with a 3.0L Duratec-VE (VE6) engine: Connector C1E109-B from the PCM.
	8 Disconnect - Vehicles with a 2.2L diesel engine: Connector C1E108-H from the PCM.
	9 Ignition switch in position II.

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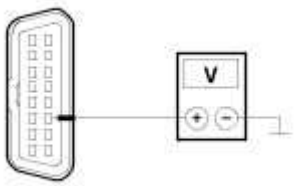
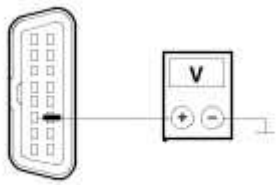


VFE0028970

	10 Measure the voltage between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the PCM and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to AK10.

AK10: CHECK THE HS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY

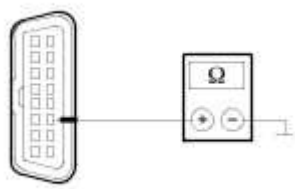


VFE0028962

	1 Measure the voltage between the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the PCM and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to AK11.

AK11: CHECK THE HS CAN BUS FOR A SHORT TO GROUND

	1 Ignition switch in position 0.



VFE0028967

	2 Measure the resistance between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and ground.

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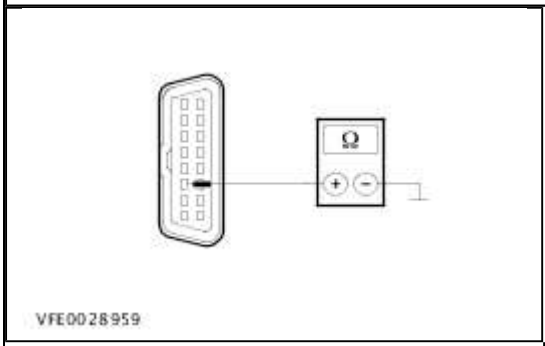
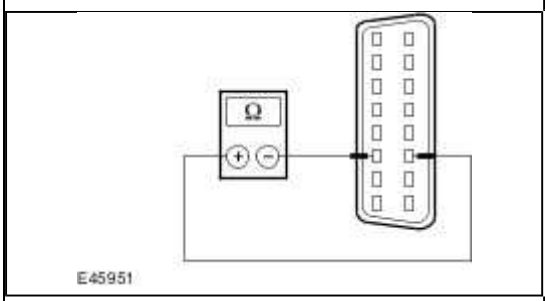
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AK12. **No** LOCATE and REPAIR the short to ground in the circuit between the PCM and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK12: CHECK THE HS CAN BUS FOR A SHORT TO GROUND	
 VFE0028959	
	1 Measure the resistance between the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the short to ground in the circuit between the PCM and the DLC with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK13: CHECK THE GEM	
	1 Disconnect Connector C1BP02-C from the GEM.
 E45951	
	2 Measure the resistance between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of between 115 and 125 Ohm measured? **Yes** GO to AK14. **No** - Vehicles with a 2.0L diesel engine:GO to AK16. - Vehicles with a 2.0L engine:GO to AK18. - Vehicles with a 2.5L engine:GO to AK20. - Vehicles with a 1.8L diesel engine:GO to AK22. - Vehicles with a 1.6L Duratec-16V (Sigma) engine:GO to AK24. - Vehicles with a 3.0L Duratec-VE (VE6) engine:GO to AK26.

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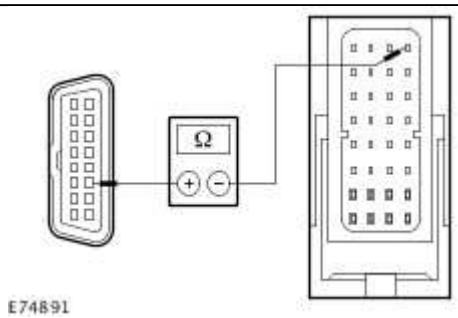
	- Vehicles with a 2.2L diesel engine:GO to AK28.
AK14: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC	
	1 Measure the resistance between the GEM, connector C1BP02-C, pin 48, circuit VDB05AB (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK15. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK15: CHECK FOR OPEN CIRCUIT BETWEEN THE GEM AND THE DLC	
	1 Measure the resistance between the GEM, connector C1BP02-C, pin 47, circuit VDB04Y (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the GEM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK16: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1E108-D from the PCM.
	2 Measure the resistance between the PCM, connector C1E108-D, pin A4, circuit VDB04E (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK17. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK17: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM,

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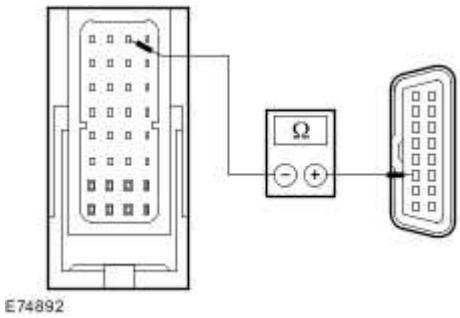
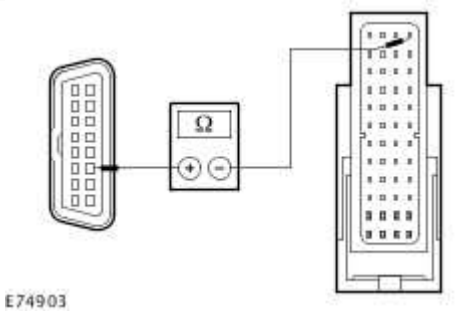
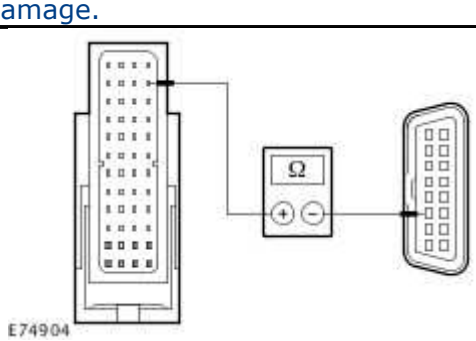
	connector C1E108-D, pin A3, circuit VDB05L (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AK18: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1E104-E from the PCM.
	2 Measure the resistance between the PCM, connector C1E104-E, pin A4, circuit VDB04H (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK19. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK19: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E104-E, pin B4, circuit VDB05AL (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered?

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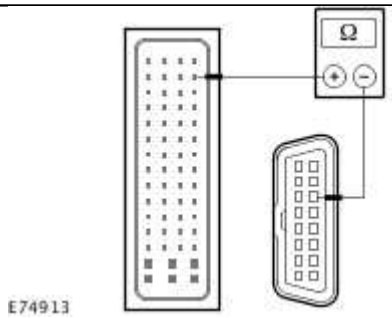
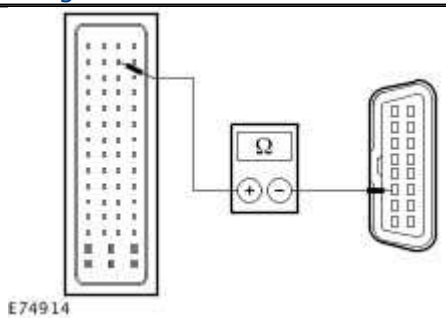
	Yes CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AK20: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1E108-B from the PCM.
	2 Measure the resistance between the PCM, connector C1E108-B, pin 57, circuit VDB04AK (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK21. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK21: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-B, pin 44, circuit VDB05A (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AK22: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	

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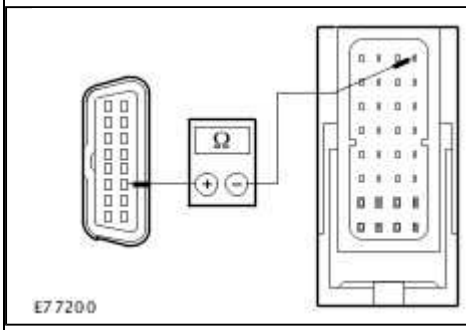
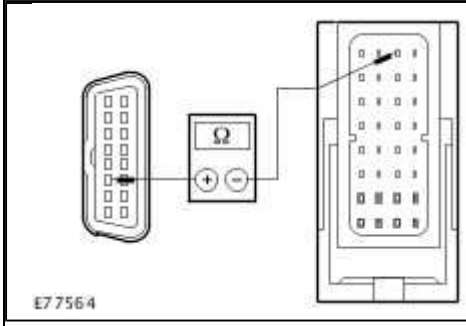
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1E108-K from the PCM.
	2 Measure the resistance between the PCM, connector C1E108-K, pin A4, circuit VDB04AE (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK23. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AK23: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Measure the resistance between the PCM, connector C1E108-K, pin A3, circuit VDB05AH (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.

AK24: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

	1 Disconnect Connector C1E104-J from the PCM.
	2 Measure the resistance between the PCM, connector C1E104-J, pin D4, circuit VDB04AX (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.

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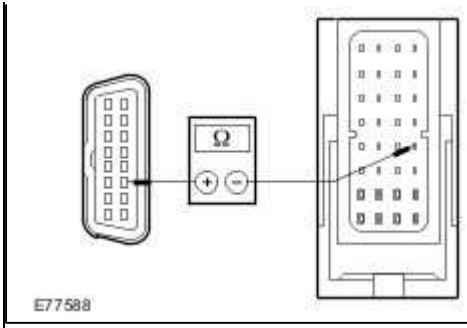


Is a resistance of less than 2 Ohms registered?

Yes

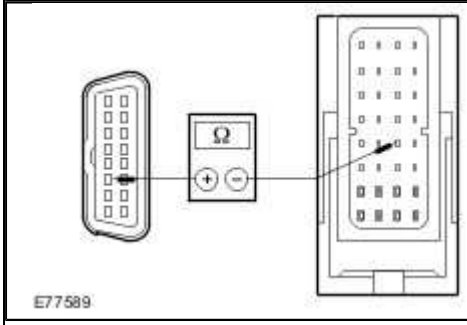
GO to AK25.

No

LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.

AK25: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.



1 Measure the resistance between the PCM, connector C1E104-J, pin E3, circuit VDB05BA (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the PCM and RENEW if necessary. CHECK the operation of the system.

No

LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.

AK26: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)

CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

1 Disconnect Connector C1E109-B from the PCM.

2 Measure the resistance between the PCM, connector C1E109-B, pin 54, circuit VDB04BC (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.

Is a resistance of less than 2 Ohms registered?

Yes

GO to AK27.

No

LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams.

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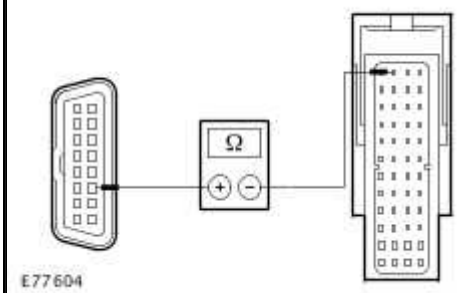
	CHECK the operation of the system.
AK27: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E109-B, pin 41, circuit VDB05BC (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the PCM and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.
AK28: CHECK FOR OPEN CIRCUIT BETWEEN THE PCM AND THE DATA LINK CONNECTOR (DLC)	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Disconnect Connector C1E108-H from the PCM.
	2 Measure the resistance between the PCM, connector C1E108-H, pin A2, circuit VDB04AV (WH/BU), wiring harness side and the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AK29. **No** LOCATE and REPAIR the open circuit between the PCM and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AK29: CHECK THE CIRCUIT BETWEEN THE PCM AND THE DLC FOR OPEN CIRCUIT	
CAUTION: The following measurement must only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.	
	1 Measure the resistance between the PCM, connector C1E108-H, pin A1, circuit VDB05AW (WH), wiring harness side and the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side.

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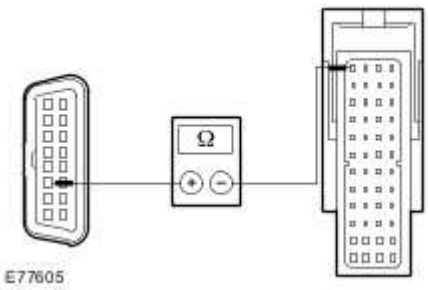

Is a resistance of less than 2 Ohms registered?

Yes

CHECK the PCM and RENEW if necessary. CHECK the operation of the system.

No

LOCATE and REPAIR the open in the respective circuit between the PCM and DLC by using the wiring diagrams. CHECK the operation of the system.

AK30: PERFORM NETWORK TEST

NOTE: The number of modules connected to the CAN bus depends on the equipment levels of the vehicle. Therefore, not every vehicle will have all the modules mentioned below.

1 Connect the ground cable to the battery.

2 Connect the diagnostic tool.

3 Disconnect a listed component, then proceed with the following test step:

- ESP module: C1CA01
- Power steering pump module: C1CS04
- Parking brake module: C4CB01
- Lights control module (LCM): C2LF23-A
- Collision warning module: C2FM01
- Steering wheel module: C2LS41
- Shock absorber control module: C4CD01-B
- Yaw rate / lateral acceleration sensor: C3CA09
- Transmission control unit (TCM) - vehicles with automatic transmission: C1ET34
- Generic Electronic Module (GEM): C1BP02-C

4 Select the vehicle with the Ford approved diagnostic tool.

Is it possible to establish communications with the PCM?

Yes

The component last disconnected is the cause of the concern; CHECK and if necessary RENEW the component. CHECK the operation of the system.

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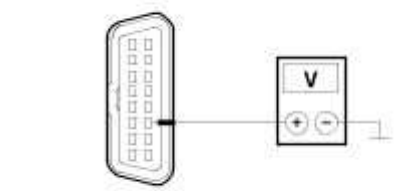
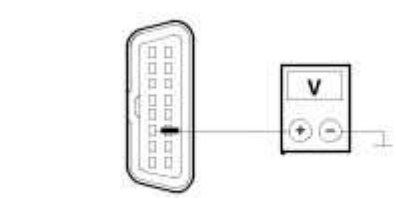
	No - If not all the listed components are disconnected:Key in OFF position. DISCONNECT the next component (go to test step 3). - If all the listed components are disconnected:GO to AK31.
AK31: CHECK THE HS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position 0.
	2 Disconnect - Vehicles with a 2.0L diesel engine: Connector C1E108-D from the PCM.
	3 Disconnect - Vehicles with a 2.0L engine: Connector C1E104-E from the PCM.
	4 Disconnect - Vehicles with a 2.5L engine: Connector C1E108-B from the PCM.
	5 Disconnect - Vehicles with a 1.8L diesel engine: Connector C1E108-K from the PCM.
	6 Disconnect - Vehicles with a 1.6L Duratec-16V (Sigma) engine: Connector C1E104-J from the PCM.
	7 Disconnect - Vehicles with a 3.0L Duratec-VE (VE6) engine: Connector C1E109-B from the PCM.
	8 Disconnect - Vehicles with a 2.2L diesel engine: Connector C1E108-H from the PCM.
	9 Ignition switch in position II.
 VFE0028970	
	10 Measure the voltage between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage supply in the relevant circuit with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to AK32.
AK32: CHECK THE HS CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
 VFE0028962	
	1 Measure the voltage between the DLC, connector

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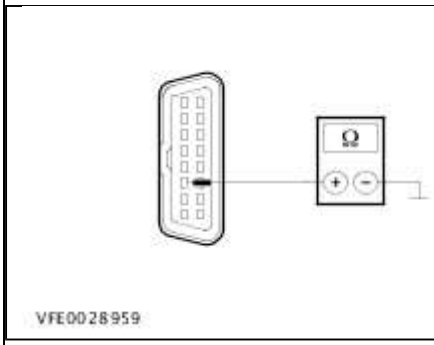
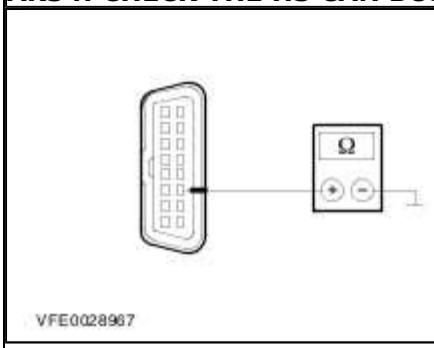
	C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage supply in the relevant circuit with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to AK33.
AK33: CHECK THE HS CAN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	
	2 Measure the resistance between the DLC, connector C3DB04, pin 14, circuit VDB05Z (WH), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AK34. **No** LOCATE and REPAIR the short to ground in the relevant circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK34: CHECK THE HS CAN BUS FOR A SHORT TO GROUND	
	
	1 Measure the resistance between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AK35. **No** LOCATE and REPAIR the short to ground in the relevant circuit with the aid of the Wiring Diagrams. CHECK the operation of the system.
AK35: CHECK THE HS CAN BUS FOR SHORT CIRCUIT	
	1 Measure the resistance between the DLC, connector C3DB04, pin 6, circuit VDB04L (WH/BU), wiring harness side and pin 14, circuit VDB05Z (WH), wiring harness side.

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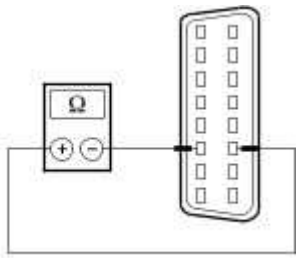
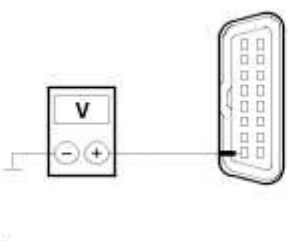


Is a resistance of more than 10,000 Ohm measured?
Yes
CHECK the PCM and RENEW if necessary. CHECK the operation of the system.
No
LOCATE and REPAIR the short circuit in the HS CAN Bus using the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST AL : FAULTY COMMUNICATIONS BETWEEN THE MODULES - MM CAN BUS

CAUTION: The measurements below may only be performed using the Ford approved diagnostic tool digital multimeter. Failure to observe this instruction can lead to damage.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AL1: CHECK FUSE F26	
	1 Ignition switch in position 0.
	2 CHECK Fuse F26 (CJB).
	Is the fuse OK? **Yes** GO to AL2. **No** RENEW fuse F26 (5 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
AL2: CHECK THE VOLTAGE AT FUSE F26	
	1 Connect Fuse F26 (CJB).
	2 Measure the voltage between fuse F26 (5 A) and ground.
	Does the meter display battery voltage? **Yes** GO to AL3. **No** REPAIR the voltage supply to fuse F26 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL3: CHECK THE VOLTAGE AT THE DATA LINK CONNECTOR (DLC)	
	1 Measure the voltage between the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side and ground.
	Does the meter display battery voltage?

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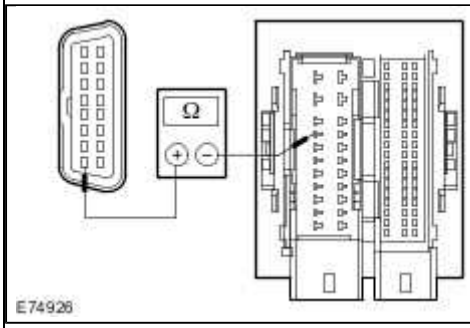
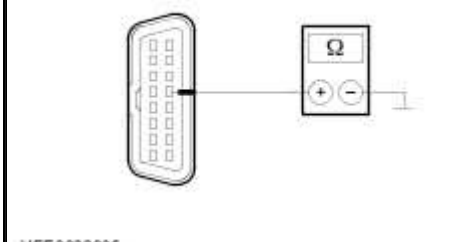
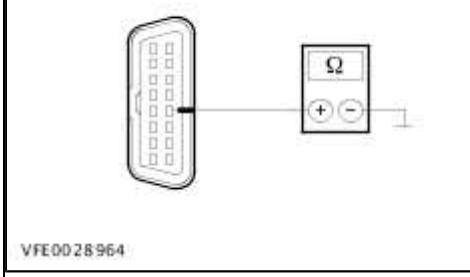
	Yes GO to AL5. **No** GO to AL4.
AL4: CHECK THE CIRCUIT BETWEEN THE CJB AND THE DLC FOR CONTINUITY.	
	1 Disconnect Connector C1BP02-C from the CJB.
	2 Measure the resistance between the CJB, connector C1BP02-C, pin 73, circuit SBP26A (YE/RD), wiring harness side and the DLC, connector C3DB04, pin 16, circuit SBP26A (YE/RD), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** CHECK the CJB and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in circuit SBP26A (YE/RD) between the DLC and the CJB with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL5: CHECK THE GROUND CONNECTION OF THE DLC - PIN 4	
	1 Ignition switch in position 0.
	2 Measure the resistance between the DLC, connector C3DB04, pin 4, circuit GD138AS (BK/WH), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AL6. **No** LOCATE and REPAIR the open circuit between the DLC and ground connection G6D139 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL6: CHECK THE GROUND CONNECTION OF THE DLC - PIN 5	
	1 Measure the resistance between the DLC, connector C3DB04, pin 5, circuit GD133BG (BK), wiring harness side and ground.
	Is a resistance of less than 2 Ohms registered? **Yes**

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	GO to AL7. **No** LOCATE and REPAIR the break in circuit GD133BG (BK) between the DLC and ground connection G3D134 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL7: PERFORM NETWORK TEST	
NOTE: The number of modules connected to the MM CAN bus depends on the equipment level of the vehicle. Therefore not every vehicle will have all the modules mentioned below.	
	1 Ignition switch in position 0.
	2 Disconnect a listed component, then proceed with the following test step: • Bluetooth voice control module: C2MM01-A • Navigation system touch screen: C2ME03-F • DVD Drive: C2ME04 • CD changer: C2ME27
	3 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communication with the audio system control panel? **Yes** The component last disconnected is the cause of the concern; CHECK and if necessary RENEW the component. CHECK the operation of the system. **No** - If not all the listed components are disconnected:DISCONNECT the next component (go to test step 1). - If all the listed components are disconnected:GO to AL8.
AL8: PERFORM NETWORK TEST (RESTRAINTS CONTROL MODULE (RCM))	
	1 Disconnect Connector C2R114A from the audio system control panel.
	2 Connect Connector C2MM01-A from the Bluetooth/voice control module.
	3 Connect the diagnostic tool.
	4 Select the vehicle with the Ford approved diagnostic tool.
	Is it possible to establish communications with the GEM? **Yes** CHECK and if necessary RENEW the safety restraint control module. CHECK the operation of the system. **No** GO to AL9.
AL9: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DATA LINK CONNECTOR (DLC)	
	1 Disconnect Connector C2MC01 from the electronic instrument cluster.
	2 Measure the resistance between the instrument cluster, connector C2MC01, pin 19, circuit VDB13X (BU/GY), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY),

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	wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AL10. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AL10: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DLC	
	1 Measure the resistance between the instrument cluster, connector C2MC01, pin 18, circuit VDB14X (VT/GY), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AL11. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AL11: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DLC	
	1 Measure the resistance between the electronic instrument cluster, connector C2MC01, pin 15, circuit VDB14L (VT/GY) (vehicles with CD changer: circuit VDB14M (VT/GY)), wiring harness side and the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AL12. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AL12: CHECK FOR OPEN CIRCUIT BETWEEN THE ELECTRONIC INSTRUMENT CLUSTER AND THE DLC	
	1 Measure the resistance between the electronic instrument cluster, connector C2MC01, pin 16, circuit VDB13L (BU/GY) (vehicles with CD changer: circuit VDB13M (BU/GY)), wiring harness side and the DLC, connector C3DB04, pin 1, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of less than 2 Ohms registered? **Yes** GO to AL13. **No** LOCATE and RECTIFY the break in the circuit between the electronic instrument cluster and the DLC using the Wiring Diagrams. CHECK the operation of the system.
AL13: CHECK THE MM CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Ignition switch in position II.
	2 Measure the voltage between the DLC, connector

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	C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection SP353 using the Wiring Diagrams. CHECK the operation of the system. **No** GO to AL14.
AL14: CHECK THE MM CAN BUS FOR A SHORT TO VOLTAGE SUPPLY	
	1 Measure the voltage between the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and RECTIFY the short to voltage supply in the circuits connected to soldered connection SP348 using the Wiring Diagrams. CHECK the operation of the system. **No** GO to AL15.
AL15: CHECK THE MM CAN BUS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Measure the resistance between the DLC, connector C3DB04, pin 8, circuit VDB14F (VT/GY), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AL16. **No** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection SP353 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL16: CHECK THE MM CAN BUS FOR A SHORT TO GROUND	
	1 Measure the resistance between the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side and ground.
	Is a resistance of more than 10,000 Ohm measured? **Yes** GO to AL17. **No** LOCATE and RECTIFY the short to ground in the circuits connected to soldered connection SP348 with the aid of the Wiring Diagrams. CHECK the operation of the system.
AL17: CHECK THE MM CAN BUS FOR SHORT	
	1 Measure the resistance between the DLC, connector C3DB04, pin 1, circuit VDB13F (BU/GY), wiring harness side and pin 8, circuit VDB14F (VT/GY), wiring harness side.
	Is a resistance of more than 10,000 Ohm measured? **Yes** CHECK and if necessary RENEW the electronic instrument cluster. CHECK the operation of the system. **No** LOCATE and REPAIR the short in the MM CAN bus

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	with the aid of the Wiring Diagrams. CHECK the operation of the system.

Component checks

Power supply relay

1. **1.** Check the normally open contact in the unswitched state:
    - Measure the resistance at the power supply relay, between pin 3 and pin 5, component side.
    - Is a resistance of more than 10,000 Ohm measured? If yes, go to 2. If no, RENEW the power supply relay.
2. **2.** Check the normally open contact in the switched state:
    - Using a fused test cable (1 A), connect pin 1 of the power supply relay, component side, with the battery positive terminal.
    - Using a test cable, connect pin 2 of the power supply relay, component side, to the battery negative terminal.
    - Measure the resistance at the power supply relay, between pin 3 and pin 5, component side.
    - Is a resistance of less than 2 Ohms registered? If yes, the power supply relay is OK. If no, RENEW the power supply relay.

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General Procedures

1. The vehicles utilize a new form of module configuration called "central module configuration". Here, all of the necessary configuration parameters are stored in the generic electronic module (GEM) at the factory, and from there they are transmitted via the CAN bus network to the individual modules. The Worldwide Diagnostic System (WDS) now includes a new routine for replacing or subsequently changing the configuration data. This new routine is used to perform the central module configuration. However, in this case the data are no longer read into WDS like before - instead, they are transmitted by the GEM to the relevant module. WDS is only used to initiate and monitor the process. For safety reasons all of the configuration data which are saved in the GEM are also backed up in the instrument cluster. If the GEM then needs to be replaced, this means that the required configuration data can be read out from the instrument cluster with the aid of WDS and then transferred to the new GEM. The GEM checks the configuration data for consistency and stores a WDS trouble code (DTC) in the event of a fault. In the event of a fault the functionality of a particular module may be restricted. When installing a new GEM, both the key for the radio remote control and for PATS must be re-programmed (also see the description "Module Controlled Functions"). The procedure for this is the same as for current vehicles.
2. NOTE: Ensure that the most up-to-date software version is installed in WDS.
   NOTE: In the case of engine running concerns, module-reprogramming of the PCM may be required. To do this, a revised software version is transferred to the PCM via the GEM using WDS.
   In WDS, select "Central module configuration" from the tool box and follow the instructions.
3. NOTE: Following installation of a wheel/tire combination, for which the tire-tread circumference does not correspond to that of standard tires, the tire size must be changed in the GEM using WDS.
   In WDS, select the "Central module configuration" from the tool box and then the "Programmable parameters" submenu and enter the corresponding tire size under the "tire size" menu item.

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General Procedures

1. NOTE: In order to minimize module variations, different equipment levels and functionalities are incorporated in the same module. For this reason, modules must be programmed following replacement. For this purpose, the vehicle-specific data is read out of the module to be replaced using WDS and is transferred to the new module. In the process, it is also possible to replace older software versions with more up-to-date versions, for example.
   NOTE: If, before replacing a module, it was not possible to read out the vehicle-specific data using WDS (the module to be replaced does not respond) then, during programming of the new module, the vehicle-specific data must be entered manually via a selection list in WDS or via a code which can be obtained from the Technical Hotline.
   NOTE: Ensure that the most up-to-date software version is installed in WDS.
   In order to program, select the "Install programmable module" submenu in the "Module programming" menu tool box and then follow the instructions.
2. NOTE: The number of modules installed in the vehicle can vary according to equipment level.
   - The following modules must be programmed after replacement:
   - Generic electronic module (GEM)
   - Powertrain control module (PCM)
   - Instrument cluster (IC)
   - Anti-lock braking system module (ABS)
   - Restraint control module (RCM)
   - Electrical parking brake (EPB)
3. NOTE: If, before replacing a PCM, it was not possible to read out the vehicle-specific data using WDS (the PCM to be replaced does not respond), configuration of the PCM must be performed following programming. For this purpose, the vehicle-specific data must be entered manually.
   In order to configure the PCM, select the "Programmable parameters" submenu in the "Module programming" menu tool box and then follow the instructions.
4. Following configuration of the GEM, module-resetting of the GEM using WDS must be performed. For this purpose, select the "Programmable parameters" submenu in the "Module programming" menu tool box and then follow the instructions under the "GEM reset"

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menu item.

5. For vehicles with anti-lock braking system and electronic stability program, these must also be configured using WDS following replacement of the lateral acceleration sensor, yaw rate sensor or pressure sensor. Configuration is performed in the "Programmable parameters" menu tool box.

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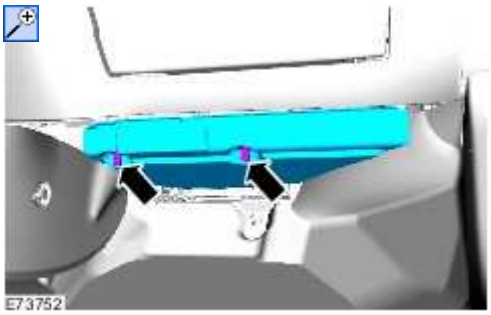
Print

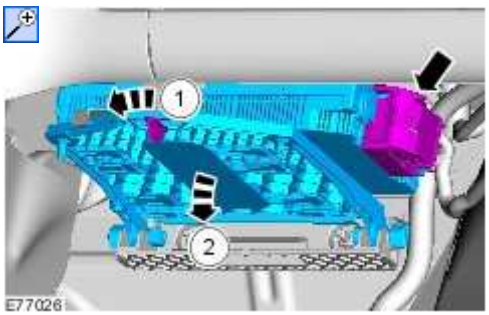
Removal and Installation

Removal

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



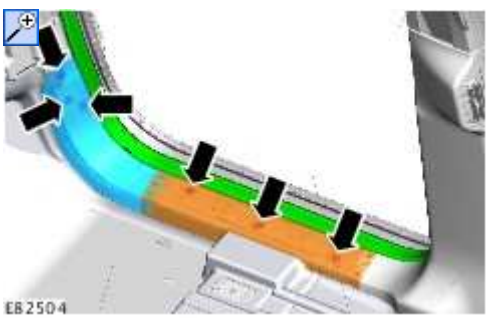
1.



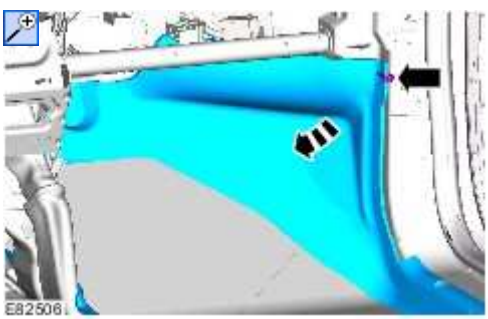
2.

3. Remove the instrument panel.

   Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).



4.
   - On both sides.



5.
   - On both sides.

6.

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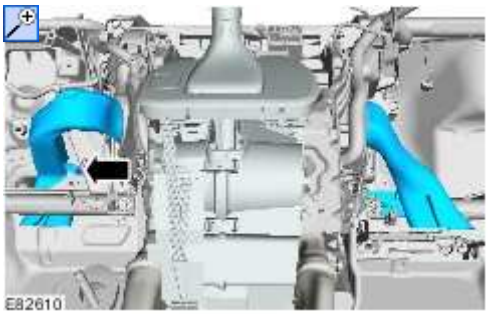
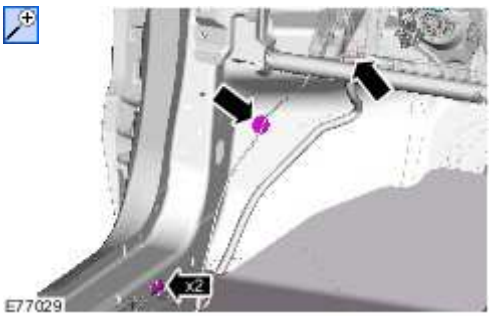
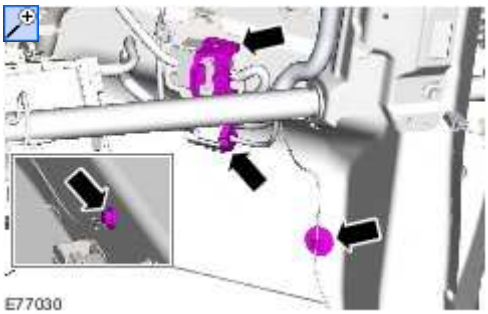
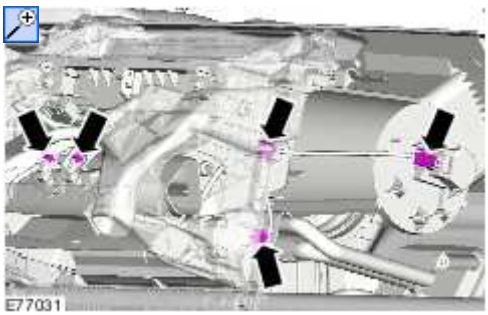




7. *Torque:* 10 Nm



8. *Torque:* 10 Nm



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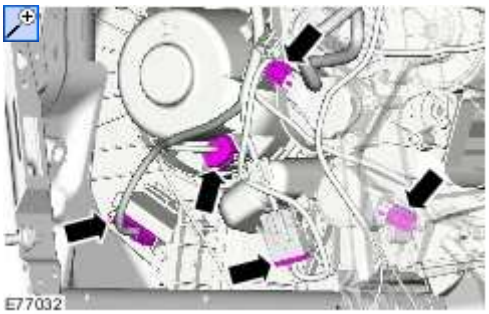

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11.

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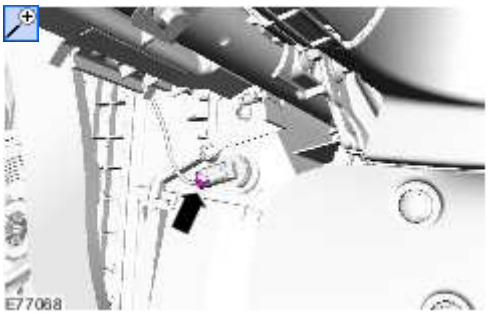

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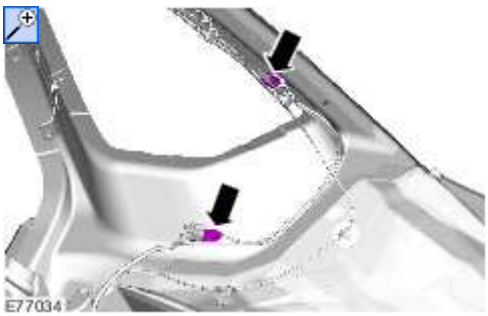
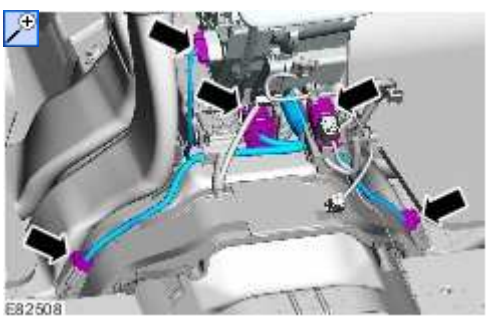


13. *Torque:* 10 Nm

14.



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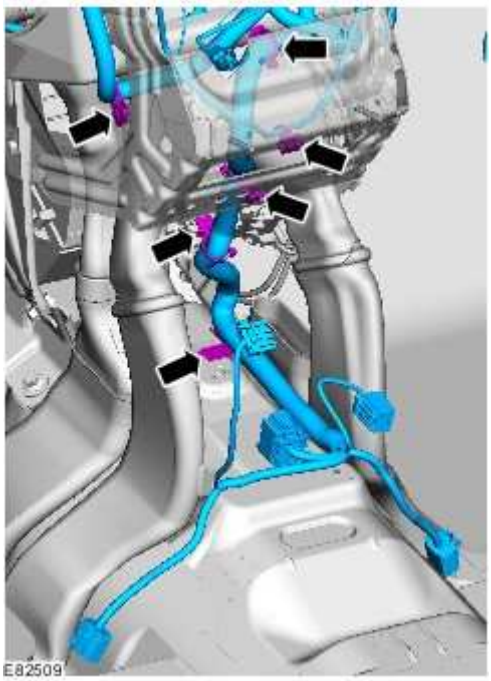

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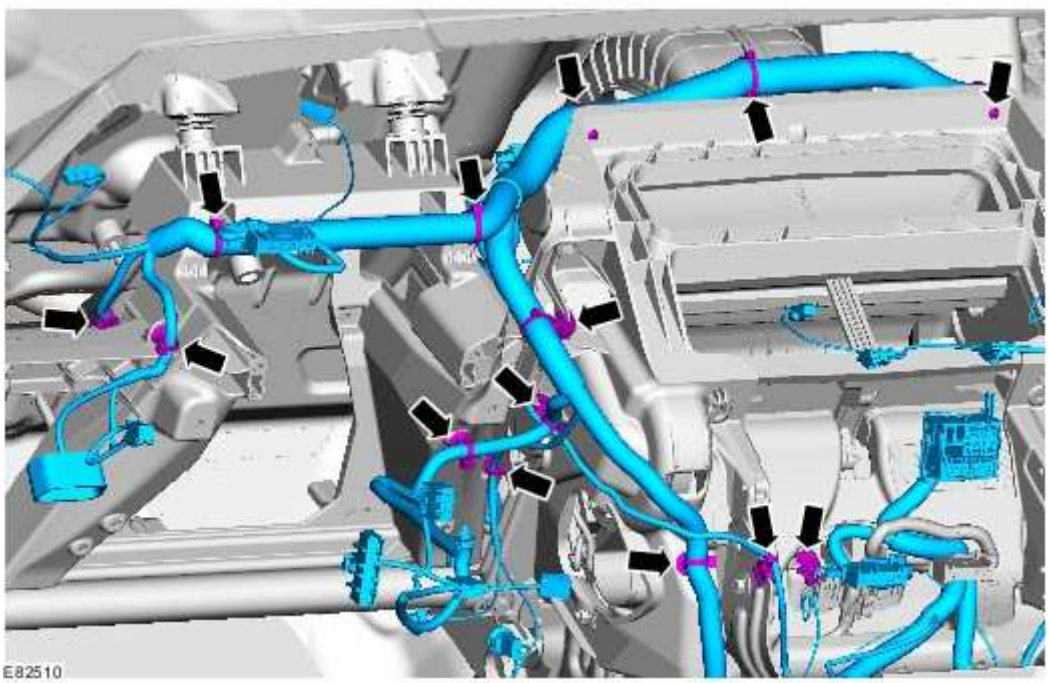

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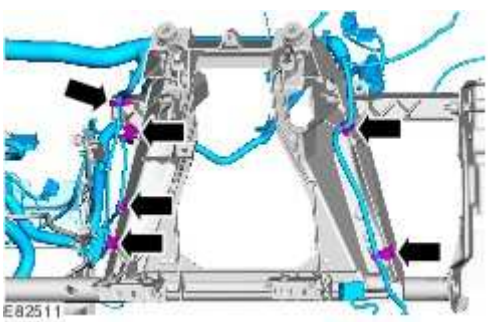

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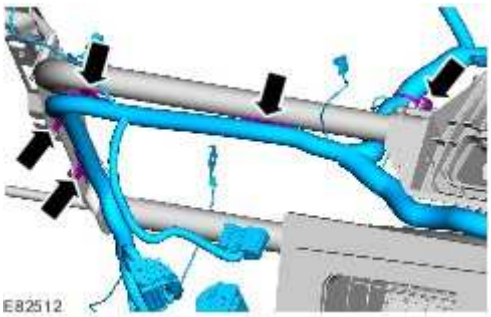
http://vnx.su



Installation

1. To install, reverse the removal procedure.

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Pri

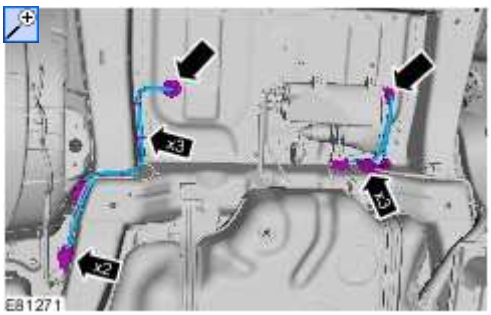
Removal and Installation

Removal

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

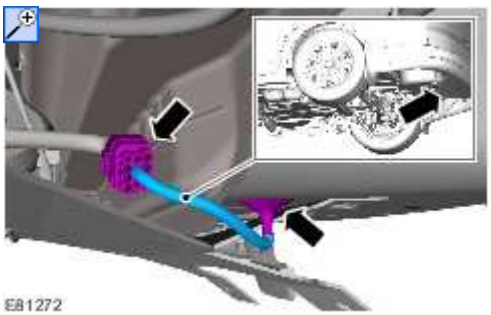
1. Raise vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2.

Vehicles with parking aid



3.

All vehicles

4. Remove the front seats.

   Refer to: Front Seat (501-10 Seating, Removal and Installation).

5. Remove the rear seats.

   Refer to: Rear Seat (501-10 Seating, Removal and Installation).

6. Remove the center console.

   Refer to: Floor Console - VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).

7. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. Refer to: Loadspace Trim Panel - VIN Plate Body

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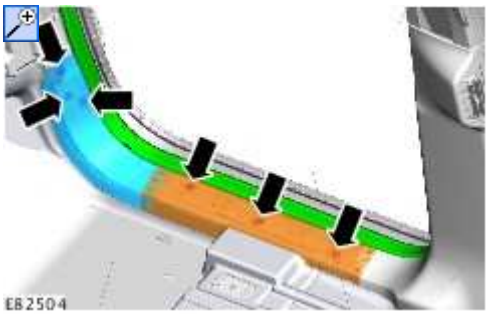
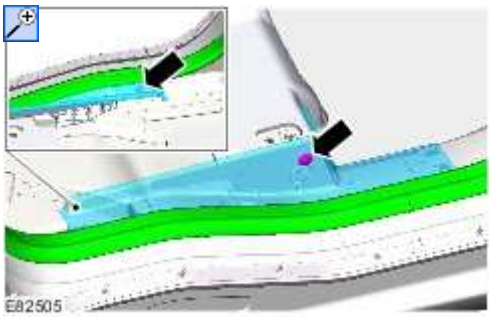
Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).



9.

- On both sides.

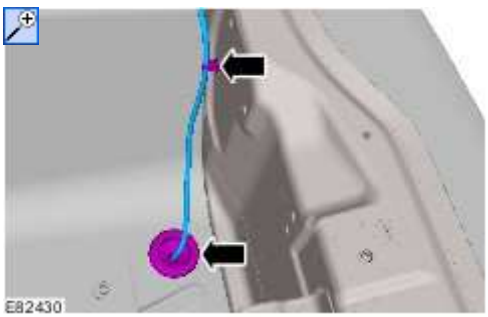


10.

- On both sides.

11.

Vehicles with parking aid



12.

All vehicles

13.

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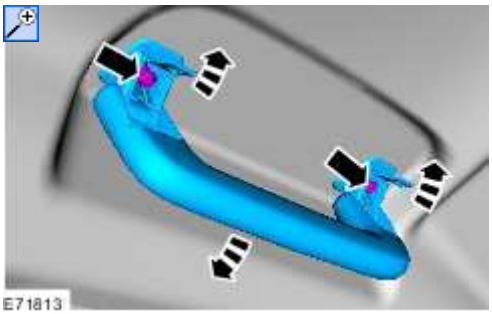
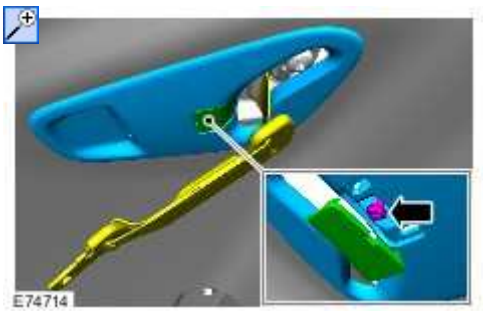


- All.



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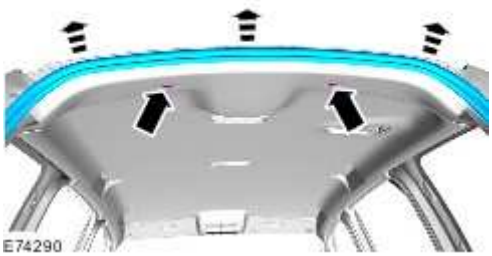

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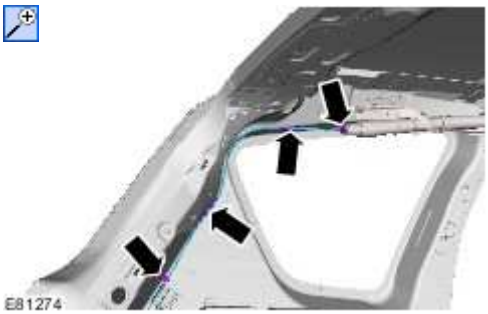

- On both sides.

18. *Torque:* 10 Nm

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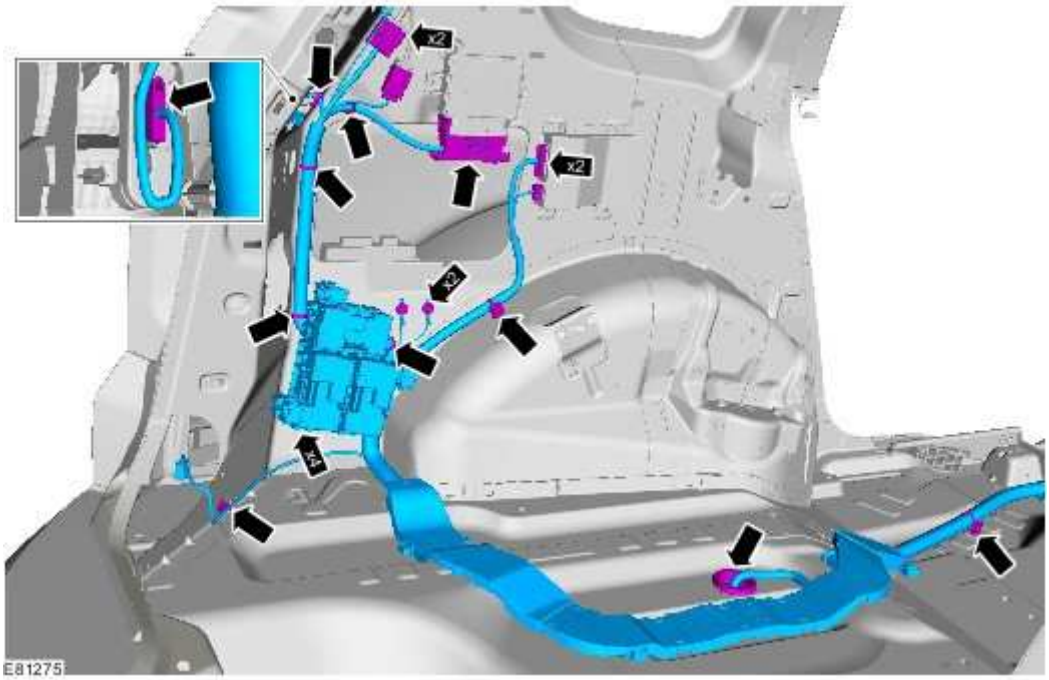
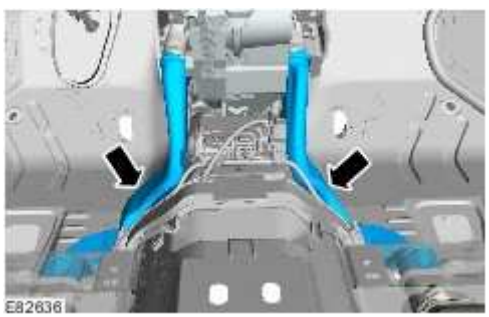


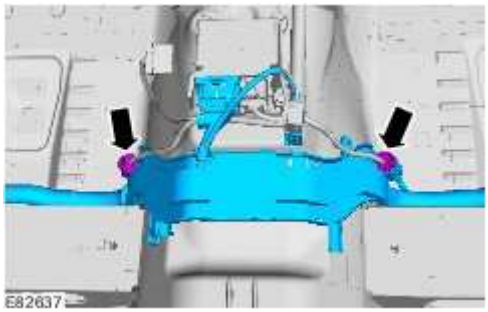
19. *Torque:* 10 Nm

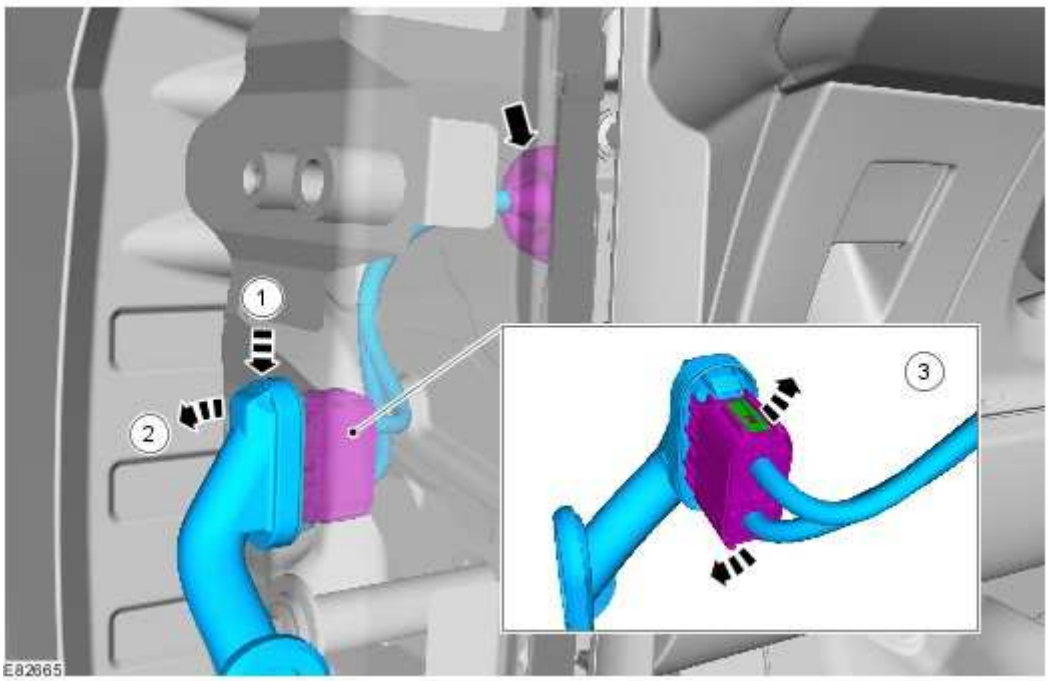


20.

21.

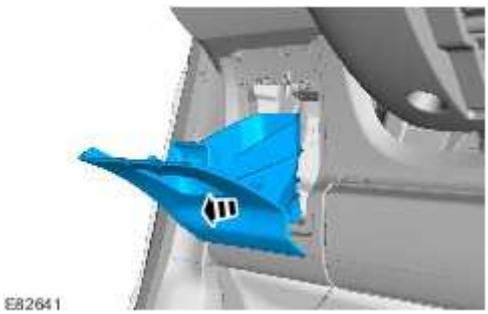
http://vnx.su





22.

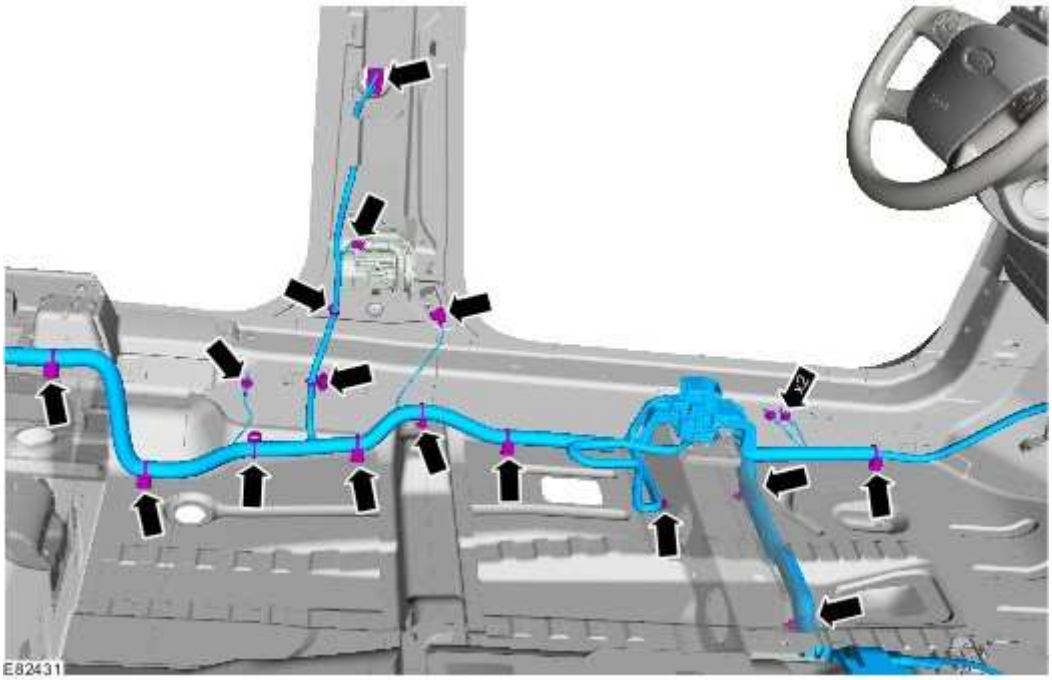
- On both sides



23.

24. *Torque:* 10 Nm

http://vnx.su



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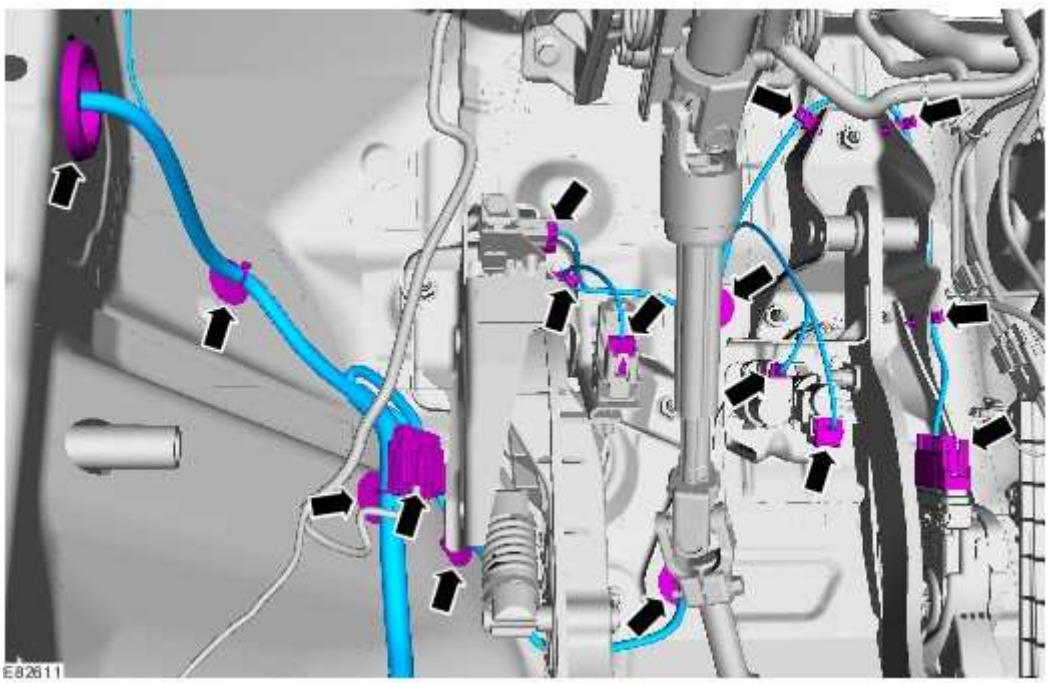

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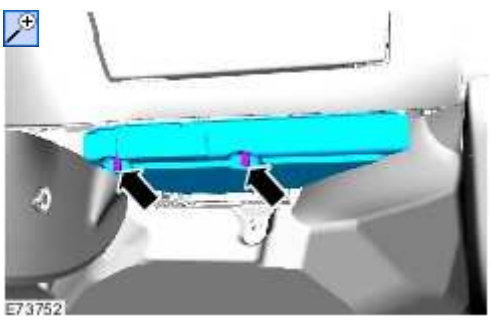

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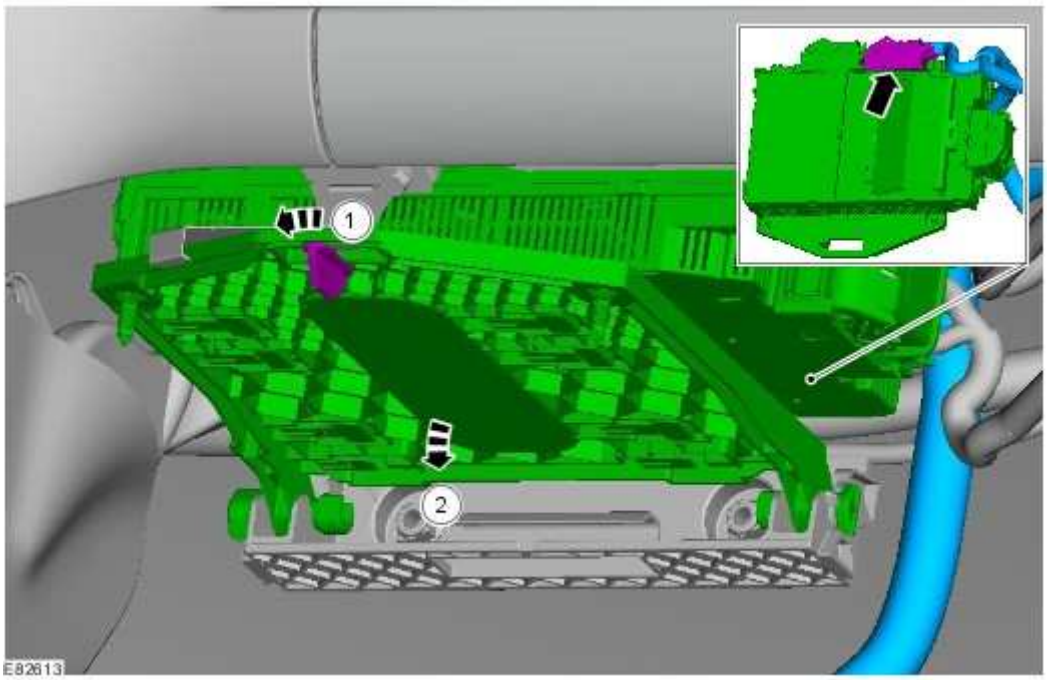

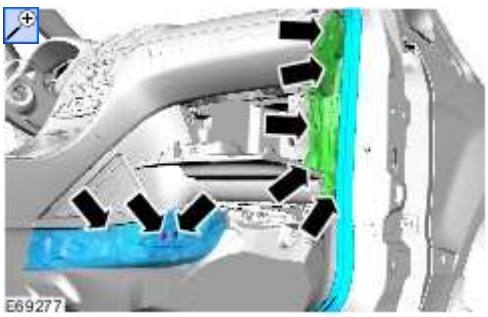

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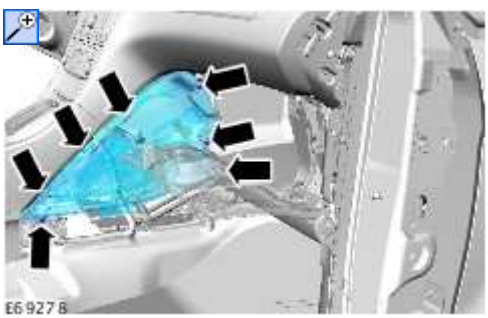

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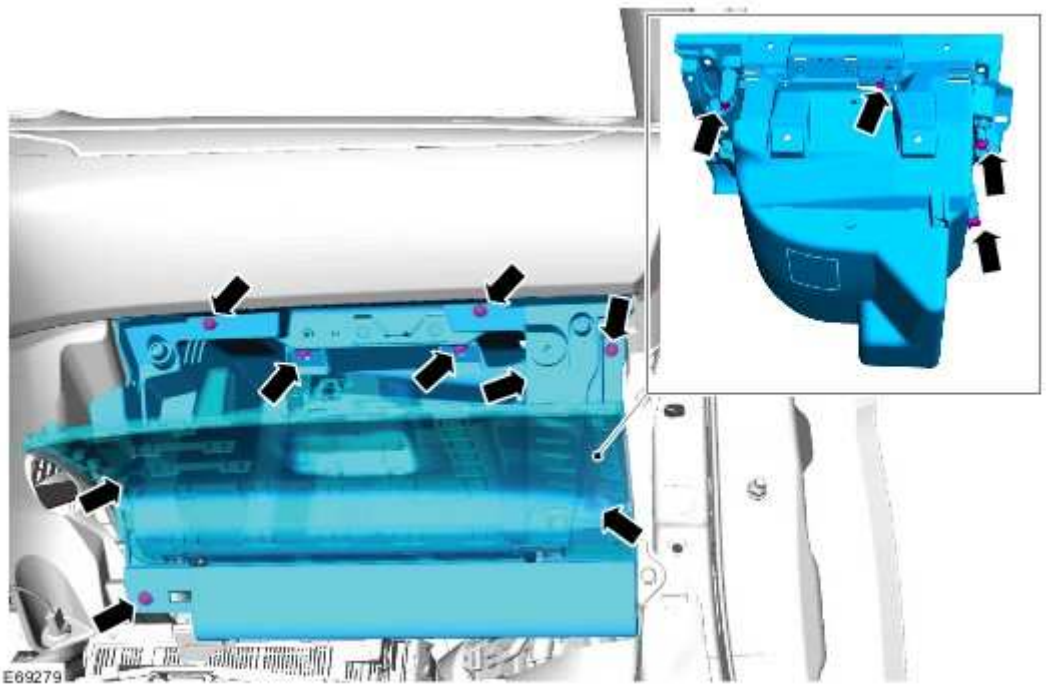
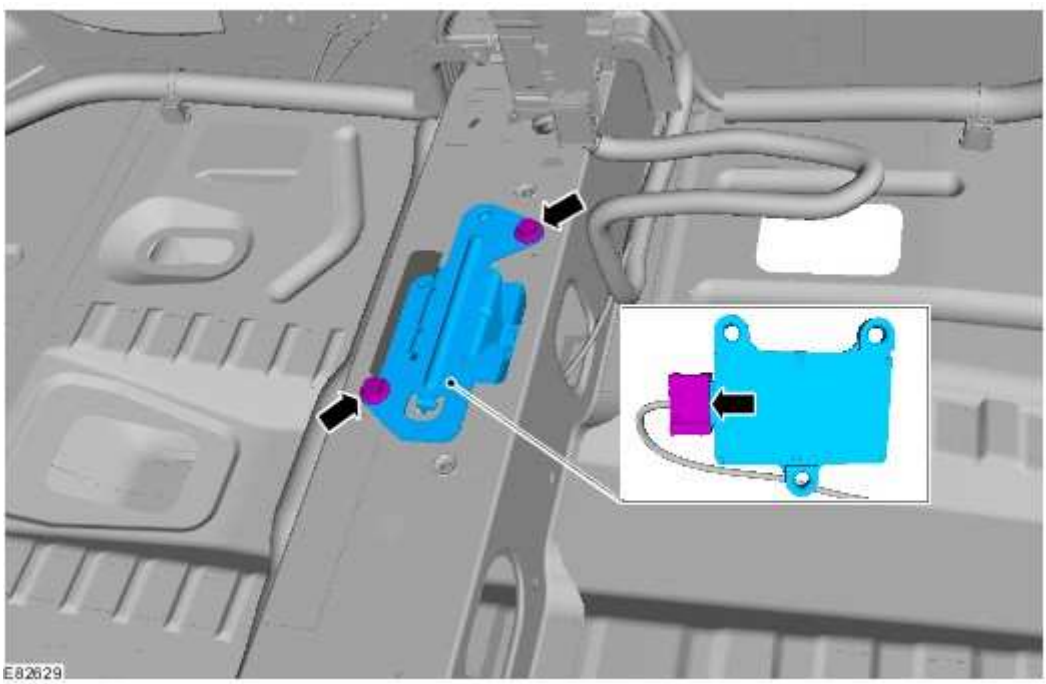
30.

http://vnx.su



31. *Torque:* 8 Nm



32. *Torque:* 1(Nm

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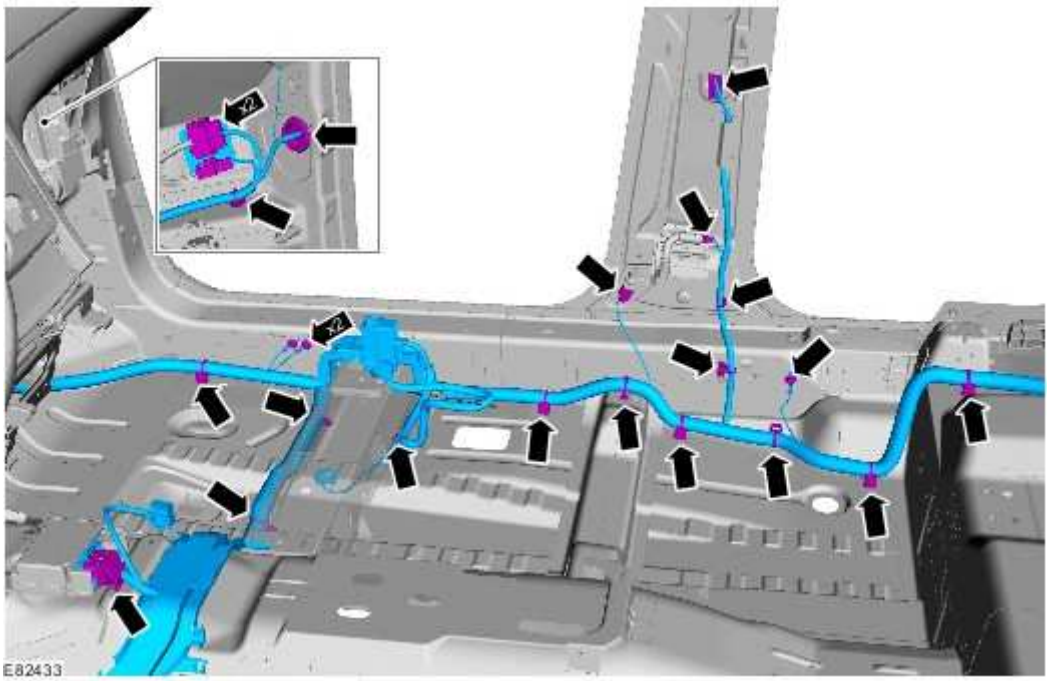

Installation

1. To install, reverse the removal procedure.

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Print

Removal and Installation

General Equipment

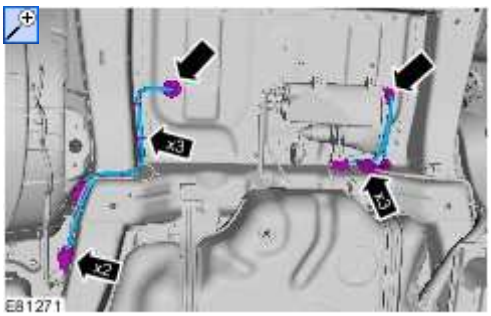
Schlitzschraubendreher

Removal

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

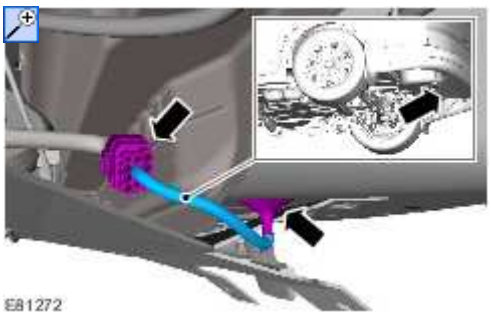
1. Raise the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2.

Vehicles with parking aid



3.

All Vehicles

4. All.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

5. All.

   Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. *Torque:* 35 Nm

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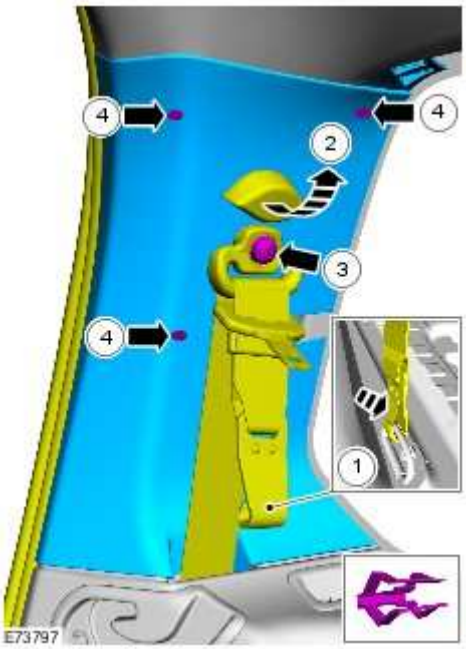

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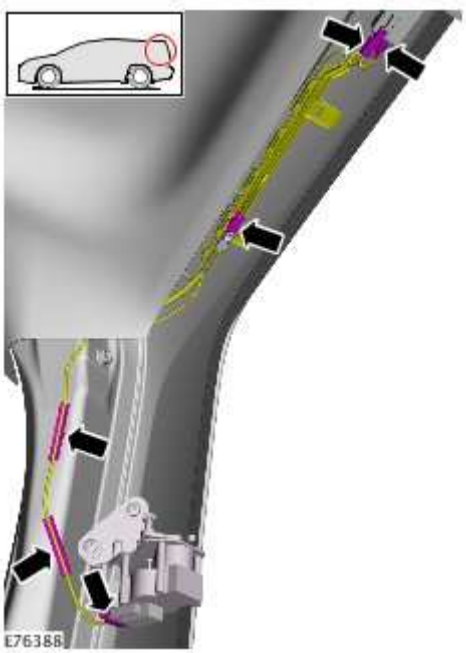

9.

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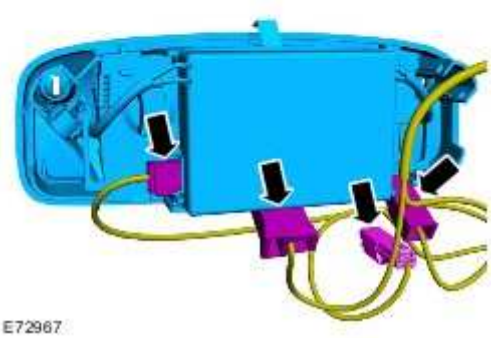
10. *General Equipment:* Schlitzschraubendreher



11.

12. If equipped.

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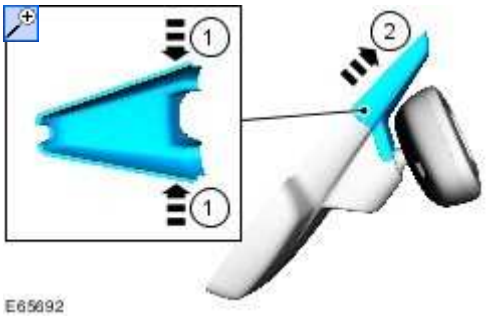
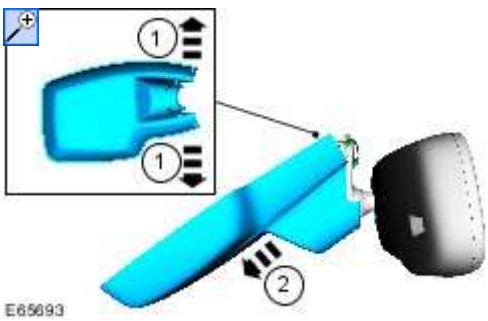
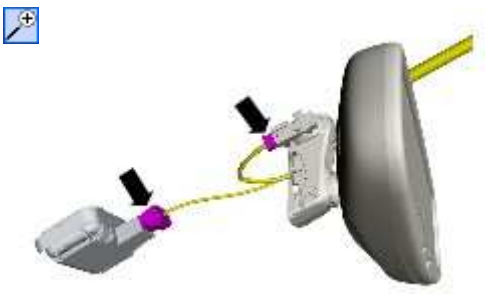


E65892

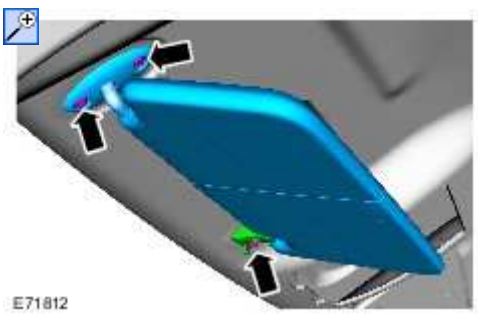


E65893

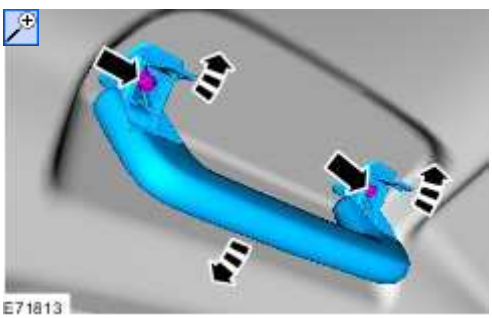
13. If equipped.


E74631

14. If equipped.


E71812

15. All.


E71813

16. All.

17.

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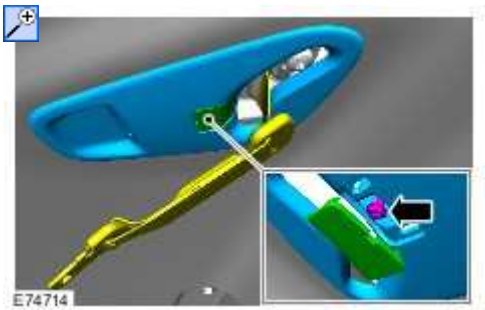
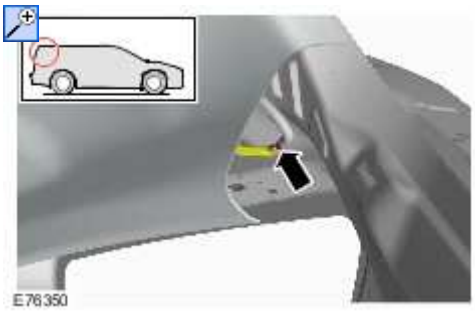




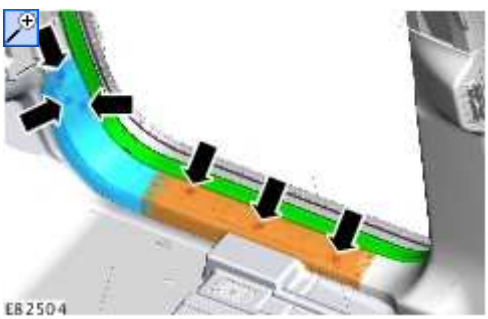
18.

19. All.

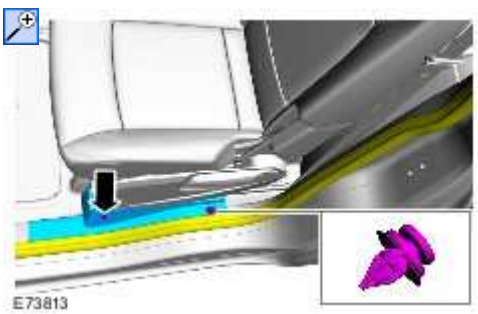
    Refer to: Front Seat (501-10 Seating, Removal and Installation).

20. Refer to: Rear Seat (501-10 Seating, Removal and Installation).

21. Refer to: Floor Console - VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
    Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).



22. All.



23. All.

24. All.

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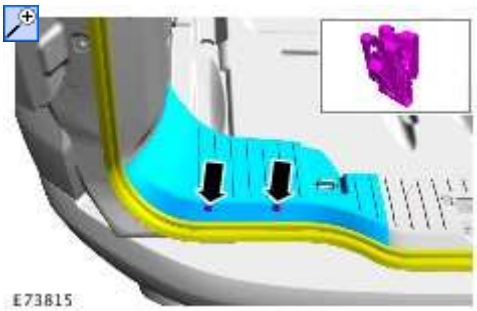
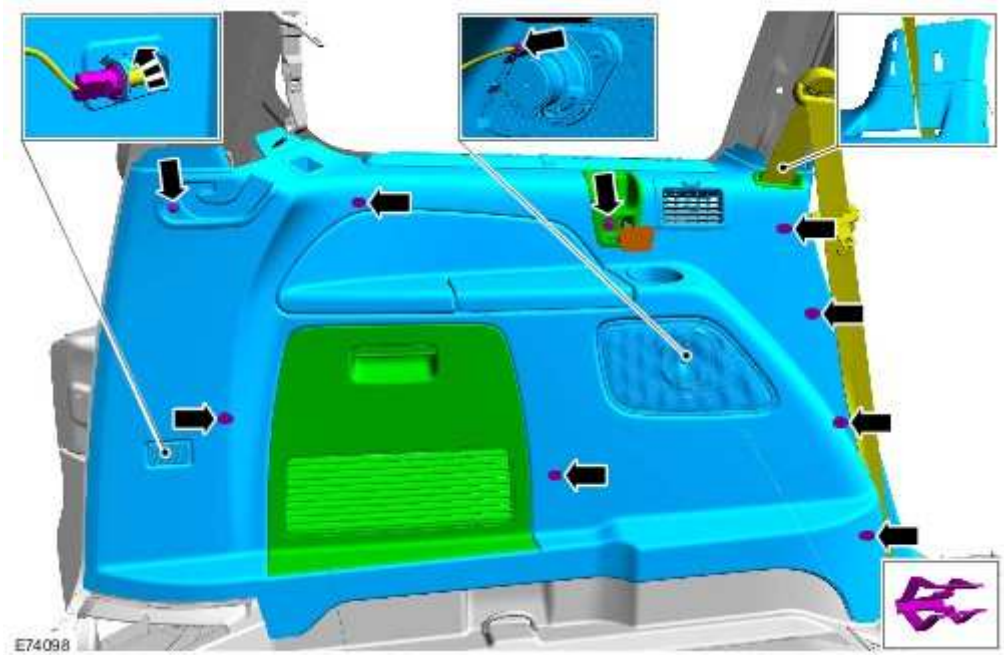


25. All.



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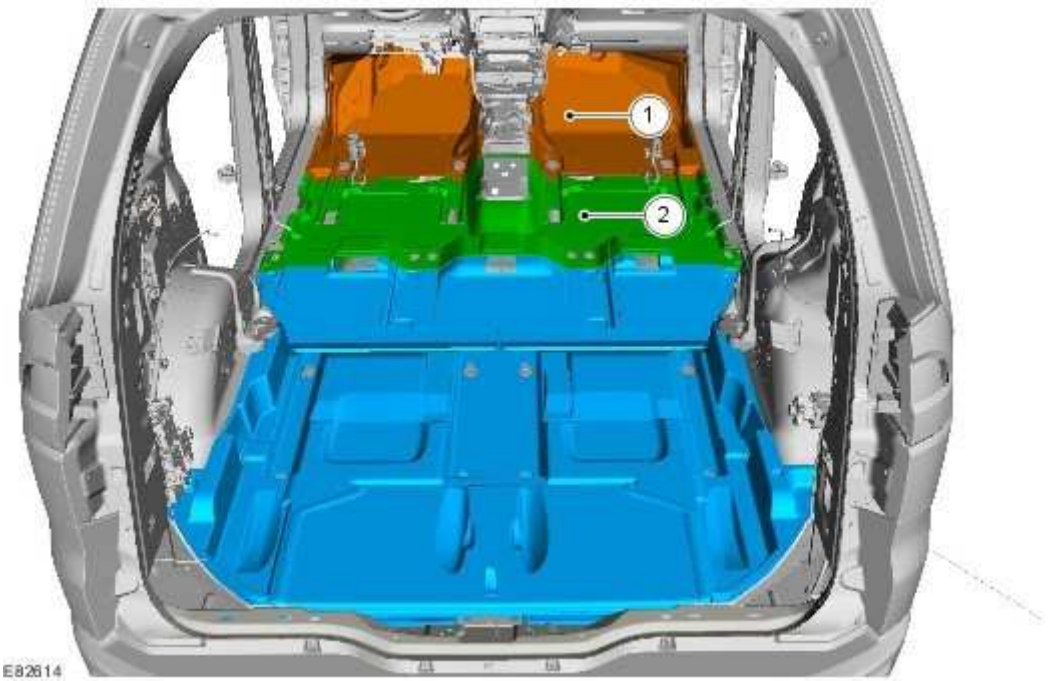

Vehicles with parking aid

27.

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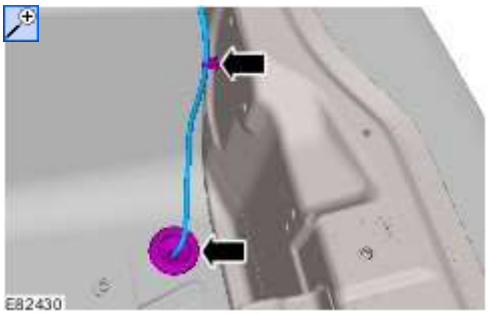
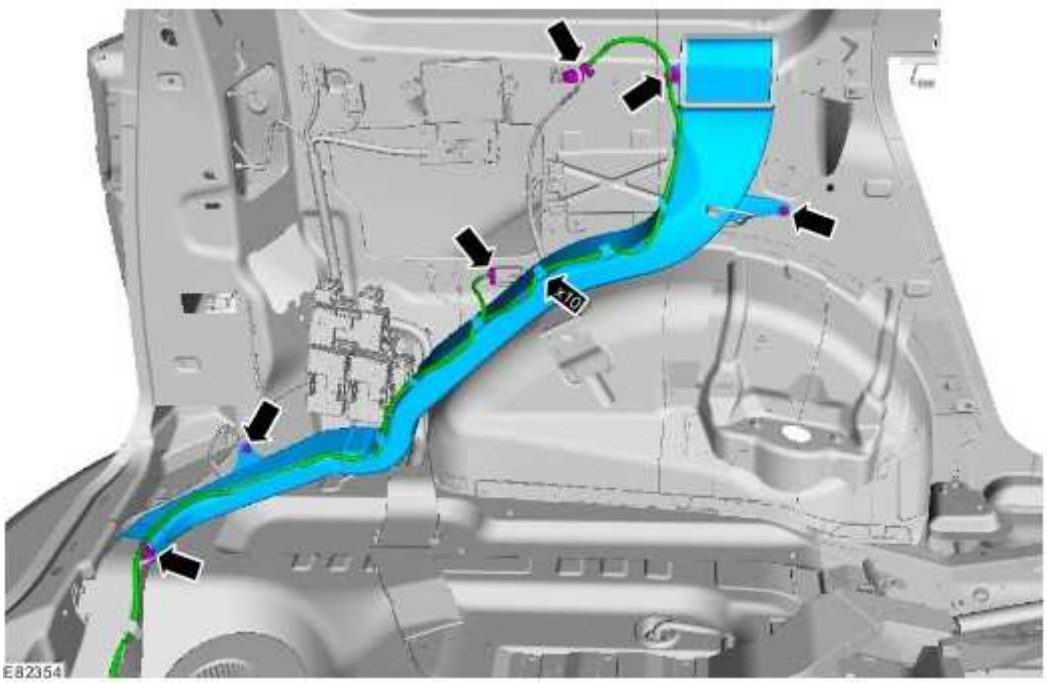
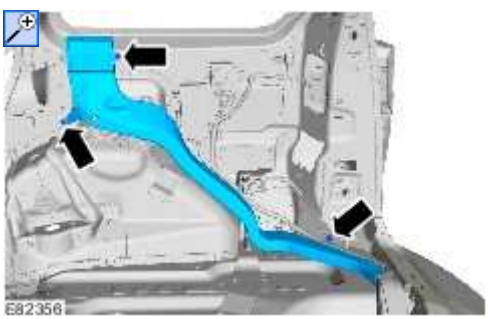


Vehicles with additional air conditioning system

28.





29.

All Vehicles

30. *Torque:* 10 Nm

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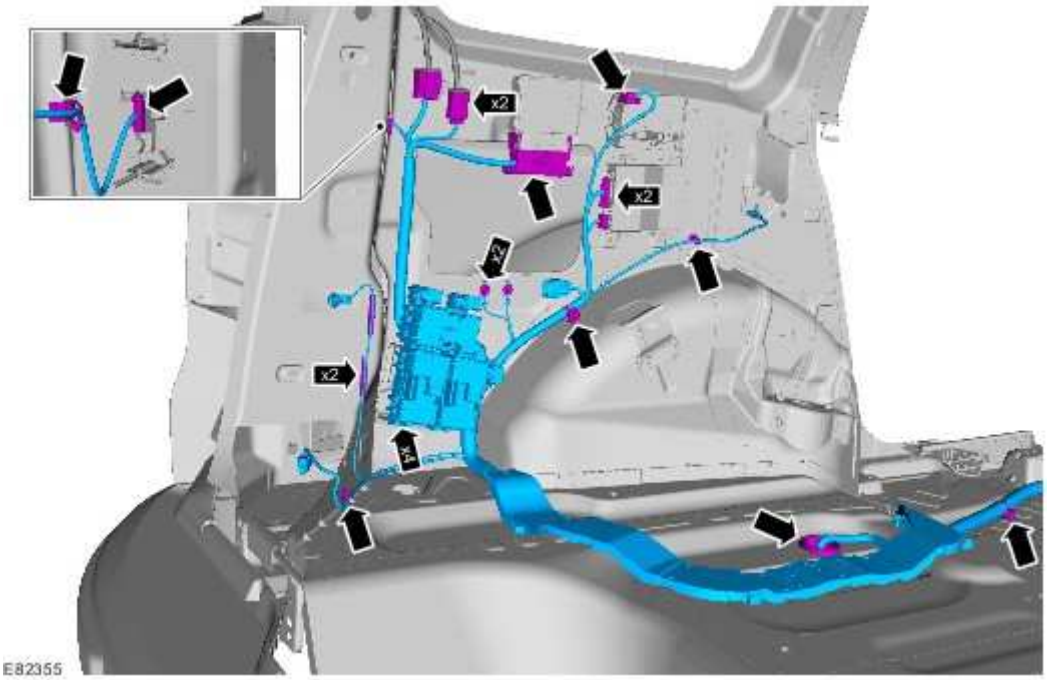
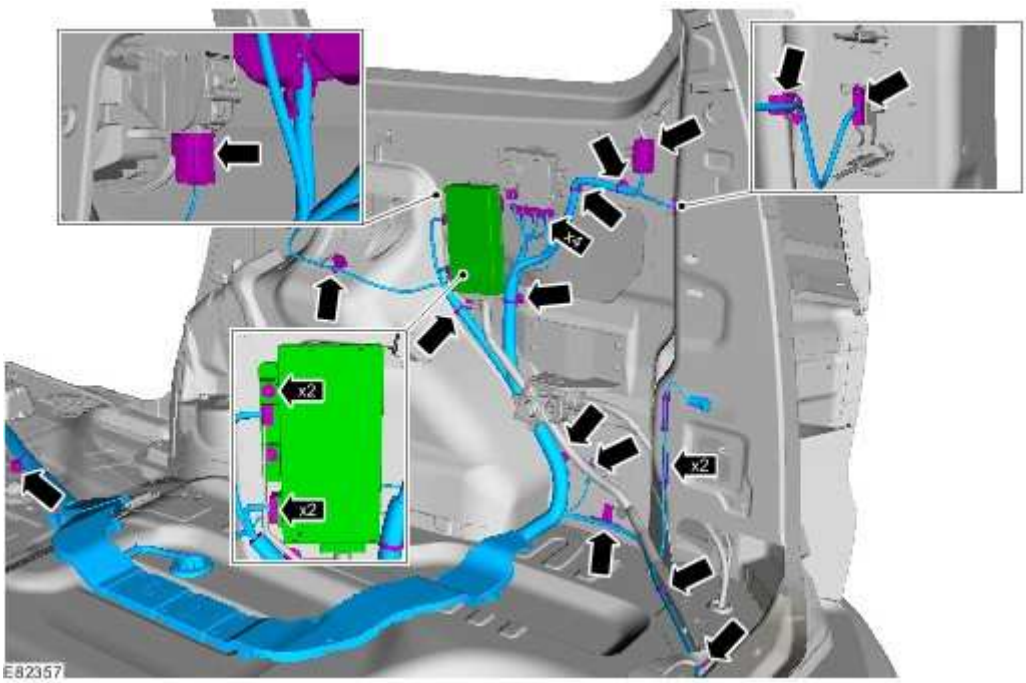
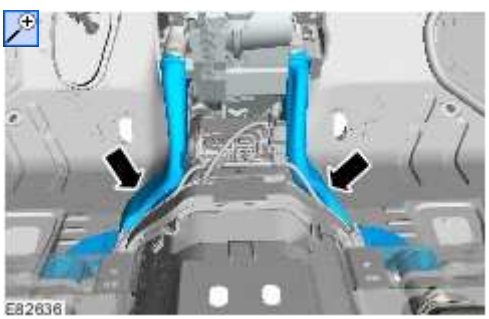




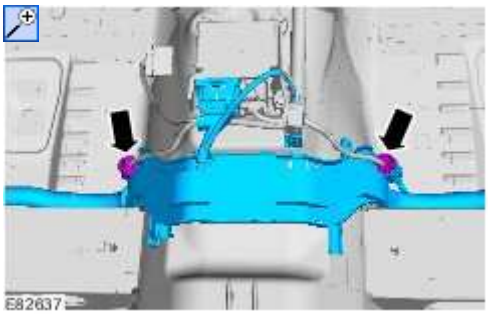
31. *Torque:* 10 Nm

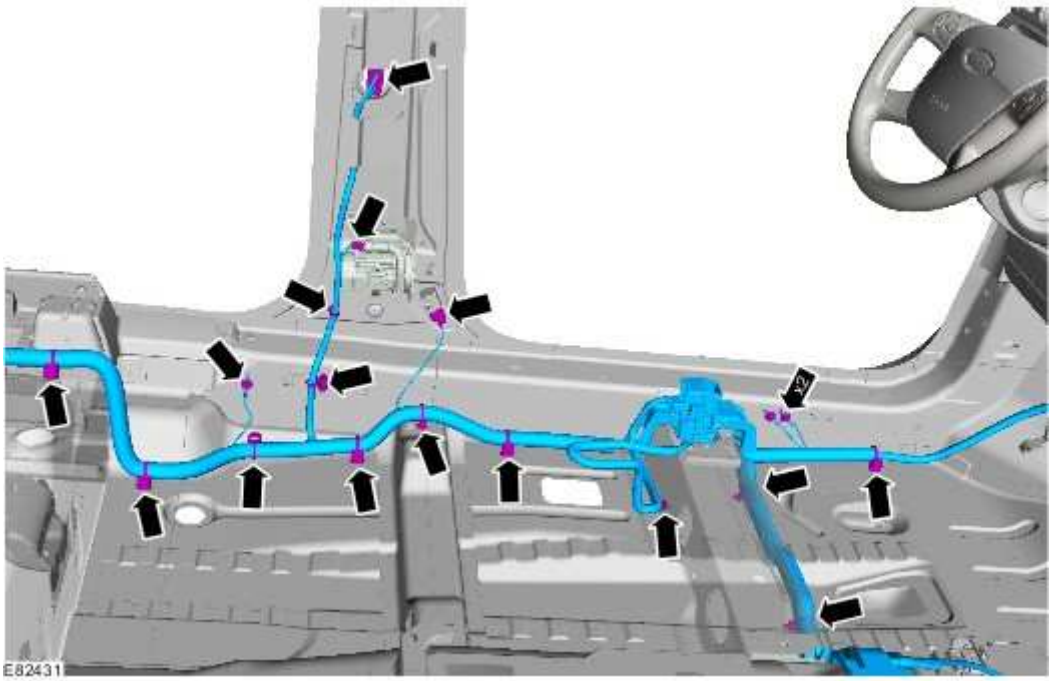


32.

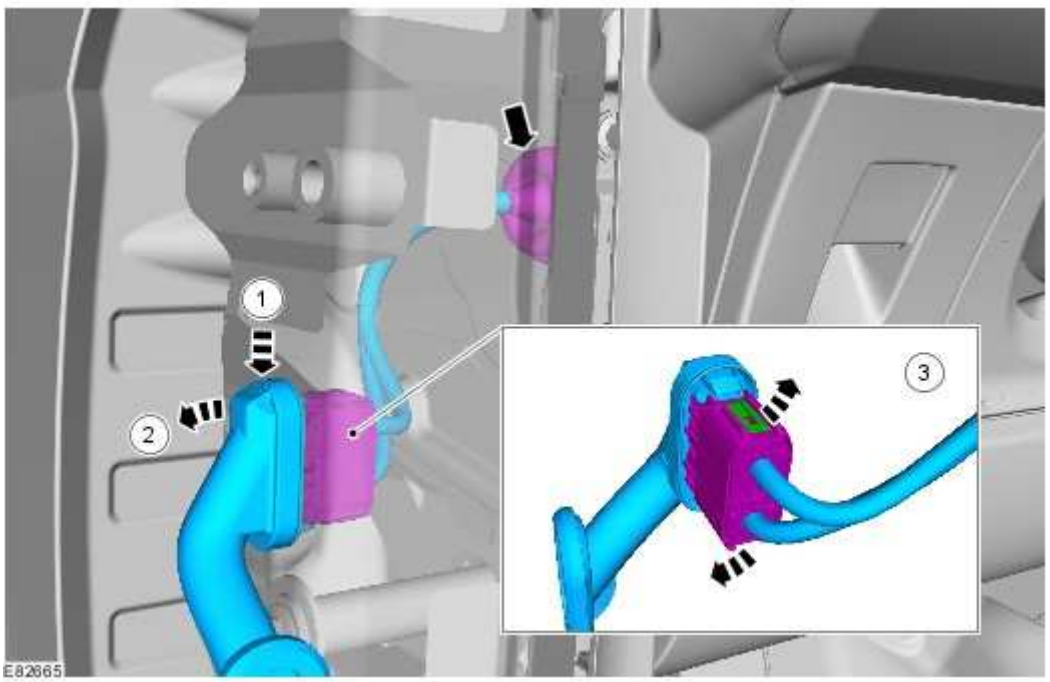
33.

http://vnx.su





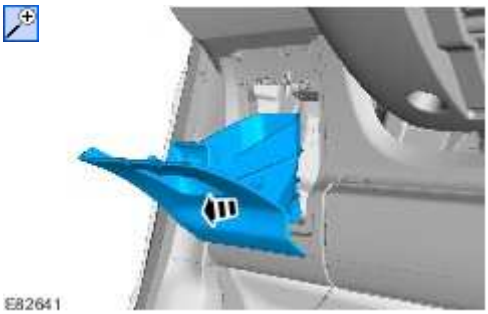
34. *Torque:* 10 Nm



35. All.

36.

http://vnx.su



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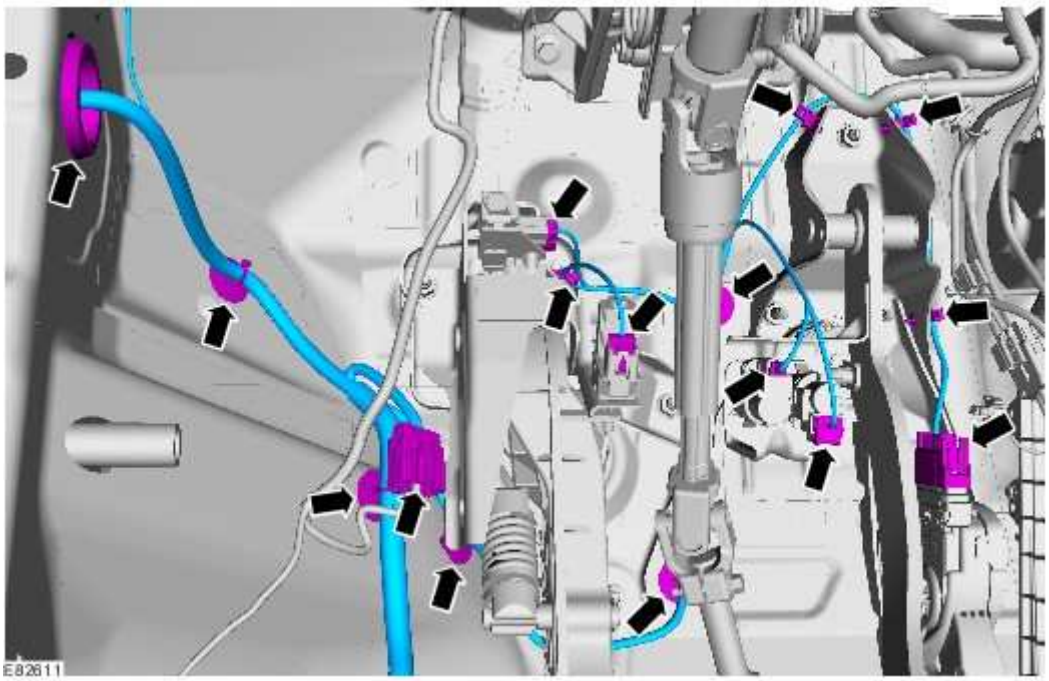

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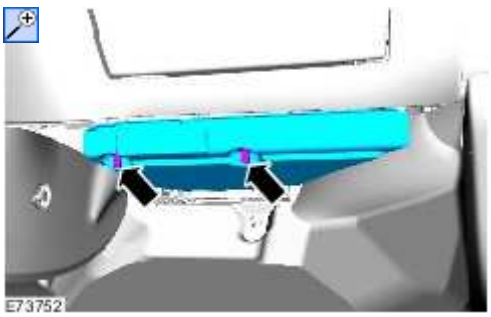
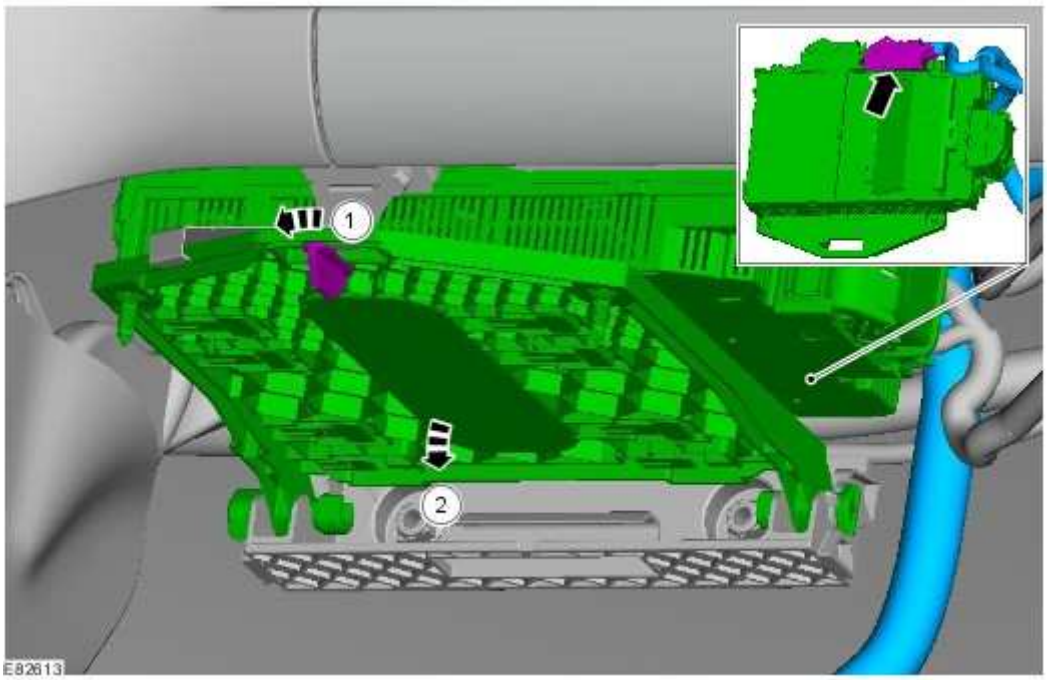
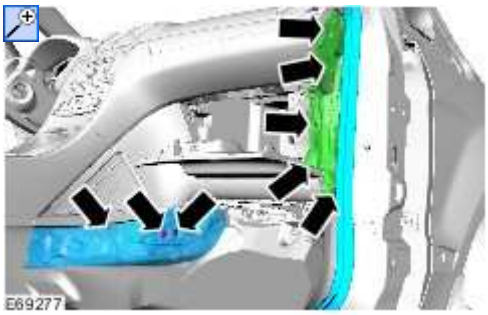


39.

http://vnx.su





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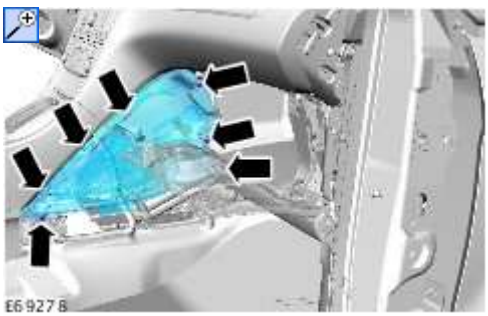
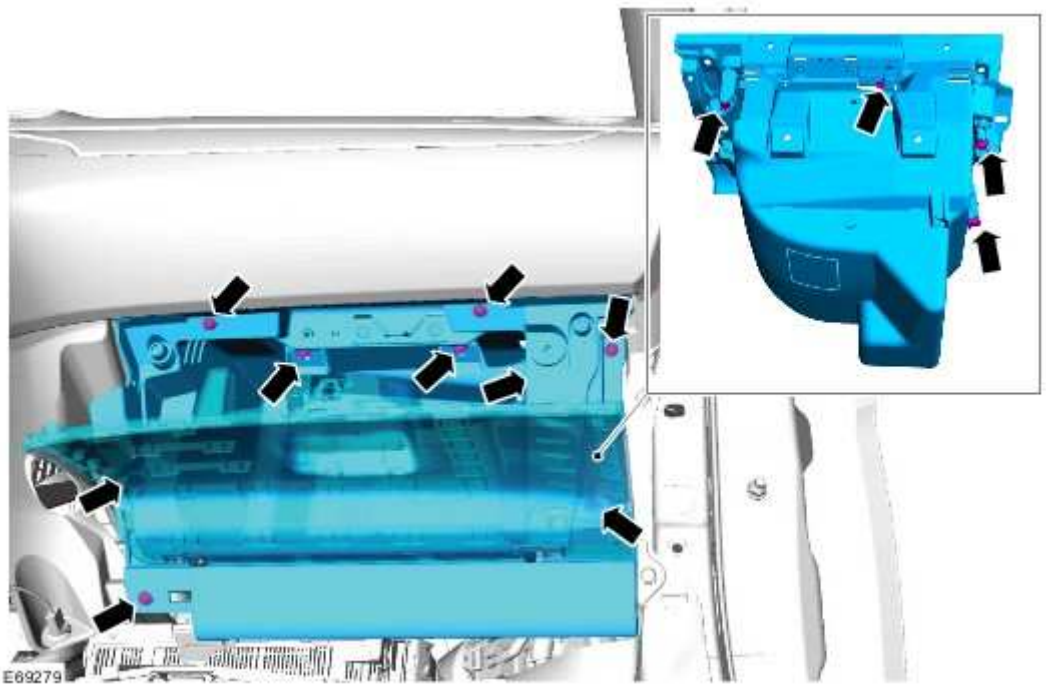


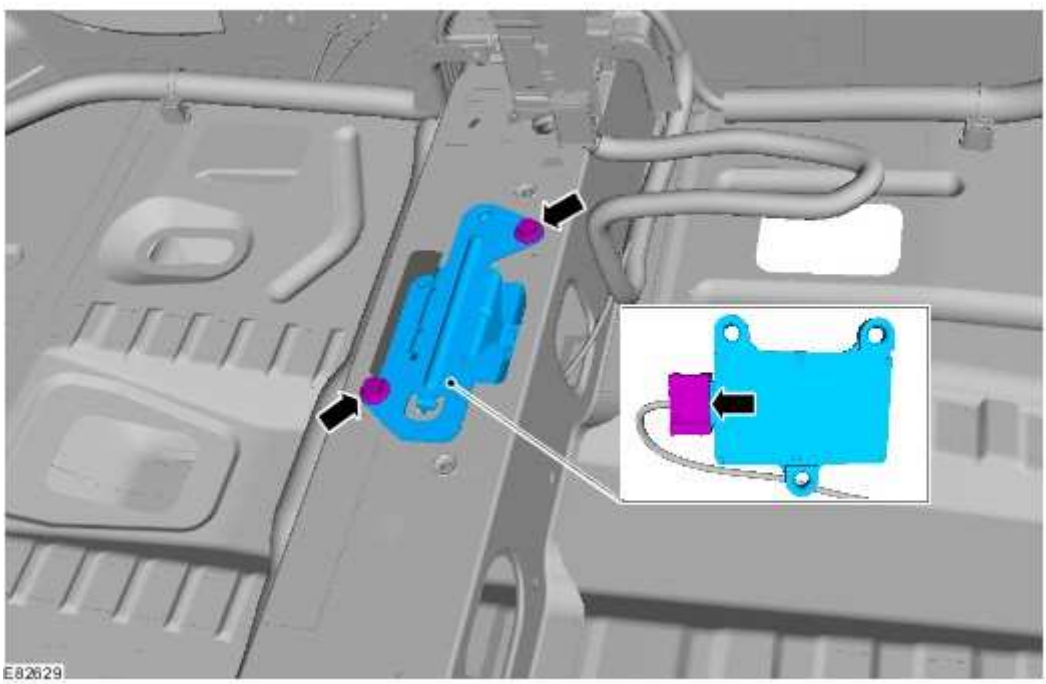
41.

42.

http://vnx.su



43. *Torque:* 8 Nm



44. *Torque:* 10 Nm

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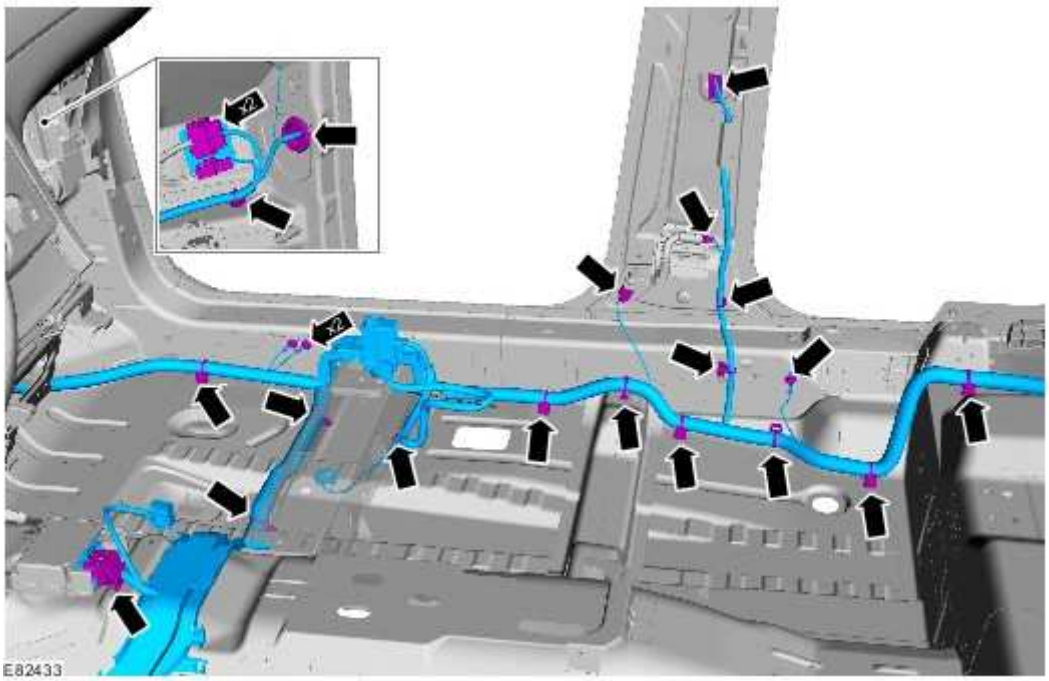

45. Support the headliner.

46.

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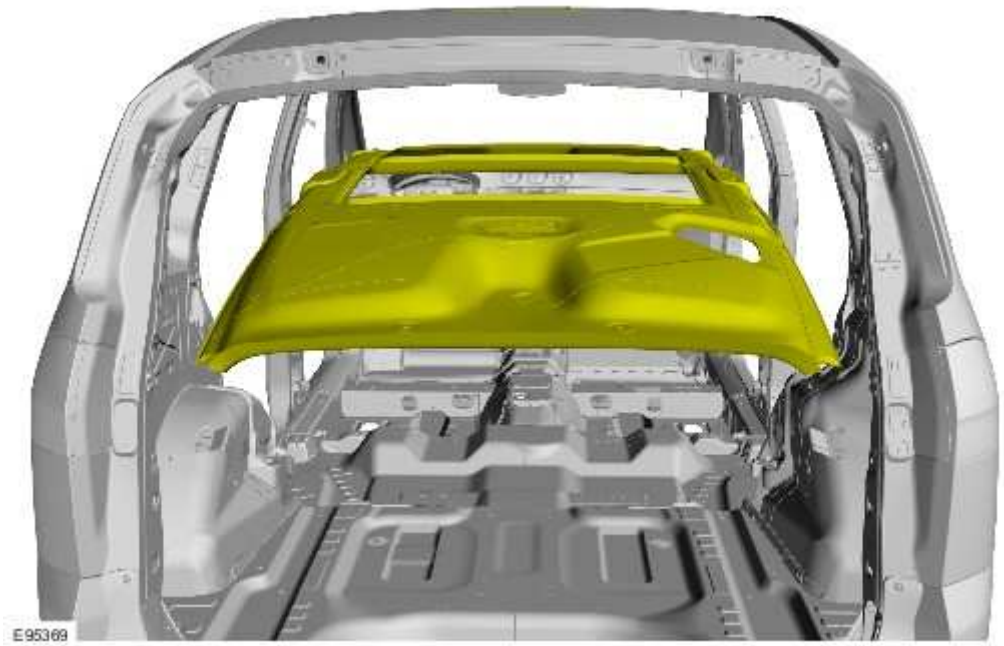
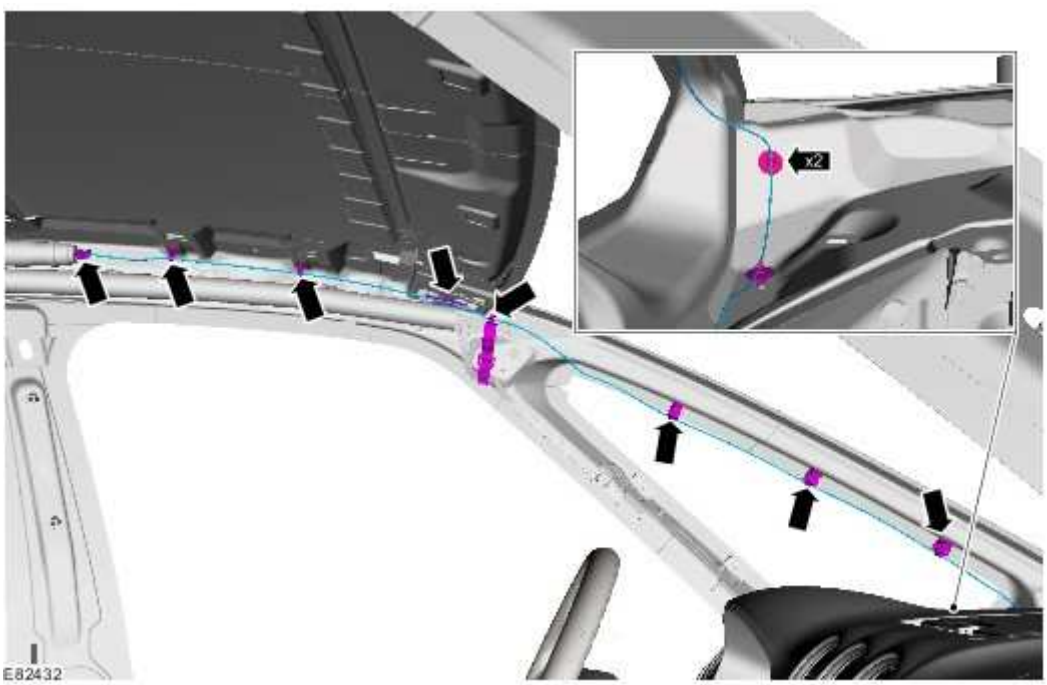


47.



48.

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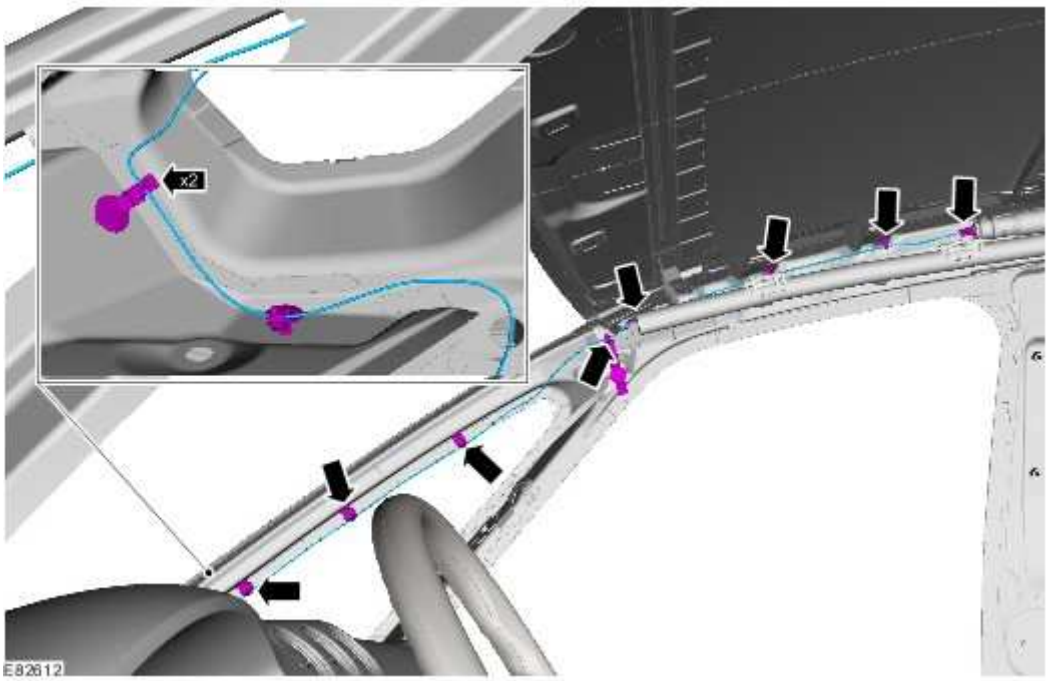

Installation

1. To install reverse the removal procedure.

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Print

Removal and Installation

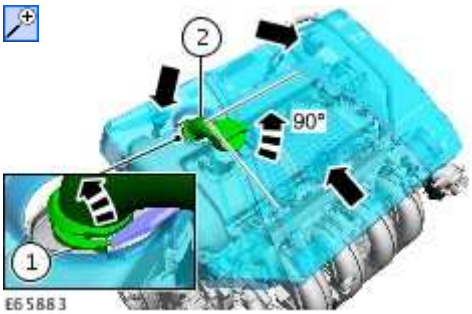
General Equipment

3.5 mm drill bit
Center punch

Removal

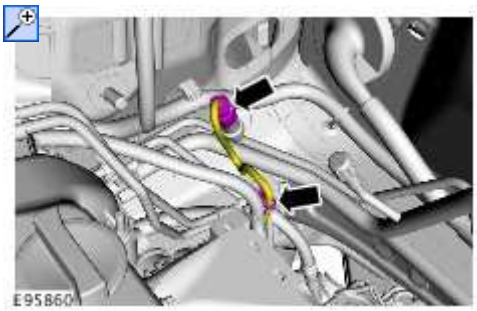
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 2.0L Duratec-HE (107kW/145PS) - MI4/2.0L Duratec-HE Flex Fuel (107kW/145PS) - MI4/2.3L Duratec-HE (118kW/160PS) - MI4, Removal and Installation).
3.



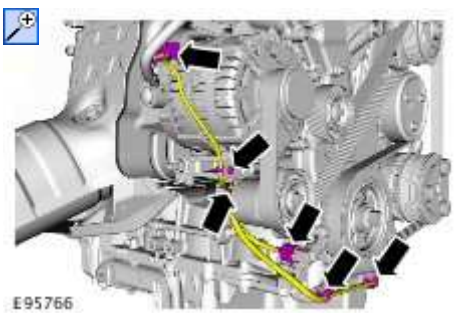
Vehicles built up to 09/2007

4.



All vehicles

5. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
6.



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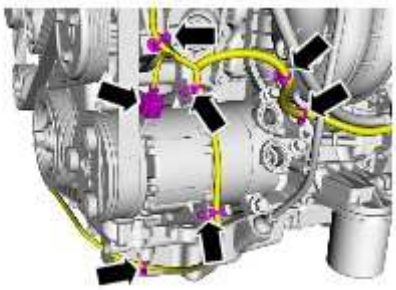
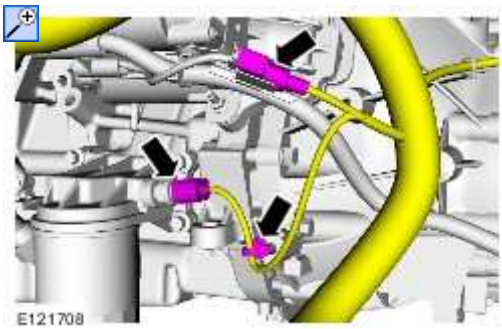


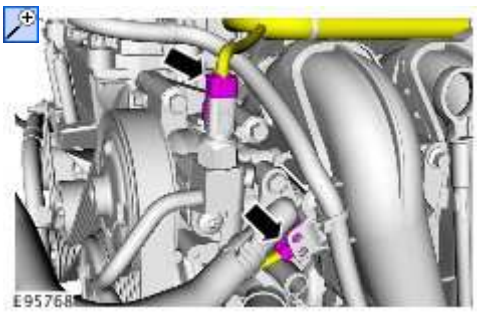
7.



8.

9. Right-hand headlamp.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



10.

Vehicles with 2.0L engine

11. *Torque:*
    10 Nm

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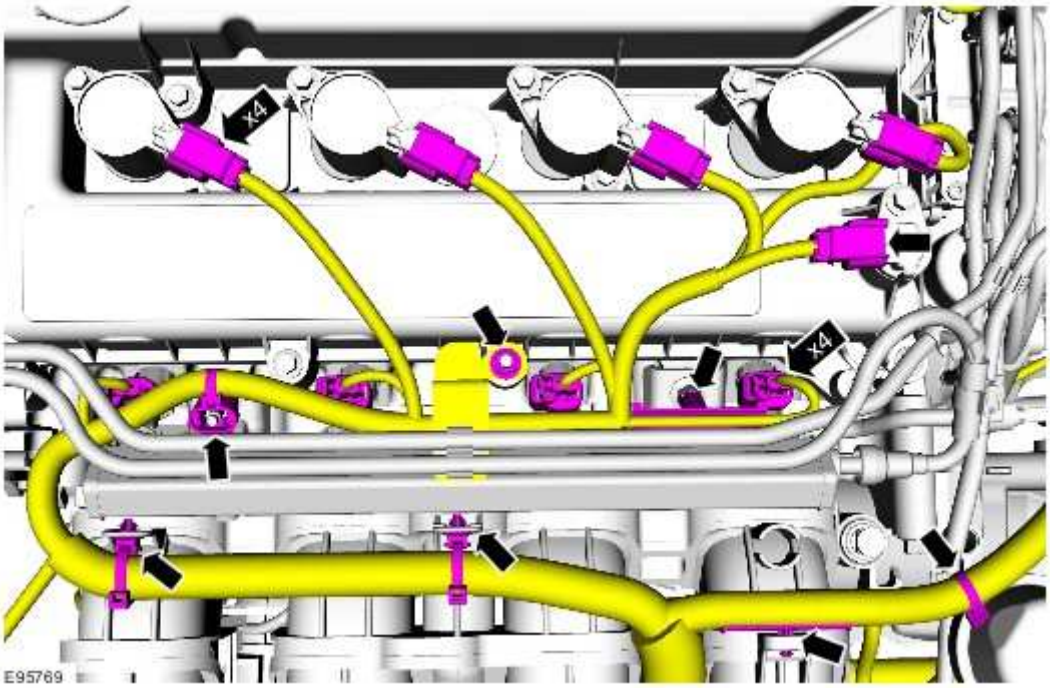
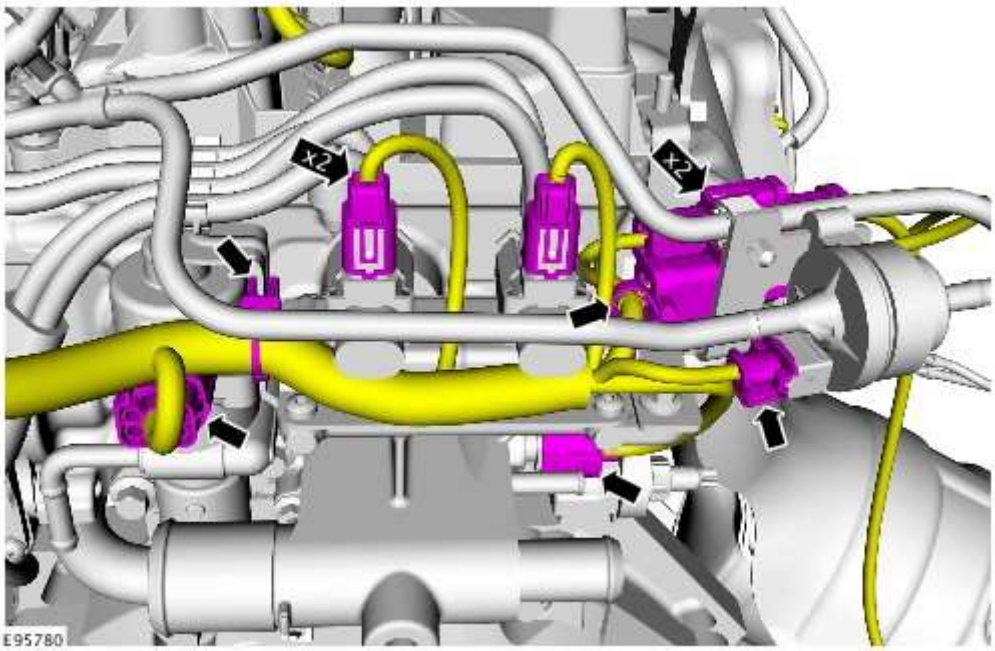
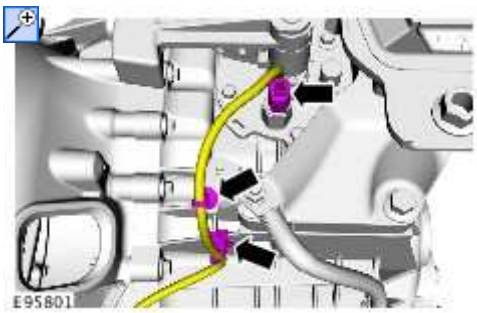


12.





13.

Vehicles with 2.3L engine

14.

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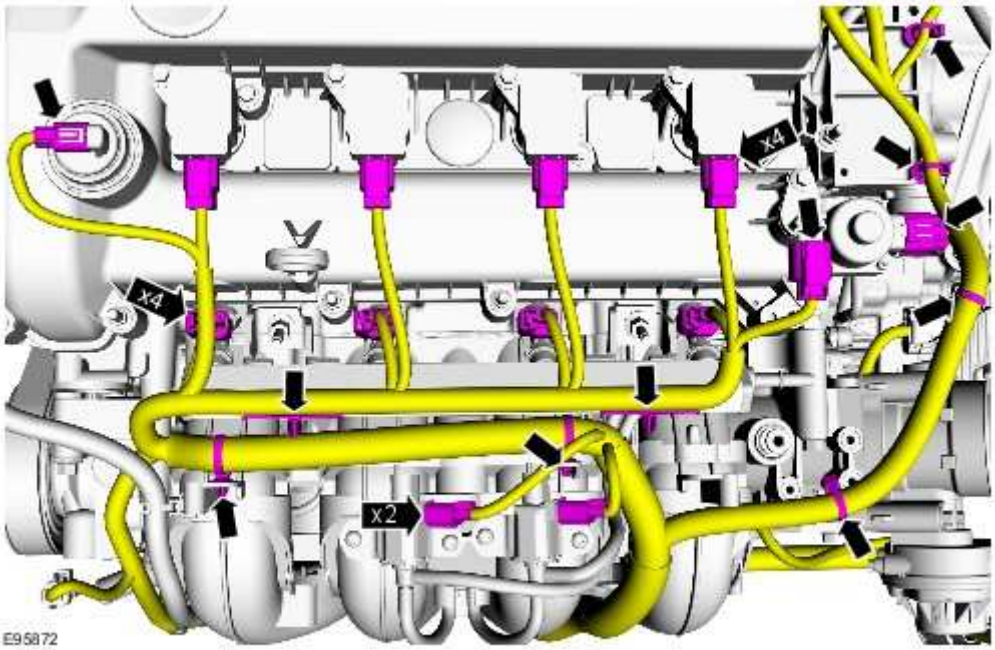

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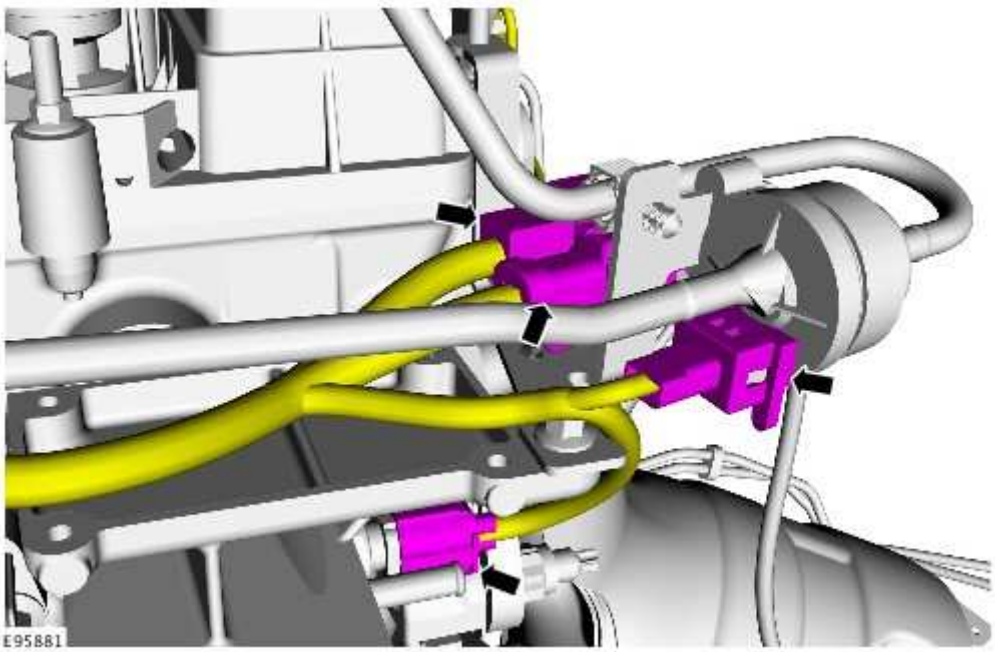
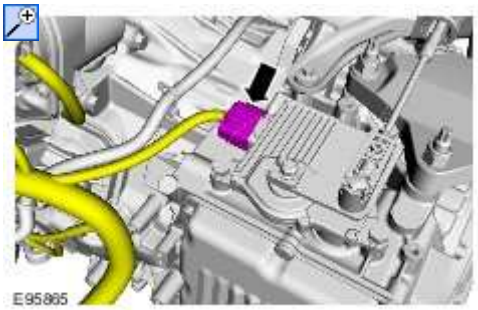


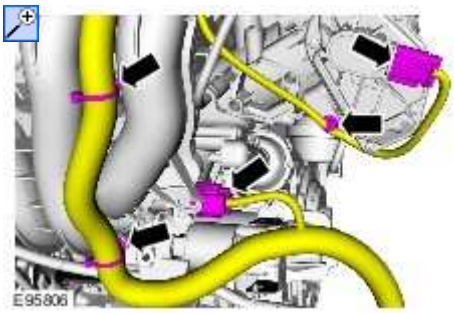
16.

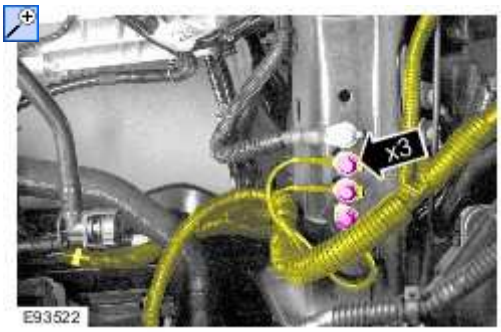


All vehicles

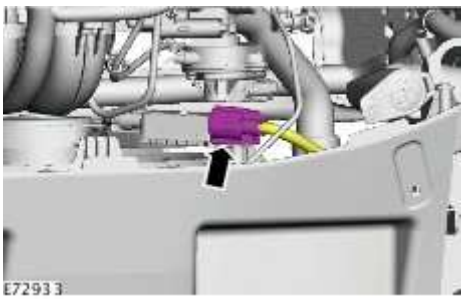
17.

http://vnx.su



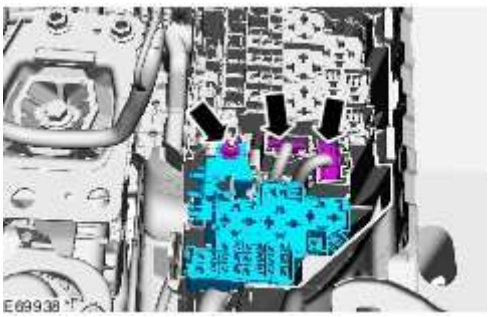


18. *Torque:* 10 Nm



19.

20.



21. *Torque:* 10 Nm

22. Remove the left-hand front wheel and tire.

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

23.

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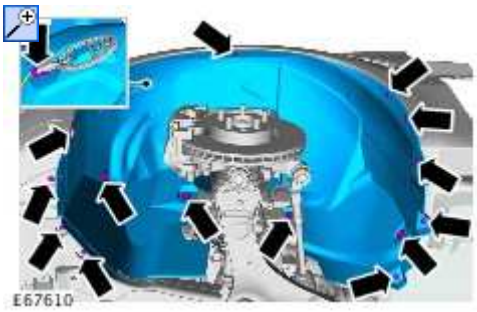
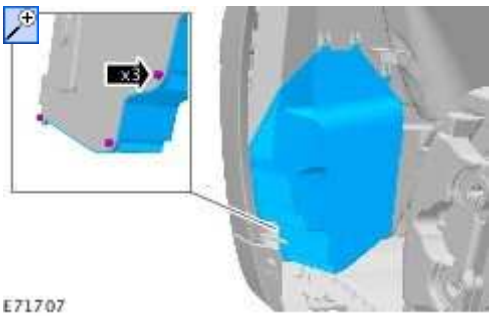
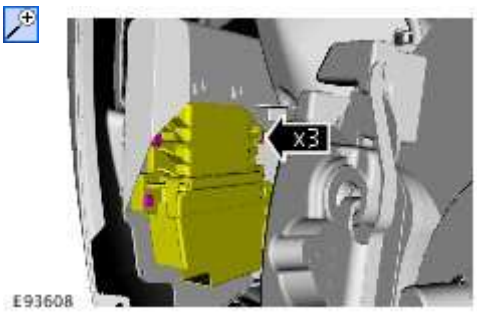


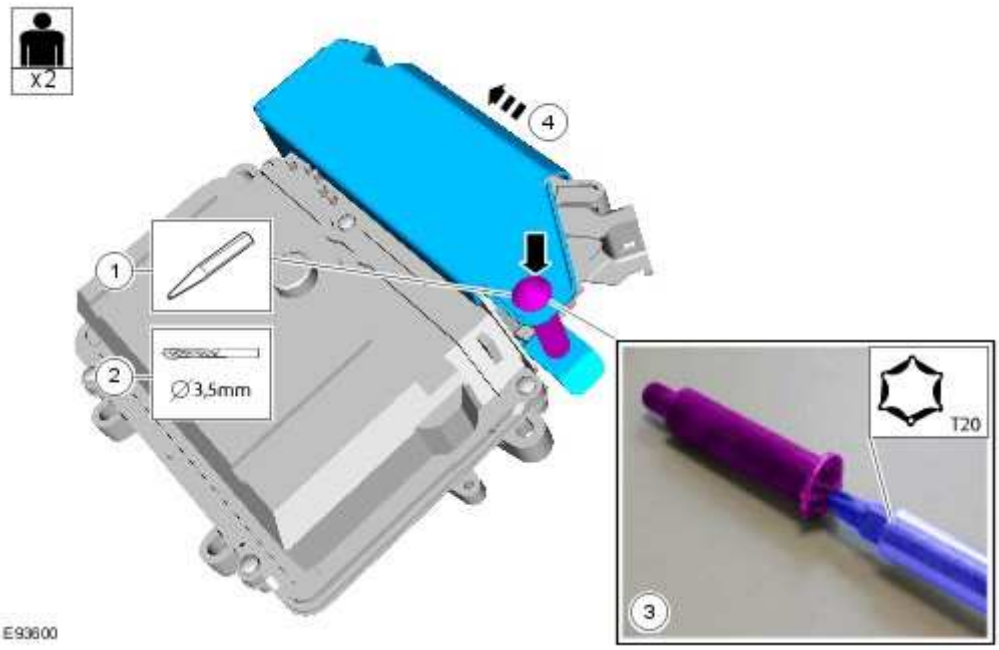


24.

Vehicles with PCM security shield



25. *Torque:* 3 Nm



26. *General Equipment:* Center punch
General Equipment: 3.5 mm drill bit

All vehicles

27.

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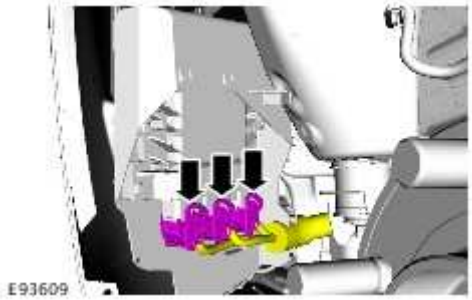
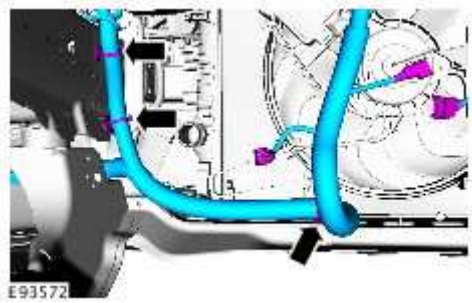


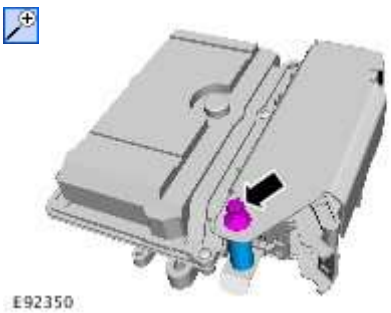


28.

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield



2. Tighten the shear bolt until the head is sheared off.

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Print

Removal and Installation

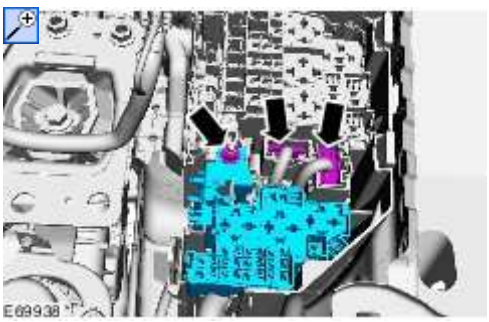
General Equipment

3.5 mm drill bit
Center punch

Removal

1. Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
2. Refer to: Air Cleaner (303-12B Intake Air Distribution and Filtering - 2.0L EcoBoost SCTi (149kW/203PS) - MI4, Removal and Installation).
3.

4.

5. *Torque:* 10 Nm


6. Remove the left-hand front wheel and tire.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).
7.

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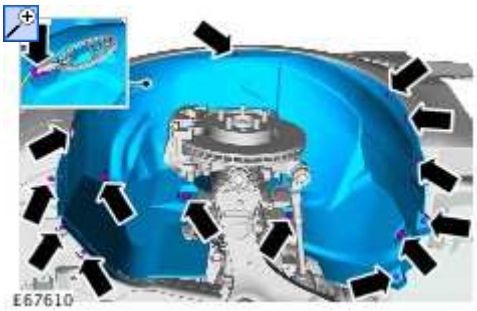
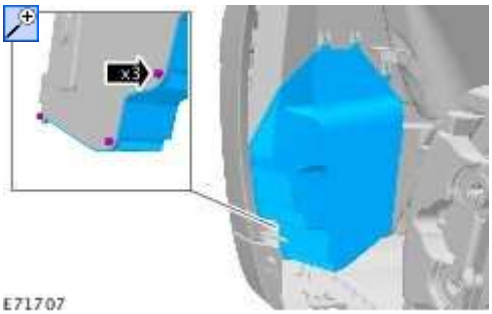
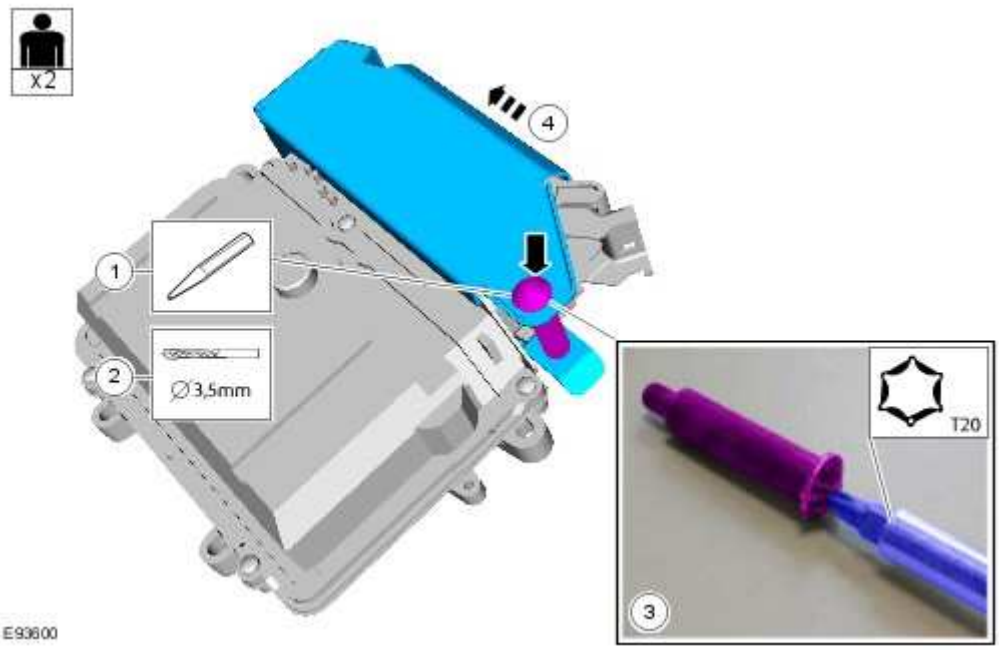




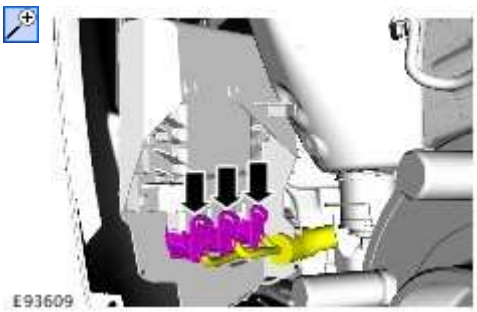
8.

Vehicles with PCM security shield

9. *General Equipment:* Center punch *General Equipment:* 3.5 mm drill bit



All vehicles



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11.

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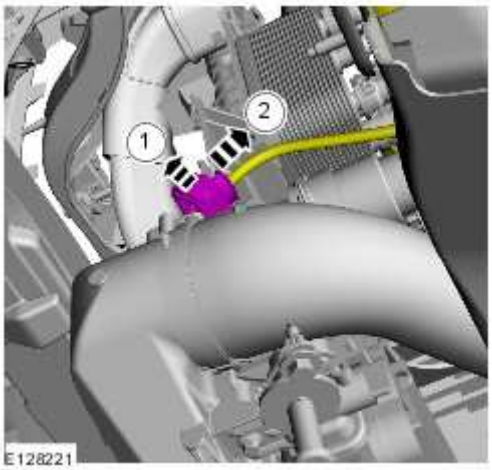

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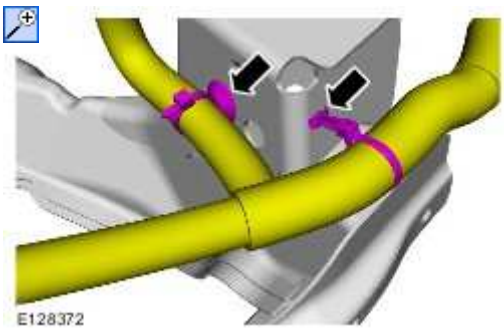

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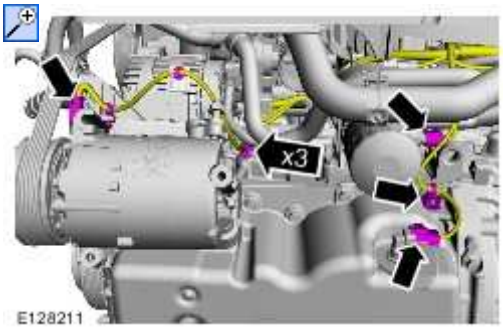

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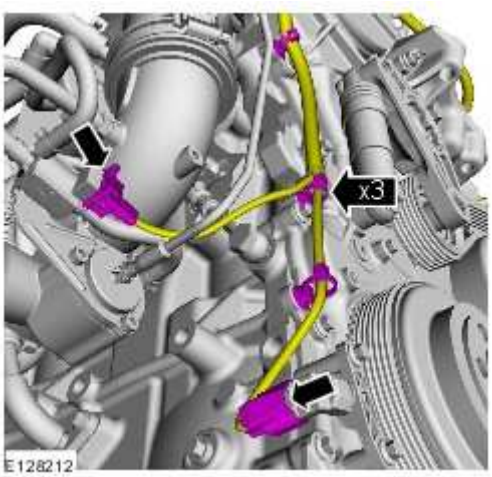

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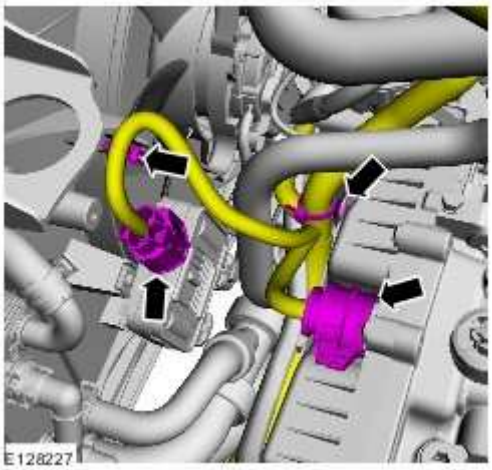

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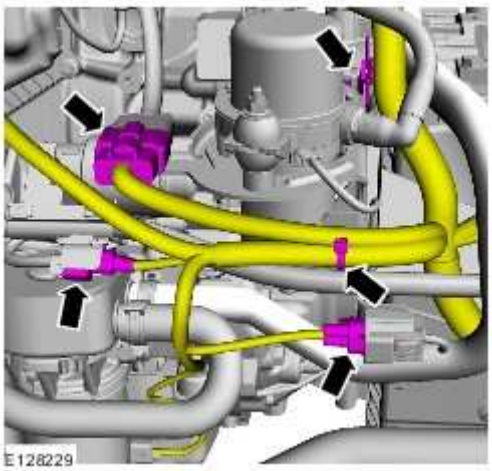

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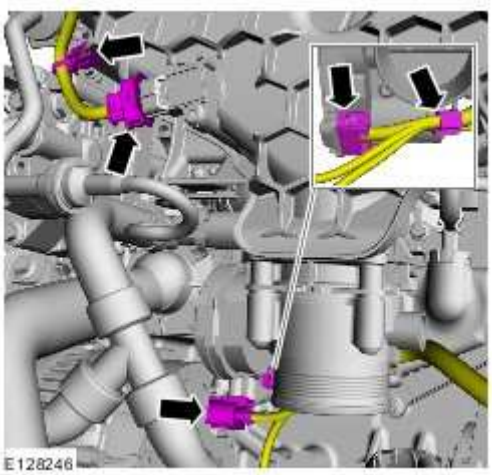

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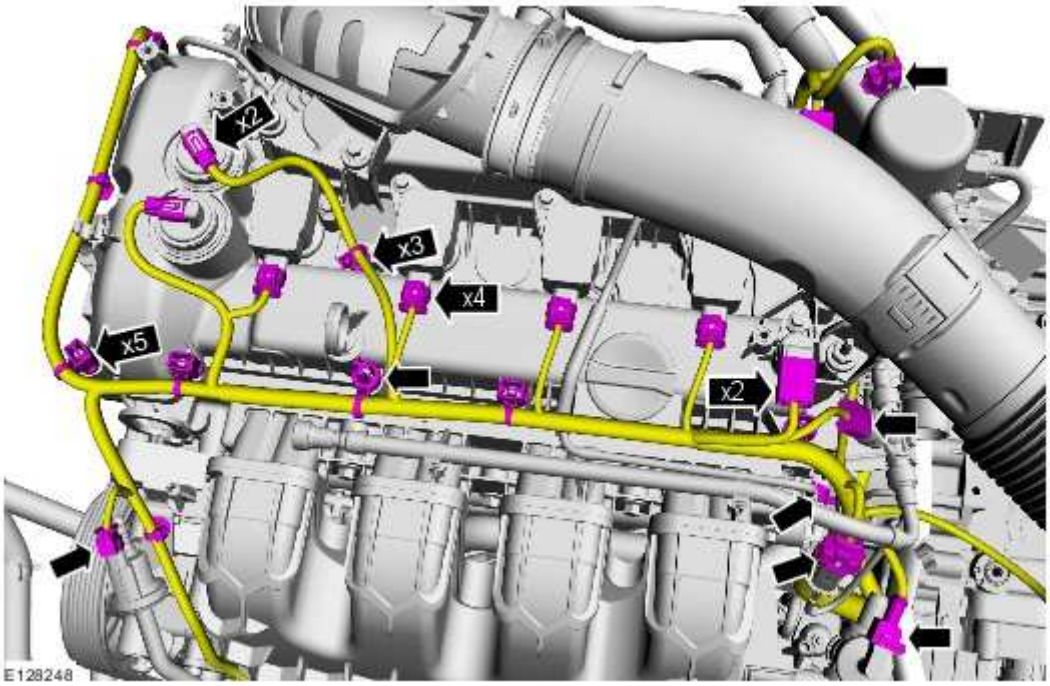
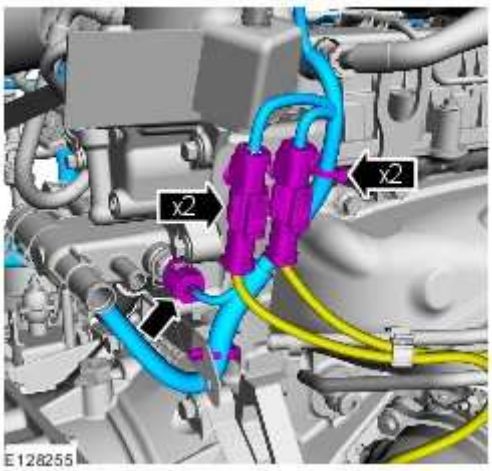


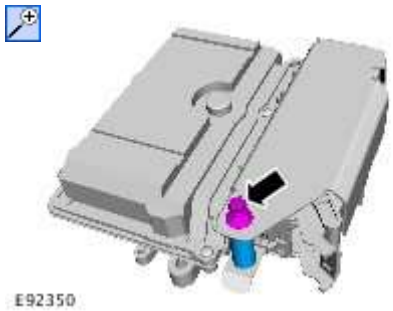


19.

Installation

1. To install, reverse the removal procedure.

Vehicles with PCM security shield



2. Tighten the shear bolt until the head is sheared off.

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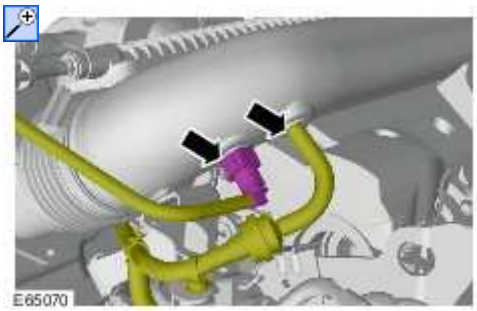
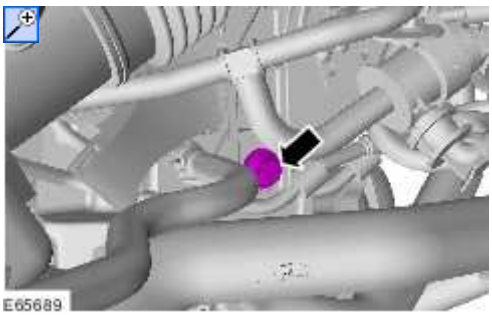
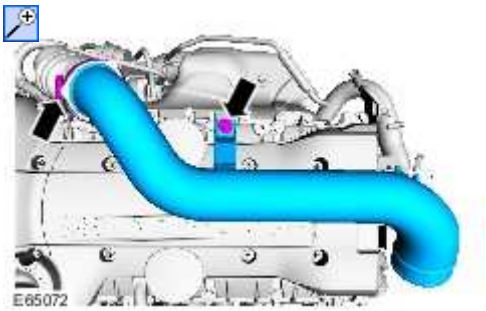
Print

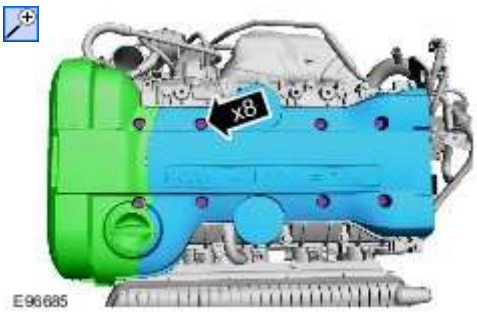
Removal and Installation

Removal

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.5L Duratec (162kW/220PS) - VI5, Removal and Installation).
3. 

4. *Torque:* 10 Nm


5. *Torque:* 10 Nm


6. *Torque:* 10 Nm


7. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
8.

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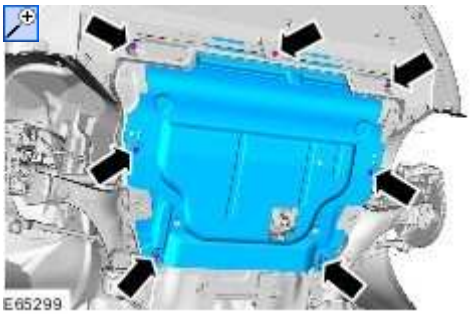
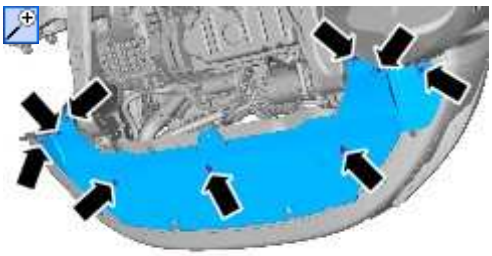

E65299

9.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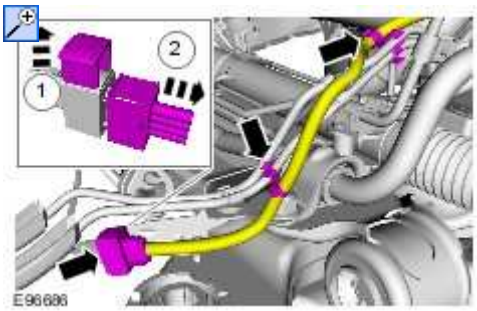

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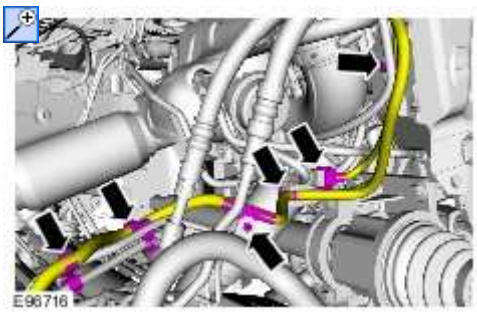
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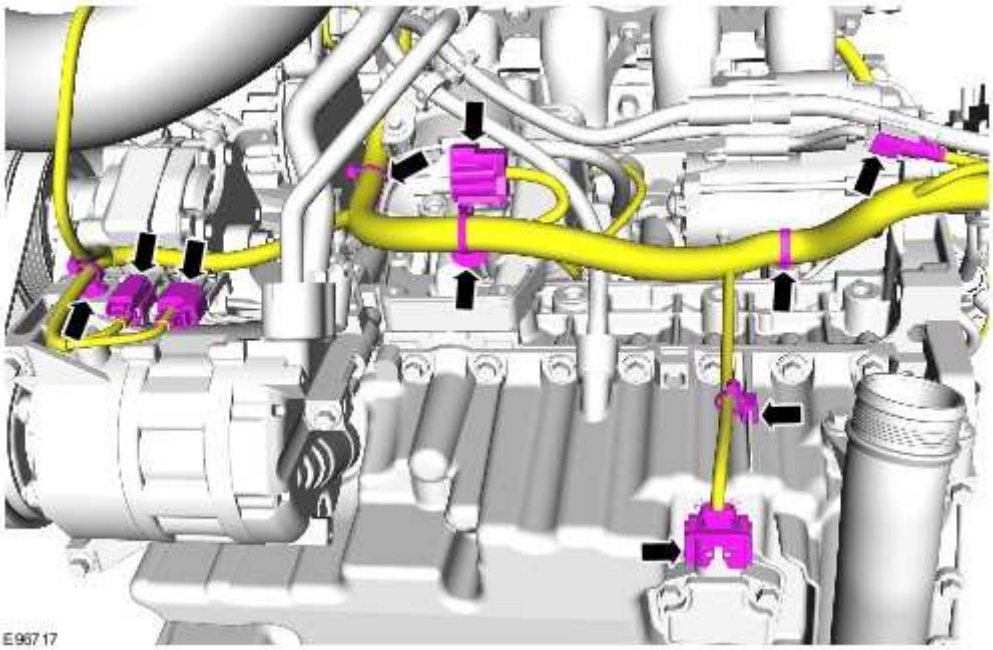
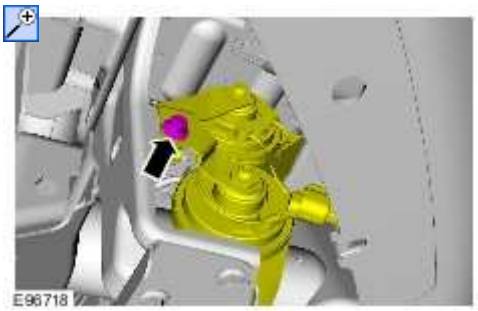
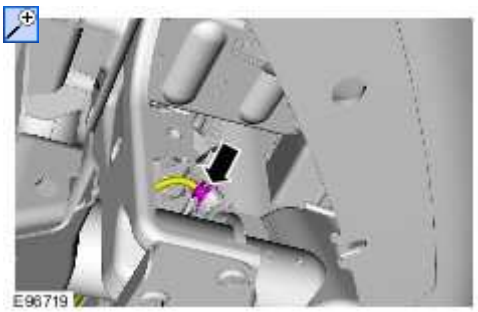
http://vnx.su





13. *Torque:* 15 Nm



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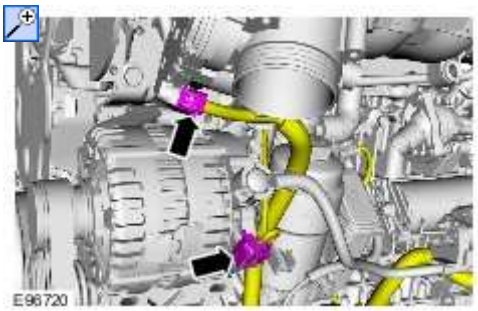

15.

16.

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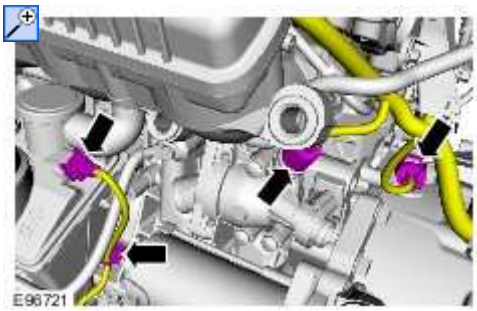

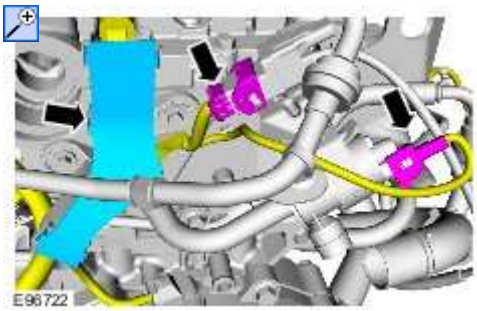

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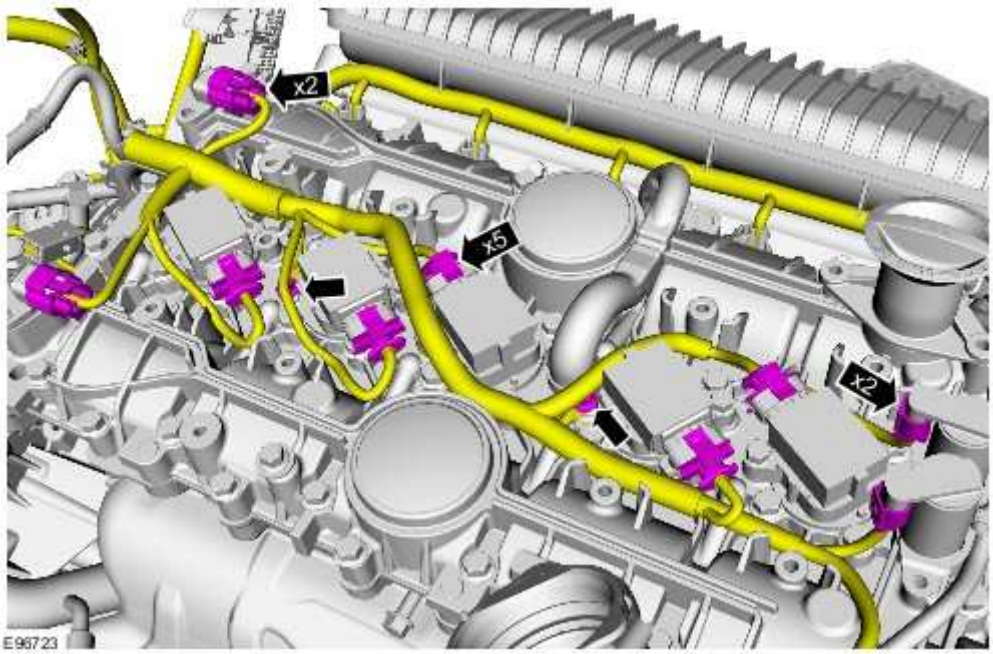
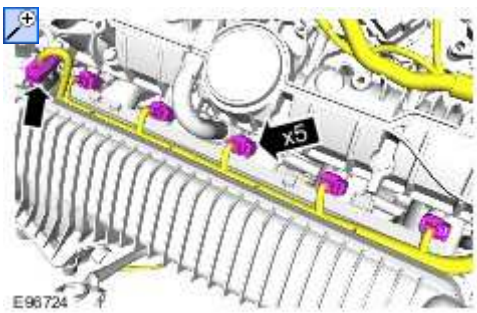


18. *Torque:* 10 Nm



19.

Vehicles built up to 09/2007

20.

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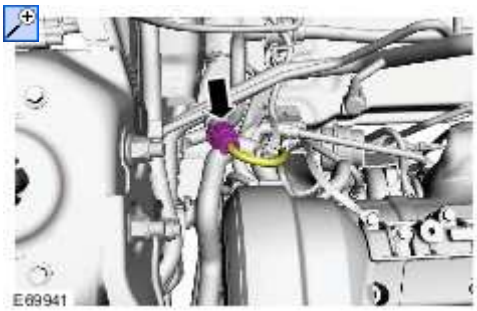
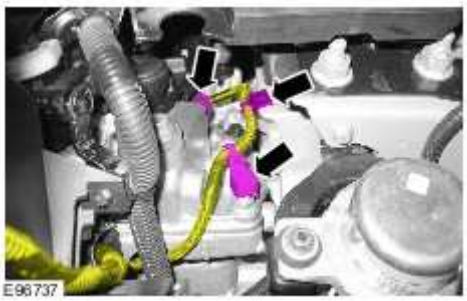
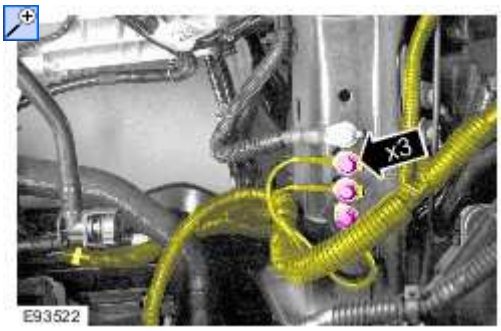


21.

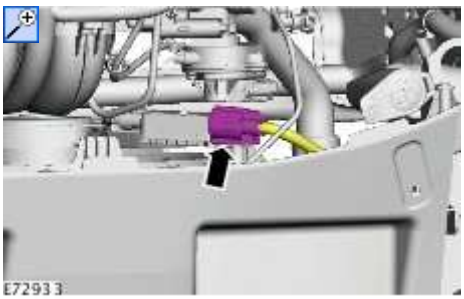
All vehicles

22.





23. *Torque:* 10 Nm



24.

25.

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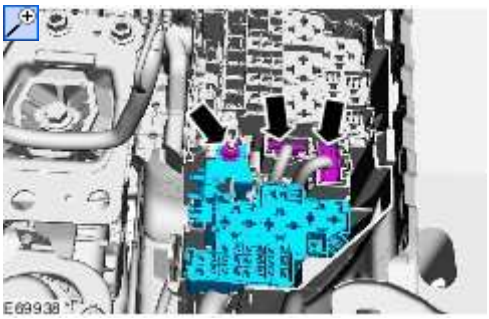

26. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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Pri

Removal and Installation

Removal

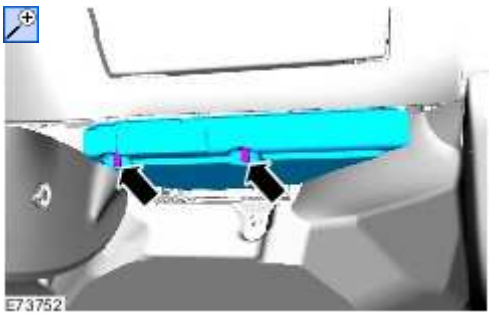
NOTE: Removal steps in this procedure may contain installation details.

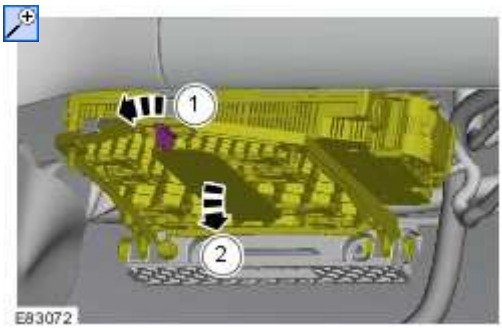
1. Remove the right- and left-hand headlamps.

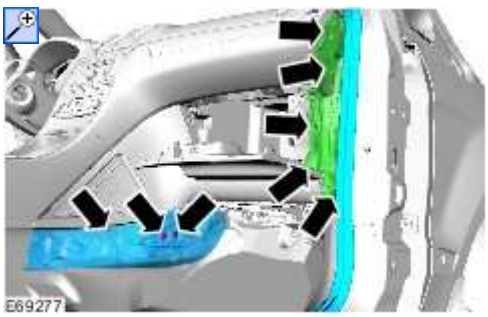
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

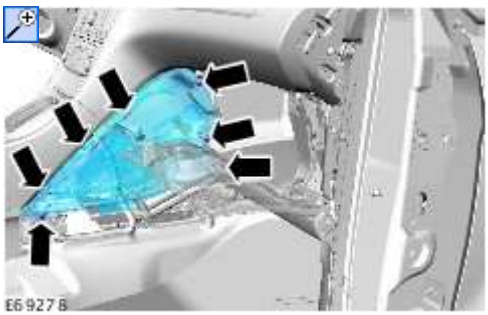
2. Remove the hydraulic control unit (HCU).

   Refer to: Hydraulic Control Unit (HCU) (206-09A Anti-Lock Control, Removal and Installation).

3. 

4. 

5. 

6. 

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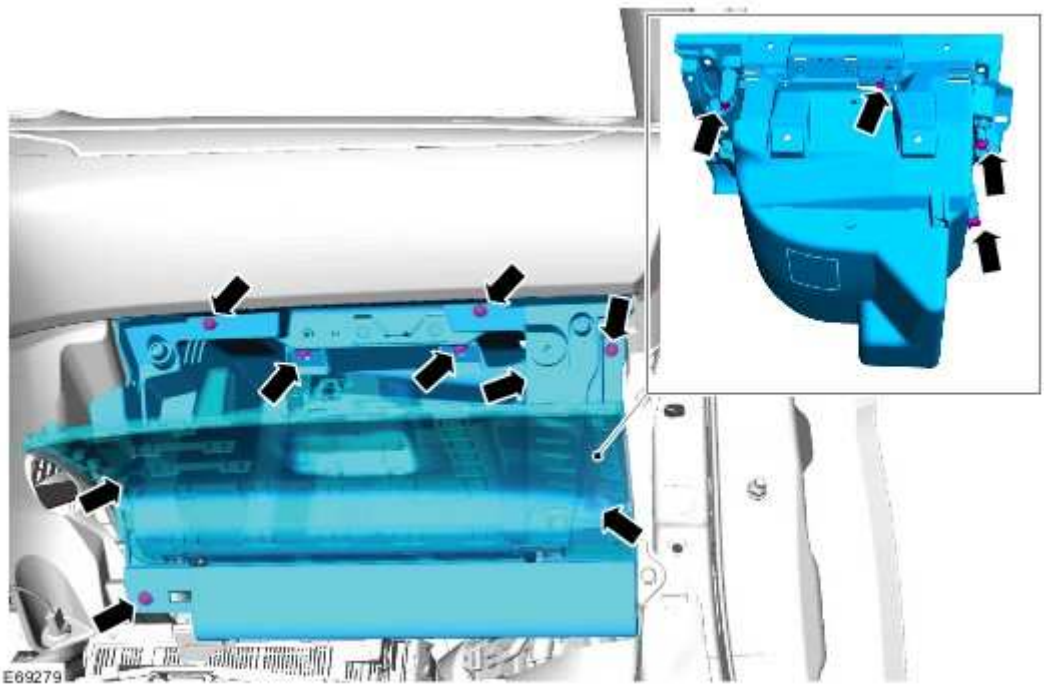

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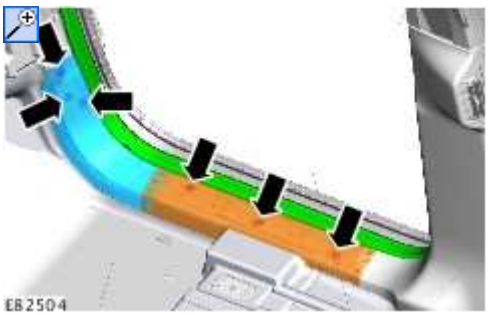

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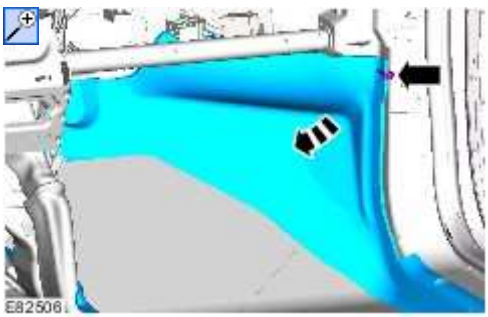

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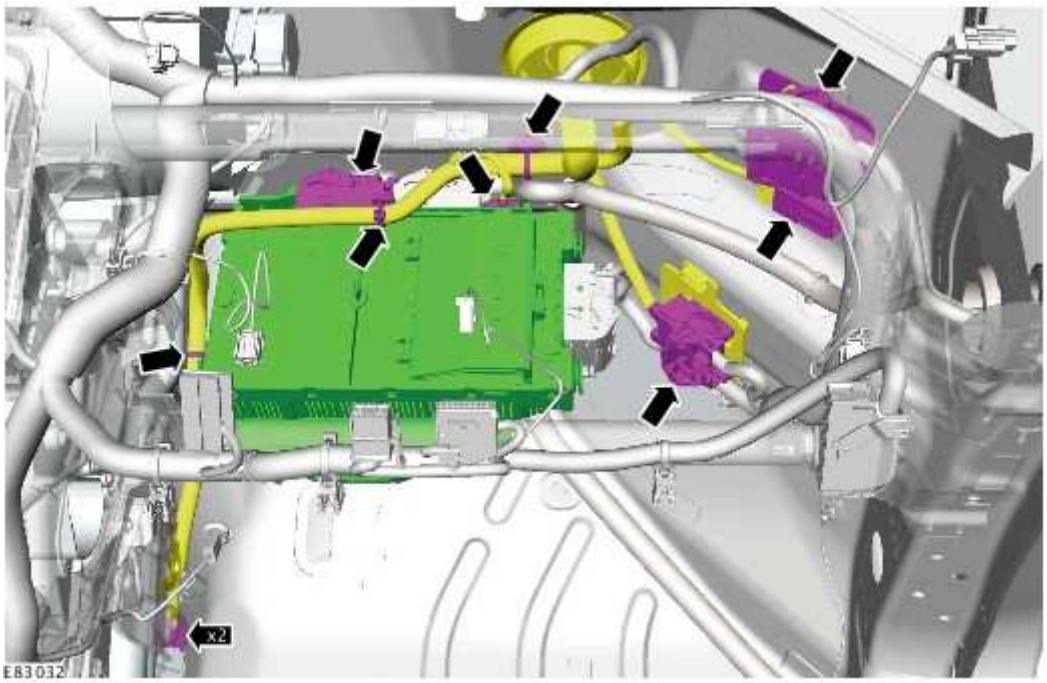


Vehicles with fuel fired heater

11. Remove the fuel fired booster heater.

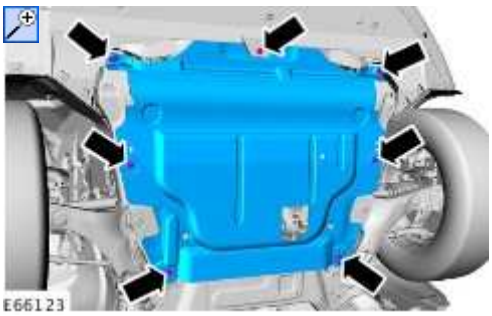
    Refer to: Fuel Fired Booster Heater (412-02 Auxiliary Climate Control, Removal and Installation).

All Vehicles

12. Raise the vehicle.

    Refer to: Anheben mit Hebebühne (100-02 Fahrzeug anheben, Description and Operation).

13.



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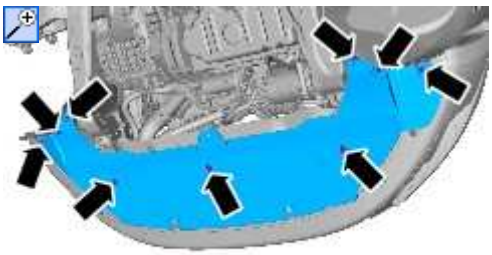

15.

- On both sides

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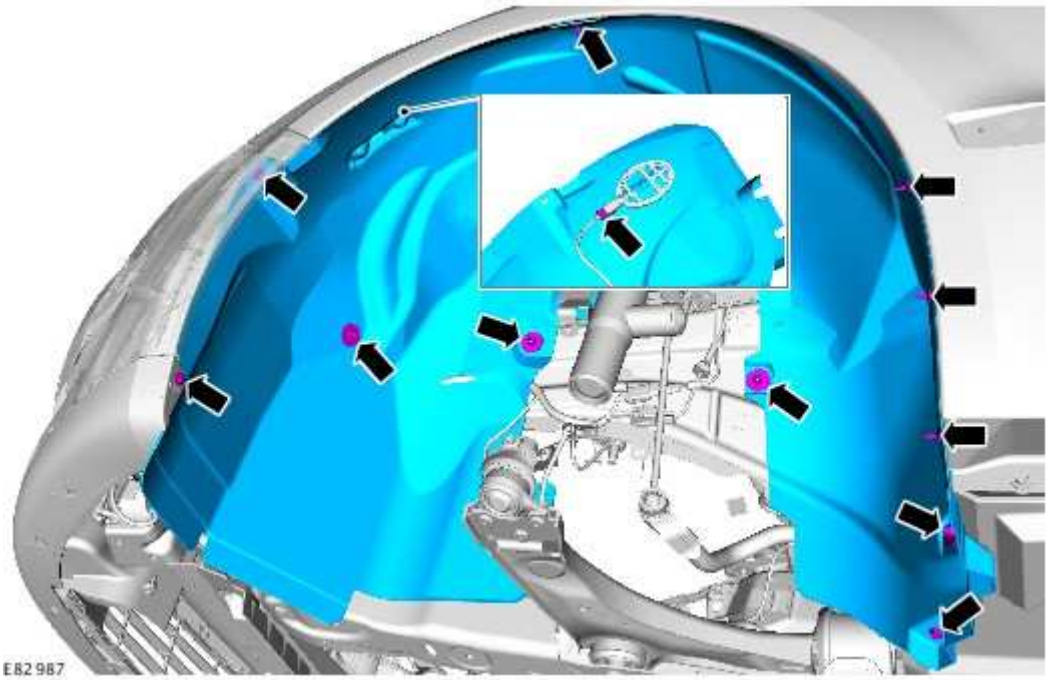

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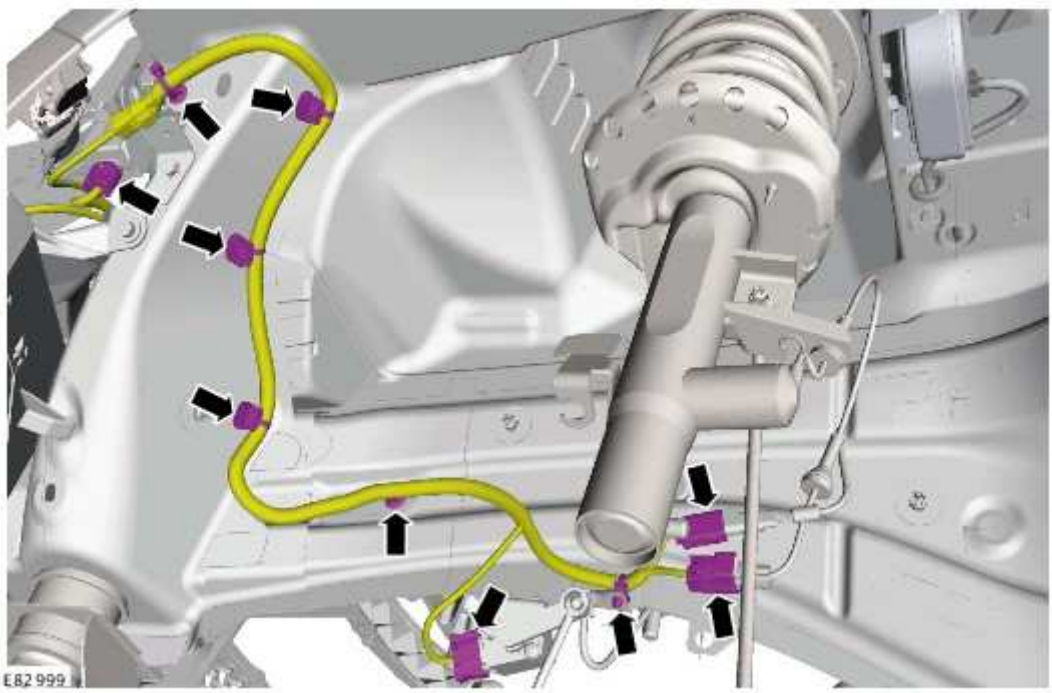

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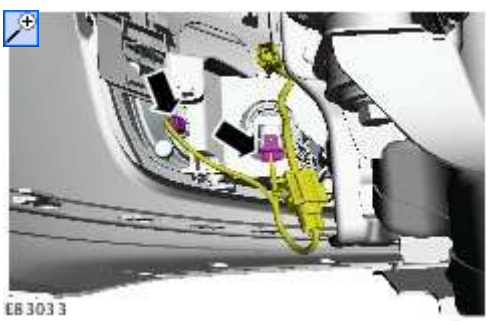

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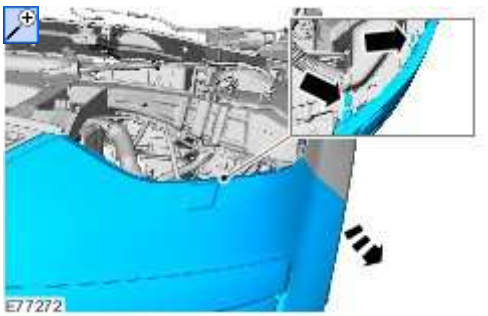
19.



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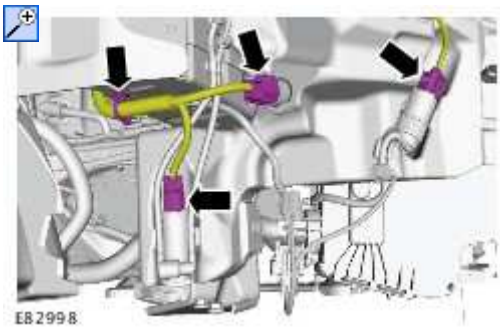

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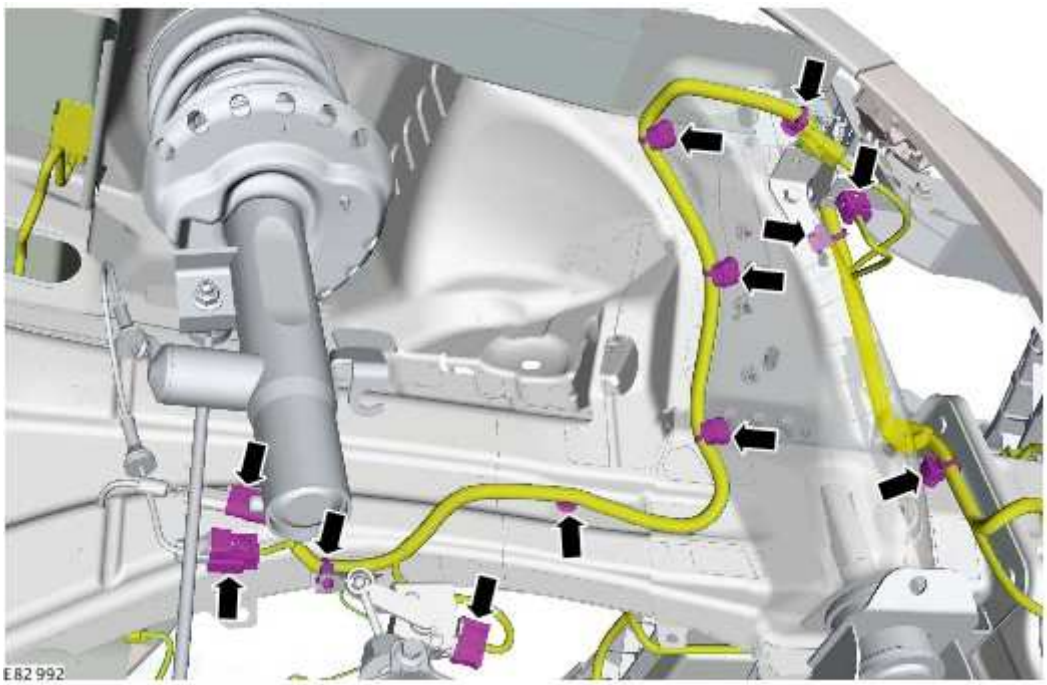

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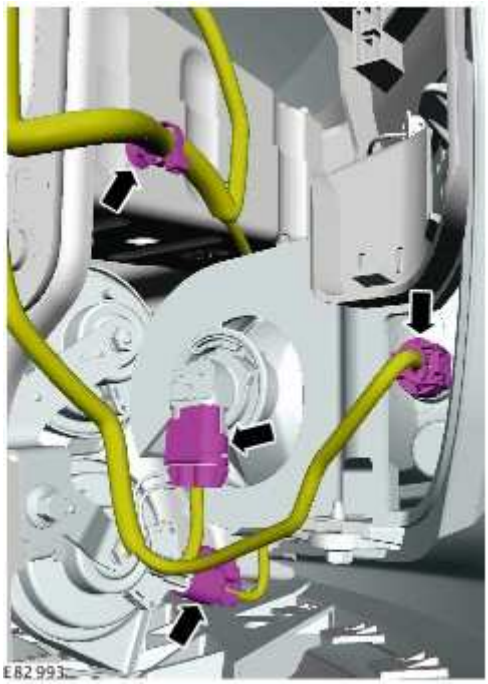
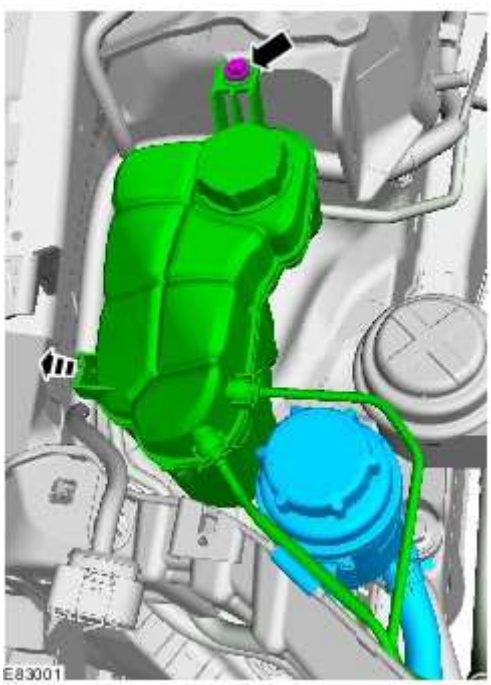


23. Lower the vehicle.
24.



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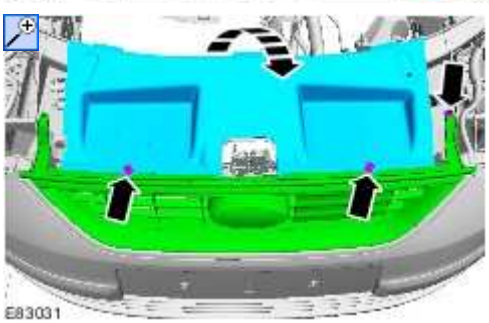

26.

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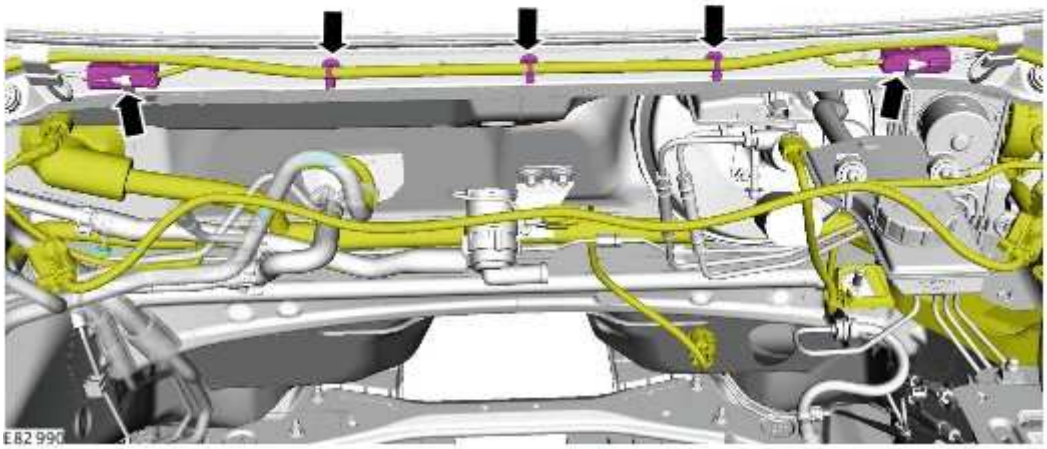
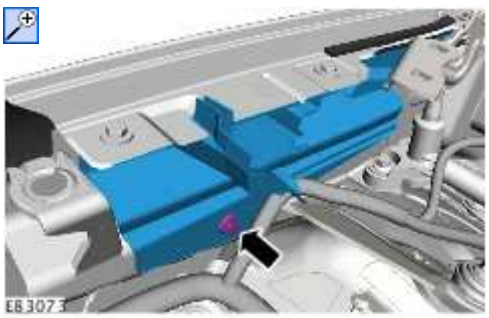
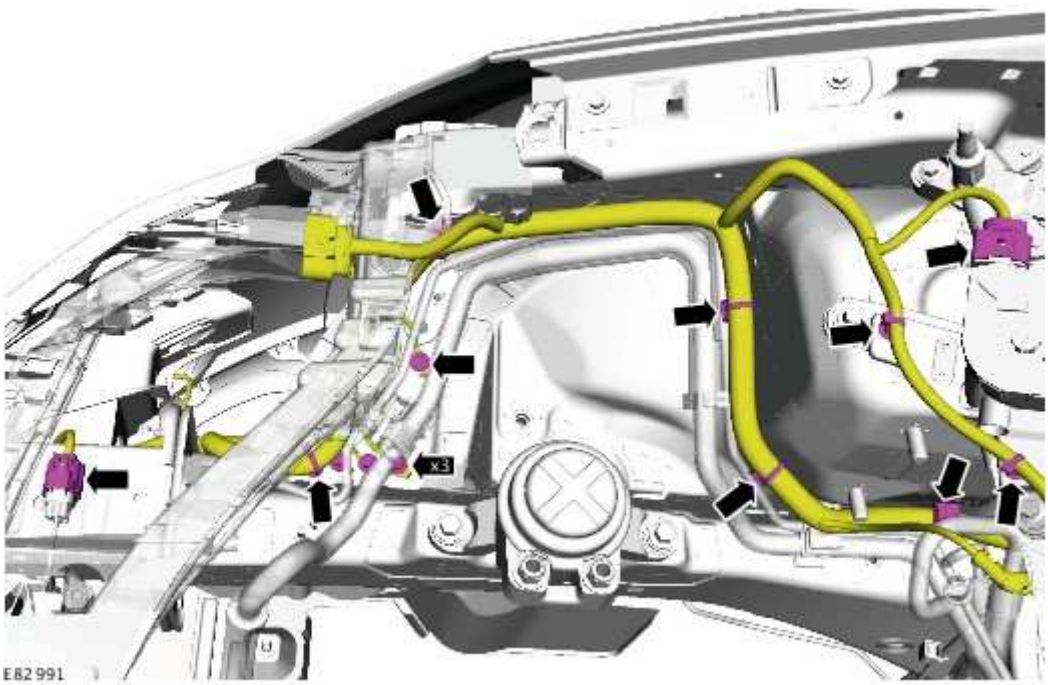




27.

28. *Torque:* 10 Nm



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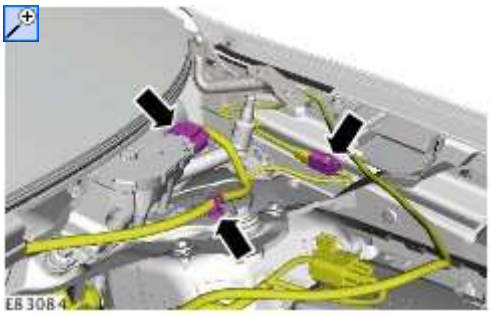
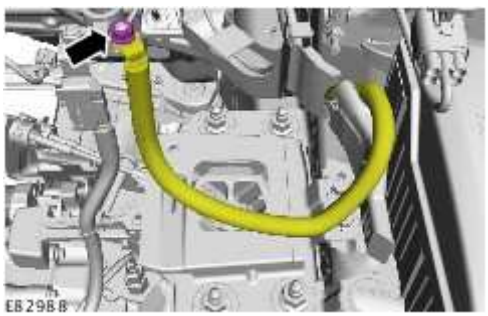
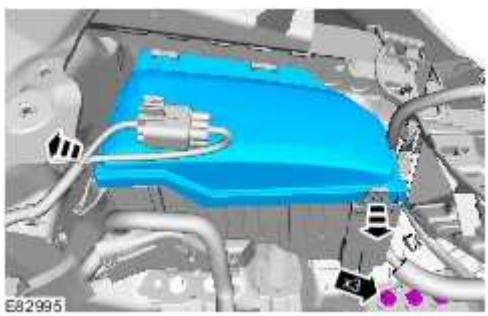
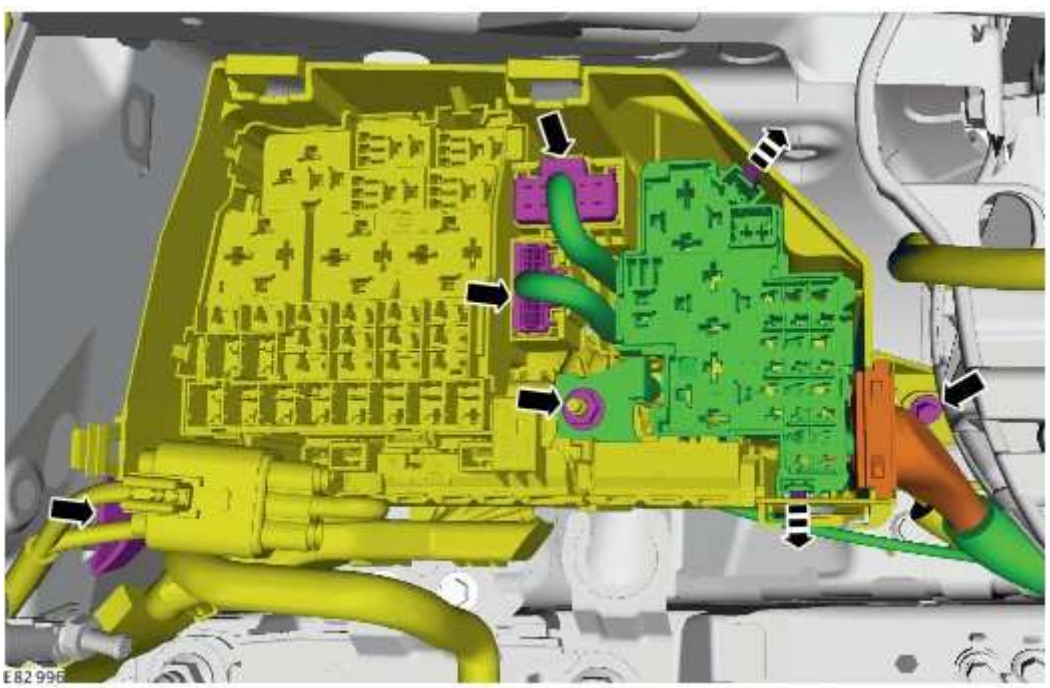




30. *Torque:* 13 Nm



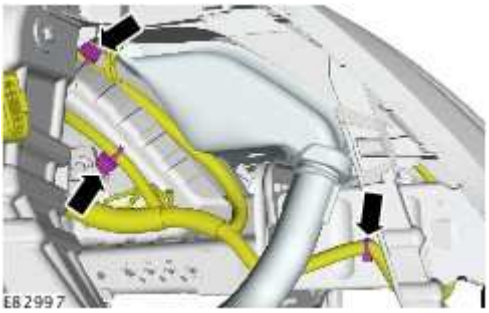
31. *Torque:* 10 Nm



32. *Torque:* 1(Nm

33.

http://vnx.su



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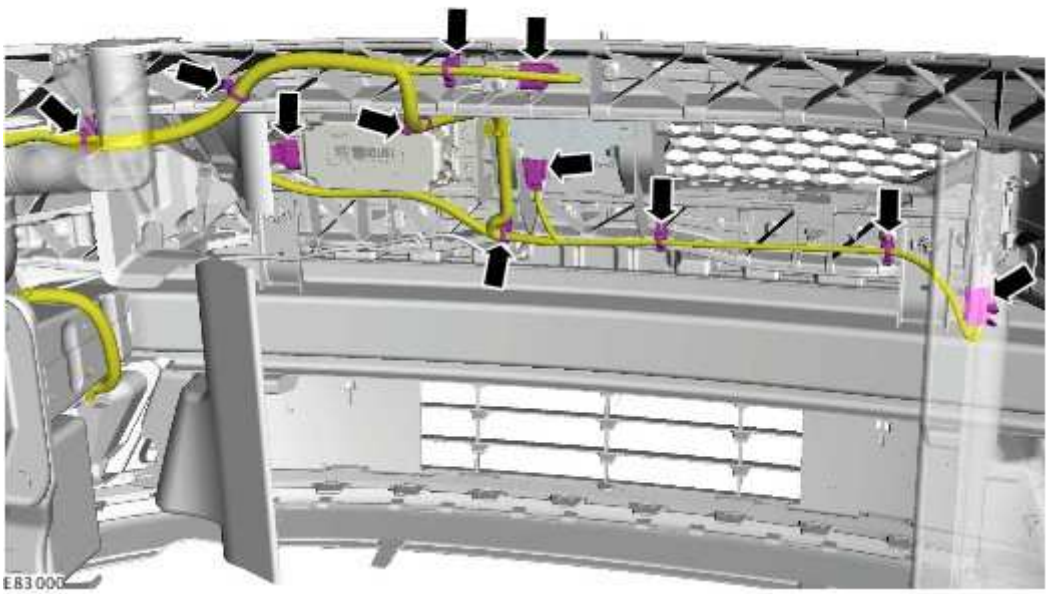
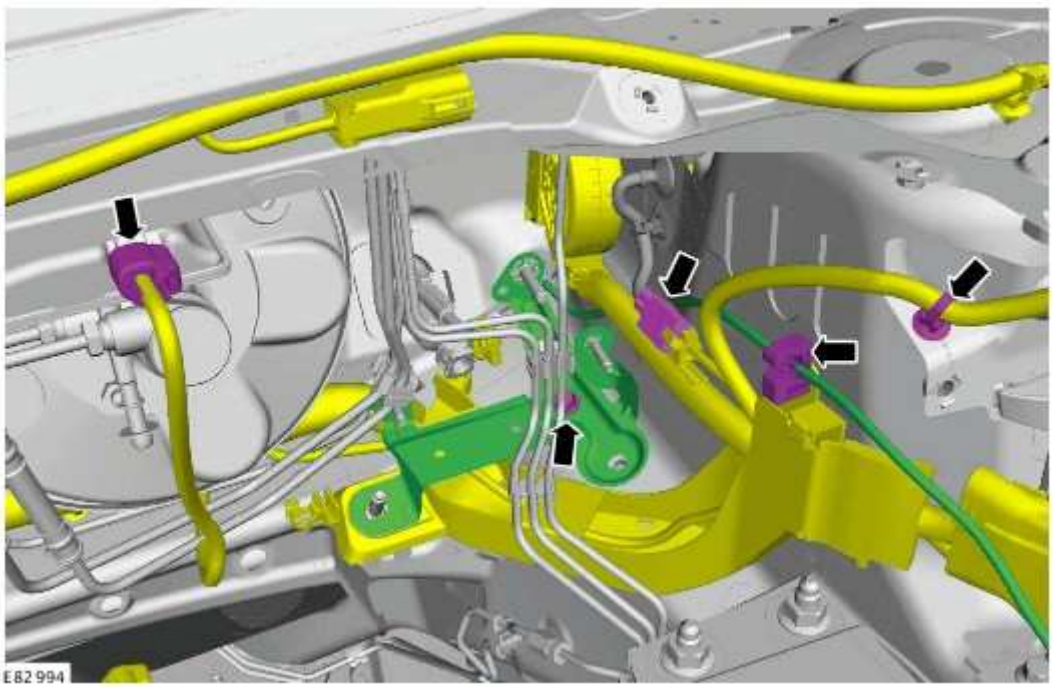


35. *Torque:*
<u>12 Nm</u>



Vehicles with fuel fired heater

36.

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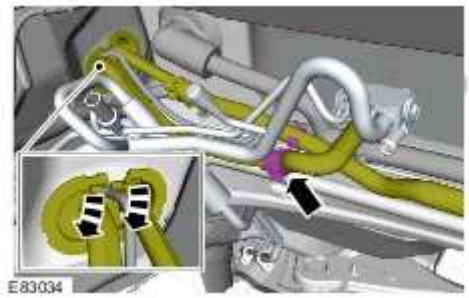
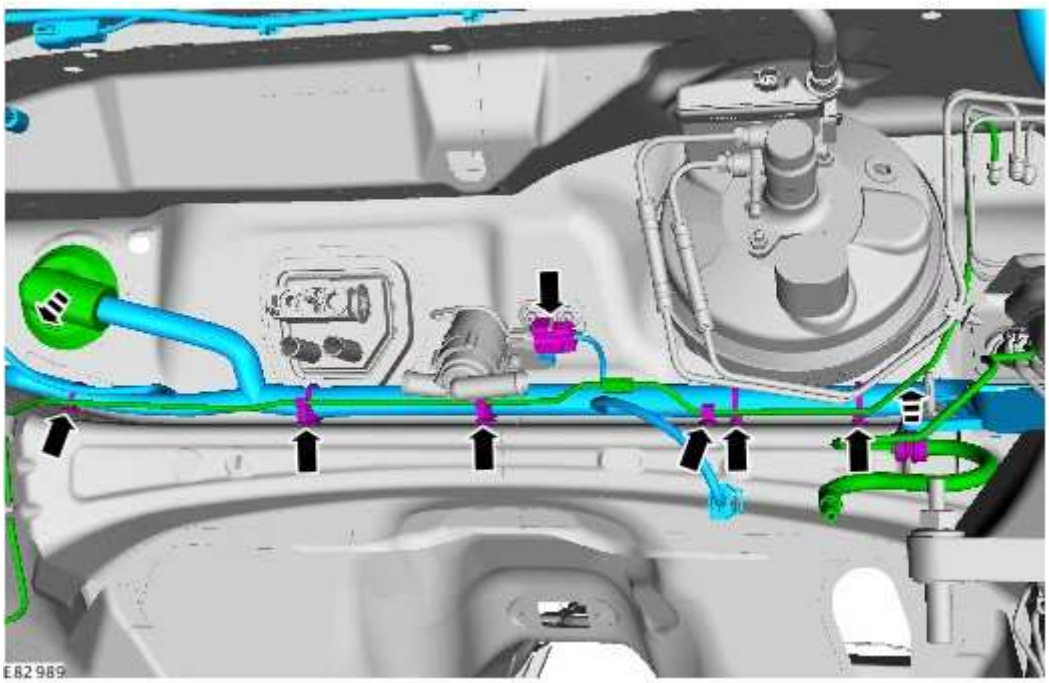


All Vehicles

37.



Installation

1. To install reverse the removal procedure.

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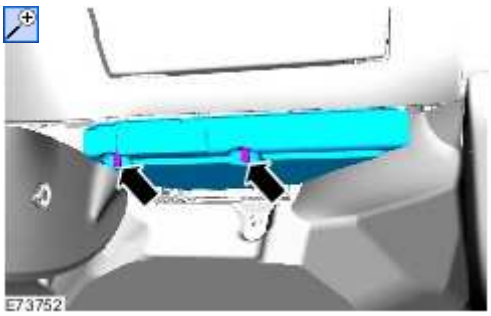
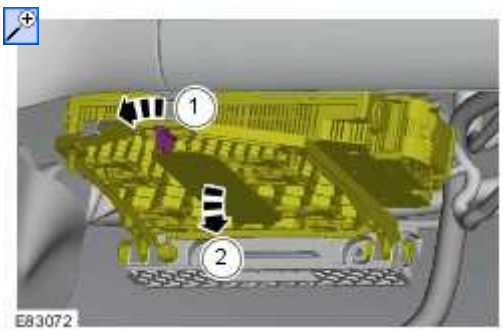
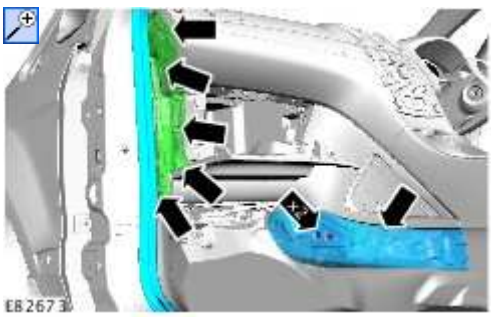
Removal and Installation

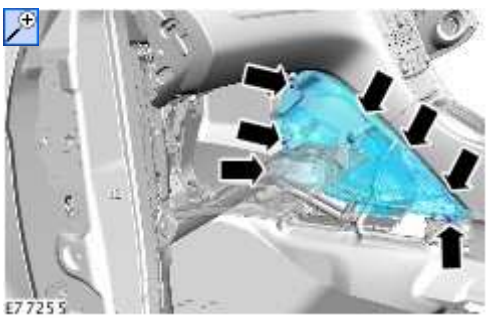
Removal

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

1. Refer to: Headlamp Assembly (417-01 Exterior Light Removal and Installation).
2. Refer to: Hydraulic Control Unit (HCU) (206-09A Ant Control, Removal and Installation).
3. 

4. 

5. 

6. 

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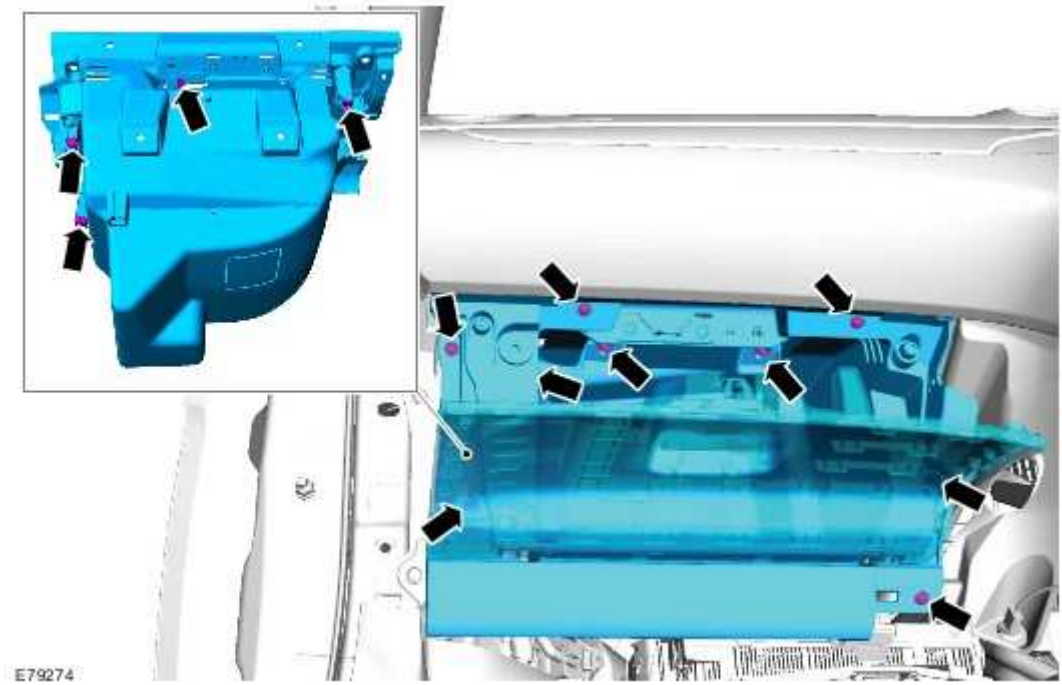

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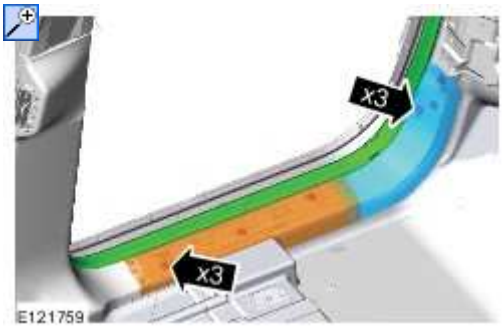

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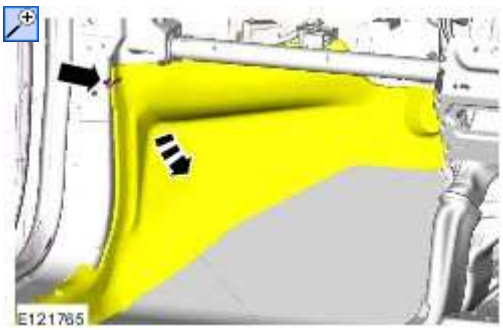

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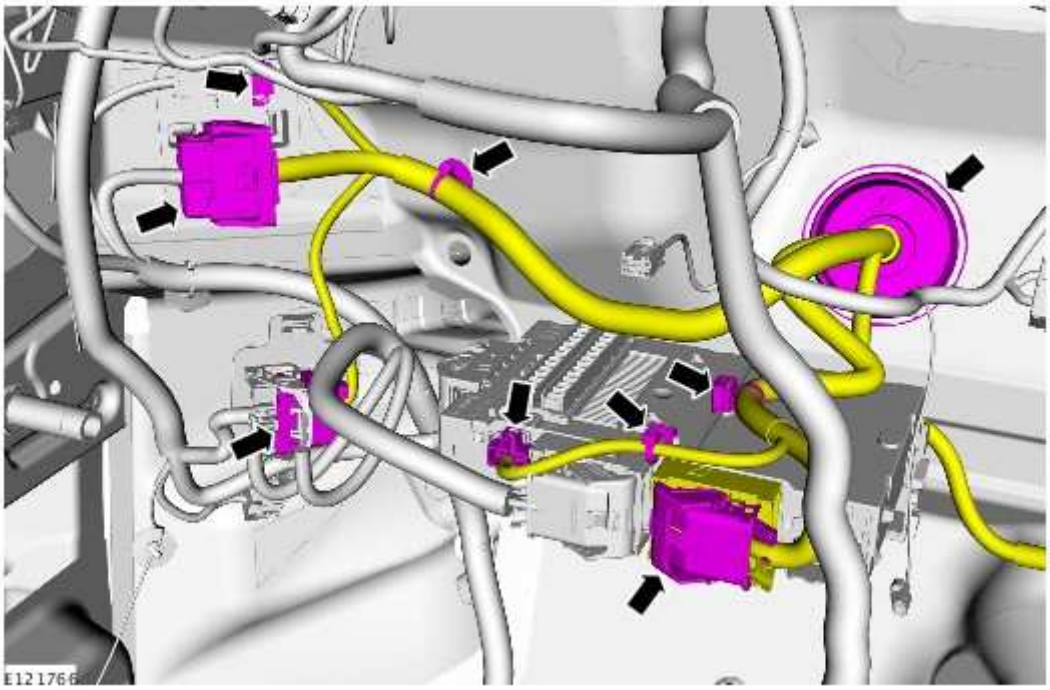

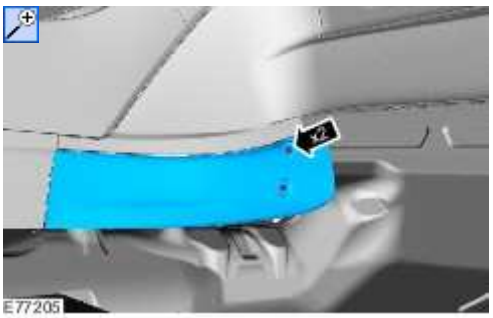

11.

12.

13.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

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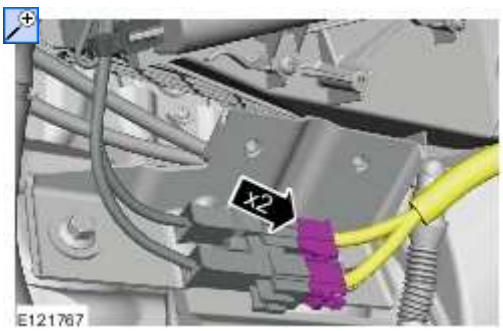
14.



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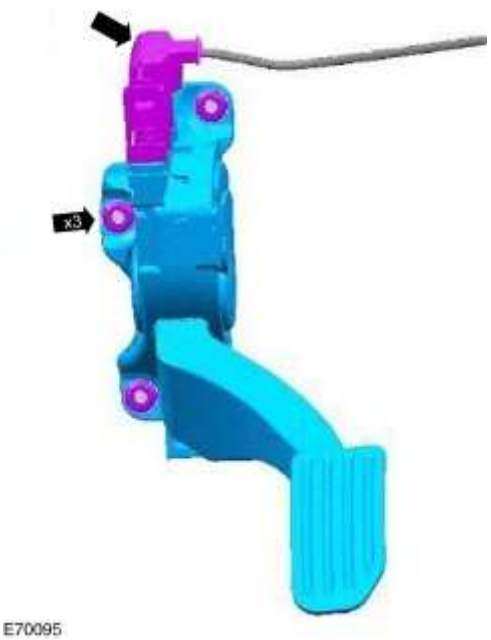

16. NOTE: The brake pedal actuating rod pin will be damaged during removal.
Torque: 24 Nm

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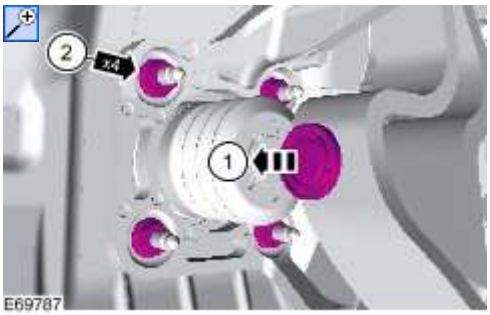
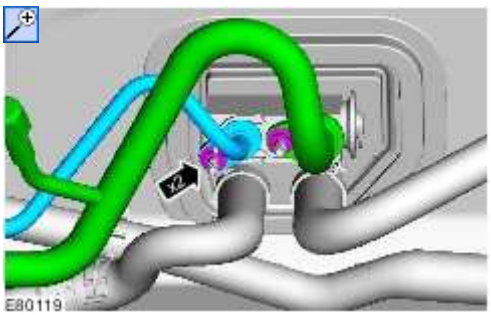


17. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control Sy General Information, General Procedures).



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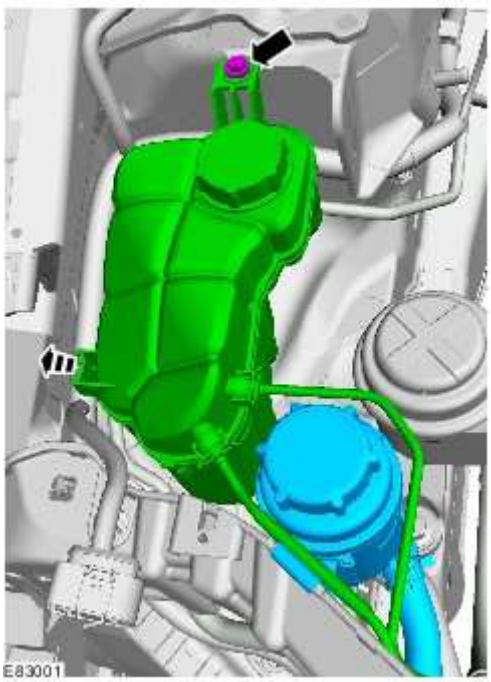

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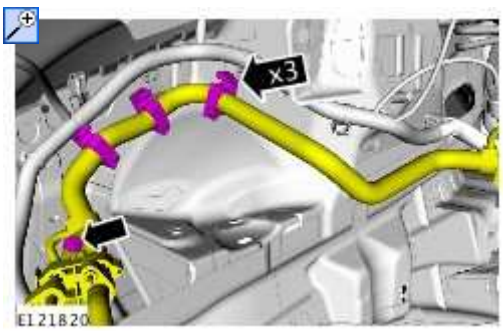

20. *Torque:* 10 Nm

21. CAU Make su

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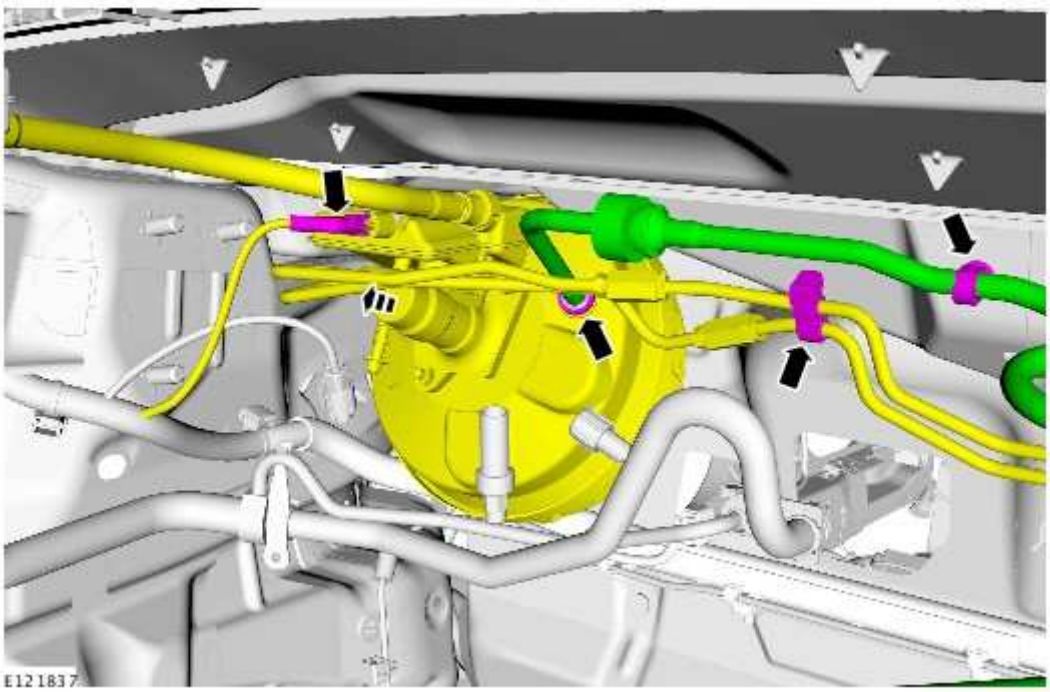


that the booster rod is correctly located.

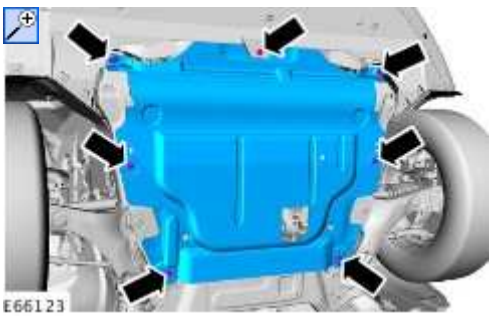
Vehicles with fuel fired heater

22. Refer to: Fuel Fired Booster Heater (412-02 Auxiliary Climate Control, Removal and Installation).

All vehicles

23. Refer to: Lifting (100-02 Jacking and Lifting, Descrip Operation).

24.



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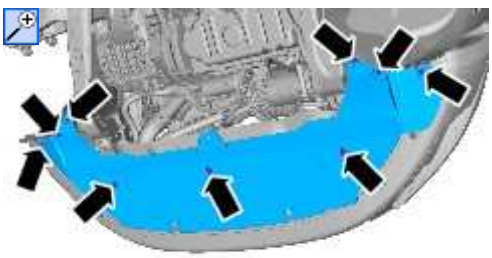

26.

- On b side

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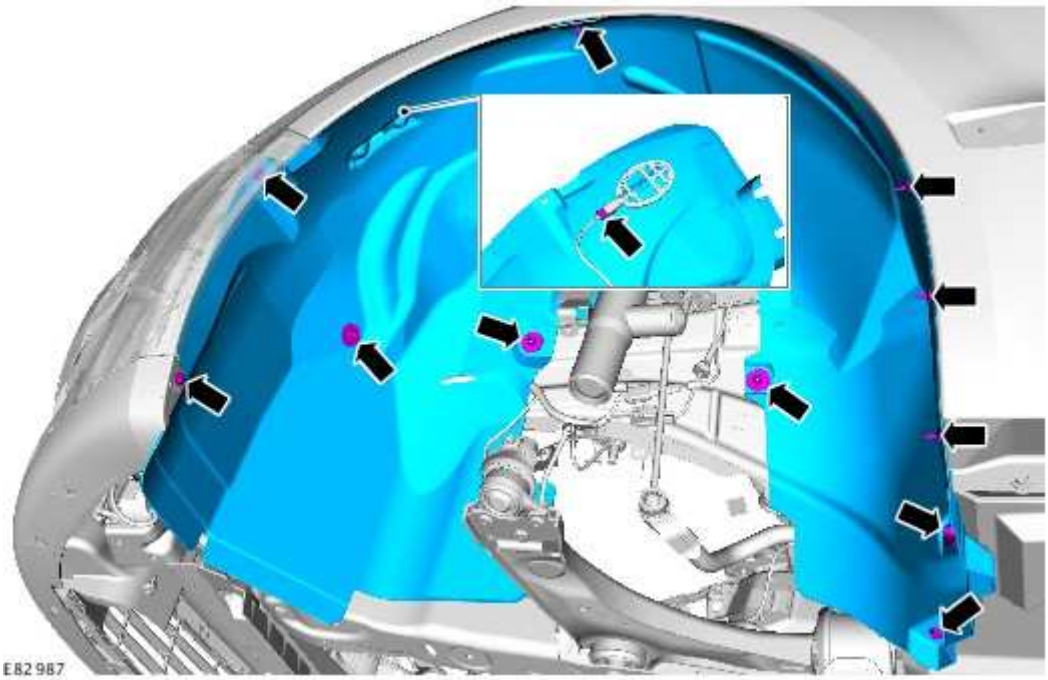

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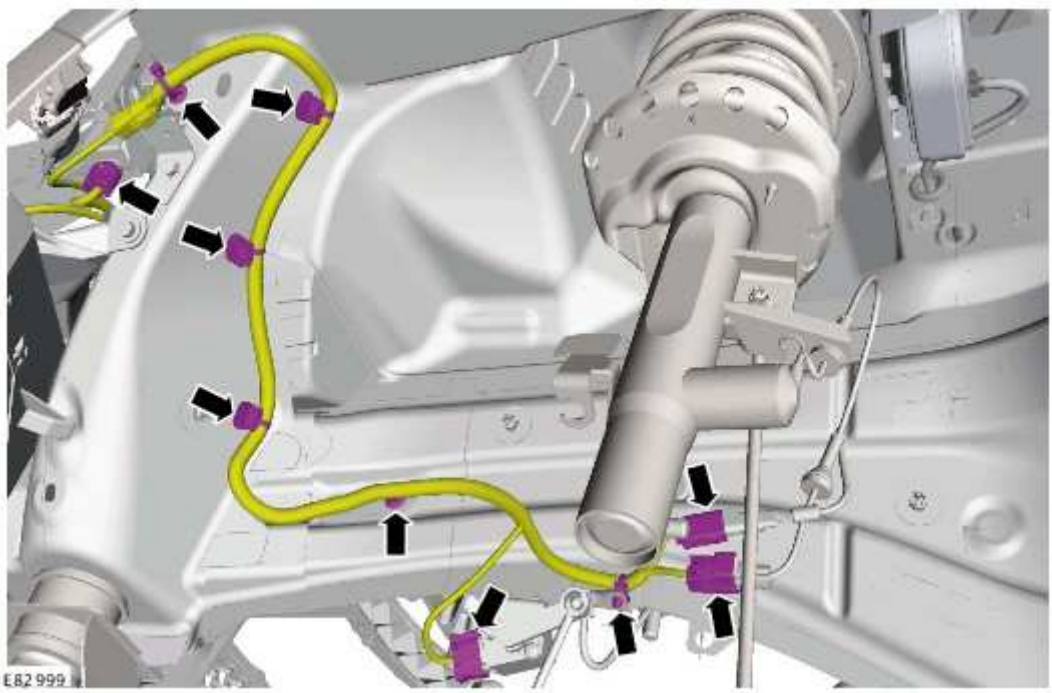

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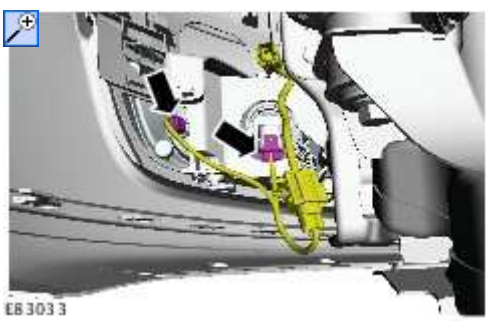

29.

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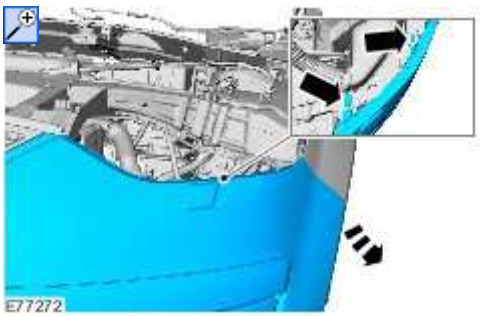
30.



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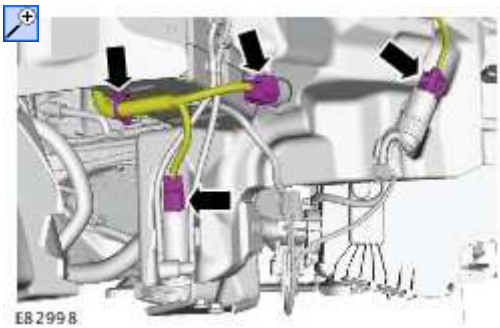

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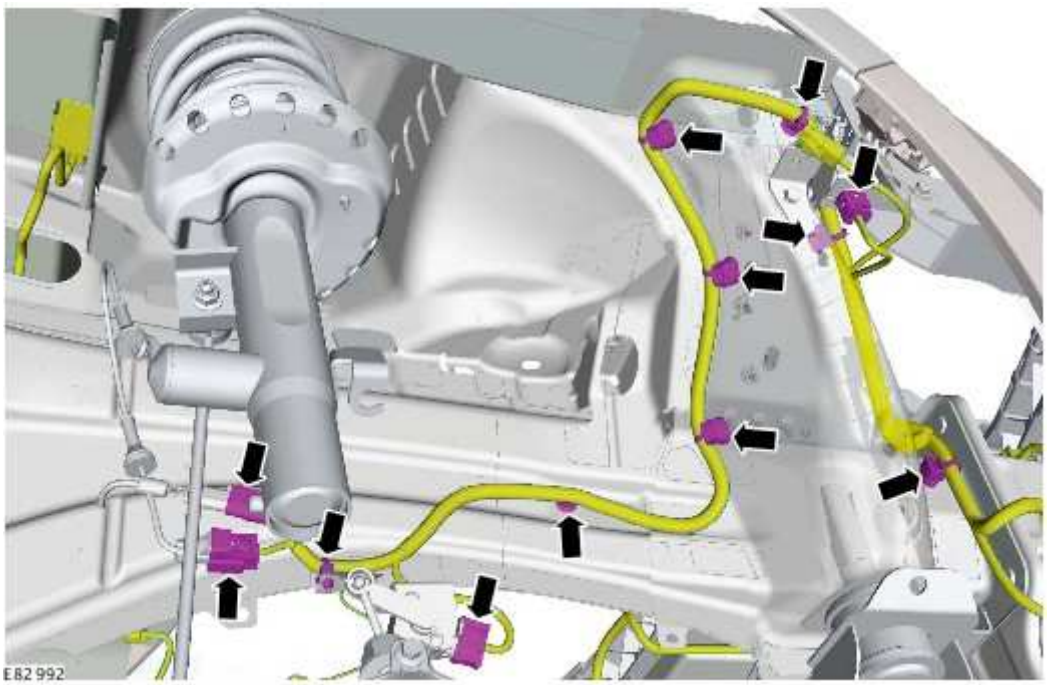

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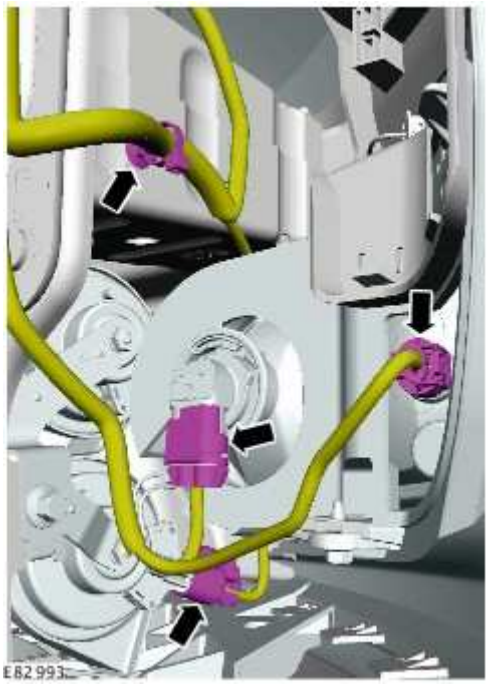

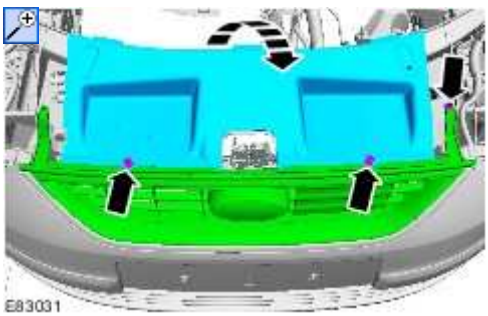

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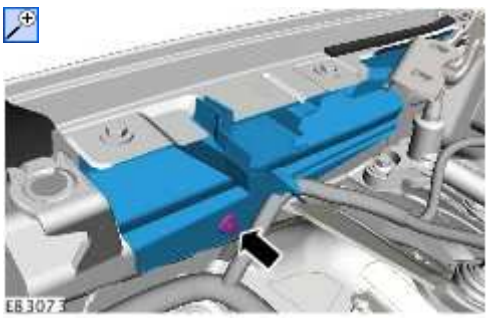

35.

36. *Torque:* 1(

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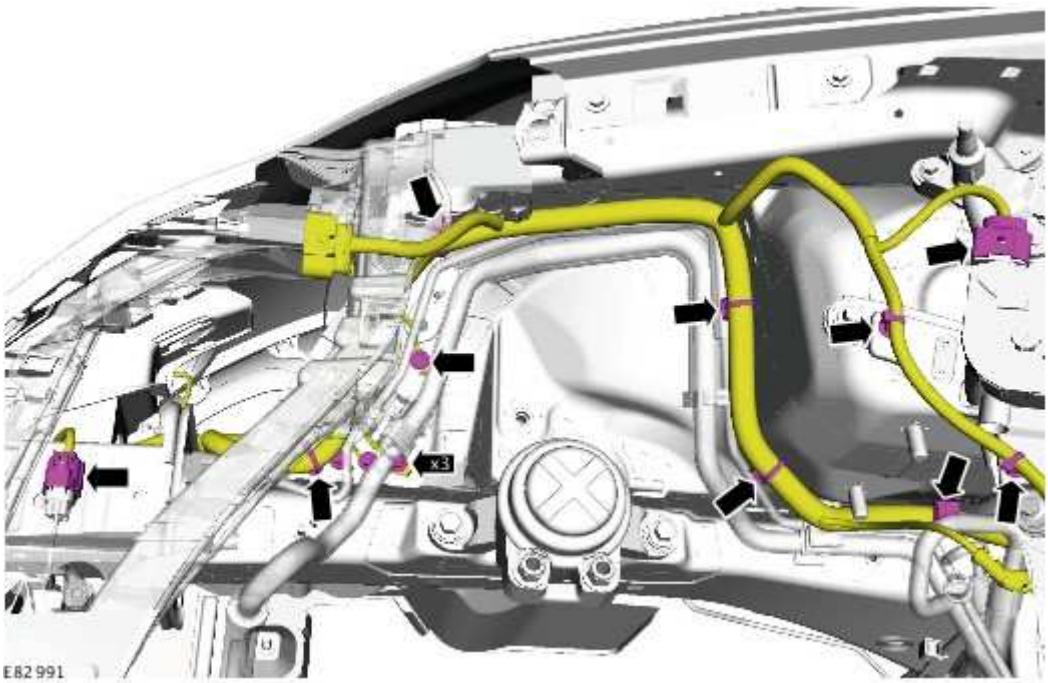

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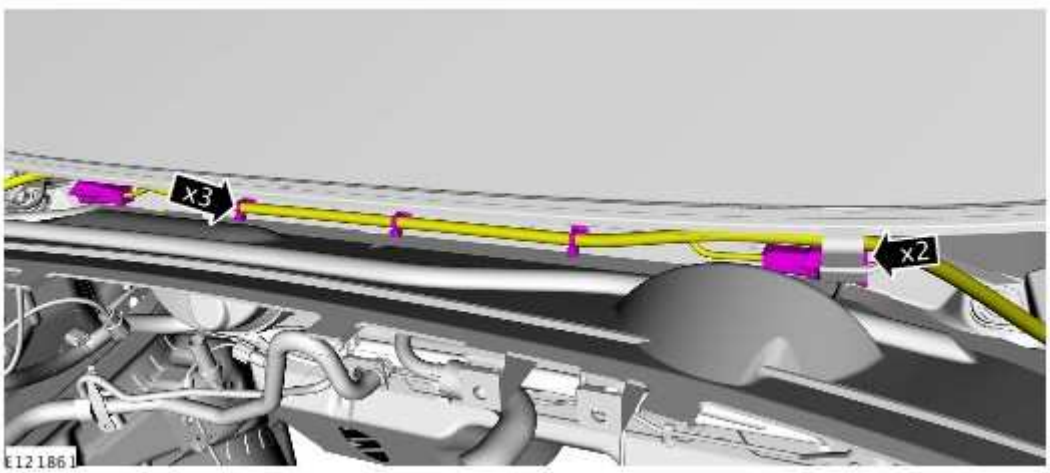

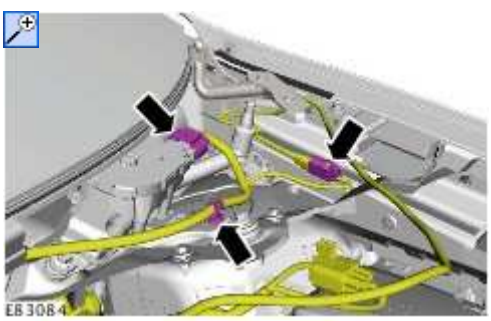

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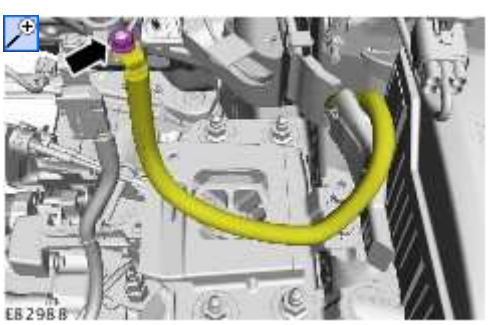

39. *Torque:* 13 Nm

40. *Torque:* 10 Nm

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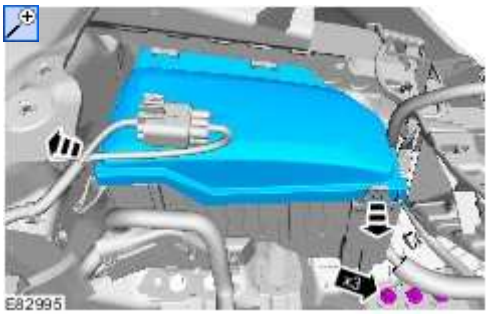
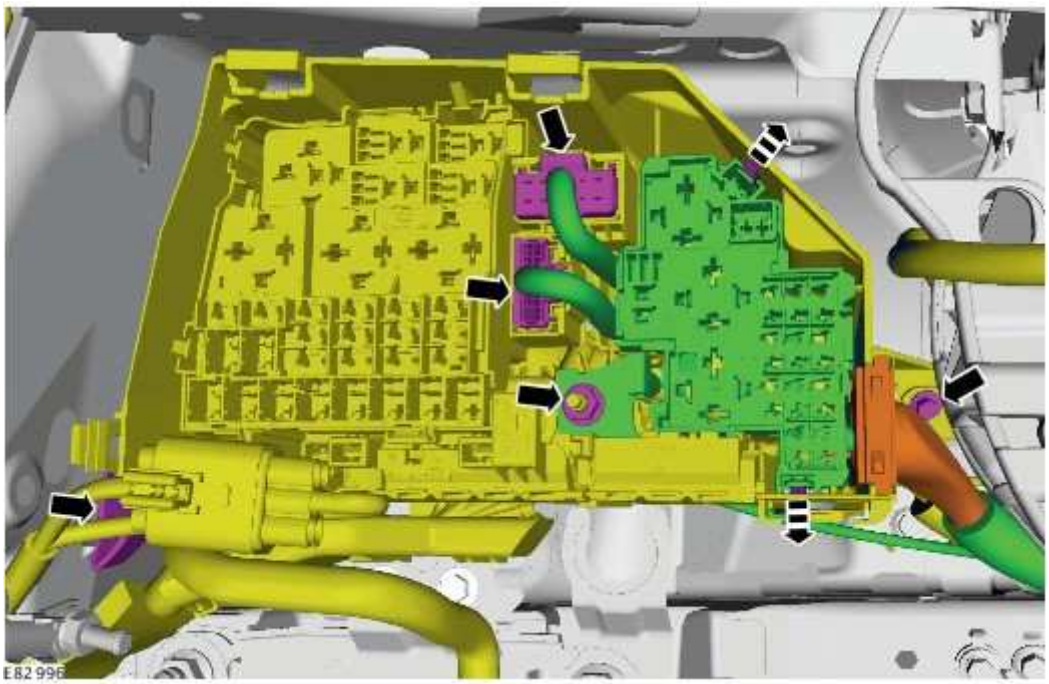
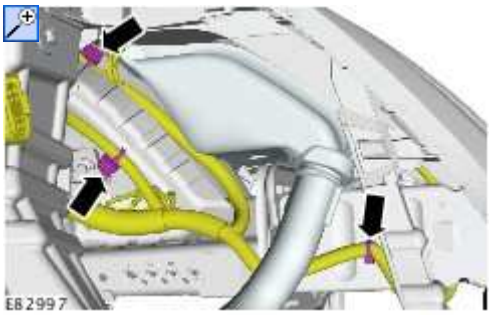




41. *Torque:* 10



42.

43.

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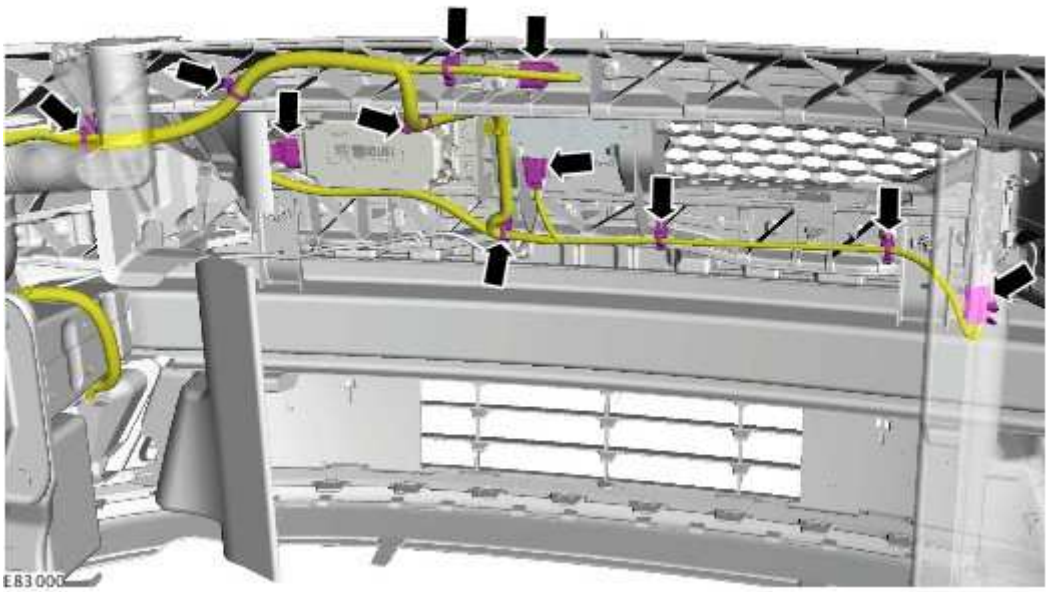
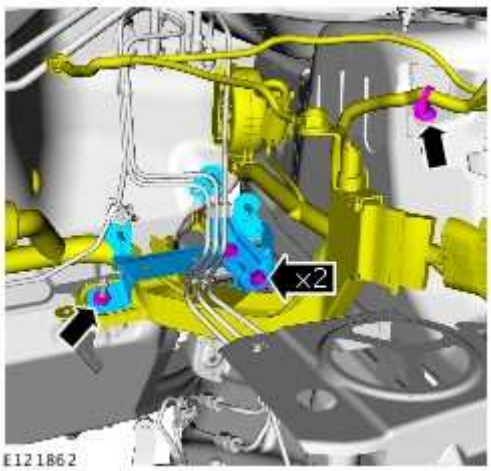
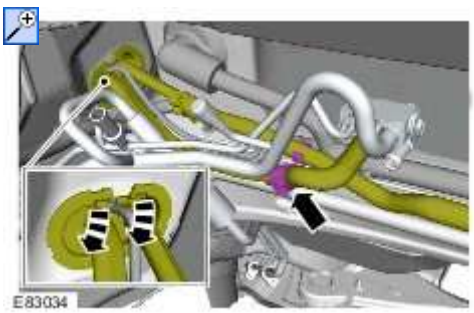




44. *Torque:* 12 Nm

Vehicles with fuel fired heater



45.

All vehicles

46.

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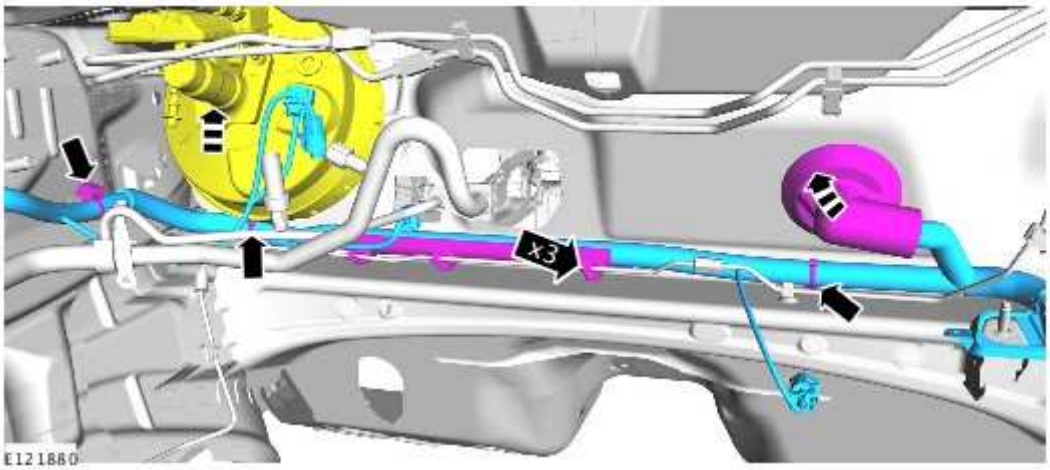

Installation

1. To install, reverse the removal procedure.

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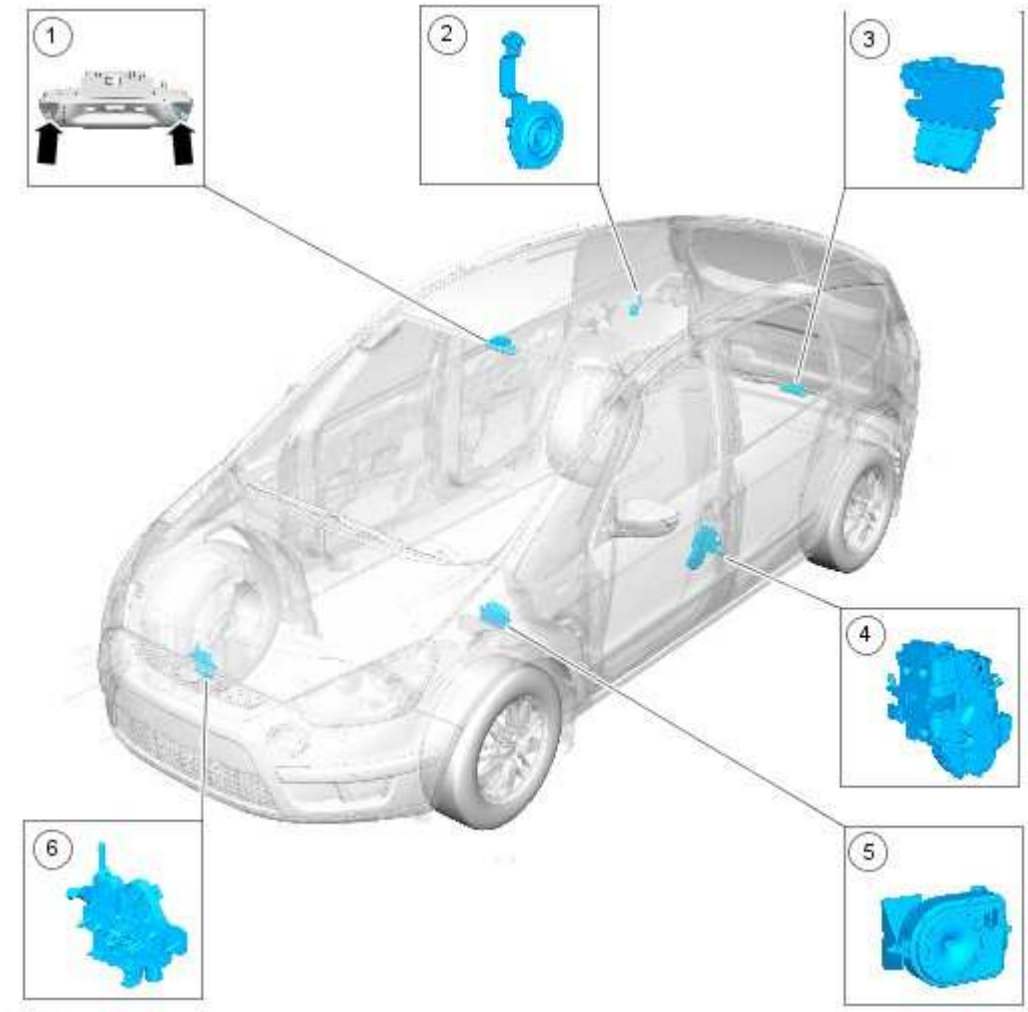
Print

Description and Operation



E81133

Item	Part Number	Description
1	-	Interior scanning sensors
2	-	Anti-theft alarm horn
3	-	Liftgate latch
4	-	Door latch
5	-	Anti-theft alarm horn with integral battery
6	-	Hood latch

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Removal and Installation

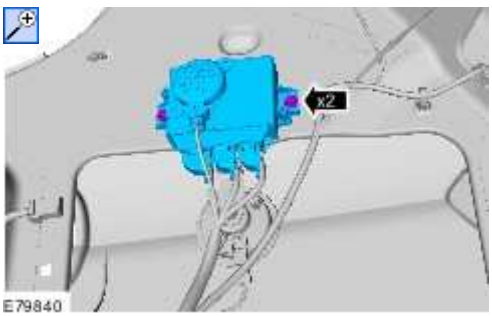
Removal

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

1. Remove the right-hand load space trim panel.

   Refer to: Loadspace Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



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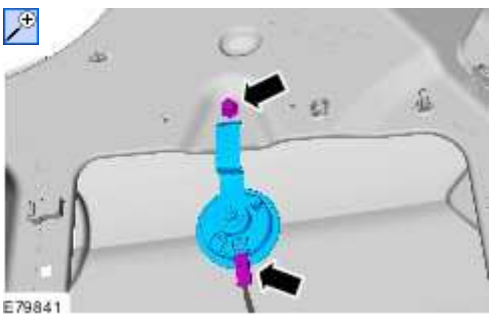

Installation

1. To install, reverse the removal procedure.

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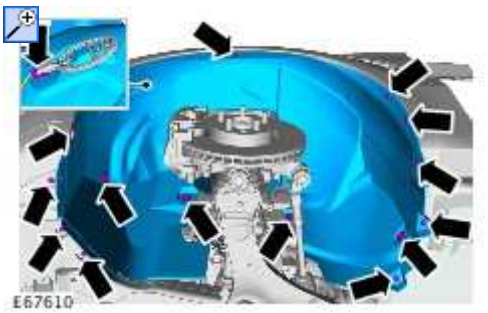
Removal and Installation

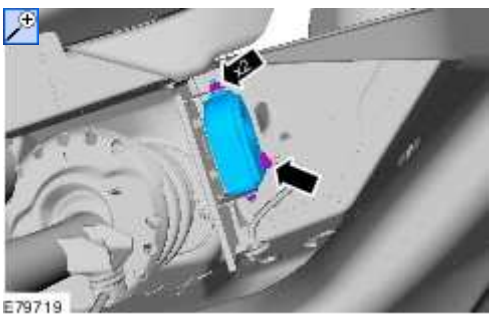
Removal

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

1. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. Remove the left-hand side wheel and tire.

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

4. 

Installation

1. To install, reverse the removal procedure.

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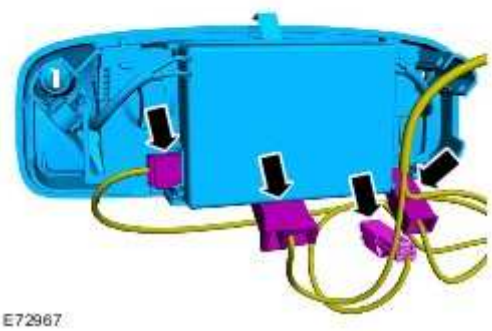
Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

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



1. *General Equipment:* Flat-bladed screwdriver

Installation

1. To install, reverse the removal procedure.

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Description and Operation

Component location

E68649

Item	Part Number	Description
1	-	Passive anti-theft (PATS) transponder
2	-	PATS transceiver

Operation

PATS

The PATS is a passive system designed to increase the anti-theft security of the vehicle.

The driver does not need to actively do anything to protect the vehicle. The PATS is activated automatically after the ignition is switched off.

The PATS system uses specially encoded keys.

If a valid key is inserted into the ignition lock cylinder and turned to position II, the code from the PATS transponder is received by the PATS transceiver. The code is then sent to the passenger junction box (PJB) which checks that a correct key has been inserted and communicates with the powertrain control module (PCM) to enable the engine to start.

If the code received by the PATS transceiver does not agree with any of the codes programmed to the vehicle, or if errors occur in the PATS, the engine cannot be started.

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To indicate a concern in the PATS, the following message will be shown in the information and message center (located in the instrument cluster):

- Immobiliser
  - active

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Diagnosis and Testing

Refer to Wiring Diagrams Section 419-01B, for schematic and connector information.

General Equipment

Worldwide Diagnostic System (WDS)

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
• Ignition lock cylinder • Passive anti-theft system (PATS) ignition key • Use of a non-encoded PATS ignition key • More than one PATS key in close proximity of the PATS transceiver • Central junction box (CJB) • Powertrain control module (PCM) • Instrument cluster	• Fuse(s) • Wiring harness • Electrical connector (s) • Relay(s) • CJB • PCM • PATS transceiver • Ignition switch • Instrument cluster

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, refer to the Diagnostic Trouble Code (DTC) Index.

Diagnostic Trouble Code (DTC) Index

DTC	Description/Condition	Possible Source	Action
9D1796	Anti-theft alarm horn with integral battery internal failure	Anti-theft alarm horn with integral battery	INSTALL a new anti-theft alarm horn with integral battery. REFER to: Anti-Theft Alarm Horn with Integral Battery (419-01A Anti-Theft - Active, Removal and Installation). TEST the system for normal operation.
9D1700	Microphone internal inclination sensor failure	Anti-theft alarm horn with integral battery	INSTALL a new anti-theft alarm horn with integral battery. REFER to: Anti-Theft Alarm Horn with Integral Battery (419-01A Anti-Theft - Active, Removal and Installation). TEST the system for normal operation.
90A512	Anti-theft alarm horn with integral battery circuit short to battery	Anti-theft alarm horn with integral battery or wiring harness	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90A514	Anti-theft alarm horn with integral battery circuit short to	Anti-theft alarm horn with integral battery	REFER to the WDS. Select the PATS test and follow the

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	ground or open	or wiring harness	instructions on screen.
90D800	Number of keys programmed below minimum	Incorrect number of keys programmed or PATS encoded ignition key	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90D781	Partial key read of PATS key	PATS encoded ignition key and PATS transceiver	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90D705	PATS key programming failure	PATS encoded ignition key and PATS transceiver	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90D794	PATS key unexpected operation	PATS encoded ignition key and PATS transceiver	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90D594	PATS transceiver antenna failure	PATS transceiver	INSTALL a new PATS transceiver. REFER to: Passive Anti-Theft System (PATS) Transceiver (419-01B Anti-Theft - Passive, Removal and Installation). TEST the system for normal operation.
90D751	PATS key not programmed	PATS encoded ignition key and PATS transceiver	REFER to the WDS. Select the PATS test and follow the instructions on screen.
90D787	PATS key missing message	PATS transceiver data not received	CHECK the ignition key for damage and compatibility. REFER to the WDS. Select the PATS test and follow the instructions on screen.

5. **5.** If the cause is not visually evident, verify the symptom and refer to the WDS to diagnose the system.

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General Procedures

General Equipment

Ford diagnostic equipment

NOTE: This procedure requires access to the Global Secure Vehicle Information System (GSEVIN) database in order to obtain the coded security access.

1. From the diagnostic tool menu Select: Body/Security/PATS Functions. Follow the instructions on the screen.

   General Equipment: Ford diagnostic equipment
2.
   - When installing a new passenger junction box (PJB), the following sequence must be completed:
   - 1. Ignition Key Programming.
   - 2. Module Initialization.
3.
   - When installing a new powertrain control module (PCM) the following must be completed:
   - 1. Module Initialization.

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General Procedures

General Equipment

Ford diagnostic equipment

NOTE: This procedure requires access to the Global Secure Vehicle Information System (GSEVIN) database in order to obtain the coded security access.
NOTE: A minimum of 2 ignition keys with the correct mechanical cut must be available to carry out a key programming procedure.
NOTE: Make sure that all the ignition keys for the vehicle are available before carrying out this procedure.

1. From the diagnostic tool menu Select: Body/Security/PATS Functions. Follow the instructions on the screen.

   General Equipment: Ford diagnostic equipment
2. From the diagnostic tool menu Select: Ignition Key Erase. Follow the instructions on the screen.

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General Procedures

General Equipment

Ford diagnostic equipment

NOTE: This procedure requires access to the Global Secure Vehicle Information System (GSEVIN) database in order to obtain the coded security access.
NOTE: This procedure will not erase programmed ignition keys from the passive anti-theft system (PATS).
NOTE: A maximum of 8 ignition keys can be programmed to a vehicle equipped with a passive anti-theft system (PATS).

1. From the diagnostic tool menu Select: Body/Security/PATS Functions. Follow the instructions on the screen.

   General Equipment: Ford diagnostic equipment
2. From the diagnostic tool menu Select: Ignition Key Programming. Follow the instructions on the screen.

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General Procedures

1. A maximum of eight keyless entry remote transmitters can be programmed to the central junction box (CJB). Programming must be carried out at the same time for all the remote transmitters.
2. To enter programming mode, first make sure that the vehicle battery is fully charged and that the anti-theft system is not armed or triggered.
3. Make sure that the turn signal lamp switch is in the OFF position.
4. Fasten the safety belts and close all doors to make sure that conflicting chimes do not sound during programming.
5. The ignition switch must be turned to position II exactly four times during remote transmitter programming. Failure to follow this instruction may result in incorrect remote transmitter programming.
6. Turn the ignition switch from position 0 to position II four times exactly within six seconds.
7. Turn the ignition switch to position I.
8. Press and hold one of the buttons on the remote transmitter.
9. After each successful programming, another 10 second learning mode is automatically entered, up to a maximum of seven times.
10. To program additional remote transmitters, repeat step 9.
11. The system will leave the learning mode after the ignition switch is turned to either position II or III, or if no new remote transmitter is programmed during the 10 seconds, or if eight remote transmitters have been programmed.
12. An incorrect programming procedure does not affect the stored codes.
13. After successful programming, only the new programmed remote transmitters will be accepted.
14. Test all the programmed remote transmitters, by activating and deactivating the locking/unlocking functions.

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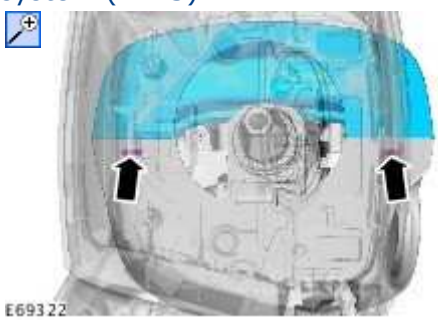
Removal and Installation

Removal

NOTE: This procedure will not erase programmed ignition keys from the passive anti-theft system (PATS).



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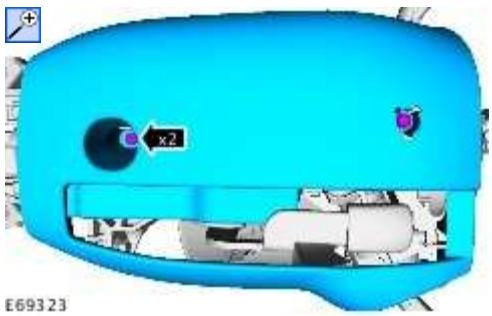
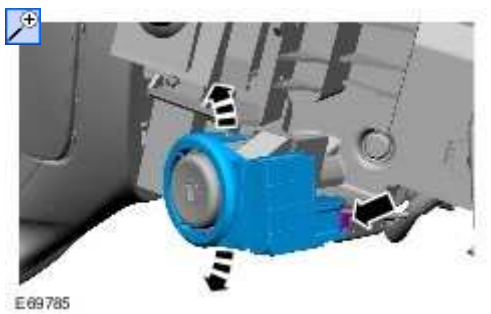


2.



3.

Installation

1. To install, reverse the removal procedure.

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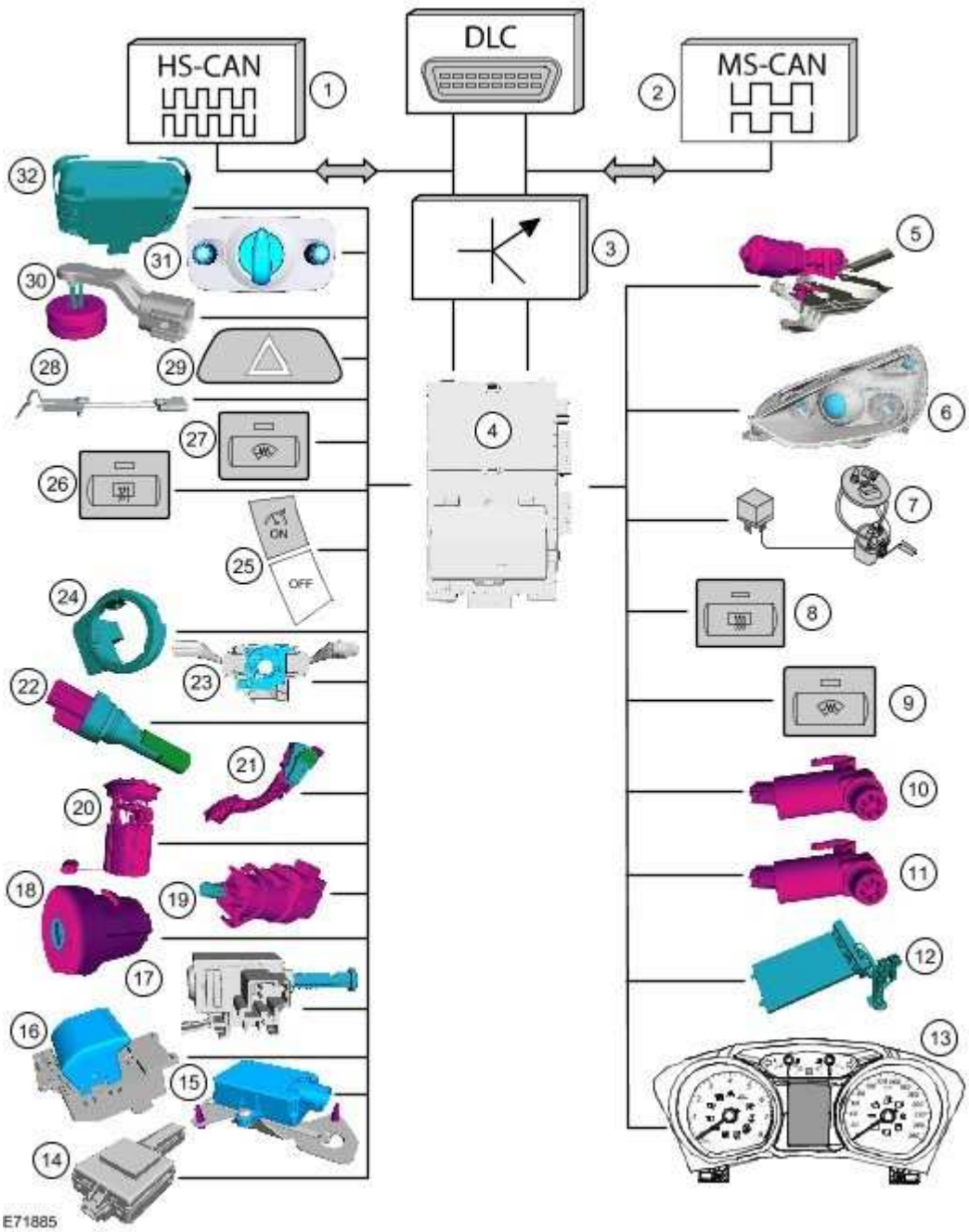
Description and Operation

Overview



Item	Part Number	Description
1	-	HS CAN bus
2	-	MS CAN bus
3	-	Gateway (GEM)
4	-	GEM
5	-	Front/rear window wiper motors
6	-	Headlamp
	-	

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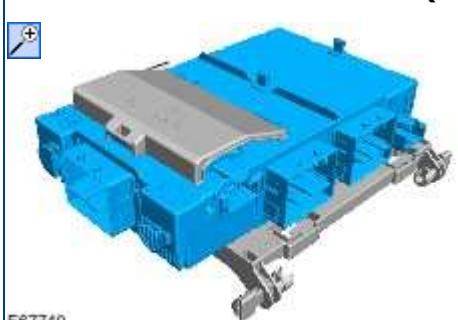
7			Fuel pump module (FPDM)
	8	-	Heated windscreen
9		-	Heated rear window, heated exterior mirrors
10		-	Window washer pump
11		-	Headlamp washer pump
12		-	Electric booster heater
13		-	Instrument cluster
14		-	Remote control receiver module
15		-	Yaw rate sensor
16		-	Parking brake (electriic/mechanical)
17		-	Clutch travel sensor
18		-	Ignition lock
19		-	Stoplamp switch
20		-	Fuel level sensor
21		-	Accelerator pedal position (APP) sensor
22		-	Backup lamp switch
23		-	Multifunction switch
24		-	PATS transceiver
25		-	Speed control switch
26		-	Windscreen heater switch
27		-	Rear window heater switch
28		-	Evaporator temperature sensor
29		-	Hazard flasher switch
30		-	Brake fluid level switch
31		-	Light switch module
32		-	Light/rain sensor

Generic electronics module (GEM)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The generic electronic module is installed on the passenger's side underneath the dash panel.

It replaces separate components such as the central locking module, the timer relay and the fuse box in the passenger compartment.

It consists of a power distribution section (including fuses and relays) and an electronic control module, which controls the operation of most of the electronic convenience systems.

New vehicles are supplied with different versions of the GEM (depending on the equipment specification of the vehicle). Only one version is available for service repair work. When

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installing a replacement GEM it needs to be configured for the specific vehicle.

The following functions are controlled or executed by the GEM if the battery voltage is between 9 and 16 V.

- Battery saving function
- Current distribution
- Exterior lighting (except the adaptive front lighting function on vehicles with dynamic cornering lights)
- Interior lighting
- Wiper system
- Washer fluid level indicator
- Window heating (heated windshield, heated rear window, heated exterior mirrors)
- Speed control system (reads the speed control switches and transmits signals on the CAN bus)
- Locking / Unlocking
- Anti-theft
- Air conditioning controls (partial)
- Handbrake (it monitors the switch and transmits the signal on the CAN bus)
- Monitoring of the brake fluid level.
- Fuel pump (vehicles with 2.0L engine)
- Fuel level indicator
- Battery charging (smart charge, partially)
- Electric booster heater
- Detection of the accelerator pedal position (APP) sensor
- Detection of the clutch pedal switch
- Detection of the clutch pedal position (CPP sensor)
- Brake pedal position (BPP) switch.
- Tire Pressure Monitoring System
- Communications via the mid-speed CAN bus
- Main module in the LIN bus system
- PATS (interface for transceiver)
- Clock control

The GEM can be diagnosed via the WDS. Furthermore, an integrated service mode enables testing of the input and output signals without the need for further tools.
For additional information, refer to: Generic Electronic Module (GEM) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).

Emergency function

The GEM is equipped with restricted emergency running functions on vehicles with medium or high levels of equipment.

A monitoring function within the GEM is sent a control signal at regular intervals by the microcontroller. If for example the battery voltage drops below a voltage of approx. 7.5 Volt then the control signal is not sent and the GEM goes into emergency running mode after a specified time.

In this case the dipped beam headlamps and the side lights are switched on permanently depending on the position of the light switch.

In the event of a communication fault between the wiper switch and the GEM the wiper system performs continuous wiping at normal wipe speed regardless of the wiper switch position. The emergency running mode is switched off when the ignition switch is turned to "0".

In the event of a communication fault between the GEM and the wiper motors the wiper system runs through the following emergency running sequence regardless of the wiper switch position:

- Continuous wipe at speed setting 2 for 5 minutes

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- Continuous wipe at speed setting 1 for 5 minutes
- Intermittent operation for 5 minutes

At the end of this 15-minute sequence the emergency running mode automatically switches off. It cannot be started up again until the fault has been rectified. Emergency running mode cannot be interrupted by switching off the ignition.

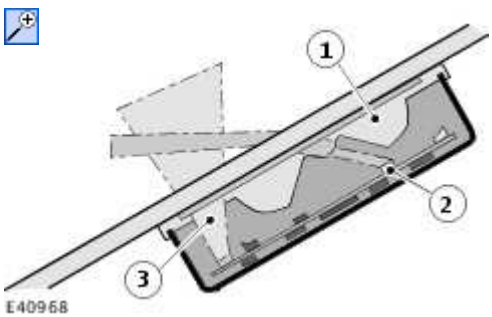
When the control signal is present again the GEM resumes normal functions.

Light switch

The light switch has been modified and now includes electronic controls. It is connected to the GEM via the control module subnetwork (LIN) bus.

If the ignition lock is in position "0" for more than 30 minutes then the front fog lamps, rear fog lamp and the main beam headlamps are deactivated if they were previously activated.

Combined rain sensor/light sensor



Item	Part Number	Description
1	-	Lens
2	-	Front light sensor
3	-	Ambient light sensor

The combined rain sensor/light sensor is attached to the windshield, near the interior rear view mirror.

The ambient light sensor determines the general light intensity.

For this purpose, it detects the light over as wide an angle as possible, without taking the direction of incidence into account.

The front light sensor determines the light intensity directly in front of the vehicle.

Automatic headlamps

The low beams, side lamps, license plate lamps as well as the instrument cluster and instrument panel illumination are switched on automatically if all the following conditions are met:

- Ignition switch in the "II" or "III" position
- Light switch in the "AUTO" position
- Detected ambient light conditions below a stored threshold value

They are switched on or off by the GEM depending on the input signals of the combined rain sensor/light sensor.

If both the ambient light sensor and the front light sensor simultaneously detect a sudden reduction in light intensity then algorithm-based calculations are performed to determine that the vehicle has entered a tunnel, multi-storey car park or a long underpass.

In this type of case a request to switch on the exterior lights and the display lamps in the

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instrument cluster is transmitted to the GEM.

If the vehicle is suddenly thrown into the shade by a large truck, the two sensors will register different light intensities. In this case, the algorithm-based calculation will not result in the lights being switched on.

If the vehicle returns to brighter surroundings then the GEM gradually switches off the dipped beam headlamps, side lights, license plate lamps and the instrument cluster and dashboard lighting. Following a request from the light sensor, the GEM first switches off the dipped beam headlamps. After waiting approx. 6 seconds, it then switches off the side lights, the license plate lamps and the instrument cluster and dashboard lighting.

Headlamp switch-off delay

In vehicles with mid to high-end equipment, the headlamp switch-off delay uses the low beams and the peripheral lights (if equipped) for illuminating the vehicle surroundings. The function is activated by operating the high beam lever when the ignition switch is in the "0" position.

After the last door has been closed, the function remains active for a further 30 seconds and then switches off automatically.

When a door or the tailgate is open, the switch-off time is extended to 180 seconds. After the last door has been closed, the switch-off time is reset to 30 seconds.

The headlamp switch-off delay can be deactivated prematurely by operating the high beam lever again or by switching on the ignition.

The switch-off time is adjusted to set values at the factory and cannot be re-programmed using WDS.

Interior lighting

Depending on the vehicle specification, the interior lighting which is controlled by the GEM may include:

- Left and right-hand footwell lamps
- Front and rear dome lamps (in "door contact" switch position)

Depending upon vehicle specification, the interior lamps which can be switched by the operator include:

- Front and rear dome lamps (in "On" switch position)
- Map lights
- Mirror lights in sun visors
- Glove compartment lamp
- Luggage compartment lamp

The GEM-controlled interior lighting is switched on with dimmed brightness if one of the following conditions is satisfied:

- One of the vehicle's doors is opened.
- The ignition key is in the "0" or "I" position and the vehicle is unlocked.
- The ignition key is turned from the "II" to the "I" or "0" position.

The GEM-controlled interior lighting is switched off if all of the doors are closed and one of the following conditions is satisfied:

- 25 seconds have elapsed since the last door was closed.
- The ignition key is turned from the "0" or "I" to the "II" position.
- The ignition key is in the "0" or "I" position while the vehicle is locked.

The duration of the dimmer function is 1.7 seconds in both the switch-on and switch-off

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phases.

The dimmer function is not used if the interior lighting is switched off by the battery saving function after 30 minutes.

Heated windscreen

The heated windshield is switched on by the GEM under the following conditions:

- The heated windshield switch is operated, the ignition switch is in position "II" and the charge warning lamp is switched off.
- The "Defrost" function of the EATC has been activated, the ignition switch is in position "II" and the charge warning lamp is switched off.

The heated windshield is switched off by the GEM under the following conditions:

- More than 4 minutes have elapsed since the switch for the heated windshield was operated.
- The ignition switch is turned to the "I" or "0" position.
- The "Defrost" function is deactivated or the switch for the heated windshield is pressed again while the heated windshield is still switched on.
- The charging system warning indicator is switched on.

Heated rear window and heated external mirrors

The heated rear window and the heated exterior mirrors are switched on by the GEM under the following conditions:

- The heated rear window switch is operated, the ignition switch is in position "II" and the charge warning lamp is switched off.
- The "Defrost" function of the air conditioning has been activated, the ignition switch is in position "II" and the charge warning lamp is switched off.

On vehicles with door modules the GEM transmits the request signal for switching on the exterior mirror heating via the CAN bus to the door modules.

The heated rear window and the heated exterior mirrors are switched off by the GEM under the following conditions:

- More than 14 minutes have elapsed since the switch for the heated rear window was operated.
- The ignition switch is turned to the "0" or "I" position.
- While the heated rear window is switched on, the switch for the heated rear window is pressed or the "Defrost" function of the air conditioning is deactivated.
- The battery voltage has dropped below 10.3 V for more than 20 seconds (power management strategy). Manual requests for switching on the heated rear window by pressing the switch, are ignored at this time.

If the battery voltage returns to the normal range then the disabling of the heated rear window is cancelled - the heated rear window is then in a switched-off state.

On vehicles with door modules the GEM transmits the request signal for switching off the exterior mirror heating via the CAN bus to the door modules.

Windshield wash/wipe system

The windshield wash/wipe system will only operate if the ignition switch is in the position "I" or "II".

Four wipe functions are available: "Single Wipe", "Speed 1", "Speed 2" and "Intermittent Wipe" or "Automatic Wipe" (depending on the specification of the vehicle)".

In "Speed 1" or "Speed 2" mode, the wipers are operating continuously at either normal

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speed or fast speed.

When the intermittent wipe mode is switched on the windshield wipers operate at normal speed with the following wiper delays:

- Wiper delay 1: 1 second
- Wiper delay 2: 3.5 seconds
- Wiper delay 3: 6 seconds
- Wiper delay 4: 9.5 seconds
- Wiper delay 5: 15.5 seconds
- Wiper delay 6: 22 seconds

NOTE: In the event of a failure, the default time for the wiper delay is 3.5 seconds.
When the windshield washer switch is operated washer fluid is sprayed onto the windshield. After a short delay designed to protect the wiper blades the wipers perform 2 or 3 wipes at low speed.

If when the windshield washer switch is activated the windshield wipers are switched off, a single wipe is performed 4 seconds after the wipers have returned to the home position after performing the 2 or 3 wipes.

If the wipers are set to intermittent wipe and the window washer switch is actuated, the wipes are only performed if no further wipe request has been selected via a shorter delay time within the 4-second delay time.

The post wipe function on the windshield ensures that any water remaining on the windshield after washing is wiped away. It is only required if the wipers are switched off or they are set to intermittent mode.

Rain sensor

CAUTIONS:

The automatic wipe function must be switched off before the vehicle is taken through a car wash.

If the windshield is iced up, the wipers may only be activated by the rain sensor after the windshield has been completely defrosted.
NOTE: The rain sensor is an optical measuring instrument. Contamination such as oil, grease or dust impair its correct operation. Before switching on the automatic windshield wipers, the windshield must be clean in the area of the rain sensor.
The rain sensor is built into a housing which is mounted behind the rear view mirror on the windshield.

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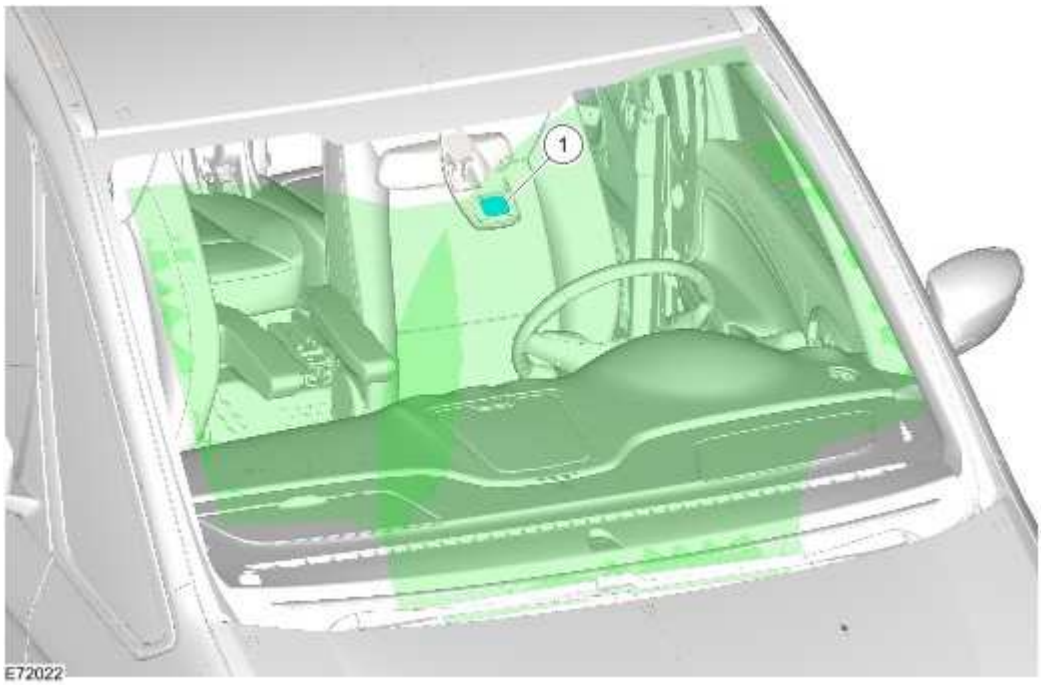
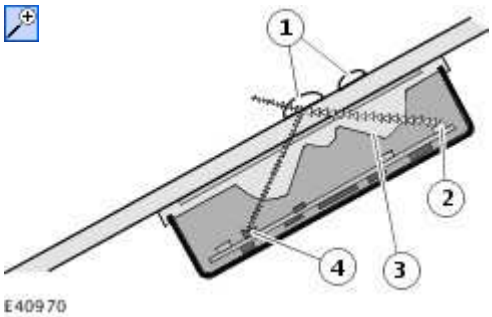


The rain sensor (1) consists of an opto-electronic measuring and evaluation circuit. The sensor can calculate the amount of precipitation falling on the windshield and request that the windshield wipers are switched on.

On the basis of the information provided by the rain sensor, the windshield wipers are then set to the required wipe speed by the generic electronic module (GEM).

Mode of operation of the rain sensor



Item	Part Number	Description
1	-	Raindrop
2	-	LED
3	-	Lens
4	-	Photodiode

The rain sensor consists of three optical components:

- an LED
- a photodiode
- a lens

The photodiode emits an infrared light beam of known intensity; the emitted light exits through the lens and is reflected by the windshield.

The reflected light beam enters back through the lens and then reaches the photodiode. The corresponding value taken without moisture on the windshield is used as the reference

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value for the automatic calibration process.

Subsequent deviations from this value cause the windshield wipers to be switched on.

If rain lands on the windshield then the light reflected by the windshield has a lower intensity. This loss of intensity is registered by the photodiode and, proportionally to the loss of intensity, the module switches on the windshield wipers with the required wipe speed (in intermittent or continuous mode).

On vehicles built up to 07/2006 the wipers are only activated after switching on the automatic wipe function (wiper lever to intermittent position) when the water has been detected on the windshield by the rain sensor.

On vehicles built from 07/2006 a single confirmation wipe is performed after the automatic wipe function has been switched on.

It is not necessary to calibrate the rain sensor, as this has already been done at the factory.

The sensitivity of the rain sensor can be changed by adjusting the control resistor for the intermittent mode of the windshield wipers.

- Adjusting ring position - wide symbol: High sensitivity
  - The wipers wipe even if only a small amount of water has been measured on the windshield.
- Adjusting ring position - narrow symbol: Low sensitivity
  - The wipers only wipe if a large amount of water has been measured on the windshield.

Rear window wash/wipe system

The rear window wash/wipe system will only operate if the ignition switch is in the position "II".

If the windshield wiper switch is in the "Off", "Intermittent mode" or "Automatic wipe" (no wiping or low speed) position, then the wipe interval of the rear window wiper is 10 seconds.

If the switch for the rear window washer is pressed, then washer fluid is sprayed onto the rear window, and the wiper operates continuously at low speed. When the switch is released the rear window wiper performs another 2-3 wipes.

If reverse gear is engaged and the windshield wiper switch is in the normal, high speed or automatic windshield wiper (wiping at high speed) position, the rear window wiper will operate continuously until the gearshift lever is moved back to the neutral position.

Headlamp washer system

The headlamp washer system will start to operate when the windshield washer function is activated if, at the same time, the light switch is set to "dipped beam" or the headlamps have been switched on by the "automatic headlamps" function. Electrical control is performed by the headlamp washer system relay which itself is controlled by the generic electronic module (GEM).

In order to prevent excessive water consumption, the headlamp washer system is only activated every fourth time the windshield wash/wipe switch is operated, provided the time elapsed since the first operation of the washer system does not exceed 10 minutes. If the windshield wash/wipe switch is activated again after 10 minutes the the headlamp washer system is activated and the time encoder is restarted.

If the wash water level warning lamp on the instrument cluster comes on because the wash water level in the washer reservoir is too low then the headlamp washer pump is no longer activated until the washer reservoir is topped up.

central door locking

Locking/unlocking – central locking

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The central locking system locks all doors, the liftgate and the tank flap, so that none of these can be opened from the outside of the vehicle. The locking of the tank flap is linked to the locking/unlocking of the driver's door.

On vehicles with door modules in the front and rear doors, all door lock motors and door lock switches are controlled via the door locking modules. The signals from the door contact switches are forwarded directly to the GEM.

On vehicles without rear door modules the door lock motors are also directly actuated by the GEM.

Vehicles without rear door modules only have manually operated windows in the rear.

Vehicles with 4 door modules can be identified by the two-stage window regulator switches in the front and rear.

The central locking is actuated if one of the following conditions is satisfied:

- A key is inserted into one of the door locks and turned to the "locking" position.
- The locking button on the remote control is pressed once.
- The inside door handle is pressed (if equipped).

If one of the doors is not properly closed when the central locking function is performed then all doors are locked and unlocked again. This procedure is signaled acoustically.

The turn signal lamps flash twice when the vehicle has been successfully centrally locked.

Locking/unlocking – double locking

The double locking system locks all doors so that they cannot be opened from outside the vehicle. In addition to the central locking function, the double locking system also disconnects the door opening levers from the locking mechanism. This means that the doors can no longer be opened from inside the vehicle.

The double locking mechanism only works when the ignition key is not in the ignition lock.

The double locking is activated if one of the following conditions is satisfied:

- A key is inserted into a door lock and turned to the "locking" position twice within 3 seconds.
- The locking button on the remote control is pressed twice within the space of 3 seconds (if the vehicle is configured for activation of the double locking upon a single press of the locking button on the remote control).

If the ignition key has been turned to position "I" then the vehicle is centrally locked but not double-locked.

If on a double-locked vehicle the corresponding ignition key is inserted into the ignition, the system switches over from double locking to central locking.

Double locking is not indicated by additional flashing of the turn signal lamps.

The turn signal lamps already flash twice after successful central locking.

Locking/unlocking – central unlocking

The central locking system unlocks all doors of the vehicle and the fuel filler flap.

The central locking is actuated if one of the following conditions is satisfied:

- The door lock is turned to the unlocking position.
- The release button on the radio remote control is pressed once (provided that the vehicle is not configured for unlocking via the driver's door lock).
- The release button on the radio remote control is pressed twice within 3 seconds (provided that the vehicle is not configured for unlocking via the driver's door lock).

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- The door opening lever is pulled to the unlocking position on a centrally locked vehicle.

If the vehicle has been configured for unlocking via the driver's door lock and the "unlocking" button on the remote control is only pressed once, then just the driver's door and the tank flap are unlocked.

If the "unlocking" button on the remote control is then pressed again within 3 seconds the remaining doors are unlocked via the central unlocking function.

If the vehicle was double locked beforehand, then the other doors are centrally locked, whereas the driver's door is unlocked.

Unlocking of the vehicle with the ignition switched off, is confirmed by one long flash of the turn signal lamps.

Locking/unlocking - automatic re-locking function

The automatic re-locking function returns the locking system of the vehicle to its last status if it was centrally locked or double locked and the following conditions are satisfied:

- The vehicle is unlocked via remote control.
- Neither a door nor the liftgate has been opened within 45 seconds.
- The ignition is not switched on.

Liftgate

The liftgate unlocking mechanism unlocks the liftgate if the ignition switch is either in position "0" or position "1" and one of the following conditions is met:

- The liftgate unlocking button on the outside of the vehicle is pressed, provided the vehicle has been unlocked either via the driver's door lock or centrally.
- The liftgate unlocking button on the remote control is pressed once (provided the vehicle has been configured for liftgate unlocking after a single press of the button on the remote control).
- The liftgate unlocking button on the remote control is pressed twice within 3 seconds (if the vehicle has not been configured for liftgate unlocking after a single press of the button on the remote control).

Smart Charge system

In addition to the familiar functions, the Smart Charge system also performs the following functions:

- Automatic deactivation of non-critical high power electrical consumers when the battery voltage is low in order to reduce the level of current drawn.
- Automatic activation of non-critical high power electrical consumers when the battery voltage is excessively high in order to protect components which are sensitive to increased voltages.

The battery charging current is optimized through continuous calculation of the battery temperature and monitoring of the alternator output voltage.

By receiving the forwarded alternator load signal, the PCM is given early warning whenever an electric consumer is switched on or off. This means that the PCM receives information about imminent changes in the torque drawn by the alternator. By evaluating this information the PCM can provide a higher level of idling stability.

The two remaining functions of the Smart Charge System are controlled by the GEM.

Electrical consumers are switched off due to low voltage when the GEM determines (on the basis of the message received from the PCM on the CAN bus via the instrument cluster)

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that the battery voltage has dropped below the threshold.

When the threshold for low battery voltage is reached the GEM automatically deactivates the following consumers - in this order and with a gap of 5 seconds between each:

- Electric booster heater (vehicles with diesel engines)
- Heated door mirror
- Heated rear window
- Heated windscreen

If the battery voltage rises back above the lower threshold then the GEM re-enables all of the electrical consumers which were previously disabled. They then have switched off status and must be switched back on by the driver.

Electrical consumers are switched on due to excessively high voltage if the GEM determines that the battery voltage is above the threshold for overvoltage and the charge control lamp has been switched on.

When the threshold is reached the GEM automatically activates the following consumers - in this order and with a gap of 5 seconds between each:

- Heated rear window
- Heated door mirror
- Electric booster heater (vehicles with diesel engines)
- Blower motor

If the battery voltage drops back below the threshold then the GEM automatically deactivates any consumers that were switched on. However, if they were switched on by the driver before the automatic activation, they will then be switched on again in turn with a 5-second time interval.

Ignition overload protection

The ignition overload protection intermittently disconnects certain circuits in order to restrict the current being drawn from the battery while the starter motor is operating.

The position of the ignition switch is transmitted by the instrument cluster on the MS CAN bus.

The ignition overload protection relay which is integrated in the battery junction box is activated by the GEM when the message "ignition switch position III" is received from the instrument cluster.

The activated ignition overload protection then switches off the following electrical consumers:

- EXTERIOR LIGHTING
- Windscreen/rear window wash/wipe systems
- Backup lamps
- Heated washer nozzles
- Control unit for gas discharge headlamps
- Seat heating
- Electric window regulators

Electric window regulators

The ignition key must be in position "II" before the electric window regulators can be operated. The electric window regulator open or close the door windows when the switch is moved to the corresponding position.

The movement of the window glass stops when the window regulator button is released or

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when the ignition key is moved from position "II" to position "I", "III" or "0".

The driver door window can only be operated via the driver door switch; the other windows can be opened and closed via the driver door switch panel or the relevant door switch.

If the window in the front passenger door or in one of the rear doors is operated via the switch in the switch panel on the driver's door, the driver's door module receives the signal via a cable from the switch and forwards it on the CAN bus to the relevant door module, which then moves the corresponding window in the appropriate direction.

The disabling switch in the switch panel on the driver's door can be used to disable the window regulator switches in the rear doors.

Speed control

The GEM acts as the gateway for the signals of the speed control system. The signals which come from the switch unit in the steering wheel are converted in the steering wheel module and sent via the LIN bus to the GEM.

From there the message is sent on to the PCM via the HS CAN bus.

The PCM then adjusts the power output of the engine to maintain the selected vehicle speed.

Brake fluid level

If the brake fluid level is normal the brake fluid level switch is closed and sends a ground signal via cable to the GEM.

If the brake fluid level is below the threshold and the level switch opens for more than two seconds then the GEM generates a CAN signal which it sends to the instrument cluster.

Power management

The power management system offers various modes which can be used in different situations to ensure an effective power supply to individual modules.

The power management function is integrated in the GEM.

Four different vehicle modes are used depending on the operating status of the vehicle:

Factory mode:

- Factory mode is activated while the vehicle is in production. In this mode, power supply is reduced to a minimum by switching off relays. Once the vehicle leaves the factory the factory mode is deactivated, and transport mode is activated instead.

Transport mode:

- Transport mode is activated while the vehicle is en route from the factory to the dealer. In this mode, the vehicle can be driven without any adverse effects on vehicle safety.
- Individual modules and electrical systems (e.g. anti-theft alarm system, clock and remote control) are deactivated.
- This ensures that the battery is sufficiently charged when the vehicle is handed over to the customer.

If the engine is started while the vehicle is in transport mode then the transport mode is temporarily suspended. It is reactivated once the ignition is switched off.

Transport mode must be deactivated by the **dealer**. This is done when the ignition is switched off by pressing the brake pedal five times and the hazard flasher switch twice within 10 seconds.

When the transport mode is deactivated the GEM automatically changes into normal mode.

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Normal mode:

- The full functionality of all electrical systems is available in normal mode.

Crash mode:

- Crash mode is activated as soon as the restraints control module (RCM) registers a sufficiently severe vehicle impact.
- The vehicle is then centrally unlocked if it was locked at the time of the crash.
- In addition the hazard warning lights are activated.
- Crash mode is deactivated if the ignition key is turned to position "0" and then back to position "II" after at least 500 ms. The hazard warning switch needs to be operated to deactivate the hazard warning lights.

PATS

The PATS function is integrated in the GEM. Correspondingly, the send/receive unit is directly connected to the GEM (previously it was connected to the powertrain control module (PCM)).

After reading in the key code (in ignition lock position "II"), a corresponding message is placed by the GEM on the HS CAN databus for the PCM.

The ABS module is queried at the same time.

Depending on the outcome of this query and the status of the key, the PCM then issues the start enable.

Central module configuration

Previously, modules in the vehicle have been configured with the aid of WDS and the "Module Programming" function (Inhale/Exhale). Here, the current status of each module is read into the WDS and then saved in the new module.

A new module configuration method, the so-called central module configuration, is used on Galaxy/SMax 2006.5 (02/2006-) vehicles.

Here, all of the necessary configuration parameters are stored in the GEM at the factory, and from there they are transmitted via the CAN bus network to the individual modules.

The WDS is equipped with a new routine for performing the central module configuration which is used to replace or subsequently change configuration data. Instead of reading the data into the WDS as was done in the past, they are transmitted by the GEM to the relevant module. WDS is only used to initiate and monitor the process.

For safety reasons all configuration data which are stored in the GEM are also stored in parallel in the instrument cluster. If the GEM then needs to be replaced, this means that the required configuration data can be read out from the instrument cluster with the aid of WDS and then transferred to the new GEM.

The GEM checks the configuration data for consistency and stores DTCs in the event of any faults (WDS trouble codes).

In the event of a fault the functionality of a particular module may be restricted.

When the GEM is replaced it is necessary to re-learn the keys for the remote control and for the PATS system. The procedure for doing this is the same as on the current vehicles.

VIN identification

During the VIN identification, the VIN is saved in individual modules at the factory.

As soon as a module is identified when the ignition is switched on (even after the battery has been disconnected), it can be operated without further inputs.

If no VIN or an invalid VIN is read in from a module then this is stored in a memory.

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Subsequently the functionality of the module may be restricted depending on its use.

Tire pressure monitoring system

The system comprises the following components:

- GEM
- Instrument cluster
- Control components
- 4 sensors with corresponding aerials

The GEM contains the entire control electronics for the tire pressure monitoring system, and it evaluates the input signals.

In addition, the GEM also holds the required configuration parameters (tire pressure tables for the relevant vehicle) which are needed for evaluation of the data.

In addition to the input signals which are part of the system, the GEM also processes the following signals for the evaluation:

- Vehicle speed signal
- Ambient air pressure

The information required for the display in the instrument cluster are transmitted by the GEM via the MS CAN databus to the instrument cluster.

The instrument cluster displays all of the information for the driver via the multifunction display and by means of an additional warning lamp (yellow/red).

The aerials are used to locate and initialize the tire pressure warning sensors. They are each located above a wheel arch trim panel and connected to the GEM via a shielded cable.

Recorded data are sent to the GEM once per minute.

If the vehicle is parked for a longer period of time then the tire pressure data are obtained in a 13-hour interval. After approximately 7 days the tire pressure warning sensors stop sending data to the GEM.

The system is equipped with a self-diagnosis function which is integrated in the GEM. Any fault codes which are present can be read out with the aid of WDS.

Climate control

Evaporator temperature.

On vehicles with air conditioning the evaporator temperature is measured via the evaporator temperature sensor. On vehicles with manual air conditioning the evaluation is performed by the GEM.

If a temperature below +1 °C is determined then the GEM sends a signal to the PCM via the HS CAN bus which then shuts off the air conditioning clutch. If the temperature is above +2.5 °C the GEM sends a signal to the PCM and the air conditioning clutch is switched back on again.

Electric booster heater

If the interior temperature is set to "HI" on the heater / air conditioning control assembly or the temperature control switch is set to its highest setting then the DEATC (electronic temperature control) module sends an "electric booster heater ON" request signal via the MS CAN bus to the GEM. If a manual air conditioning system is installed, the signal is transmitted via a conventional cable connection.

The GEM controls the electric booster heater according to the available alternator capacity.

In contrast to other Ford vehicles, there is no link to the coolant temperature or the

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ambient temperature.

The electric booster heater electronics activates three output stages depending on a pulse width modulated signal (PWM) generated by the GEM. The output stages switch the three heating elements of the electric booster heater ON or OFF individually, whereby the heating periods of the individual elements can overlap. Due to the variable switch-on duration, continuously variable temperature control is possible. The overall heating power of the three heating elements is linearly proportional to the PWM signal. If the PWM signal is below 10% or above 95%, the electric booster heater is not activated.

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Print

Diagnosis and Testing

Special Tool(s)

	Terminal Probe Kit 418-S035

General Equipment

Digital multimeter
The Ford approved diagnostic tool

Inspection and Testing

1. **1.** VERIFY the customer concern.
2. **2.** Visually CHECK for any obvious mechanical or electrical damage.

NOTE: Ensure correct locking of wiring harness connector.

Visual Inspection

Electrical
Fuses.
Wiring harness.
Electrical connectors.

3. **3.** RECTIFY any obvious causes for a concern found during the visual inspection before performing any further tests. CHECK the operation of the system.
4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis with the Ford approved diagnostic tool and RECTIFY any displayed faults in accordance with the displayed fault description. Afterwards DELETE the displayed fault(s). CHECK the operation of the system.
5. **5.** For vehicles with no stored fault(s), PROCEED in accordance with the Symptom Chart according to the fault symptom.
6. **6.** Following checking or elimination of the fault and after completion of operations, the fault memories of all vehicle modules must be READ OUT and any stored faults must be DELETED. READ OUT all fault memories again following a road test.

Diagnostic Trouble Code (DTC) Table

CAUTION: Before replacing the GEM in the event of a GEM malfunction, PERFORM a "hardware reset" after WORKING THROUGH the relevant DTC. To do this, disconnect connector C1BP02-G from the GEM and reconnect it. CHECK the operation of the system. If the malfunction persists, make sure that the latest release of the software is loaded in the Ford approved diagnostic tool and that the correct variant of the GEM is installed. CONFIGURE the GEM again using the Ford approved diagnostic tool. If the fault occurs again, RENEW THE GEM.

DTC	Description	Action
B110A-77, B10ED-	Circuit of the front or rear	Refer to the Ford approved diagnostic tool.

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77	driver's side door lock release switch faulty.	
B110B-77, B10EE-77	Circuit of the front or rear passenger side door lock release switch faulty.	Refer to the Ford approved diagnostic tool.
B1109-77, B10EC-77	Circuit of passenger side door lock release switch or passenger side door lock release switch faulty.	Refer to the Ford approved diagnostic tool.
B1108-77, B10EB-77	Circuit of driver's side door lock release switch or driver's side door lock release switch faulty.	Refer to the Ford approved diagnostic tool.
B10A2-02, B10A2-11, B10A2-15,	Power/signal circuits of crash sensor faulty.	REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).
B1130-07	Light switch unit, component fault.	REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).
C2003-07, B112B-07	Circuit of cruise control switch faulty.	REFER to: Steering Column Switches (211-05 Steering Column Switches, Description and Operation).
C1A41-21, C1A41-22	Signal circuits of clutch pedal position switch faulty.	Refer to the Ford approved diagnostic tool.
B1029-21. B1029-22	Signal circuits of accelerator pedal position switch faulty.	Refer to the Ford approved diagnostic tool.
U0301-00	Synchronization fault between the PCM and the GEM.	Refer to the Ford approved diagnostic tool.
B10AF-14	Circuit of cooling fan relay faulty (short to ground or open circuit).	Refer to the Ford approved diagnostic tool.
B10AF-12	Circuit of battery protection relay faulty (short to voltage).	Refer to the Ford approved diagnostic tool.
B1D06-13	Circuit of left-hand turn signal lamps faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D06-11	Circuit of left-hand turn signal lamp faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D07-11	Circuit of right-hand turn signal lamp faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D07-13	Circuit of right-hand turn signal lamps faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B113C-11	Circuit of light for hazard warning switch faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B113C-15	Circuit of light for hazard warning switch faulty (short to voltage or open circuit).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D35-24	Circuit of hazard warning lamps switch faulty.	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

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U2010-15	Circuit of interior light faulty (short to voltage)	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
U2010-11	Circuit of interior light faulty (short to ground).	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B10E1-12, B10E1-14, B10E2-12, B10E2-14, B10E3-12, B10E3-14	Circuits of rear central locking relay faulty.	Refer to the Ford approved diagnostic tool.
B1D00-11	Circuit of left-hand headlamp faulty (short to ground).	REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation) / Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D01-11	Circuit of right-hand headlamp faulty (short to ground).	REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation) / Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D00-13	Circuit of left-hand headlamp faulty (open circuit).	REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation) / Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D01-13	Circuit of right-hand headlamp faulty (open circuit).	REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation) / Headlamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1098-11	Circuit of left-hand marker lamp faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1098-13	Circuit of left-hand marker lamp faulty (short to voltage).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1099-11	Circuit of right-hand marker lamp faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1099-13	Circuit of right-hand marker lamp faulty (short to voltage).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B109B-13	Circuit of license plate lamp faulty.	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B109B-11	Circuit of license plate lamp faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D38-17	Windshield wiper motor (s), overvoltage	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1D38-16	Windshield wiper motor (s), undervoltage	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1D38-96	Front left windshield wiper motor (Master), internal system fault.	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10EF-12	Circuit of sliding sun roof module faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B10EF-14	Circuit of sliding sun roof module faulty (short to ground or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B113D-14	Circuit of sliding sun roof module "general close function" faulty (short to ground or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).

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B113D-12	Circuit of sliding sun roof module "general close function" faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B10AD-09	Rain sensor/light sensor, component fault.	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing), Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10AD-04	Internal circuit of rain sensor/light sensor faulty.	REFER to: Autolamps (417-01 Exterior Lighting, Diagnosis and Testing), Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1133-11	Circuit of heated windshield LED faulty (short to ground).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1133-12	Circuit of heated windshield LED faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1097-12	Circuit of heated windshield relay faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1097-44	Circuit of heated windshield relay faulty (short to ground).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B112D-11	Circuit of heated rear window LED faulty (short to ground).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1120-12	Circuit of heated rear window LED faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C84-14	Circuit of heated rear window relay faulty (short to ground).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C84-12	Circuit of heated rear window relay faulty (short to voltage).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1D38-04	Front right windshield wiper motor (Slave), internal system fault.	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1D38-19	Windshield wiper motor (s), overload protection.	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1D38-08	Front right windshield wiper motor (Slave), bus wire/signal interrupted.	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
U2018-41, U2017-41, U3000-51, P1674-00, B1A99-04, U2101-00	Module configuration faulty.	Make certain that the latest release of the software is loaded in the Ford approved diagnostic tool and that the correct variant of the GEM is installed. CONFIGURE the GEM again using the Ford approved diagnostic tool. If the fault occurs again, RENEW THE GEM.
P0604-00. P0605-00	Internal control unit fault.	Make certain that the latest release of the software is loaded in the Ford approved diagnostic tool and that the correct variant of the GEM is installed. CONFIGURE the GEM again using the Ford approved diagnostic tool. If the fault occurs again, RENEW THE GEM.
B10A5-12	Wiring of anti-theft alarm	Refer to the Ford approved diagnostic tool.

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	horn faulty (short to voltage).	
B10A5-14	Wiring of anti-theft alarm horn faulty (short to ground).	Refer to the Ford approved diagnostic tool.
B1D17-96, B1D17-00	Internal circuit of the battery backed horn for the anti-theft system (BBS) faulty.	Refer to the Ford approved diagnostic tool.
B1C82-12	Circuit of headlamp washer relay faulty (short to voltage)	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B1C82-14	Circuit of headlamp washer relay faulty (short to ground).	REFER to: Wipers and Washers (501-16 Wipers and Washers, Diagnosis and Testing).
B10D9-87, B10D5-13, B10DA-51, B10D8-00, B10D7-51, B10D7-05, B10D7-94, B10D7-8F, B10E6-11, B10E6-15	PATS system fault.	REFER to: Anti-Theft - Passive (419-01B Anti-Theft - Passive, Diagnosis and Testing).
B112A-12, B112A-14	Ignition relay circuits faulty.	Refer to the Ford approved diagnostic tool.
U3003-16, P0563-00, U3003-17	Charging system at fault.	Refer to the Ford approved diagnostic tool.
U0181-00	No communications possible with the headlamp leveling module.	REFER to: Headlamp Leveling (417-01 Exterior Lighting, Diagnosis and Testing).
B10AC-95, B10AC-87, B10AC-86	Speed control system, system fault.	Refer to the Ford approved diagnostic tool.
U2108-53, U2107-53,	Adaptive speed control system, system fault.	Refer to the Ford approved diagnostic tool.
B1C55-12	Circuit of signal horn relay faulty (short to voltage).	Refer to the Ford approved diagnostic tool.
B1C55-14	Circuit of signal horn relay faulty (short to ground or open circuit).	Refer to the Ford approved diagnostic tool.
B1D13-12	Circuit of interior light switch-off delay faulty (short to voltage)	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1D13-14	Circuit of interior light switch-off delay faulty (short to ground or open circuit).	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1A79-13	Circuit of rear fog lamp faulty.	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A79-11	Circuit of rear fog lamp faulty (short to ground).	REFER to: Fog Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
C0023-11	Stop lamp circuit faulty.	REFER to: Stoplamps (417-01 Exterior Lighting, Diagnosis and Testing).
P0462-00	Circuit of fuel level indicator sensor faulty (short to ground).	REFER to: (310-00 Fuel System - General Information) Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (Diagnosis and Testing), Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel

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		(Diagnosis and Testing).
P0460-15	Circuit of fuel level indicator sensor faulty (short to voltage or open circuit).	REFER to: (310-00 Fuel System - General Information) Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (Diagnosis and Testing), Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (Diagnosis and Testing).
B100A-11	Circuit of fuel pump relay faulty (short to ground).	REFER to: (310-00 Fuel System - General Information) Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (Diagnosis and Testing), Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (Diagnosis and Testing).
B100A-15	Circuit of fuel pump relay faulty (short to voltage or open circuit).	REFER to: (310-00 Fuel System - General Information) Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (Diagnosis and Testing), Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (Diagnosis and Testing).
B10C0-11, B10C0-15	Fuel pump circuits faulty.	REFER to: (310-00 Fuel System - General Information) Fuel System - 2.0L Duratec-HE (MI4)/2.3L Duratec-HE (MI4)/2.5L Duratec (VI5) (Diagnosis and Testing), Fuel System - 1.8L Duratorq-TDCi (Lynx) Diesel/2.0L Duratorq-TDCi (DW) Diesel (Diagnosis and Testing).
C1A56-93, C1A56-16, C1A56-86	Circuits of front left tire pressure warning sensor faulty.	REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
C1A58-93, C1A58-16, C1A58-86	Circuits of front right tire pressure warning sensor faulty.	REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
C1A62-93, C1A62-16, C1A62-86	Circuits of rear right tire pressure warning sensor faulty.	REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
C1A60-93, C1A60-16, C1A60-86	Circuits of rear left tire pressure warning sensor faulty.	REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
C1D21-05	Circuit of tire pressure monitoring module faulty	REFER to: Wheels and Tires (204-04 Wheels and Tires, Diagnosis and Testing).
B10EA-12	Circuit of electric booster heater faulty (short to voltage)	REFER to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing).
B10EA-14	Circuit of electric booster heater faulty (short to voltage or open circuit)	REFER to: Climate Control System (412-00 Climate Control System - General Information, Diagnosis and Testing).
B1131-88	No communications possible with the wiper motor module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0155-00	No communication with the electronic instrument cluster.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

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U0129-00	No communication with the anti-block brake system module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0100-00	No communication with the powertrain control module (PCM).	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B112B-88	No communications possible with the steering wheel module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B112C-88	No communications possible with the interior monitoring sensor module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1D17-88	No communications possible with the anti-theft alarm signal horn with integrated battery.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0231-00	No communications possible with the rain sensor/light sensor.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B1130-88	No communications possible with the light switch unit.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0214-00	No communications possible with the keyless vehicle module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0104-00	No communications possible with the collision warning module.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0003-00, U0001-00, U0006-00	No communications possible via the HS CAN bus.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0010-00, U0012-00, U0015-00	No communications possible via the MS CAN bus.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Symptom Chart

Symptom	Possible Sources	Action
Generic electronic module (GEM) not communicating with the diagnostic unit.	* Fuse(s). * Circuit(s). * Generic electronic module (GEM).	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Voltage supply (term. 30) faulty.	* Fuse(s). * Circuit(s). * Generic electronic module (GEM).	* GO to Pinpoint Test A.

Pinpoint test

PINPOINT TEST A : VOLTAGE SUPPLY (TERM. 30) FAULTY.

CAUTION: Before replacing the GEM in the event of a GEM malfunction, PERFORM a "hardware reset" after WORKING THROUGH the relevant DTC. To do this, disconnect connector C1BP02-G from the GEM and reconnect it. CHECK the operation of the system. If the malfunction persists, make sure that the latest release of the software is loaded in the Ford approved diagnostic tool and that the correct variant of the GEM is installed. CONFIGURE the GEM again using the Ford approved diagnostic tool. If the fault occurs

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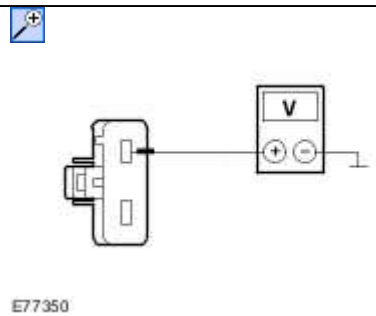
again, RENEW THE GEM.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FUSE F17	
	1 Ignition switch in position 0.
	2 CHECK Fuse F17 (EJB).
	Is the fuse OK? **Yes** GO to A2. **No** RENEW fuse F17 (60 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A2: CHECK THE VOLTAGE AT FUSE F17	
	1 Connect Fuse F17 (EJB).
	2 Measure the voltage between fuse F17 (60 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A3. **No** REPAIR the voltage supply to fuse F17 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A3: CHECK FUSE F18	
	1 CHECK Fuse F18 (EJB).
	Is the fuse OK? **Yes** GO to A4. **No** RENEW fuse F18 (60 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A4: CHECK THE VOLTAGE AT FUSE F18	
	1 Connect Fuse F18 (EJB).
	2 Measure the voltage between fuse F18 (60 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A5. **No** REPAIR the voltage supply to fuse F18 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A5: CHECK THE VOLTAGE AT THE GEM	
	1 Disconnect Connector C1BP02-G from the GEM.
	2 Measure the voltage between the GEM, connector C1BP02-G, pin 1, circuit SBB17A (RD), wiring harness side and ground.
	Does the meter display battery voltage? **Yes**

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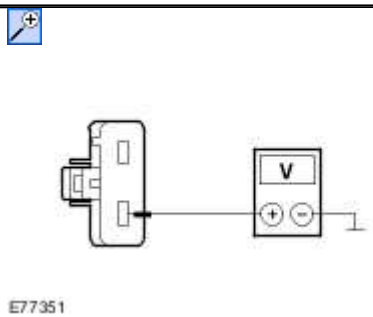
	GO to A6. **No** LOCATE and REPAIR the break in the circuit between the GEM and fuse F17 with the aid of the Wiring Diagrams. CHECK the operation of the system.
A6: CHECK THE VOLTAGE AT THE GEM	
 E77351	1 Measure the voltage between the GEM, connector C1BP02-G, pin 2, circuit SBB18A (YE), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** TEST the GEM and RENEW as necessary. CHECK the operation of the system. **No** LOCATE and REPAIR the break in the circuit between the GEM and fuse F18 with the aid of the Wiring Diagrams. CHECK the operation of the system.

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Print

Diagnosis and Testing

Special Tool(s)

	Terminal Probe Kit 418-S035

General Equipment

Digital multimeter
Ford Diagnostic Equipment

Inspection and Testing

1. **1.** VERIFY the customer concern.
2. **2.** Visually CHECK for any obvious mechanical or electrical damage.

Visual Inspection

Electrical
Fuses.
Wiring harness.
Electrical connectors.

3. **3.** RECTIFY any obvious causes for a concern found during the visual inspection before performing any further tests. CHECK the operation of the system.
4. **4.** If the concern persists after the visual inspection, PERFORM a fault diagnosis with WDS, RECTIFY any displayed faults in accordance with the displayed fault description and then DELETE the displayed fault(s). CHECK the operation of the system.
5. **5.** For vehicles with no stored fault(s), PROCEED in accordance with the Symptom Chart according to the fault symptom.
6. **6.** Following checking or elimination of the fault and after completion of operations, the fault memories of all vehicle modules must be READ OUT and any stored faults must be DELETED. READ OUT all fault memories again following a road test.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Action
B1189-29	Signal error, position sensor for the front electric window regulator.	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B118A-29	Signal error, position sensor for the rear electric window regulator.	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B14-15	Circuit of the position sensor for the front electric window regulator defective (short to voltage or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B14-11	Circuit of the position sensor for	REFER to: Glass, Frames and Mechanisms

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	the front electric window regulator defective (short to ground).	(501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B15-15	Circuit of the position sensor for the front electric window regulator defective (short to voltage or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
C1B15-11	Circuit of the position sensor for the front electric window regulator defective (short to ground).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1C13-15	Feedback circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C13-11	Feedback circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C14-15	Feedback circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C14-11	Feedback circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C15-15	Feedback circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C15-11	Feedback circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C16-15	Feedback circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C16-11	Feedback circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
U2100-00, U2101-00, U2012-08, U3002-55, U3002-81	Module configuration faulty.	Make sure that the latest release of the software is loaded in the diagnostic unit and that the correct variant is installed. CONFIGURE the driver door module again using the Ford diagnostic equipment. If the fault occurs again, INSTALL a new driver door module.
U2014-44,	Internal control unit fault.	Make sure that the latest release of the

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U3000-49, U0300-00		software is loaded in the diagnostic unit and that the correct variant is installed. CONFIGURE the driver door module again using the Ford diagnostic equipment. If the fault occurs again, INSTALL a new driver door module.
B117E-73	Circuit of the front electric window regulator faulty (window cannot be closed).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117E-72	Circuit of the front electric window regulator faulty (window cannot be closed).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117E-07	Circuit of the front electric window regulator faulty (mechanical fault).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117F-73	Circuit of the front electric window regulator faulty (window cannot be opened).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117F-72	Circuit of the front electric window regulator faulty (window cannot be opened).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117C-73	Circuit of the rear electric window regulator faulty (window cannot be closed).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117C-72	Circuit of the rear electric window regulator faulty (window cannot be closed).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117C-07	Circuit of the rear electric window regulator faulty (mechanical fault).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117D-73	Circuit of the rear electric window regulator faulty (window cannot be opened).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B117D-72	Circuit of the rear electric window regulator faulty (window cannot be opened).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1108-11	Circuit of driver central locking motor faulty (short to ground).	GO to Pinpoint Test D.
B1108-15	Circuit of driver central locking motor faulty (short to voltage or open circuit).	GO to Pinpoint Test D.
B10EB-11	Circuit of driver central locking motor with double locking faulty (short to ground).	GO to Pinpoint Test E.
B10EB-15	Circuit of driver central locking motor with double locking faulty (short to voltage or open circuit).	GO to Pinpoint Test E.
U2013-24	Driver door switch unit faulty.	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
U2002-24	Passenger door switch unit faulty.	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
U2004-24	Rear door switch unit faulty, driver side/passenger side	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1109-11	Circuit of the passenger central locking motor faulty (short to ground).	GO to Pinpoint Test C.

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B1109-15	Circuit of the passenger central locking motor faulty (short to voltage or open circuit).	GO to Pinpoint Test C.
B10EC-11	Circuit of the passenger central locking motor with double locking faulty (short to ground).	GO to Pinpoint Test F.
B10EC-15	Circuit of the passenger central locking motor with double locking faulty (short to voltage or open circuit).	GO to Pinpoint Test F.
B110A-11	Circuit of the left rear central locking motor faulty (short to ground).	GO to Pinpoint Test H.
B110A-15	Circuit of the left rear central locking motor faulty (short to voltage or open circuit).	GO to Pinpoint Test H.
B10ED-11	Circuit of the left rear central locking motor with double locking faulty (short to ground).	GO to Pinpoint Test I.
B10ED-15	Circuit of the left rear central locking motor with double locking faulty (short to voltage or open circuit).	GO to Pinpoint Test I.
B110B-11	Circuit of the right rear central locking motor faulty (short to ground).	GO to Pinpoint Test G.
B110B-15	Circuit of the right rear central locking motor faulty (short to voltage or open circuit).	GO to Pinpoint Test G.
B10EE-11	Circuit of the right rear central locking motor with double locking faulty (short to ground).	GO to Pinpoint Test J.
B10EE-15	Circuit of the right rear central locking motor with double locking faulty (short to voltage or open circuit).	GO to Pinpoint Test J.
B108F-23	Circuit of the passenger compartment locking/unlocking switch faulty.	GO to Pinpoint Test K.
B1C10-11	Circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C09-11	Circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the driver side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C11-11	Circuit for left/right adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1C12-11	Circuit for up/down adjustment of the motor for the electrically adjustable exterior mirror on the passenger side faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).

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B1163-11	Circuit of left-hand heated exterior mirror faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1163-15	Circuit of left-hand heated exterior mirror faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1164-11	Circuit of right-hand heated exterior mirror faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1164-15	Circuit of right-hand heated exterior mirror faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1165-15	Circuit of courtesy lamps integrated in the left-hand exterior mirror faulty (short to voltage or open circuit).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1165-11	Circuit of courtesy lamps integrated in the left-hand exterior mirror faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1166-15	Circuit of courtesy lamps integrated in the right-hand exterior mirror faulty (short to voltage or open circuit).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1166-11	Circuit of courtesy lamps integrated in the right-hand exterior mirror faulty (short to ground).	REFER to: Parking, Rear and License Plate Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B109C-15	Circuit of interior lighting activation switch faulty (short to ground or open circuit).	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B109C-11	Circuit of interior lighting activation switch faulty (short to ground).	REFER to: Interior Lighting (417-02 Interior Lighting, Diagnosis and Testing).
B1161-15	Circuit of rear left-hand side window anti-trap protection switch faulty (short to voltage or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1161-23	Circuit of rear left-hand side window anti-trap protection switch faulty (signal error).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1162-15	Circuit of rear right-hand side window anti-trap protection switch faulty (short to voltage or open circuit).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1162-23	Circuit of rear right-hand side window anti-trap protection switch faulty (signal error).	REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing).
B1D06-15	Circuit of turn signal lamp integrated in the left-hand exterior mirror faulty (short to voltage or open circuit).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D06-11	Circuit of turn signal lamp integrated in the left-hand exterior mirror faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1D07-15	Circuit of turn signal lamp integrated in the right-hand exterior mirror faulty (short to	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).

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	voltage or open circuit).	
B1D07-11	Circuit of turn signal lamp integrated in the right-hand exterior mirror faulty (short to ground).	REFER to: Turn Signal, Cornering and Hazard Lamps (417-01 Exterior Lighting, Diagnosis and Testing).
B1A94-11	Circuit of driver side exterior mirror faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1A94-15	Circuit of driver side exterior mirror faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1A95-15	Circuit of passenger side exterior mirror faulty (short to voltage or open circuit).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
B1A95-11	Circuit of passenger side exterior mirror faulty (short to ground).	REFER to: Rear View Mirrors (501-09 Rear View Mirrors, Diagnosis and Testing).
U3003-62	Voltage supply (terminal 30) faulty.	GO to Pinpoint Test A.
B1A98-86, B1A98-83, B1A98-87, B1B70-86, B1B70-83, B1B70-87	No communications possible via the LIN bus.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
U0010-00	No communications possible via the MS CAN bus.	REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).

Symptom Chart

Symptom	Possible Sources	Action
Driver door module not communicating with the Ford diagnostic equipment.	* Fuse(s). * Circuit(s). * Driver's door module.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Passenger door module not communicating with the Ford diagnostic equipment.	* Fuse(s). * Circuit(s). * Passenger door module.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
Voltage supply (terminal 30) at the driver door module faulty.	* Fuse(s). * Circuit(s). * Driver door module.	* GO to Pinpoint Test A.
Voltage supply (terminal 30) at the passenger door module faulty.	* Fuse(s). * Circuit(s). * Passenger door module.	* GO to Pinpoint Test B.

Pinpoint Tests

PINPOINT TEST A : VOLTAGE SUPPLY (TERMINAL 30) AT THE DRIVER DOOR MODULE FAULTY.

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.

NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: DETERMINE THE VEHICLE VARIANT.	

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	1 Determine the vehicle variant.
	Is the vehicle LHD? **Yes** GO to A2. **No** GO to A4.
A2: CHECK FUSE FA1	
	1 Ignition switch in position 0.
	2 CHECK fuse FA1 (RJB).
	Is the fuse OK? **Yes** GO to A3. **No** RENEW fuse FA1 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A3: CHECK THE VOLTAGE AT FUSE FA1	
	1 Connect fuse FA1 (RJB).
	2 Measure the voltage between fuse FA1 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** REPAIR the voltage supply to fuse FA1 with the aid of the wiring diagrams. CHECK the operation of the system.
A4: CHECK FUSE FA2	
	1 CHECK fuse FA2 (RJB).
	Is the fuse OK? **Yes** GO to A5. **No** RENEW fuse FA2 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
A5: CHECK THE VOLTAGE AT FUSE FA2	
	1 Connect fuse FA2 (RJB).
	2 Measure the voltage between fuse FA2 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to A6. **No** REPAIR the voltage supply to fuse FA2 with the aid of the wiring diagrams. CHECK the operation of the system.
A6: CHECK THE VOLTAGE AT THE DRIVER DOOR MODULE	
	1 Disconnect driver door module C5PL01-A.
	2 Measure the voltage between the driver door module connector C5PL01-A pin 2, circuit SBR01A (BK), wiring harness side and ground.

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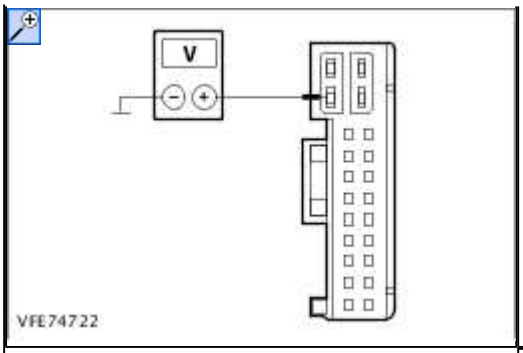

	Does the meter display battery voltage? **Yes** CHECK the driver door module and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the driver door module and fuse FA1 (LHD) or fuse FA2 (RHD) with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST B : VOLTAGE SUPPLY (TERMINAL 30) AT THE PASSENGER DOOR MODULE FAULTY.

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.

NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DETERMINE THE VEHICLE VARIANT.	
	1 Determine the vehicle variant.
	Is the vehicle LHD? **Yes** GO to B4. **No** GO to B2.
B2: CHECK FUSE FA1	
	1 Ignition switch in position 0.
	2 CHECK fuse FA1 (RJB).
	Is the fuse OK? **Yes** GO to B3. **No** RENEW fuse FA1 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
B3: CHECK THE VOLTAGE AT FUSE FA1	
	1 Connect fuse FA1 (RJB).
	2 Measure the voltage between fuse FA1 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to B6. **No** REPAIR the voltage supply to fuse FA1 with the aid of the wiring diagrams. CHECK the operation of the system.
B4: CHECK FUSE FA2	

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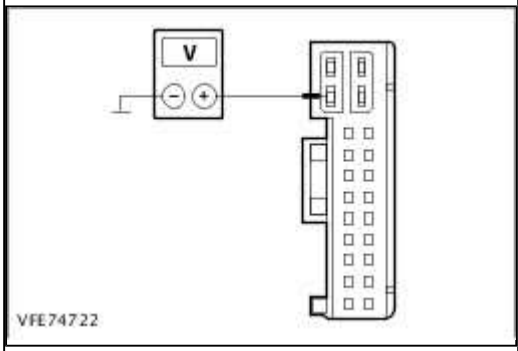
	1 CHECK fuse FA2 (RJB).
	Is the fuse OK? **Yes** GO to B5. **No** RENEW fuse FA2 (25 A). CHECK the operation of the system. If the fuse blows again, LOCATE and REPAIR the short using the Wiring Diagrams.
B5: CHECK THE VOLTAGE AT FUSE FA2	
	1 Connect fuse FA2 (RJB).
	2 Measure the voltage between fuse FA2 (25 A) and ground.
	Does the meter display battery voltage? **Yes** GO to B6. **No** REPAIR the voltage supply to fuse FA2 with the aid of the wiring diagrams. CHECK the operation of the system.
B6: CHECK THE VOLTAGE AT THE PASSENGER DOOR MODULE	
	1 Disconnect passenger door module C6PL01-A.
	2 Measure the voltage between the passenger door module connector C6PL01-A pin 2, circuit SBR02A (BK), wiring harness side and ground.
	Does the meter display battery voltage? **Yes** CHECK the passenger door module and RENEW if necessary. CHECK the operation of the system. **No** LOCATE and RECTIFY the break in the circuit between the passenger door module and fuse FA2 (LHD) or fuse FA1 (RHD) with the aid of the Wiring Diagrams. CHECK the operation of the system.

PINPOINT TEST C : CIRCUIT OF THE PASSENGER CENTRAL LOCKING MOTOR FAULTY.

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.

NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FOR SHORT TO VOLTAGE IN THE CIRCUIT BETWEEN THE PASSENGER DOOR MODULE AND THE DLC (SCP BUS)	
	1 Disconnect passenger door module C6PL01-A.
	2 Disconnect passenger door lock C6PL64.
	3 Ignition switch in position II.
	4 Measure the voltage between:

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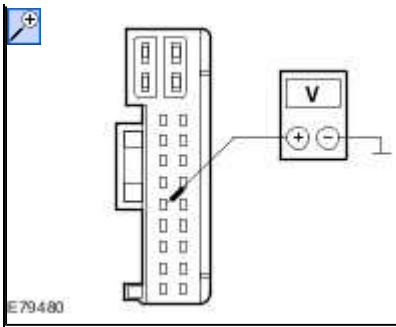


- the passenger door module connector C6PL01-A pin 7, circuit CPL66A (BK), wiring harness side and ground (LHD).
- or
- the passenger door module connector C6PL01-A pin 7, circuit CPL66AA (BK), wiring harness side and ground (RHD).

Is a voltage measured?

Yes

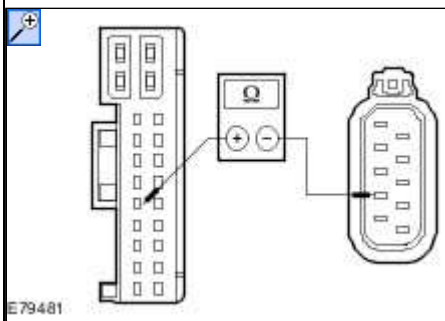
LOCATE and REPAIR the short to voltage in the circuit between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

No

LHD vehicles:GO to C2.
RHD vehicles:GO to C3.

C2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK

1 Ignition switch in position 0.



2 Measure the resistance between the passenger door module connector C6PL01-A, pin 7, circuit CPL66A (BK), wiring harness side and the passenger door lock connector C6PL64, pin 7, circuit CPL66A (BK), wiring harness side.

Is a resistance of less than 2 Ohm measured?

Yes

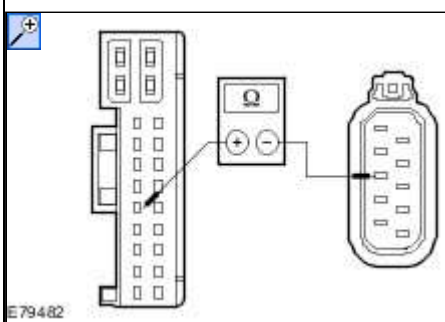
GO to C4.

No

LOCATE and REPAIR the break in circuit CPL66A (BK) between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

C3: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK

1 Ignition switch in position 0.



2 Measure the resistance between the passenger door module connector C6PL01-A pin 7, circuit CPL66AA (BK), wiring harness side and the passenger door lock connector C6PL64 pin 5, circuit CPL66AA (BK), wiring harness side.

Is a resistance of less than 2 Ohm measured?

Yes

GO to C4.

No

LOCATE and REPAIR the break in circuit CPL66AA (BK) between the passenger door module and the

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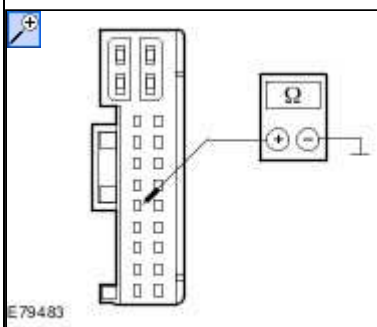
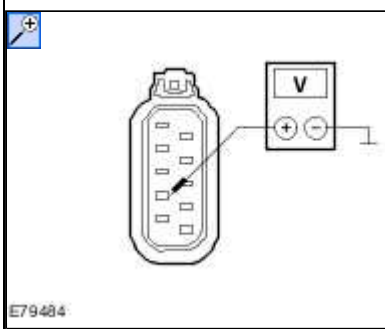
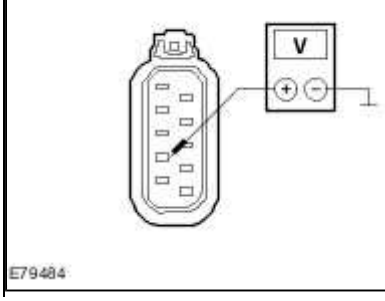
	passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
C4: CHECK FOR SHORT TO GROUND BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between: • the passenger door module connector C6PL01-A pin 7, circuit CPL66A (BK), wiring harness side and ground (LHD). • or • the passenger door module connector C6PL01-A pin 7, circuit CPL66AA (BK), wiring harness side and ground (RHD).
	Is a resistance of more than 10,000 ohms measured? **Yes** LHD vehicles:GO to C5. RHD vehicles:GO to C7. **No** LOCATE and REPAIR the short to ground in the circuit between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
C5: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect passenger door module C6PL01-A.
	2 Measure the voltage between the passenger door lock connector C6PL64 pin 7, circuit CPL66A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to C6. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
C6: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
	1 Measure the voltage between the passenger door lock connector C6PL64 pin 7, circuit CPL66A (BK), wiring harness side and ground.

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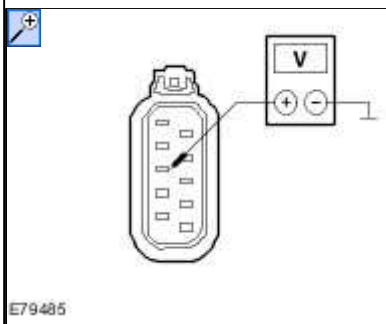
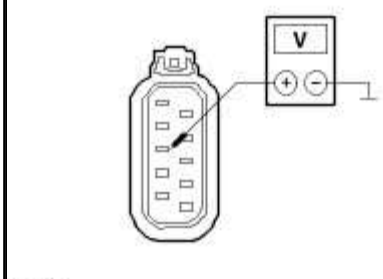
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new passenger door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
C7: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect passenger door module C6PL01-A.
 E79485	2 Measure the voltage between the passenger door lock connector C6PL64 pin 5, circuit CPL66AA (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to C8. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
C8: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
 E79485	1 Measure the voltage between the passenger door lock connector C6PL64 pin 5, circuit CPL66AA (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new passenger door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.

PINPOINT TEST D : CIRCUIT OF THE DRIVER CENTRAL LOCKING MOTOR FAULTY.
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

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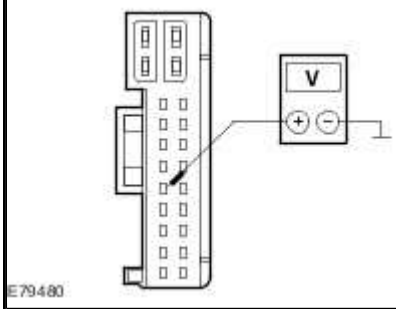
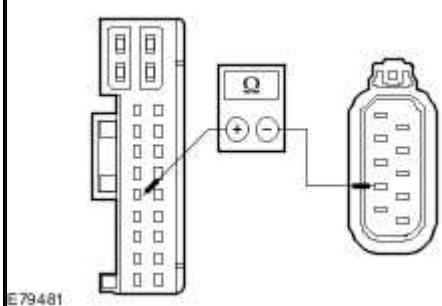
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Disconnect driver door module C5PL01-A.
	2 Disconnect driver door lock C5PL63.
	3 Ignition switch in position II.
	4 Measure the voltage between: • the driver door module connector C5PL01-A pin 7, circuit CPL51A (BK), wiring harness side and ground (LHD). • or • the driver door module connector C5PL01-A pin 7, circuit CPL51AA (BK), wiring harness side and ground (RHD).
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LHD vehicles:GO to D3. RHD vehicles:GO to D2.
D2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure resistance between driver door module connector C5PL01-A pin 7, circuit CPL51AA (BK), wiring harness side and driver door lock connector C5PL63 pin 7, circuit CPL51AA (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to D4. **No** LOCATE and REPAIR the break in circuit CPL51AA (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
D3: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between the driver door module connector C5PL01-A pin 7, circuit CPL51A (BK), wiring harness side and the driver door lock connector C5PL63 pin 5, circuit CPL51A (BK), wiring harness side.

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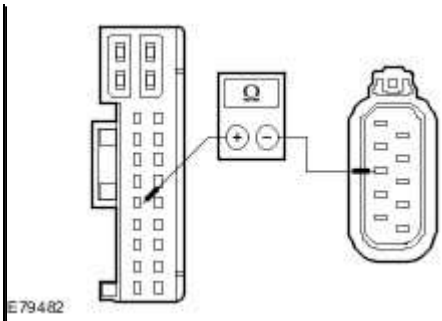


Is a resistance of less than 2 Ohm measured?

Yes

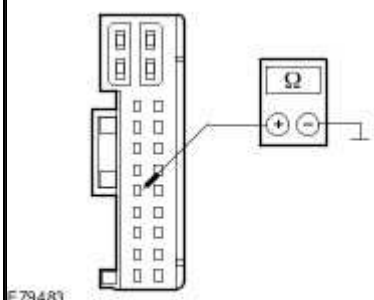
GO to D4.

No

LOCATE and REPAIR the break in circuit CPL51A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

D4: CHECK FOR SHORT TO GROUND BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK

1 Ignition switch in position 0.



2 Measure the resistance between:

- the driver door module connector C5PL01-A pin 7, circuit CPL51A (BK), wiring harness side and ground (LHD).
- or
- the driver door module connector C5PL01-A pin 7, circuit CPL51AA (BK), wiring harness side and ground (RHD).

Is a resistance of more than 10,000 ohms measured?

Yes

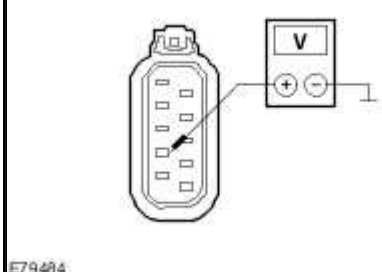
LHD vehicles:GO to D7.
RHD vehicles:GO to D5.

No

LOCATE and REPAIR the short to ground in the circuit between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

D5: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING LOCKING/UNLOCKING)

1 Connect driver door module C5PL01-A.



2 Measure the voltage between the driver door lock connector C5PL63 pin 7, circuit CPL51AA (BK), wiring harness side and ground.

3 Lock and unlock the vehicle with the key in the door lock cylinder.

Is battery voltage measured during unlocking?

Yes

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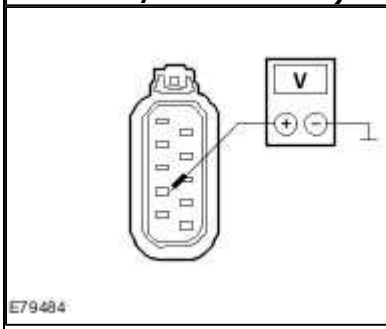
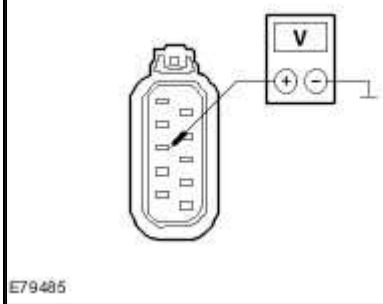
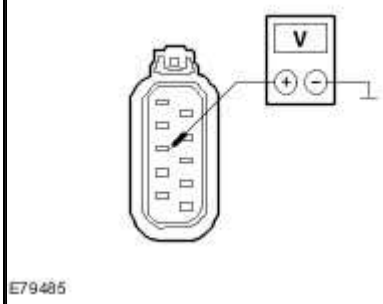
	GO to D6. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
D6: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
 E79484	1 Measure the voltage between the driver door lock connector C6PL63 pin 7, circuit CPL51AA (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new driver door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
D7: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect driver door module C5PL01-A.
 E79485	2 Measure the voltage between the driver door lock connector C5PL63 pin 5, circuit CPL51A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to D8. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
D8: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
 E79485	1 Measure the voltage between the driver door lock connector C5PL63 pin 5, circuit CPL51A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in

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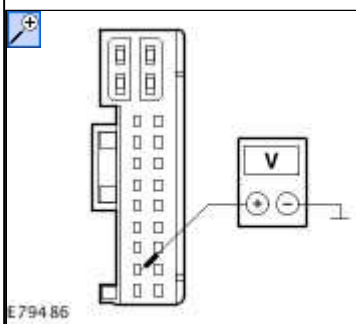
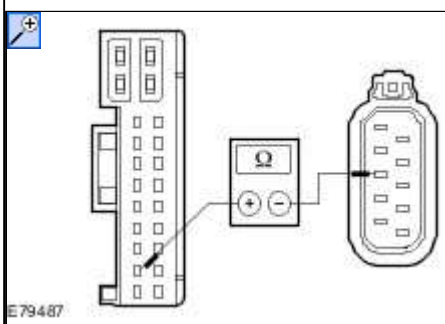
	the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new driver door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.

PINPOINT TEST E : CIRCUIT OF THE DRIVER CENTRAL LOCKING MOTOR WITH DOUBLE LOCKING FAULTY.

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.

NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Disconnect driver door module C5PL01-A.
	2 Disconnect driver door lock C5PL63.
	3 Ignition switch in position II.
	4 Measure the voltage between: • the driver door module connector C5PL01-A pin 10, circuit CPL02A (BK), wiring harness side and ground (LHD). • or • the driver door module connector C5PL01-A pin 10, circuit CPL02AA (BK), wiring harness side and ground (RHD).
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LHD vehicles:GO to E2. RHD vehicles:GO to E3.
E2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance betweenthe driver door module connector C5PL01-A pin 10, circuit CPL02A (BK), wiring harness side and the driver door lock connector C5PL63 pin 7, circuit CPL02A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes**

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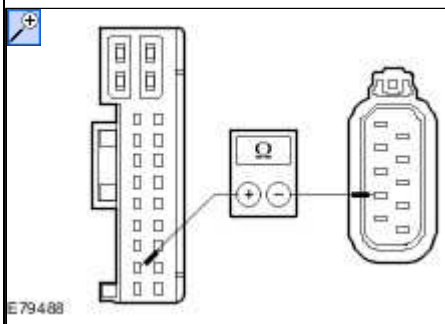
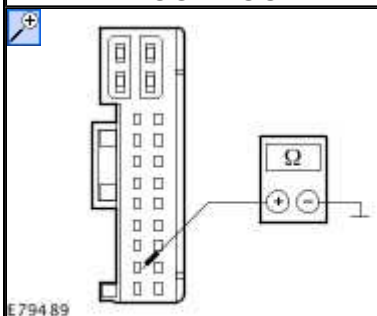
	GO to E4. **No** LOCATE and REPAIR the break in circuit CPL02A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
E3: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between the driver door module connector C5PL01-A pin 10, circuit CPL02AA (BK), wiring harness side and the driver door lock connector C5PL63 pin 5, circuit CPL02AA (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to E4. **No** LOCATE and REPAIR the break in circuit CPL02AA (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
E4: CHECK FOR SHORT TO GROUND BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Measure the resistance between: • the driver door module connector C5PL01-A pin 10, circuit CPL02A (BK), wiring harness side and ground (LHD). • or • the driver door module connector C5PL01-A pin 10, circuit CPL02AA (BK), wiring harness side and ground (RHD).
	Is a resistance of more than 10,000 ohms measured? **Yes** LHD vehicles:GO to E5. RHD vehicles:GO to E7. **No** LOCATE and REPAIR the short to ground in the circuit between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
E5: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING LOCKING/UNLOCKING	
	1 Connect driver door module C5PL01-A.
	2 Measure the voltage between the driver door lock connector C5PL63 pin 7, circuit CPL02A (BK), wiring harness side and ground.

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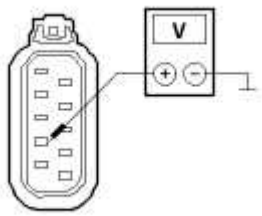
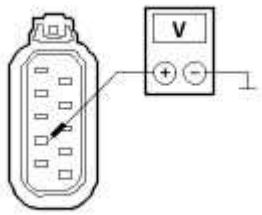
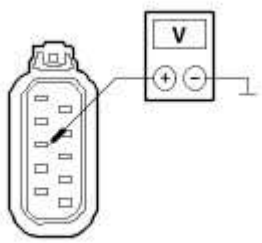
 E79484	
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to E6. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
E6: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
 E79484	1 Measure the voltage between the driver door lock connector C6PL63 pin 7, circuit CPL02A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new driver door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
E7: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect driver door module C5PL01-A.
 E79485	2 Measure the voltage between the driver door lock connector C5PL63 pin 5, circuit CPL02AA (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to E8. **No** CHECK and if necessary INSTALL a new driver door

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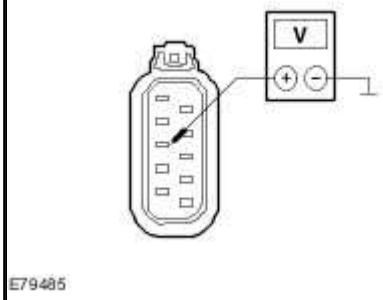
	module. CHECK the operation of the system.

E8: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)

 E79485	1 Measure the voltage between the driver door lock connector C5PL63 pin 5, circuit CPL02AA (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new driver door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.

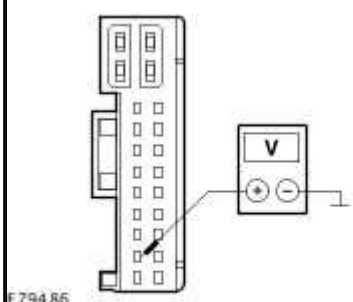
PINPOINT TEST F : CIRCUIT OF THE PASSENGER CENTRAL LOCKING MOTOR WITH DOUBLE LOCKING FAULTY.

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.

NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

F1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK

	1 Disconnect passenger door module C6PL01-A.
	2 Disconnect passenger door lock C6PL64.
	3 Ignition switch in position II.
 E79486	4 Measure the voltage between: • the passenger door module connector C6PL01-A pin 10, circuit CPL65A (BK), wiring harness side and ground (LHD). • or • the passenger door module connector C6PL01-A pin 10, circuit CPL65AA (BK), wiring harness side and ground (RHD).
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in the circuit between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** LHD vehicles:GO to F2. RHD vehicles:GO to F3.

F2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE PASSENGER DOOR MODULE

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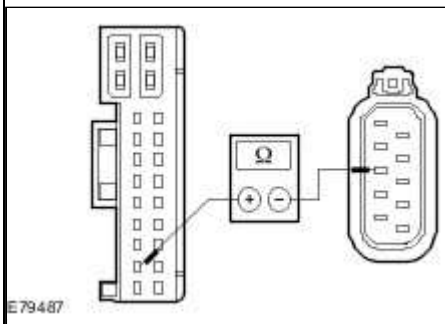
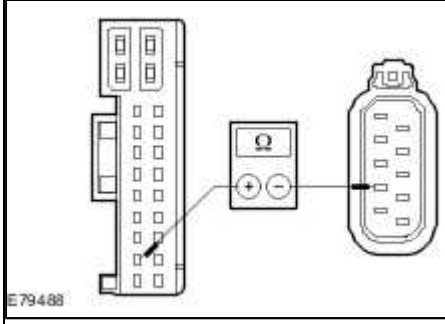
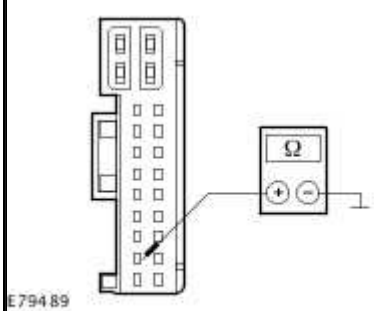
AND THE PASSENGER DOOR LOCK

	1 Ignition switch in position 0.
 E79487	2 Measure the resistance between the passenger door module connector C6PL01-A pin 10, circuit CPL65A (BK), wiring harness side and the passenger door lock connector C6PL64 pin 5, circuit CPL65A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to F4. **No** LOCATE and REPAIR the break in circuit CPL65A (BK) between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

F3: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK

	1 Ignition switch in position 0.
 E79488	2 Measure the resistance between the passenger door module connector C6PL01-A pin 10, circuit CPL65AA (BK), wiring harness side and the passenger door lock connector C6PL64 pin 7, circuit CPL65AA (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to F4. **No** LOCATE and REPAIR the break in circuit CPL65AA (BK) between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

F4: CHECK FOR SHORT TO GROUND BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER DOOR LOCK

	1 Ignition switch in position 0.
 E79489	2 Measure the resistance between: • the passenger door module connector C6PL01-A, pin 10, circuit CPL65A (BK), wiring harness side and ground. • or • the passenger door module connector C6PL01-A pin 10, circuit CPL65AA (BK), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured? **Yes**

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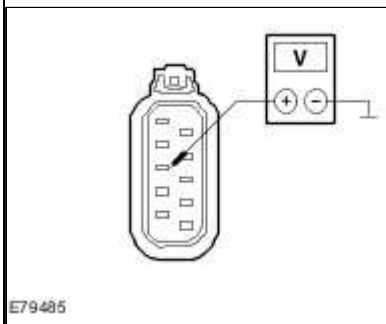
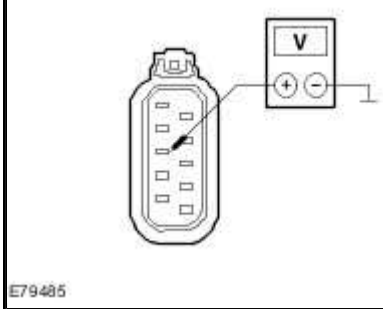
	LHD vehicles:GO to F5. RHD vehicles:GO to F6. **No** LOCATE and REPAIR the short to ground in the circuit between the passenger door module and the passenger door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
F5: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect passenger door module C6PL01-A.
	2 Measure the voltage between the passenger door lock connector C6PL64 pin 5, circuit CPL65A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to F6. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
F6: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
	1 Measure the voltage between the passenger door lock connector C6PL64 pin 5, circuit CPL65A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new passenger door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
F7: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
	1 Connect passenger door module C6PL01-A.
	2 Measure the voltage between the passenger door lock connector C6PL64 pin 7, circuit CPL66A (BK), wiring harness side and ground.

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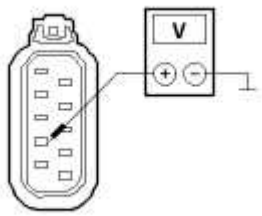
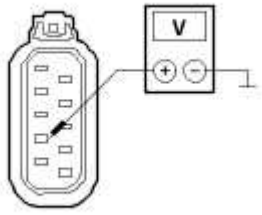
 E79484	
	3 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to F8. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.
F8: CHECK THE VOLTAGE AT THE PASSENGER DOOR LOCK (DURING LOCKING/UNLOCKING)	
 E79484	1 Measure the voltage between the passenger door lock connector C6PL64 pin 7, circuit CPL66A (BK), wiring harness side and ground.
	2 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new passenger door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new passenger door module. CHECK the operation of the system.

PINPOINT TEST G : CIRCUIT OF THE RIGHT REAR CENTRAL LOCKING MOTOR FAULTY.	
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.	
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE RIGHT REAR DOOR MODULE AND THE RIGHT REAR DOOR LOCK	
	1 Disconnect right rear door module C8PL01.
	2 Disconnect right rear door lock C8PL72.
	3 Ignition switch in position II.
	4 Measure the voltage between the right rear door module connector C8PL01 pin 10, circuit CPL11A (BK), wiring harness side and ground.

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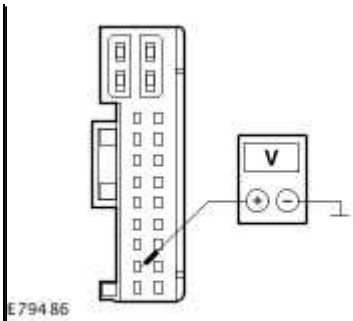


Is a voltage measured?

Yes

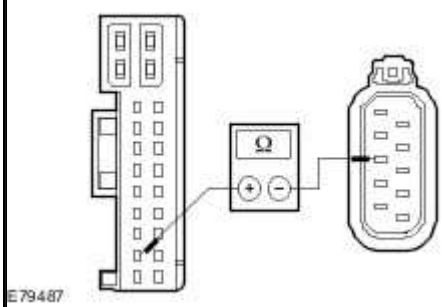
LOCATE and REPAIR the short to voltage in circuit CPL11A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

No

GO to G2.

G2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE RIGHT REAR DOOR MODULE AND THE RIGHT REAR DOOR LOCK

1. Ignition switch in position 0.



2. Measure the resistance between the right rear door module connector C8PL01 pin 10, circuit CPL11A (BK), wiring harness side and the right rear door lock connector C8PL72 pin 5, circuit CPL11A (BK), wiring harness side.

Is a resistance of less than 2 Ohm measured?

Yes

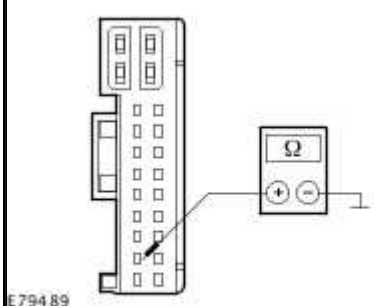
GO to G3.

No

LOCATE and REPAIR the break in circuit CPL11A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

G3: CHECK FOR SHORT TO GROUND IN THE CIRCUIT BETWEEN THE RIGHT REAR DOOR MODULE AND THE RIGHT REAR DOOR LOCK

1. Ignition switch in position 0.



2. Measure the resistance between the right rear door module connector C8PL01 pin 10, circuit CPL11A (BK), wiring harness side and ground.

Is a resistance of more than 10,000 ohms measured?

Yes

GO to G4.

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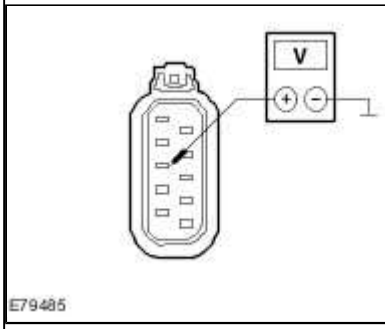
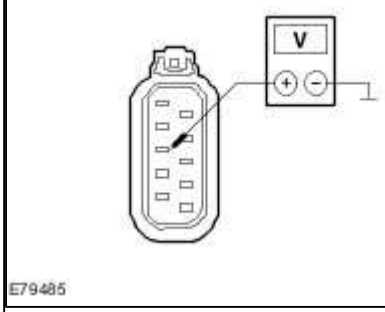
	No LOCATE and REPAIR the short to ground in circuit CPL11A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
G4: CHECK THE VOLTAGE AT THE RIGHT REAR DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect right rear door module C8PL01.
 E79485	2 Measure the voltage between the right rear door lock connector C8PL72 pin 5, circuit CPL11A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to G5. **No** CHECK and if necessary INSTALL a new right rear door module. CHECK the operation of the system.
G5: CHECK THE VOLTAGE AT THE RIGHT REAR DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
 E79485	1 Measure the voltage between the right rear door lock connector C8PL72 pin 5, circuit CPL11A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new right rear door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new right rear door module. CHECK the operation of the system.

PINPOINT TEST H : CIRCUIT OF THE LEFT REAR CENTRAL LOCKING MOTOR FAULTY.	
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.	
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK	

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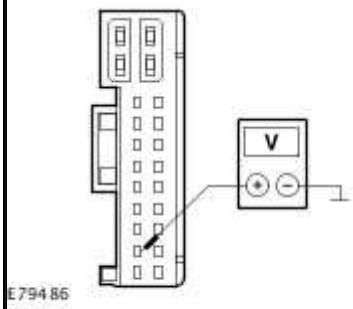
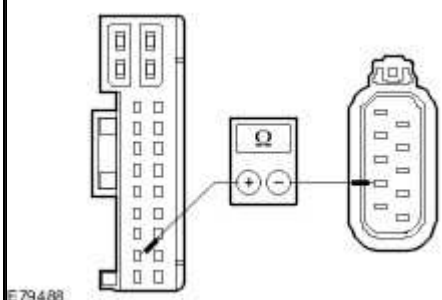
	1 Disconnect left rear door module C7PL01.
	2 Disconnect left rear door lock C7PL71.
	3 Ignition switch in position II.
	4 Measure the voltage between the left rear door module connector C7PL01 pin 10, circuit CPL04A (BK), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in circuit CPL04A (BK) between the left rear door module and the left door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to H2.
H2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left rear door module connector C7PL01 pin 10, circuit CPL04A (BK), wiring harness side and the left rear door lock connector C7PL71 pin 7, circuit CPL04A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to H3. **No** LOCATE and REPAIR the break in circuit CPL04A (BK) between the left rear door module and the left rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
H3: CHECK FOR SHORT TO GROUND BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between the left rear door module connector C7PL01 pin 10, circuit CPL04A (BK), wiring harness side and ground.

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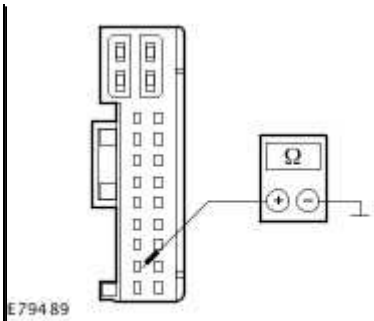
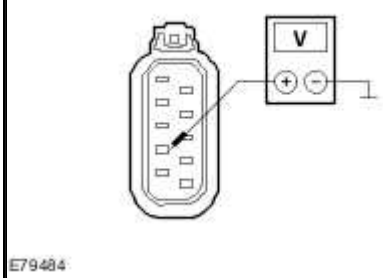


Is a resistance of more than 10,000 ohms measured?
Yes
GO to H4.
No
LOCATE and REPAIR the short to ground in circuit CPL04A (BK) between the left rear door module and the left rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

H4: CHECK THE VOLTAGE AT THE LEFT REAR DOOR LOCK (DURING LOCKING/UNLOCKING)

1 Connect left rear door module C7PL01.

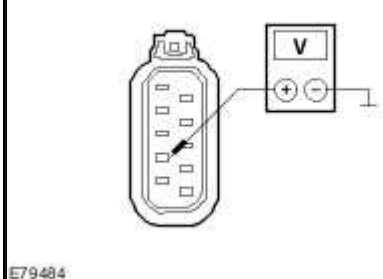


2 Measure the voltage between the left rear door lock connector C7PL71 pin 7, circuit CPL04A (BK), wiring harness side and ground.

3 Lock and unlock the vehicle with the key in the door lock cylinder.

Is battery voltage measured during unlocking?
Yes
GO to H5.
No
CHECK and if necessary INSTALL a new left rear door module. CHECK the operation of the system.

H5: CHECK THE VOLTAGE AT THE LEFT REAR DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)



1 Measure the voltage between the left rear door lock connector C7PL71 pin 7, circuit CPL04A (BK), wiring harness side and ground.

2 Double lock and unlock the vehicle with the key in the door lock cylinder.

Is battery voltage measured during unlocking?
Yes
CHECK and if necessary INSTALL a new left rear door lock. CHECK the operation of the system.

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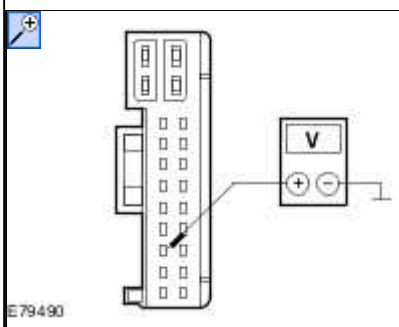
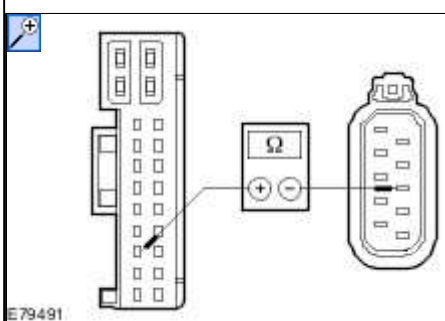
	No CHECK and if necessary INSTALL a new left rear door lock. CHECK the operation of the system.

PINPOINT TEST I : CIRCUIT OF THE LEFT REAR CENTRAL LOCKING MOTOR WITH DOUBLE LOCKING FAULTY.	
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.	
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK	
	1 Disconnect left rear door module C7PL01.
	2 Disconnect left rear door lock C7PL71.
	3 Ignition switch in position II.
 E79490	4 Measure the voltage between the left rear door module connector C7PL01 pin 9, circuit CPL08A (BK), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in circuit CPL08A (BK) between the left rear door module and the left door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to I2.
I2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK	
	1 Ignition switch in position 0.
 E79491	2 Measure the resistance between the left rear door module connector C7PL01 pin 9, circuit CPL08A (BK), wiring harness side and the left rear door lock, connector C7PL71, pin 6, circuit CPL08A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to I3. **No** LOCATE and REPAIR the break in circuit CPL08A (BK) between the left rear door module and the left rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
I3: CHECK FOR SHORT TO GROUND BETWEEN THE LEFT REAR DOOR MODULE AND THE LEFT REAR DOOR LOCK (DURING LOCKING/UNLOCKING)	

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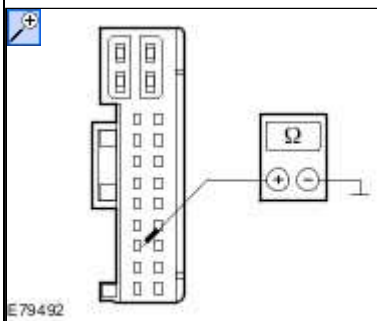
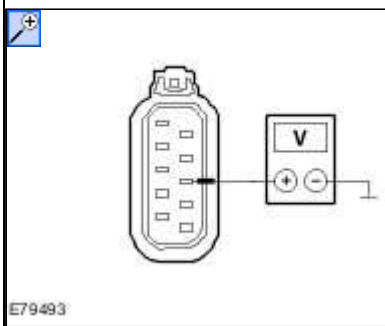
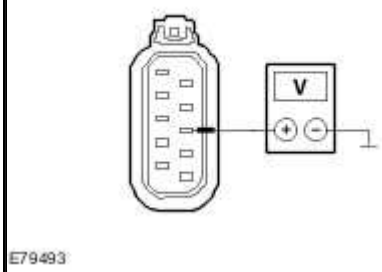
	1 Ignition switch in position 0.
	2 Measure the resistance between the left rear door module connector C7PL01 pin 9, circuit CPL08A (BK), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured? **Yes** GO to I4. **No** LOCATE and REPAIR the short to ground in circuit CPL08A (BK) between the left rear door module and the left rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
I4: CHECK THE VOLTAGE AT THE LEFT REAR DOOR LOCK (DURING LOCKING/UNLOCKING)	
	1 Connect left rear door module C7PL01.
	2 Measure the voltage between the left rear door lock connector C7PL71 pin 6, circuit CPL08A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to I5. **No** CHECK and if necessary INSTALL a new left rear door module. CHECK the operation of the system.
I5: CHECK THE VOLTAGE AT THE LEFT REAR DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)	
	1 Measure the voltage between the left rear door lock connector C7PL71 pin 6, circuit CPL08A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** CHECK and if necessary INSTALL a new left rear door

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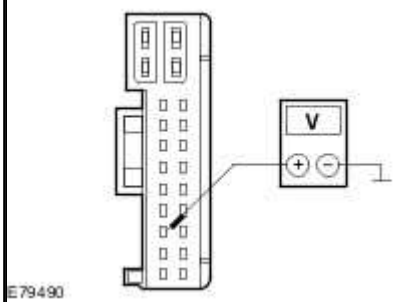
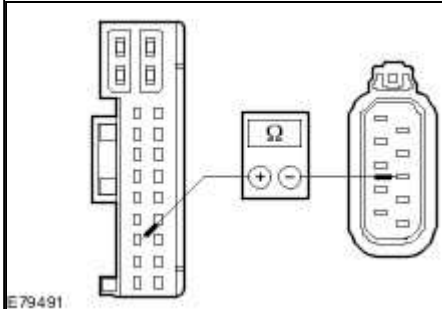
	lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new left rear door lock. CHECK the operation of the system.

PINPOINT TEST J : CIRCUIT OF THE RIGHT REAR CENTRAL LOCKING MOTOR WITH DOUBLE LOCKING FAULTY.	
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.	
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK FOR SHORT TO VOLTAGE BETWEEN THE RIGHT REAR DOOR MODULE AND THE RIGHT REAR DOOR LOCK	
	1 Disconnect right rear door module C8PL01.
	2 Disconnect right rear door lock C8PL72.
	3 Ignition switch in position II.
	4 Measure the voltage between the right rear door module connector C8PL01 pin 9, circuit CPL12A (BK), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in circuit CPL12A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to J2.
J2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE RIGHT REAR DOOR MODULE AND THE RIGHT REAR DOOR LOCK	
	1 Ignition switch in position 0.
	2 Measure the resistance between the right rear door module connector C8PL01 pin 9, circuit CPL12A (BK), wiring harness side and the right rear door lock connector C8PL72 pin 6, circuit CPL12A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to J3. **No** LOCATE and REPAIR the break in circuit CPL12A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
J3: CHECK FOR SHORT TO GROUND IN THE CIRCUIT BETWEEN THE RIGHT REAR	

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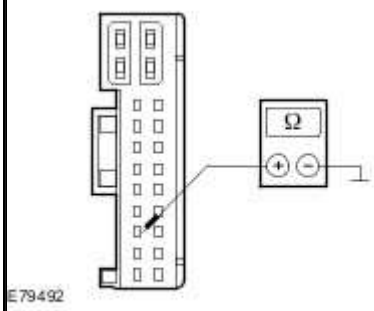
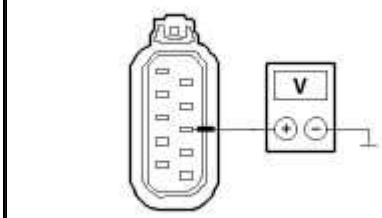
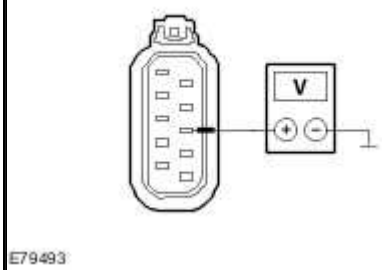
DOOR MODULE AND THE RIGHT REAR DOOR LOCK

	1 Ignition switch in position 0.
	2 Measure the resistance between the right rear door module connector C8PL01 pin 9, circuit CPL12A (BK), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured? **Yes** GO to J4. **No** LOCATE and REPAIR the short to ground in circuit CPL12A (BK) between the right rear door module and the right rear door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

J4: CHECK THE VOLTAGE AT THE RIGHT REAR DOOR LOCK (DURING LOCKING/UNLOCKING)

	1 Connect right rear door module C8PL01.
	2 Measure the voltage between the right rear door lock connector C8PL72 pin 6, circuit CPL12A (BK), wiring harness side and ground.
	3 Lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking? **Yes** GO to J5. **No** CHECK and if necessary INSTALL a new right rear door module. CHECK the operation of the system.

J5: CHECK THE VOLTAGE AT THE RIGHT REAR DOOR LOCK (DURING DOUBLE LOCKING/UNLOCKING)

	1 Measure the voltage between the right rear door lock connector C8PL72 pin 6, circuit CPL12A (BK), wiring harness side and ground.
	2 Double lock and unlock the vehicle with the key in the door lock cylinder.
	Is battery voltage measured during unlocking?

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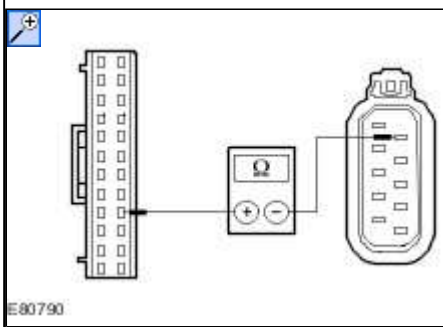
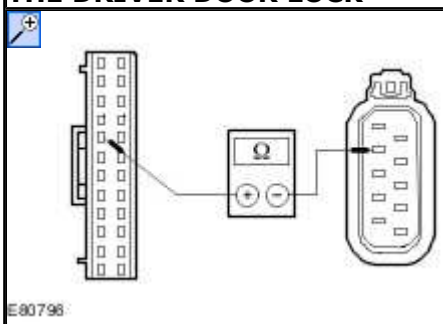
	Yes CHECK and if necessary INSTALL a new right rear door lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new right rear door lock. CHECK the operation of the system.

PINPOINT TEST K : CIRCUIT OF THE PASSENGER COMPARTMENT LOCKING SWITCH FAULTY.	
WARNING: The window anti-trap function will not operate during the window motor initialization procedure.	
NOTE: If the power to a window regulator motor has been disconnected, it is necessary to initialize that window regulator motor.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Ignition switch in position 0.
	2 Disconnect driver door module C5PL01-B.
	3 Disconnect driver door lock C5PL63.
	4 Measure the resistance between the driver door module connector C5PL01-B pin 21, circuit CPL42A (BK), wiring harness side and the driver door lock connector C5PL63 pin 2, circuit CPL42A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to K2. **No** LOCATE and REPAIR the break in circuit CPL42A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
K2: CHECK FOR A BREAK IN THE CIRCUIT BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
	1 Measure the resistance between the driver door module connector C5PL01-B pin 5, circuit CPL43A (BK), wiring harness side and the driver door lock connector C5PL63 pin 3, circuit CPL43A (BK), wiring harness side.
	Is a resistance of less than 2 Ohm measured? **Yes** GO to K3. **No** LOCATE and REPAIR the break in circuit CPL43A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.

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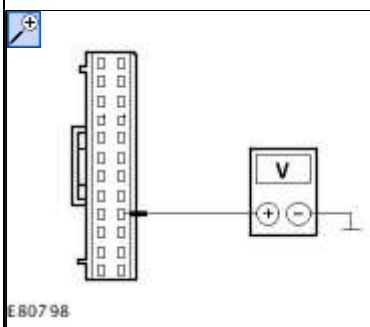
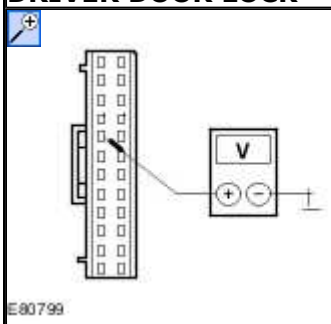
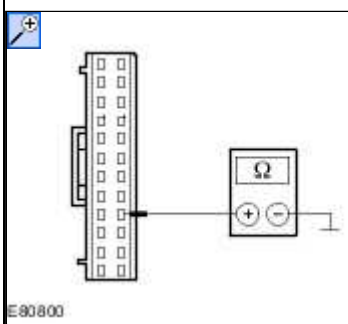
K3: CHECK FOR SHORT TO VOLTAGE BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK

	1 Ignition switch in position II.
 E80798	2 Measure the voltage between the driver door module connector C5PL01-B pin 21, circuit CPL42A (BK), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in circuit CPL42A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to K4.

K4: CHECK FOR SHORT TO VOLTAGE BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK

 E80799	1 Measure the voltage between the driver door module connector C5PL01-B pin 5, circuit CPL43A (BK), wiring harness side and ground.
	Is a voltage measured? **Yes** LOCATE and REPAIR the short to voltage in circuit CPL43A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system. **No** GO to K5.

K5: CHECK FOR SHORT TO GROUND BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK

	1 Ignition switch in position 0.
 E80800	2 Measure the resistance between the driver door module connector C5PL01-B pin 21, circuit CPL42A (BK), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured? **Yes** GO to K6. **No** LOCATE and REPAIR the short to ground in circuit

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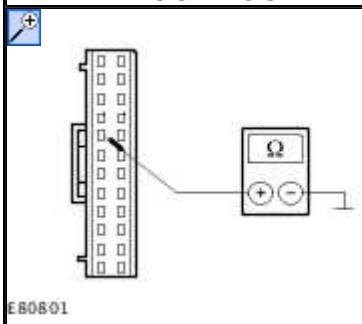
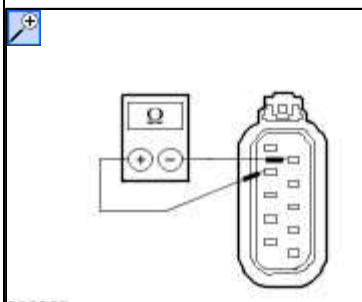
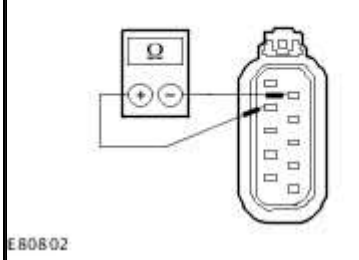
	CPL42A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
K6: CHECK FOR SHORT TO GROUND BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER DOOR LOCK	
 E80801	1 Measure the resistance between the driver door module connector C5PL01-B pin 5, circuit CPL43A (BK), wiring harness side and ground.
	Is a resistance of more than 10,000 ohms measured? **Yes** GO to K7. **No** LOCATE and REPAIR the short to ground in circuit CPL43A (BK) between the driver door module and the driver door lock with the aid of the Wiring Diagrams. CHECK the operation of the system.
K7: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING LOCKING)	
	1 Connect driver door module C5PL01-B.
 E80802	2 Measure the voltage between the driver door lock connector C5PL63 pin 3, circuit CPL43A (BK), wiring harness side and the driver door lock connector C5PL63 pin 2, circuit CPL42A (BK), wiring harness side.
	3 Lock the vehicle using the passenger compartment locking switch.
	Is a voltage of more than 3.5 V measured? **Yes** GO to K8. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.
K8: CHECK THE VOLTAGE AT THE DRIVER DOOR LOCK (DURING UNLOCKING)	
 E80802	1 Measure the voltage between the driver door lock connector C5PL63 pin 3, circuit CPL43A (BK), wiring harness side and the driver door lock connector C5PL63 pin 2, circuit CPL42A (BK), wiring harness side.
	2 Unlock the vehicle using the passenger compartment locking switch.
	Is a voltage of less than 1.5 V measured? **Yes** CHECK and if necessary INSTALL a new driver door

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	lock. CHECK the operation of the system. **No** CHECK and if necessary INSTALL a new driver door module. CHECK the operation of the system.

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Diagnosis and Testing

REFER to: Modul - Fahrertür (DDM) (419-10, Diagnosis and Testing).

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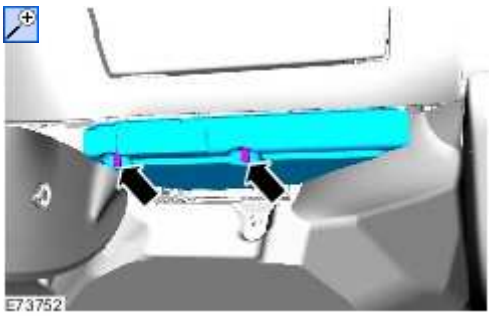
Removal and Installation

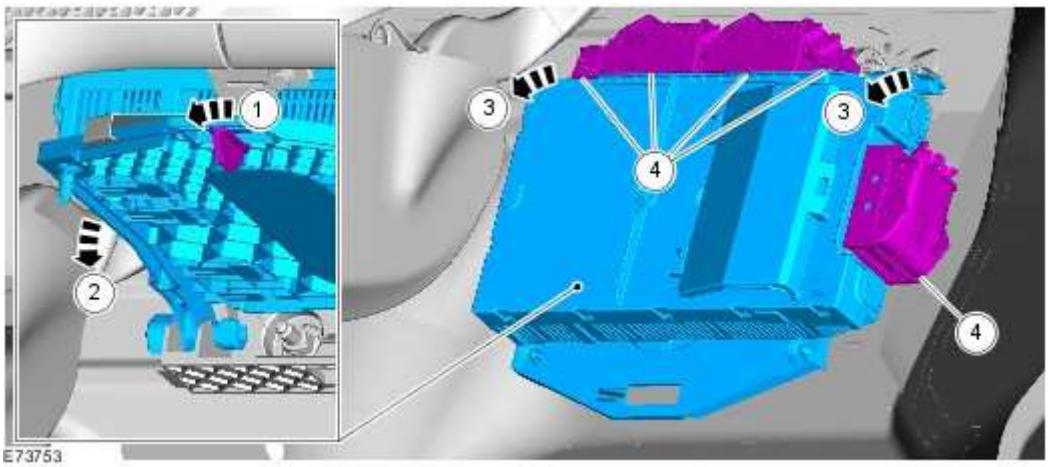
Removal

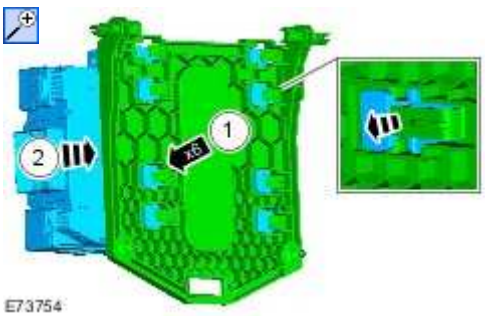
CAUTIONS:

Modules must not be swapped between vehicles.

If a new electric box is installed, make sure that the assignments are the same as on the removed electric box.

1. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. 

3. 

4. 

Installation

1. To install, reverse the removal procedure.
2. Programme the GEM.

   Refer to: Programmable Module Installation (418-01 Module Configuration, General

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Procedures).

3. Configure the GEM.

   Refer to: Module Configuration (418-01 Module Configuration, General Procedures).

4. Programme the key of the passive anti-theft system (PATS).

   Refer to: Key and Remote Transmitter Programming Using Diagnostic Equipment (419-01B Anti-Theft - Passive, General Procedures).

5. Program the remote unlocking remote control.

   Refer to: Remote Keyless Entry (RKE) Transmitter Programming (501-14 Handles, Locks, Latches and Entry Systems, General Procedures).

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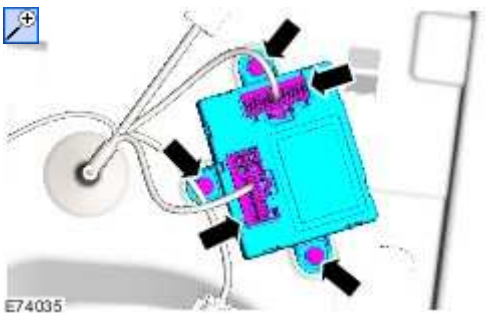
Removal and Installation

Removal

1. Remove the front door trim.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.
2. Configure the FDM.

   Refer to: Module Configuration (418-01 Module Configuration, General Procedures).
3. Initialize the window winder motor.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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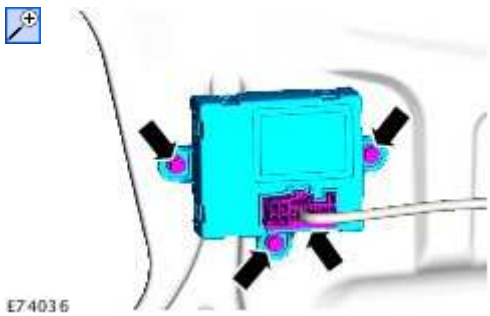
Removal and Installation

Removal

1. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.
2. Configure the RDM.

   Refer to: Module Configuration (418-01 Module Configuration, General Procedures).

3. Initialize the window winder motor.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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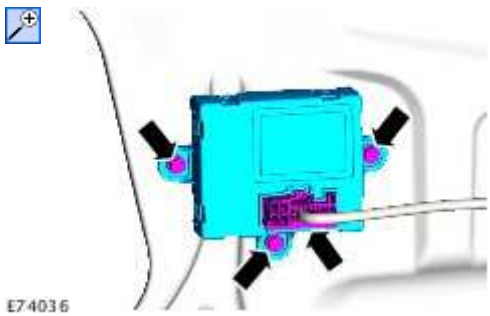
Removal and Installation

Removal

1. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

2.



Installation

1. To install, reverse the removal procedure.
2. Configure the RDM.

   Refer to: Module Configuration (418-01 Module Configuration, General Procedures).

3. Initialize the window winder motor.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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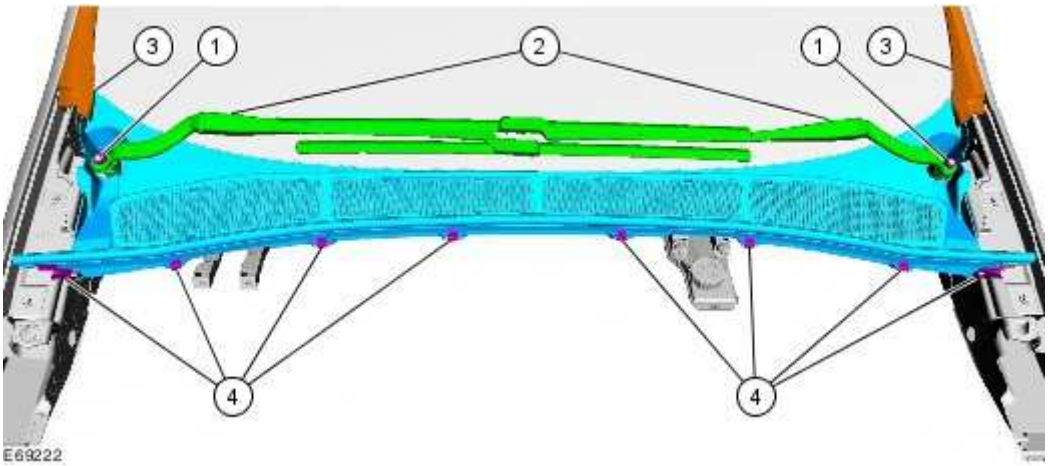
Removal and Installation

General Equipment

Two leg puller

Removal

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



1. *General Equipment* Two leg puller *Torque:* 22 Nm

Installation

1. CAUTIONS:

   The engine must be in the park position.

   The component must be aligned with the installation markings.

   To install, reverse the removal procedure.
2. Check the angle of the wiper arms to the windscreen.

   Refer to: Wiper Blade Angle Adjustment (501-16 Wipers and Washers, General Procedures).

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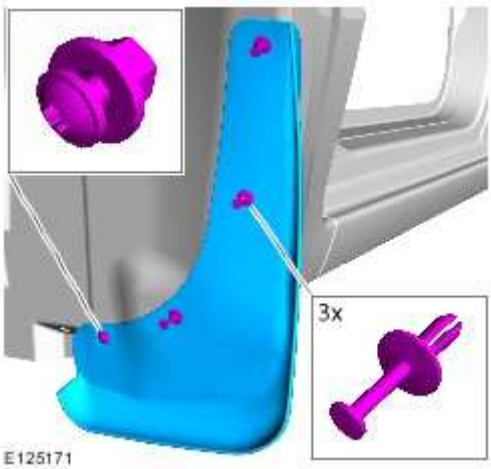
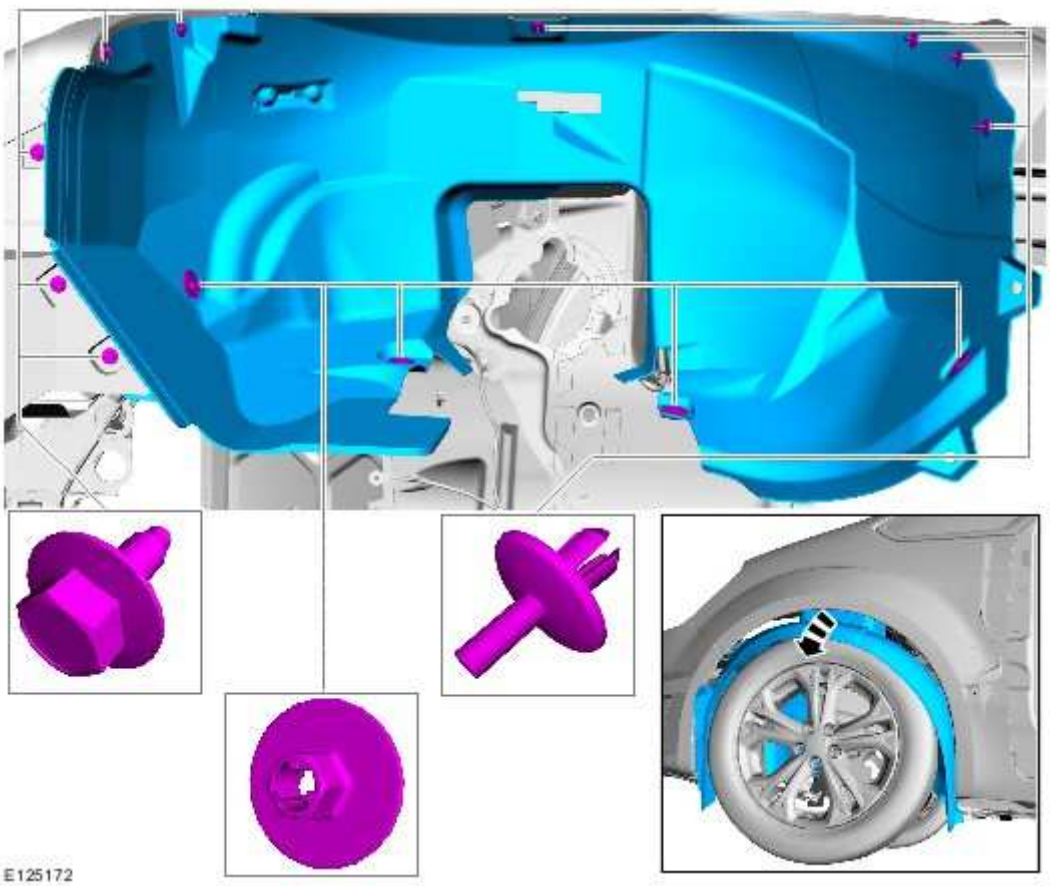
Removal and Installation

Removal

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
2. If equipped.



3.



Installation

1. To install, reverse the removal procedure.

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Torque Specifications

Item	Nm	lb-ft	lb-in
Hood hinge to body nuts	22	16	-
Hood hinge to hood nuts	10	7	-

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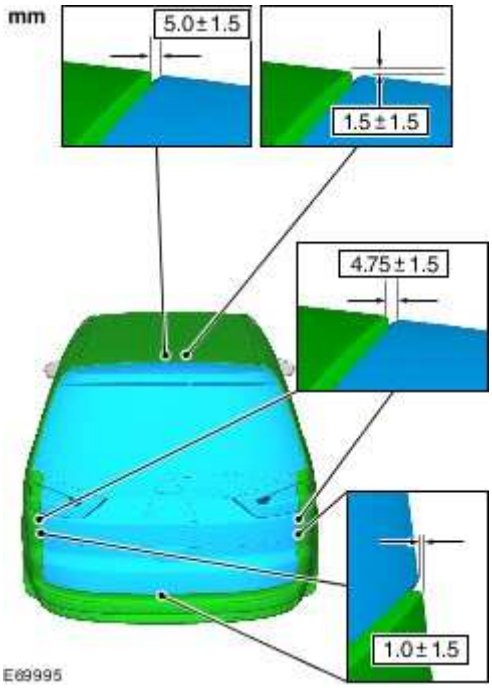
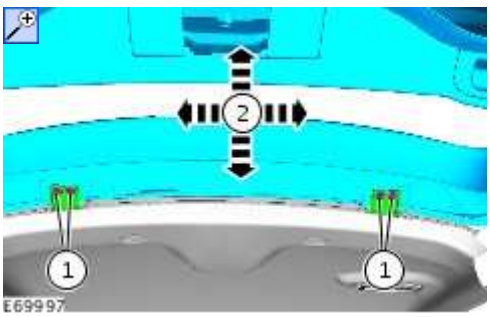
General Procedures

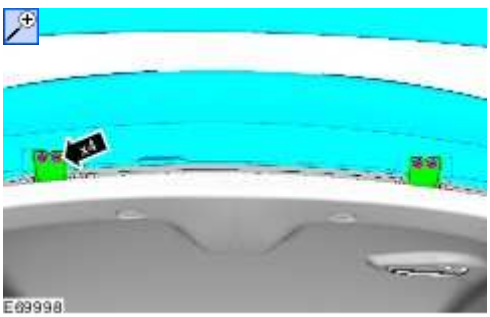


1.



2.

1. Loosen one complete turn.



3. *Torque:* 22 Nm

4.

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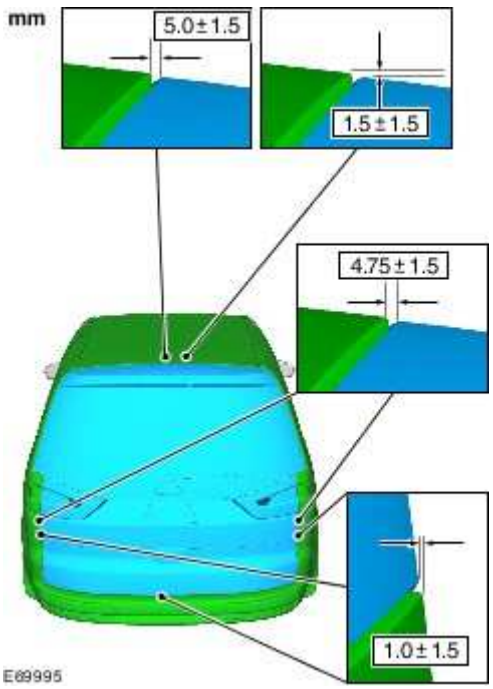
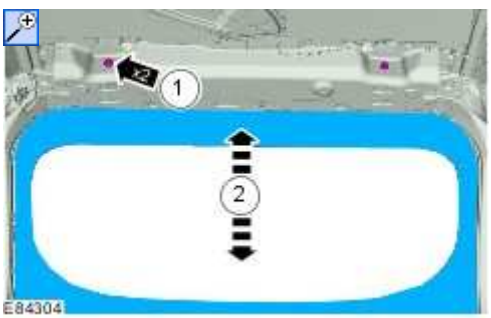


5.

- If the liftgate alignment cannot be achieved at the liftgate hinges to liftgate, adjustment must be carried out at the liftgate hinges to body.
- If adjustment of the liftgate hinges to body is required the headliner must be removed.
- Remove the headliner.

  Refer to: Headliner - Vehicles With: Metal Roof Panel, VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).
  Refer to: Headliner - VIN Plate Body Style Code: M, Vehicles With: Glass Roof Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



6.

1. Loosen one complete turn.

7. *Torque:* 22 Nm

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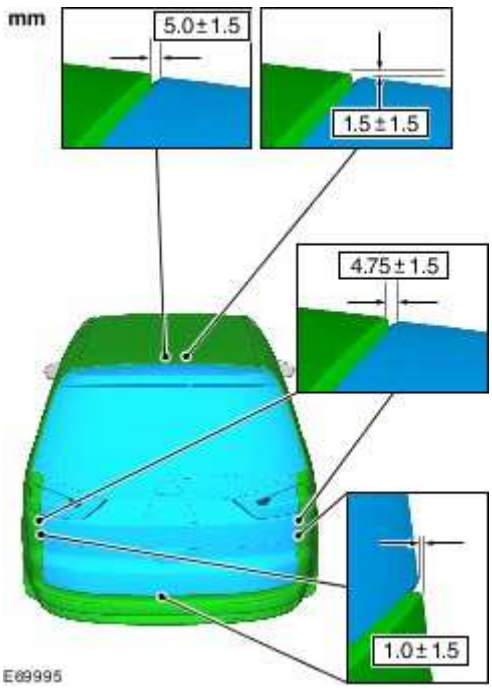
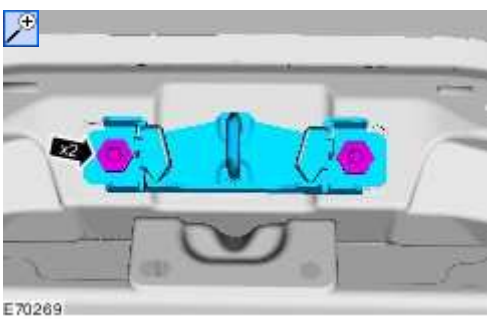
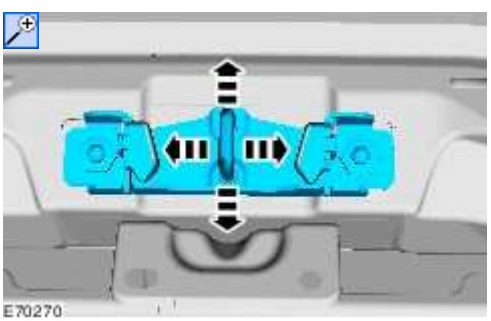


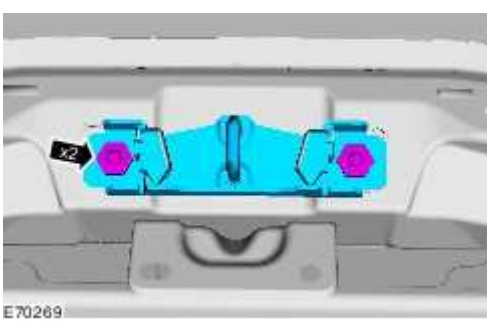
8.



9. Loosen one complete turn.



10.



11. *Torque:* 22 Nm

12.

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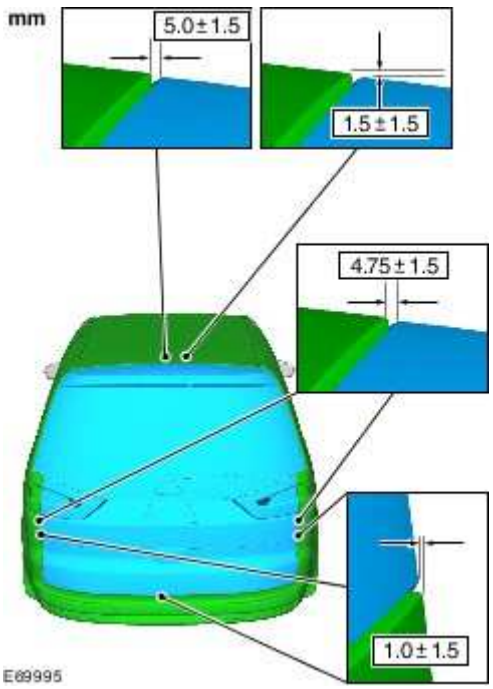

13. Install the headliner.

    Refer to: Headliner - Vehicles With: Metal Roof Panel, VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).
    Refer to: Headliner - VIN Plate Body Style Code: M, Vehicles With: Glass Roof Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

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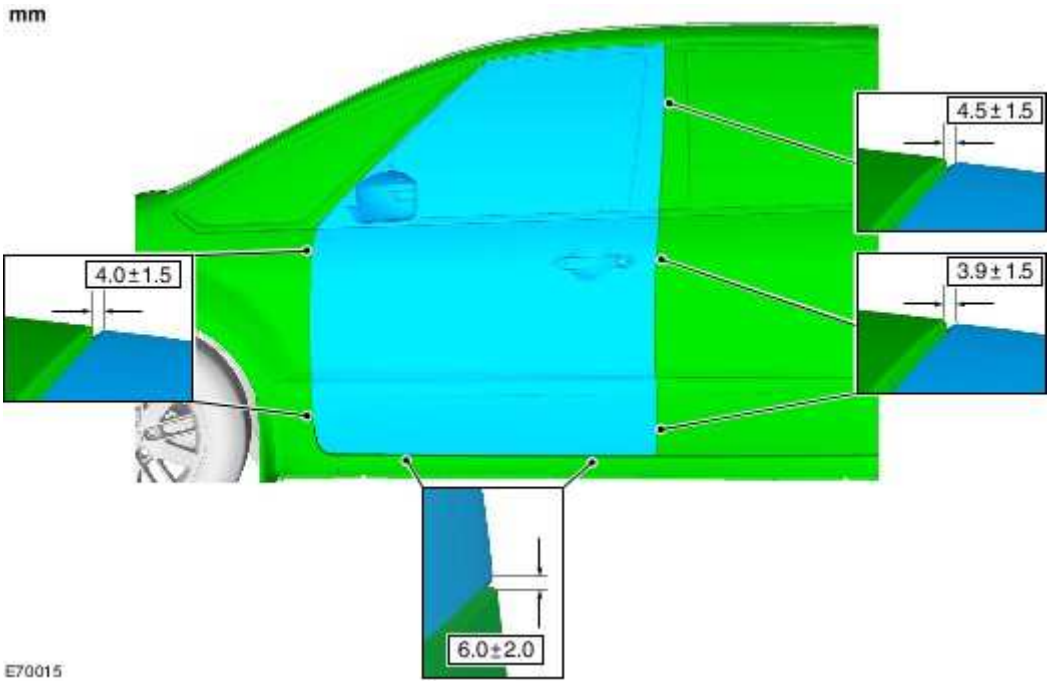
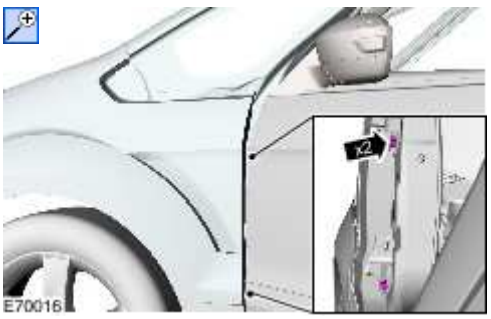
General Procedures

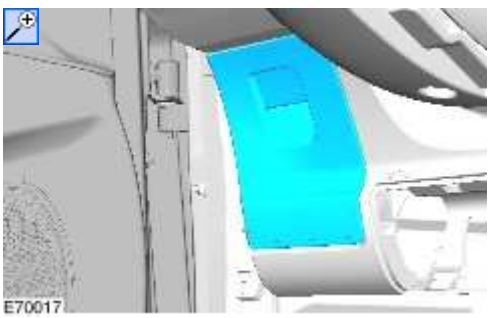
1. Refer to: Instrument Panel - Vehicles Built Up To: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).

2.





3. Loosen one complete turn.



4.

5.
   1. Loosen one complete turn.

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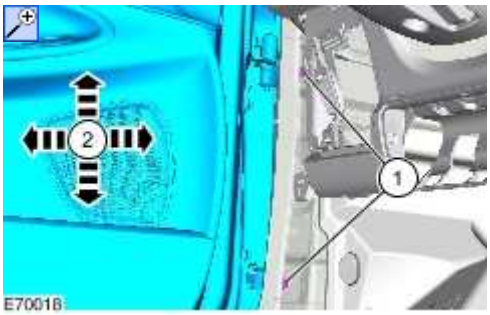
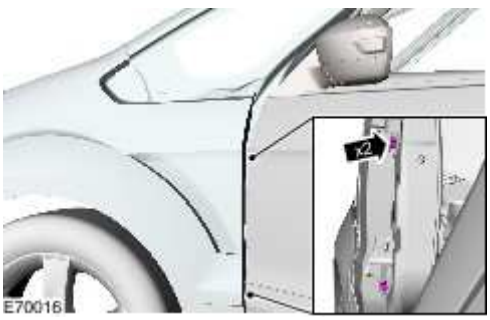
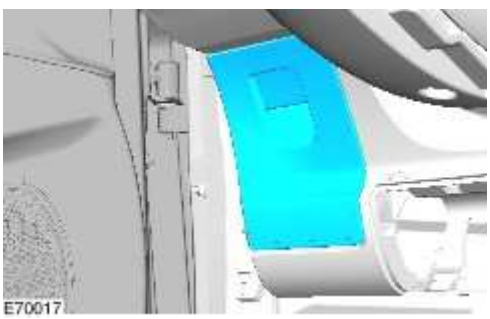


6. *Torque:* 35 Nm



7. *Torque:* 35 Nm



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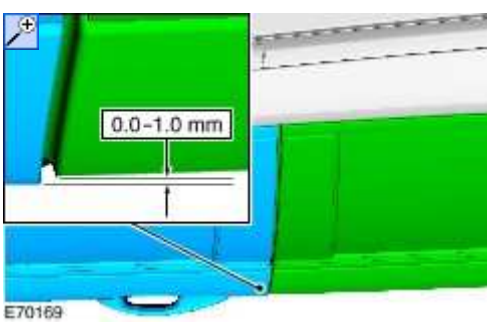

9.

10. Loosen one complete turn.

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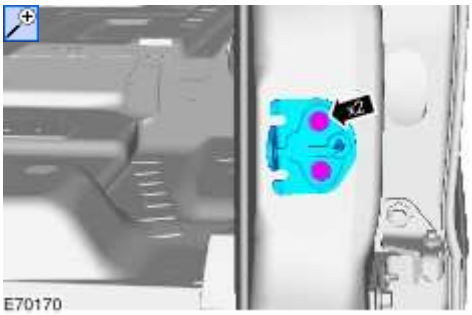

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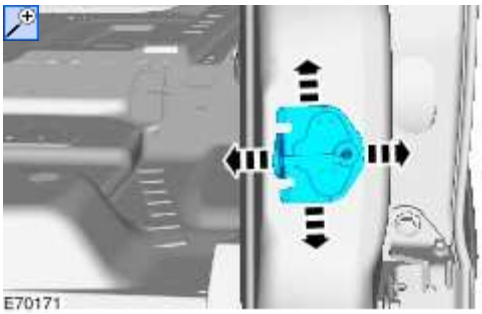
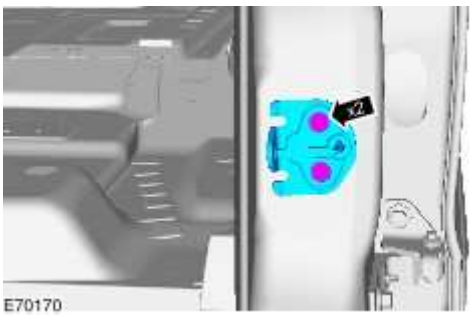


12. *Torque:* 20 Nm



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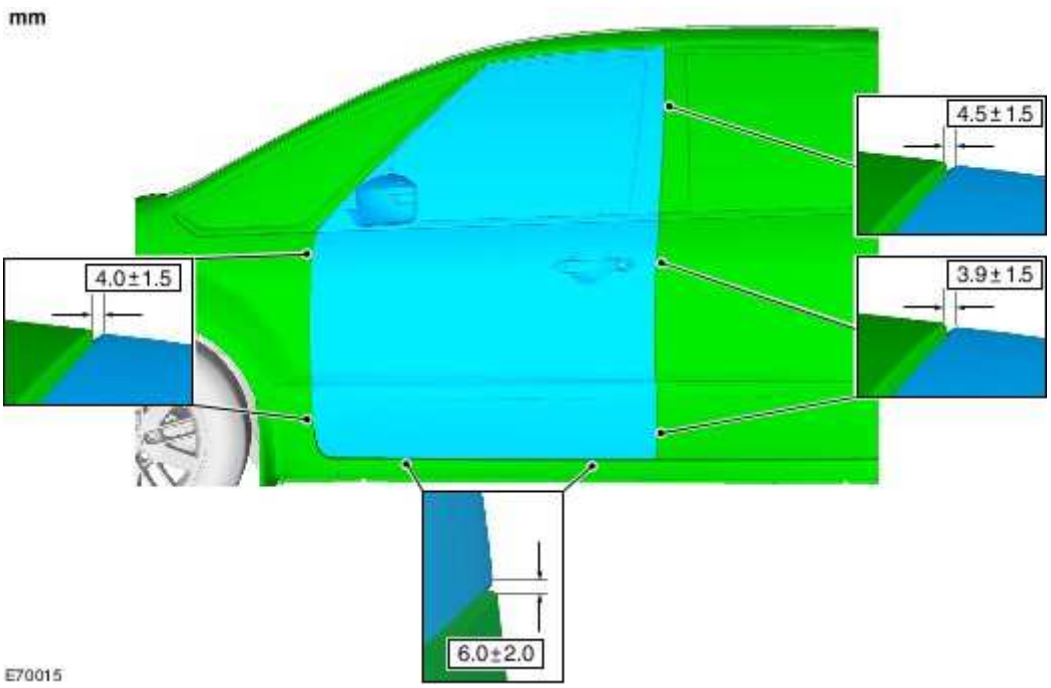

14. Refer to: Instrument Panel - Vehicles Built Up To: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).
Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).

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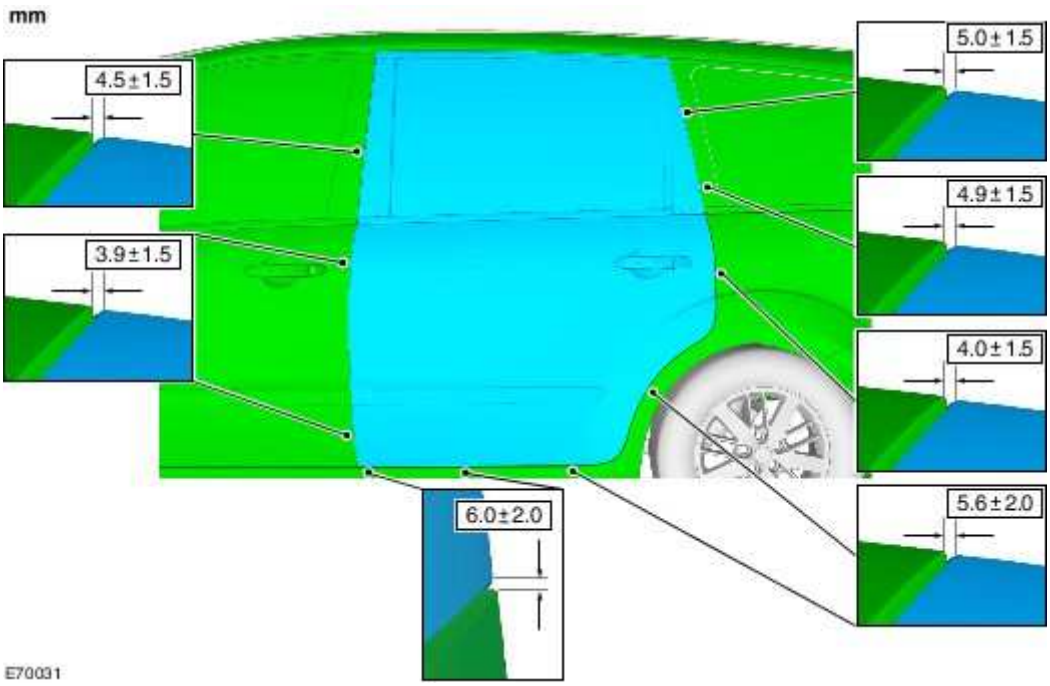
Print

General Procedures

1.



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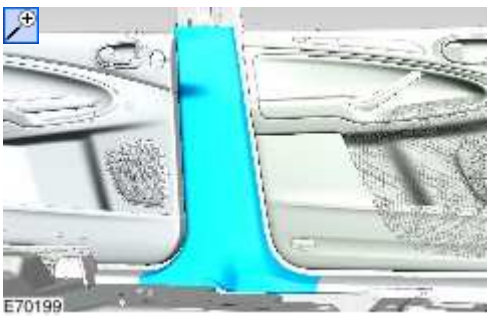
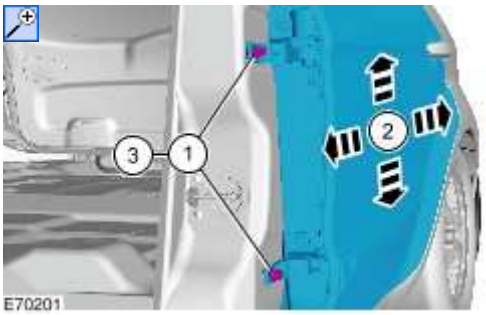


3. Loosen one complete turn.

4.



1. Loosen one complete turn.
3. *Torque:* 35 Nm

5. *Torque:* 35 Nm

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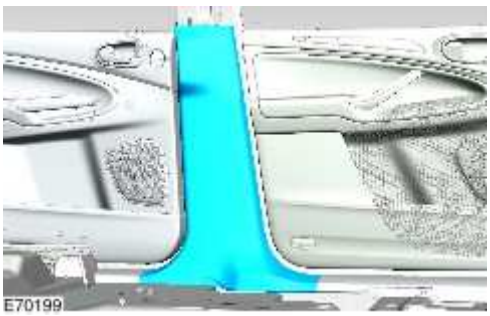
6.



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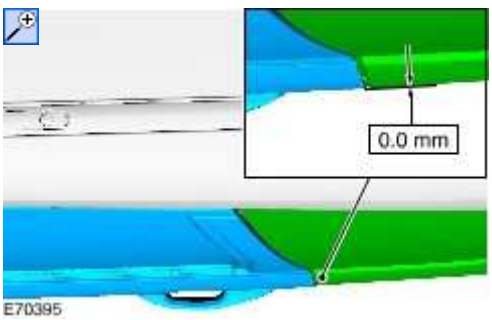
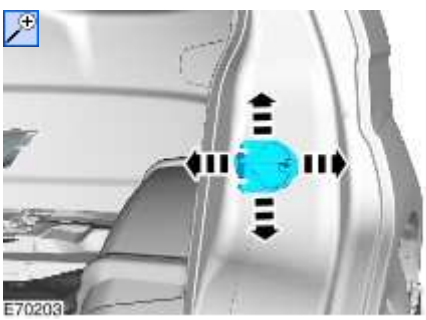


8. Loosen one complete turn.

9.



10. *Torque:* 20 Nm

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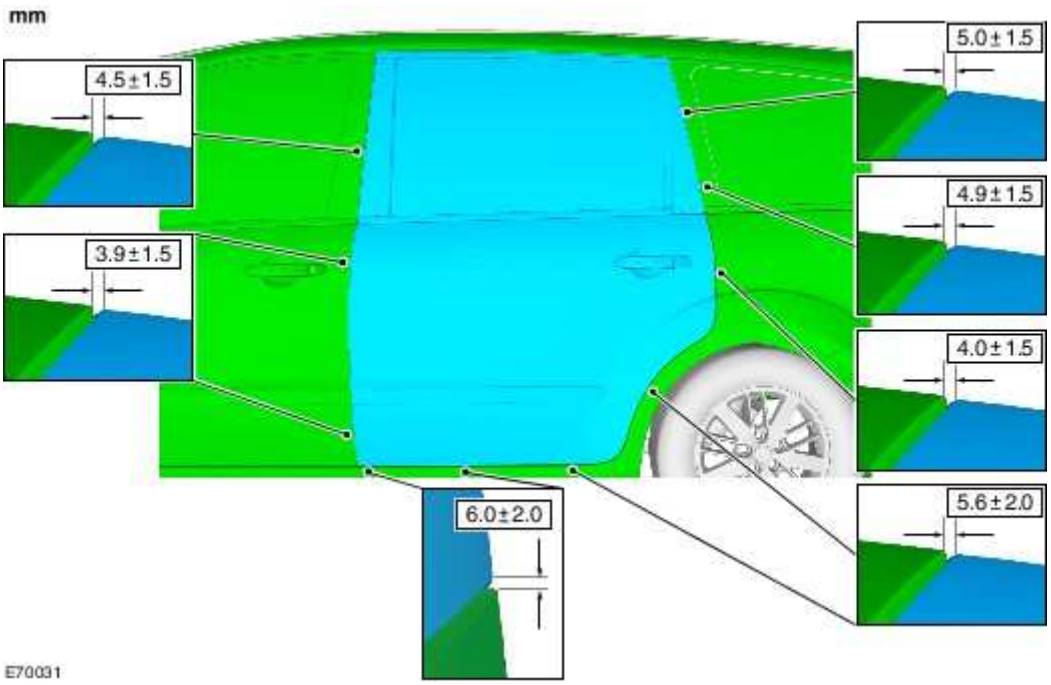
11.



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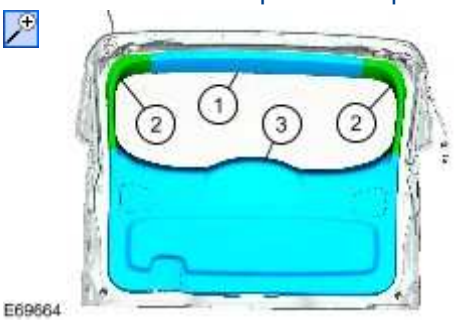
Print

Removal and Installation

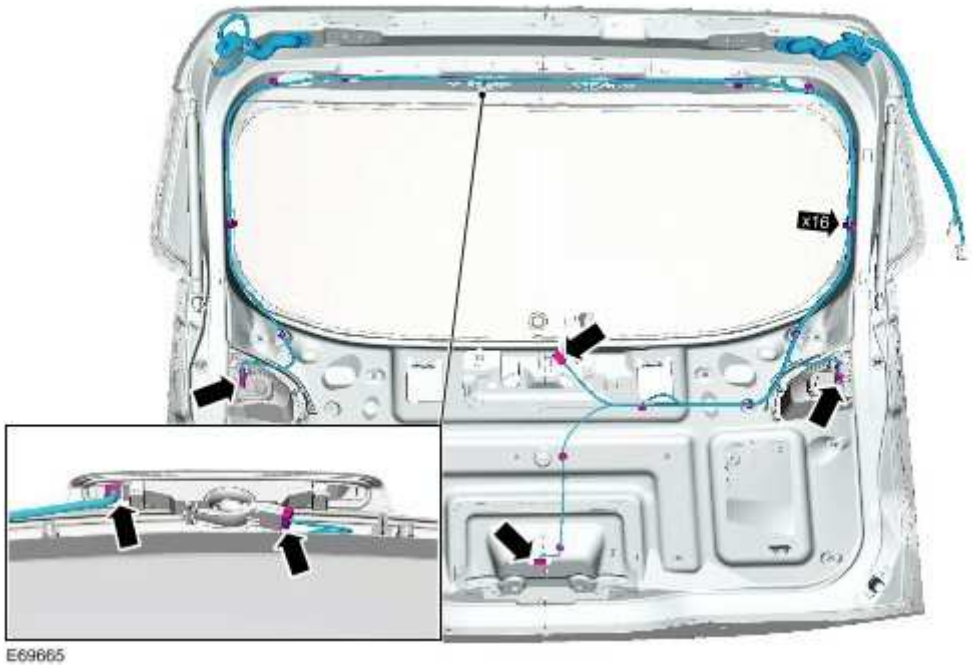
Removal

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

1.



2.



3.

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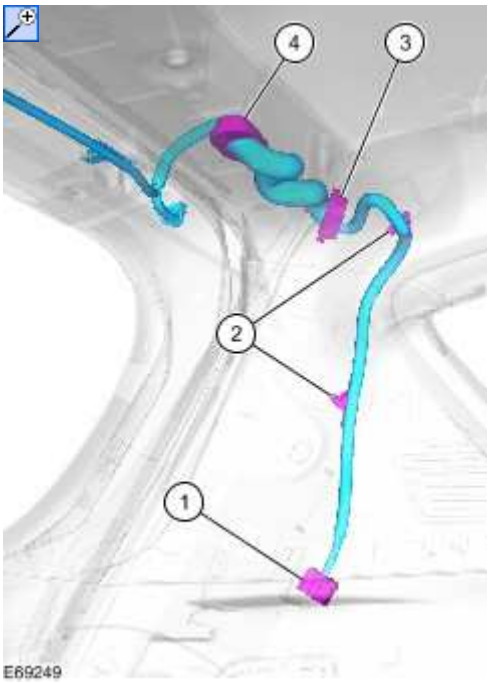

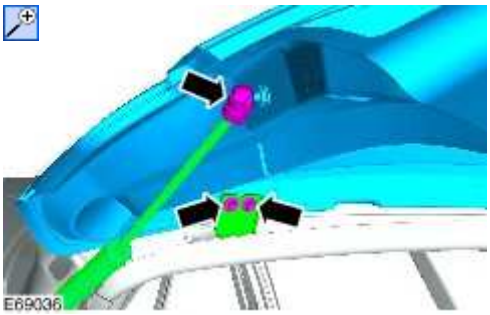

4. WARNING: This step requires the aid of another technician.
   On both sides.

   Torque: 22 Nm

Installation

1. To install, reverse the removal procedure.
2. Align the liftgate.

   Refer to: Liftgate Alignment (501-03 Body Closures, General Procedures).

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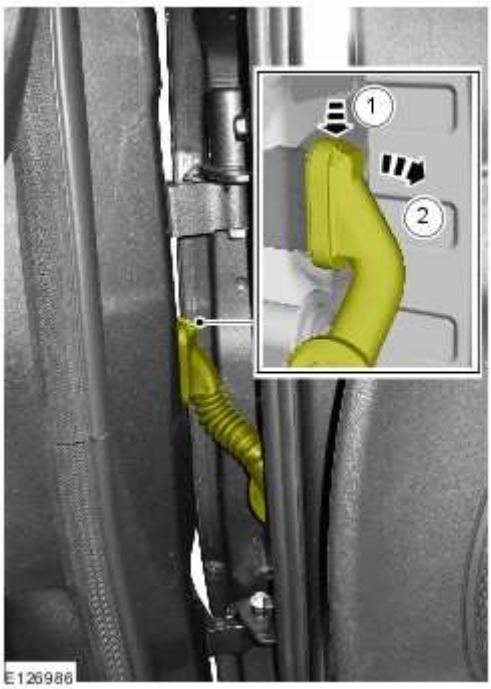
Removal and Installation

General Equipment

Trolley jack

Removal

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



1. Front Door

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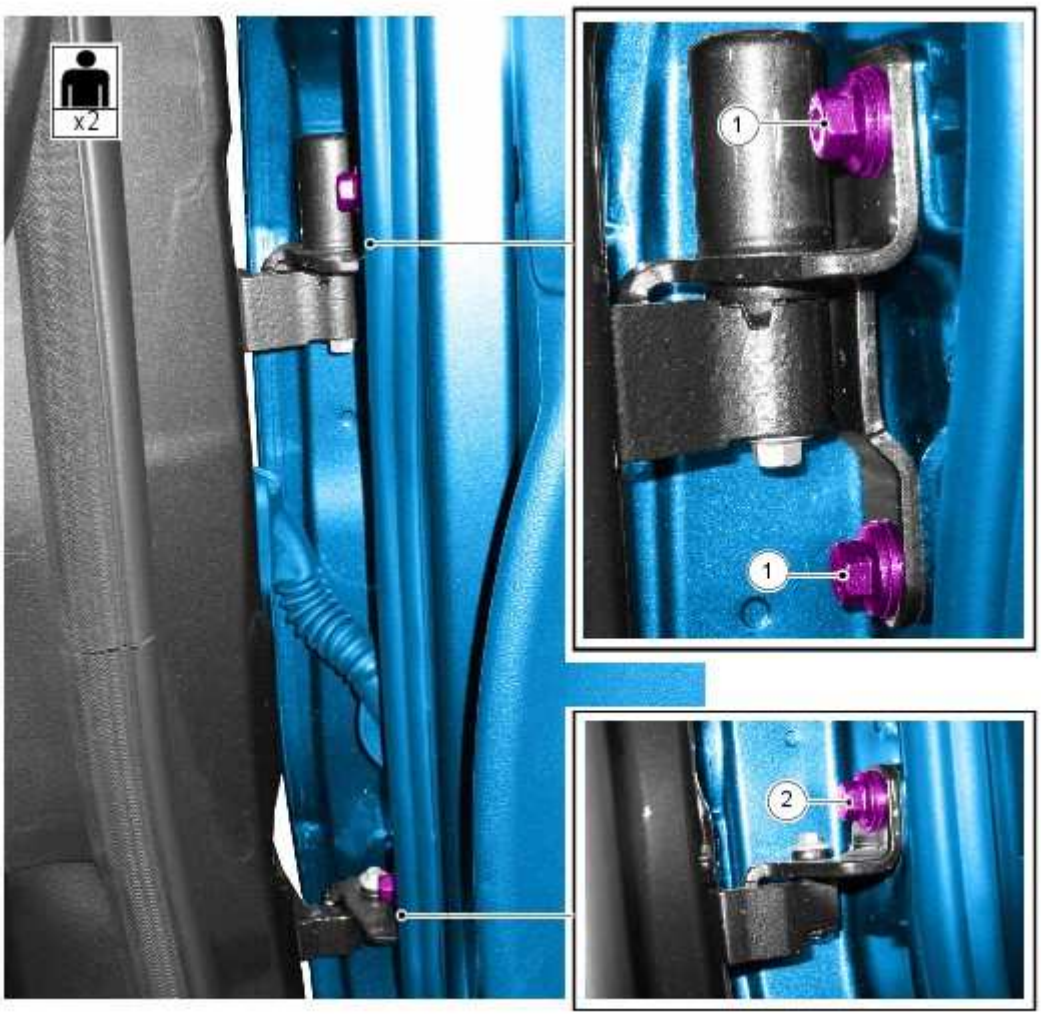

E126987

E126988

3. Rear Door

4. CAU
Use suit

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E126989

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Installation

1. To install, reverse the removal procedure.

Refer to: Front Door Alignment (501-03 Body Closur
General Procedures).
Refer to: Rear Door Alignment (501-03 Body Closure
General Procedures).

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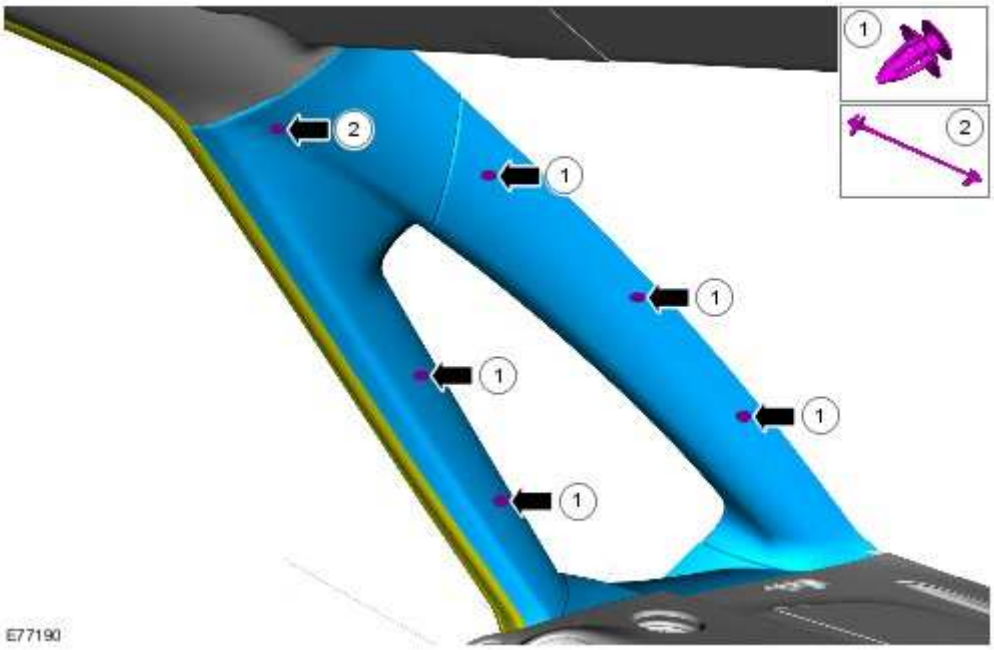
Print

Removal and Installation

Removal

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

1.



Installation

1. To install, reverse the removal procedure.

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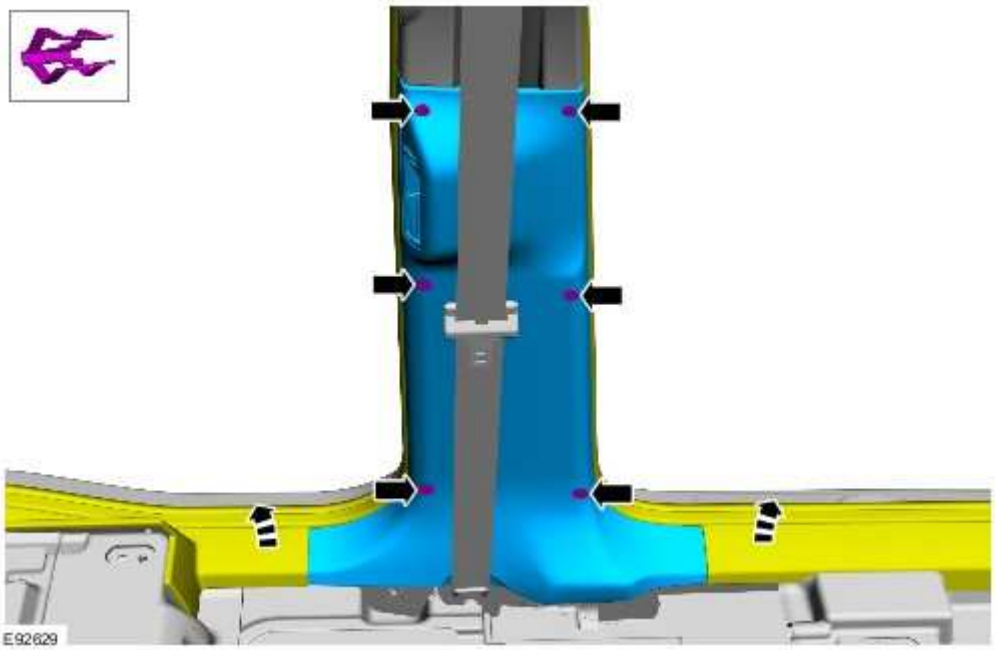
Print

Removal and Installation

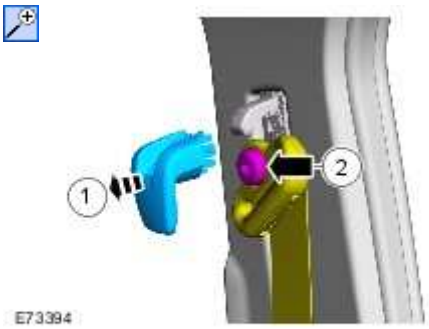
Removal

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

1.



2. *Torque:* 35 Nm



3.

http://vnx.su

Installation

1. To install, reverse the removal procedure.

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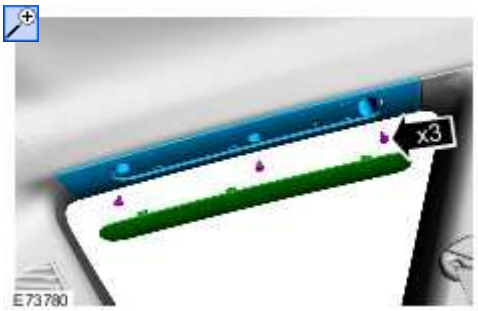
Print

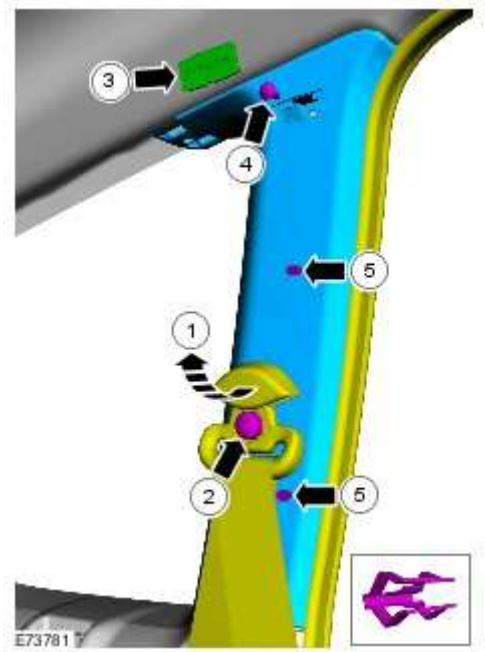
Removal and Installation

Removal

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



1.



2.

2. *Torque:* 35 Nm

Installation

1. To install, reverse the removal procedure.

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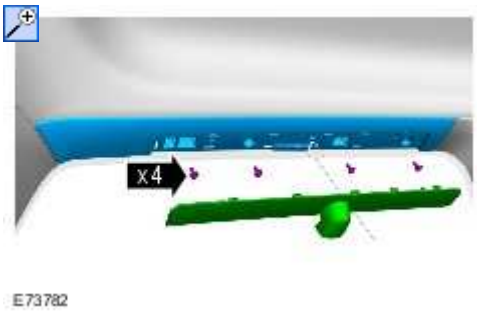
Print

Removal and Installation

Removal

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



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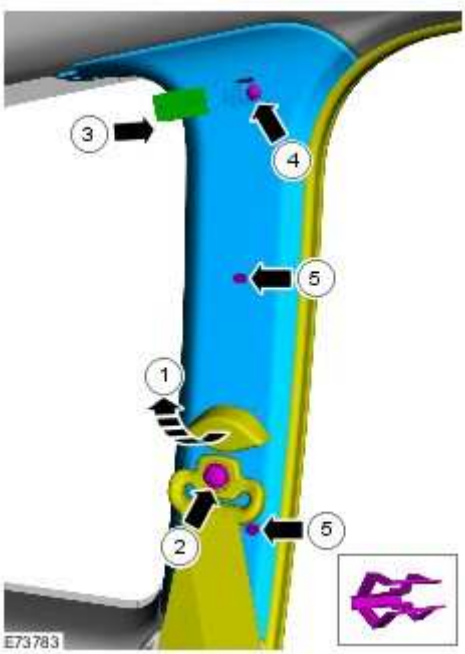


2.

2. *Torque:* 35 Nm

Installation

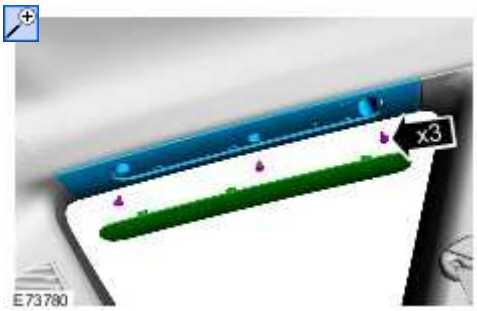
1. To install, reverse the removal procedure.

http://vnx.su

Removal and Installation

Removal

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



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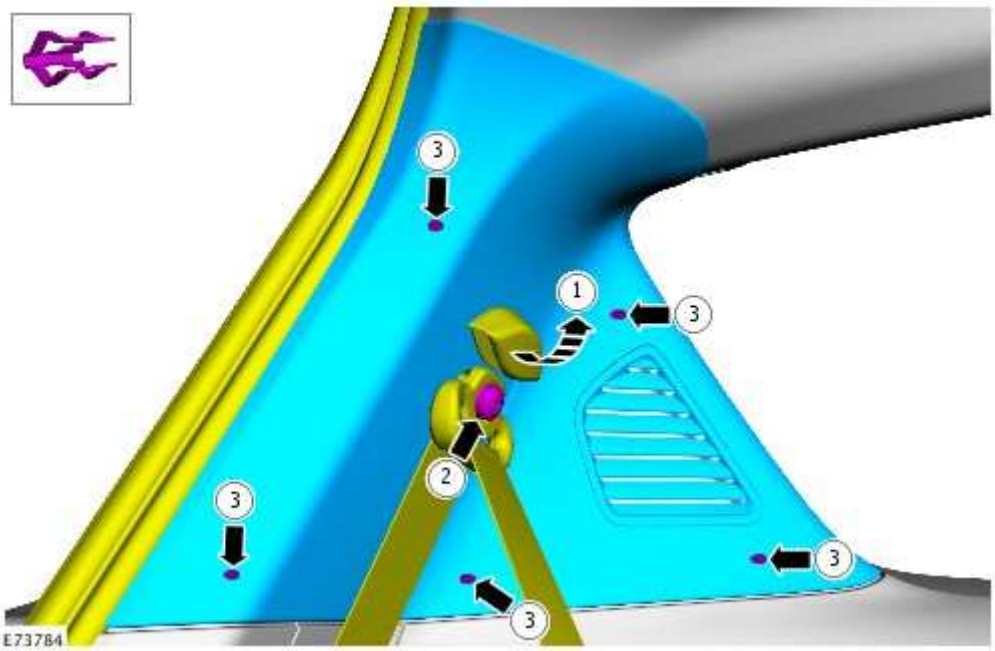

2.

1. If equipp
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Torque
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Installation

1. To install, reverse the removal procedure.

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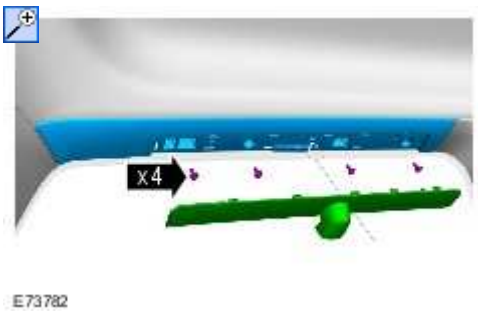
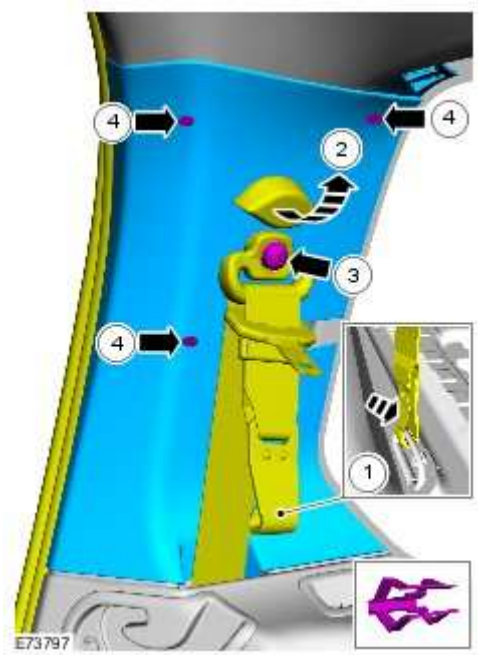
Removal and Installation

Removal

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



1.



2. *Torque:* 35 Nm

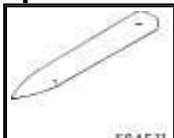
Installation

1. To install, reverse the removal procedure.

http://vnx.su

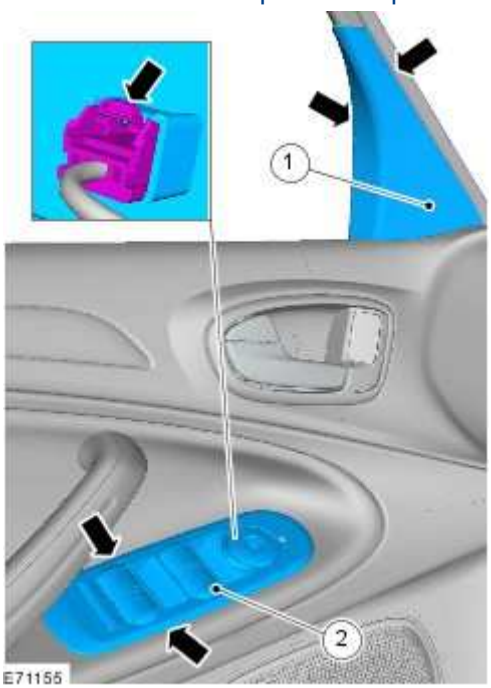
Removal and Installation

Special Tool(s)

 E84511	501-125 Remover, Grab Handle Cover

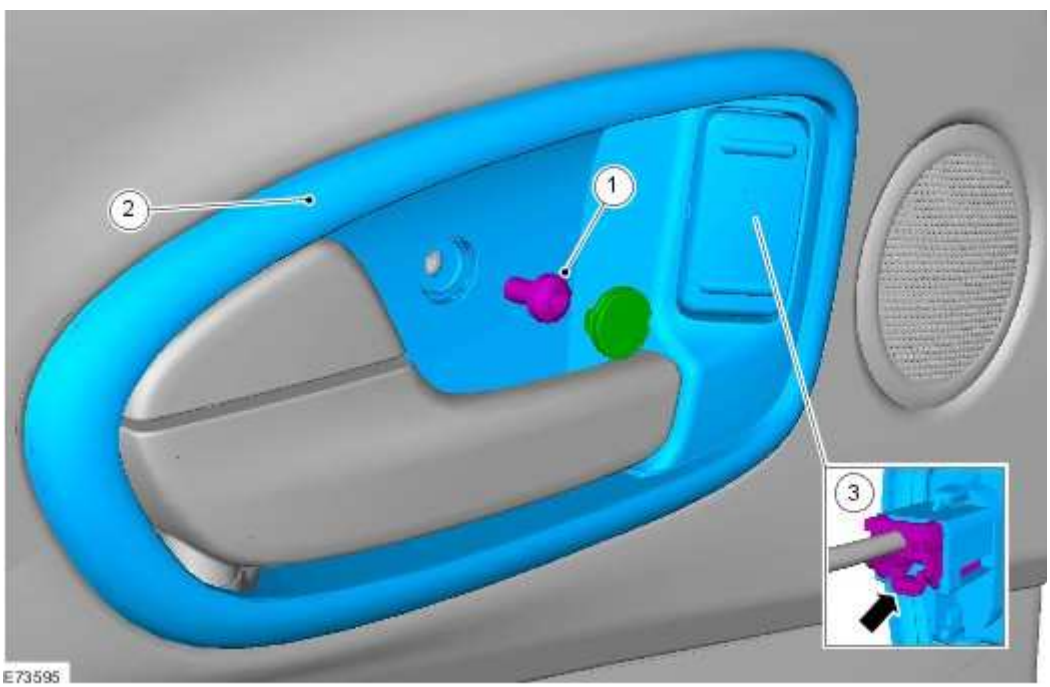
Removal

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



1.

2. If equipped.



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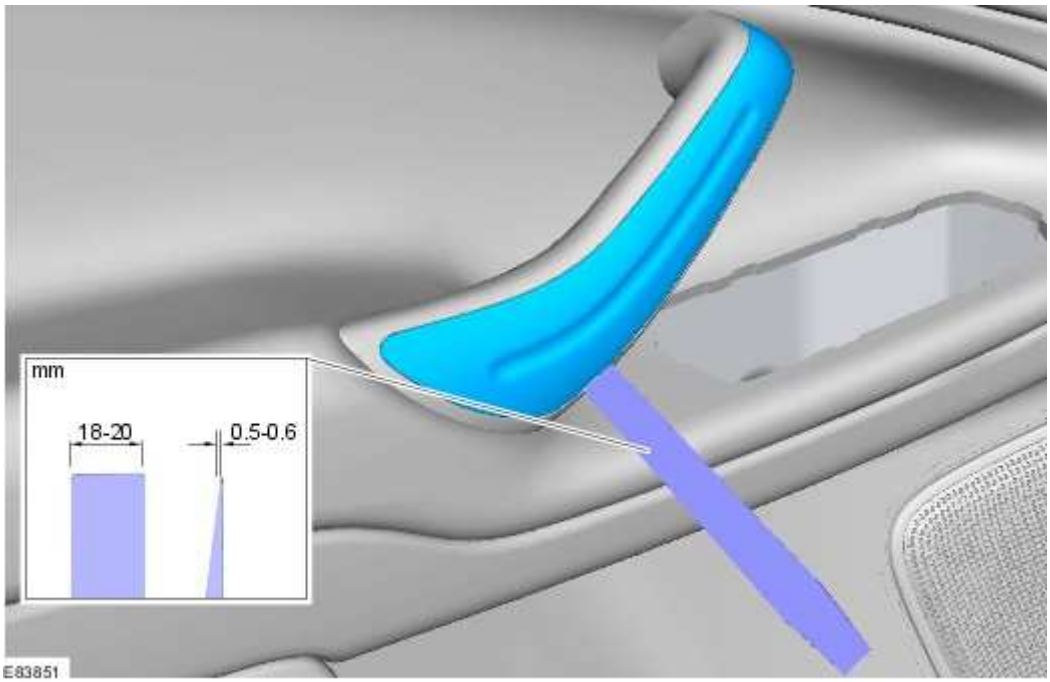

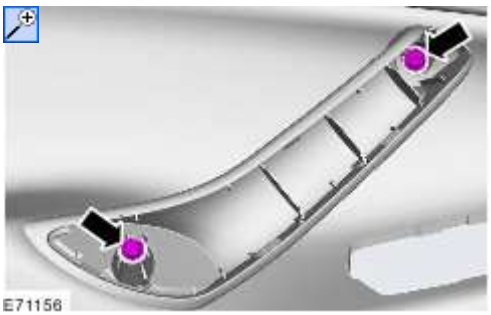

4. *Torque:* 2 Nm

5.

Installation

1. To install, reverse the removal procedure.

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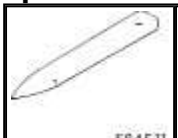
Removal and Installation

Special Tool(s)

	501-125 Remover, Grab Handle Cover

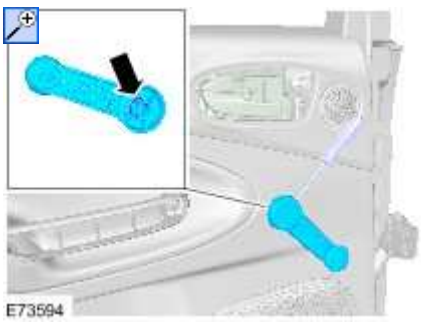
General Equipment

Flat-bladed screwdriver

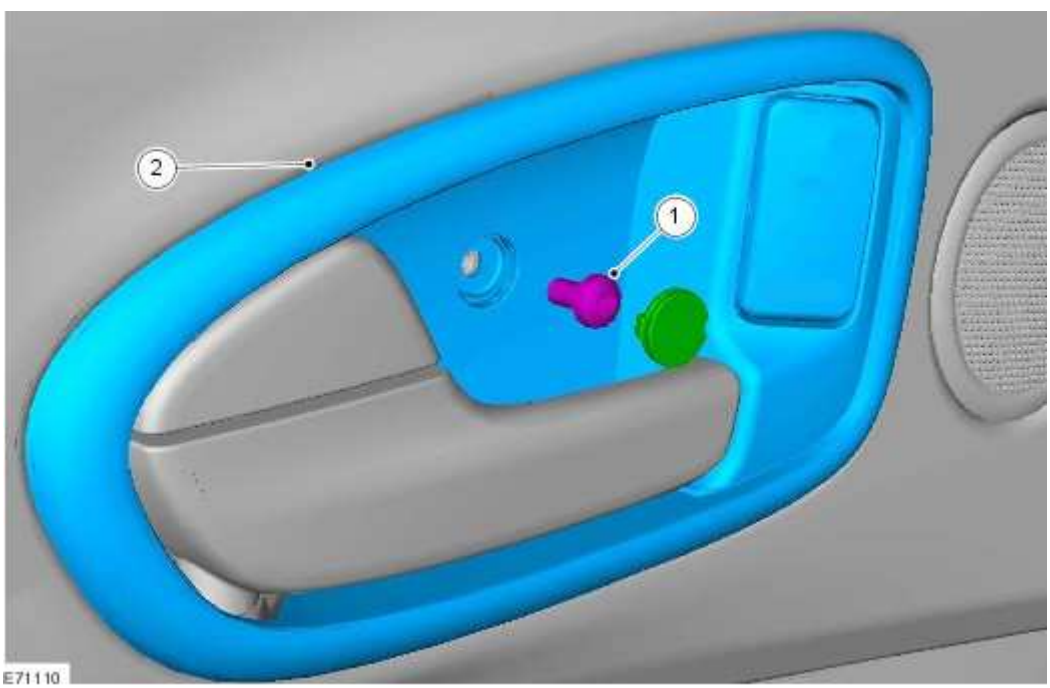
Removal

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

Vehicles with manual windows



1. *General Equipment:* Flat-bladed screwdriver



2.

Vehicles with power windows

3.

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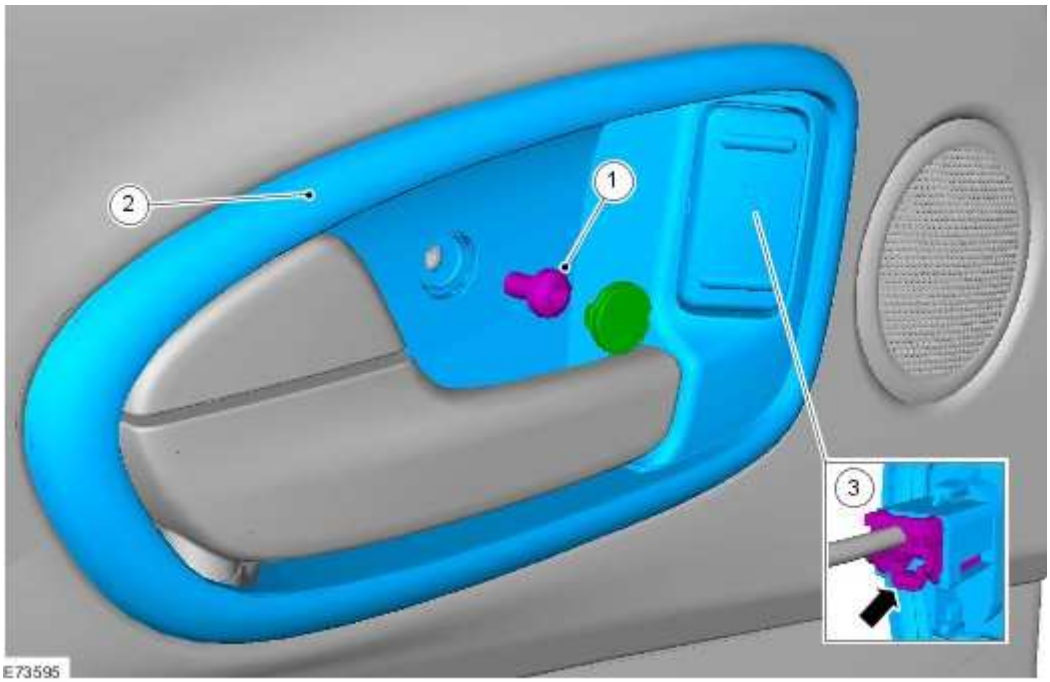
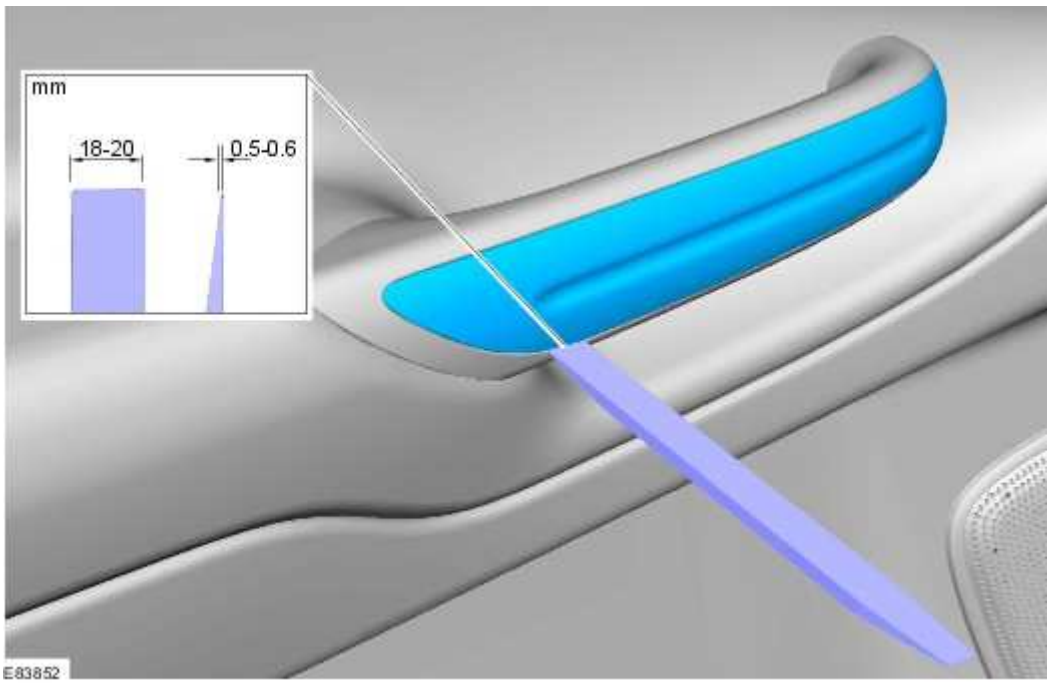


All vehicles



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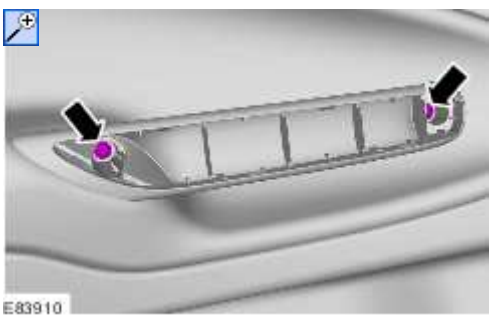
501-125



5. *Torque:* 2 Nm

6.

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Installation

1. To install, reverse the removal procedure.

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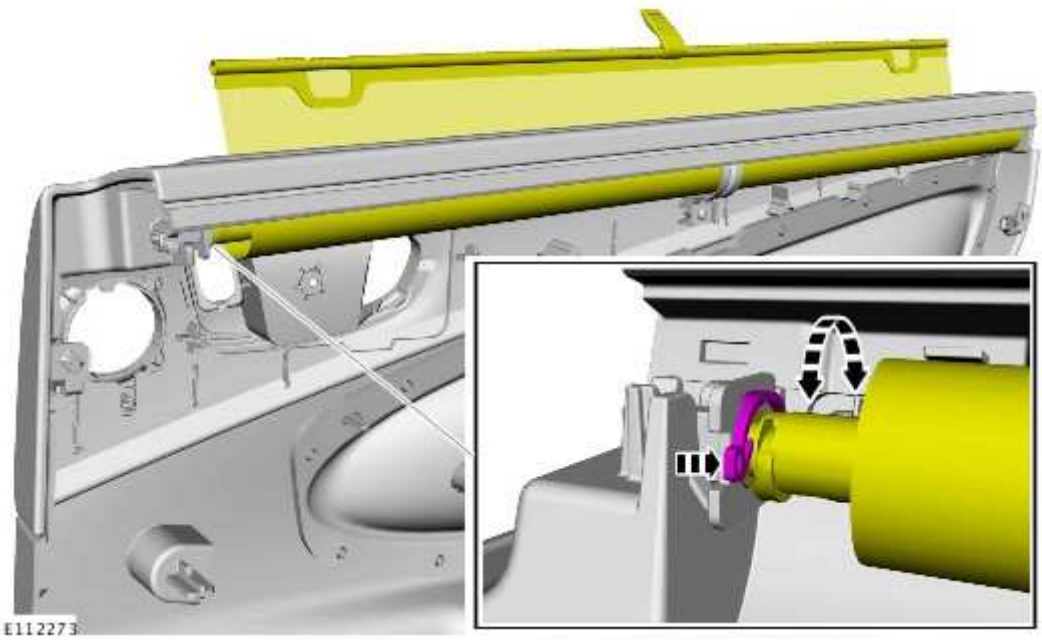
Removal and Installation

Removal

1. Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Lock sunblind rewind mechani



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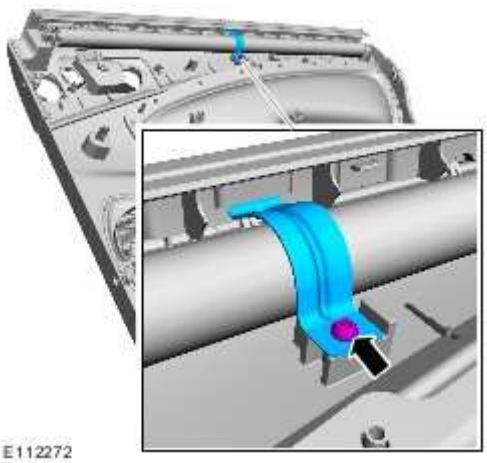

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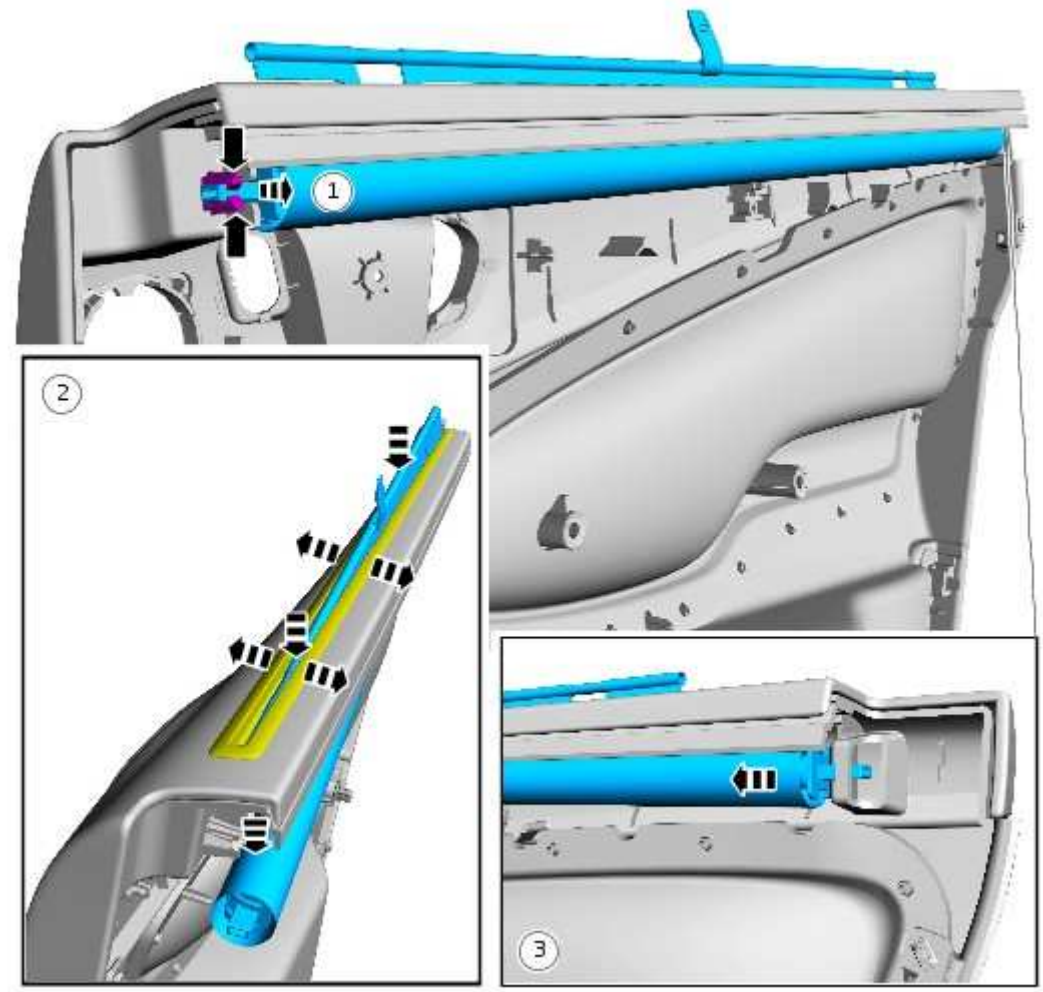
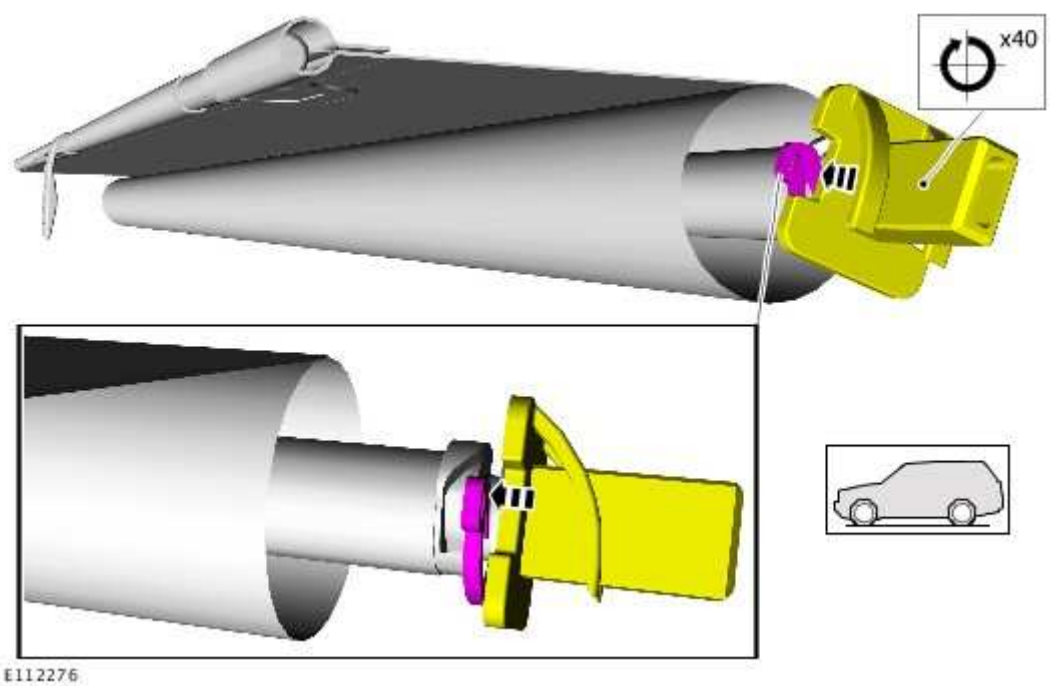


E112274

Installation



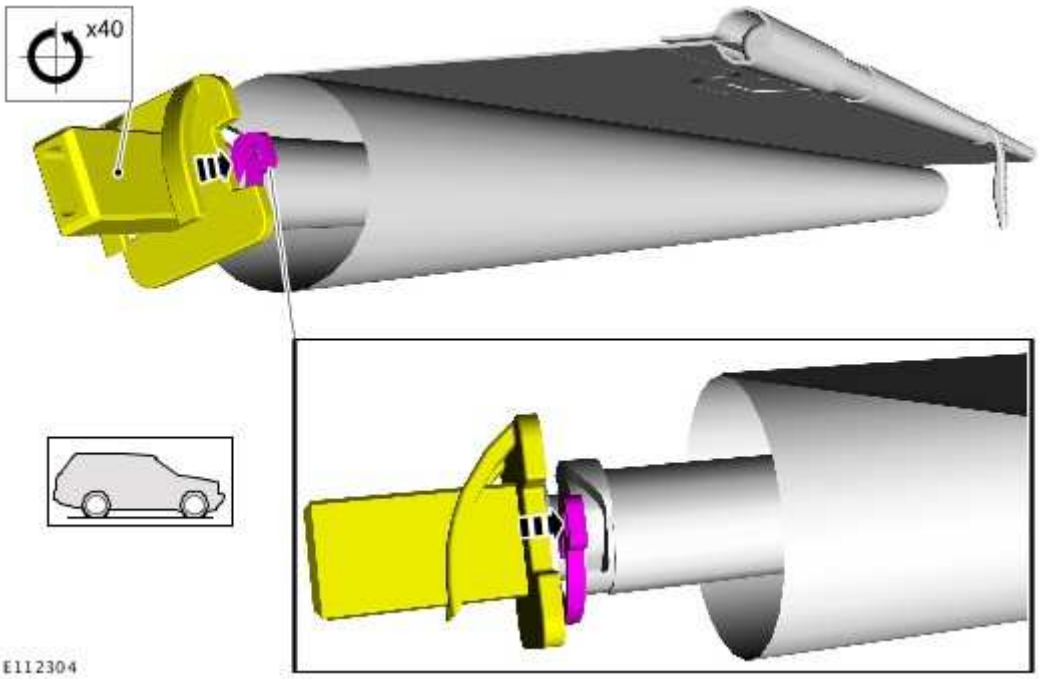
E112276

1. This step only necessary the rewinder has lost tension.

2. This step

http://vnx.su

only necessar the rewinder has lost tension.



3.

4.

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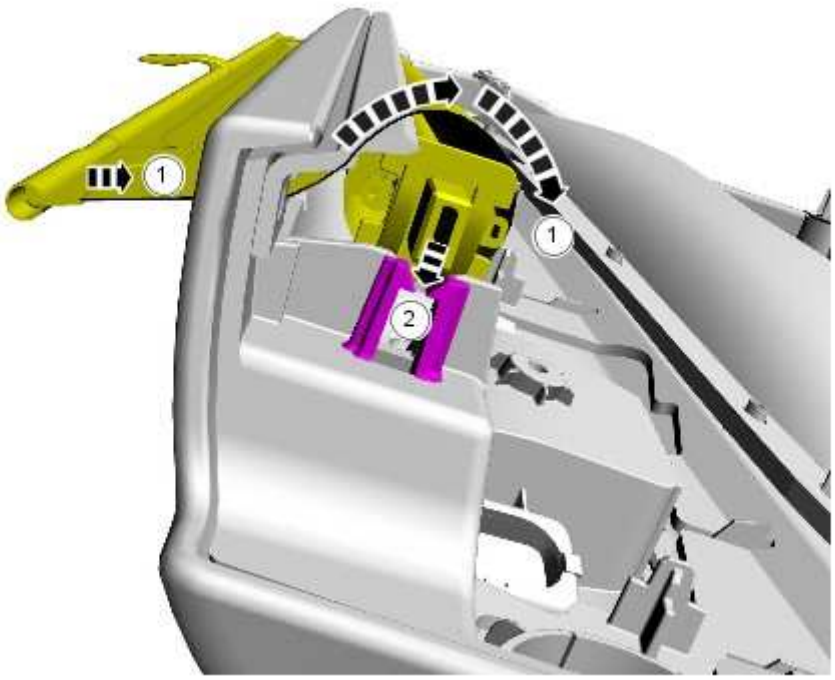
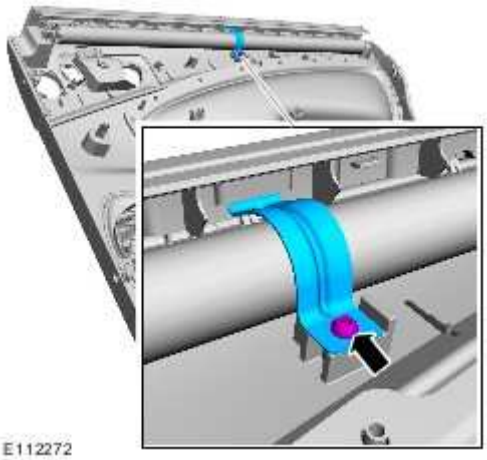


E112310

5.


E112272

6. Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

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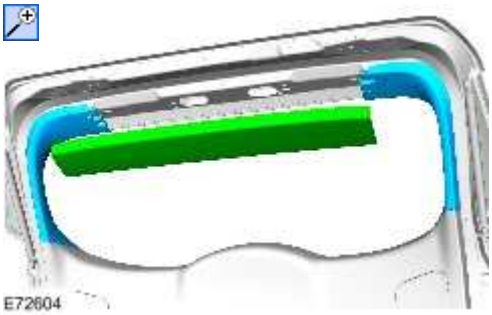
Print

Removal and Installation

Removal

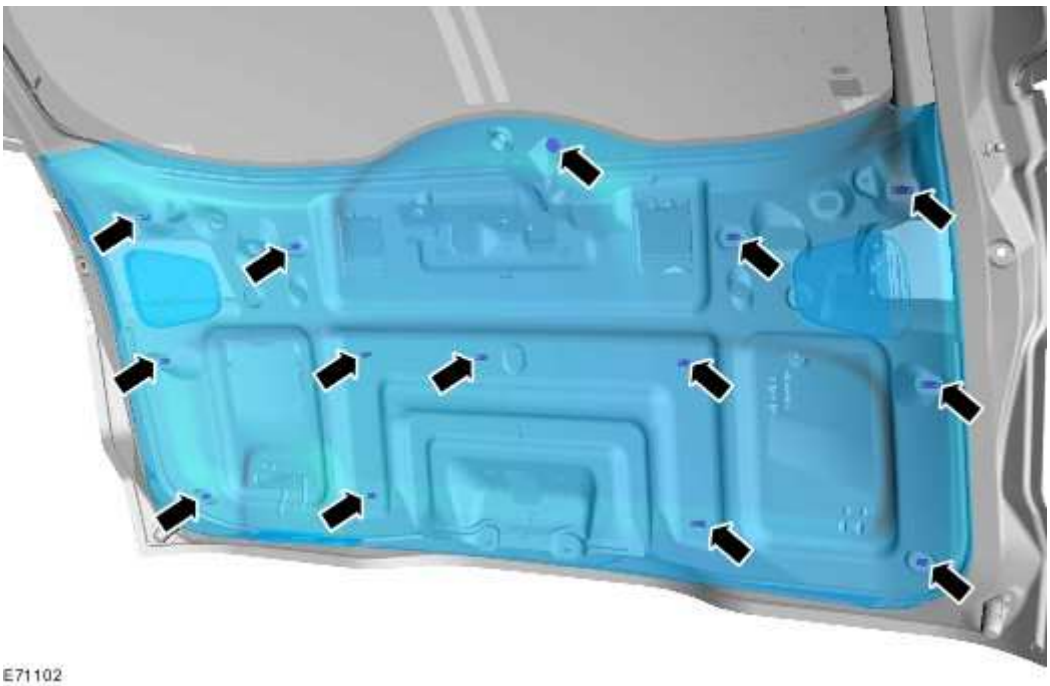
NOTE: Removal steps in this procedure may contain installation details.

1.



Vehicles with VIN plate body code: S

2.



Vehicles with VIN plate body code: M

3.

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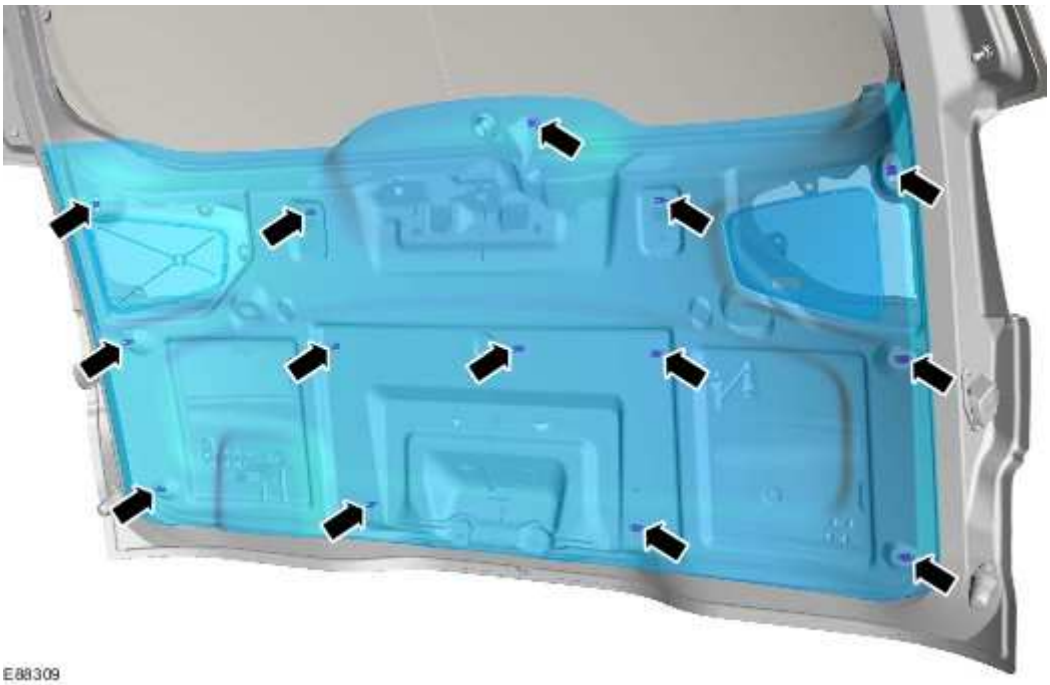

E88309

Installation

1. To install, reverse the removal procedure.

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P

Removal and Installation

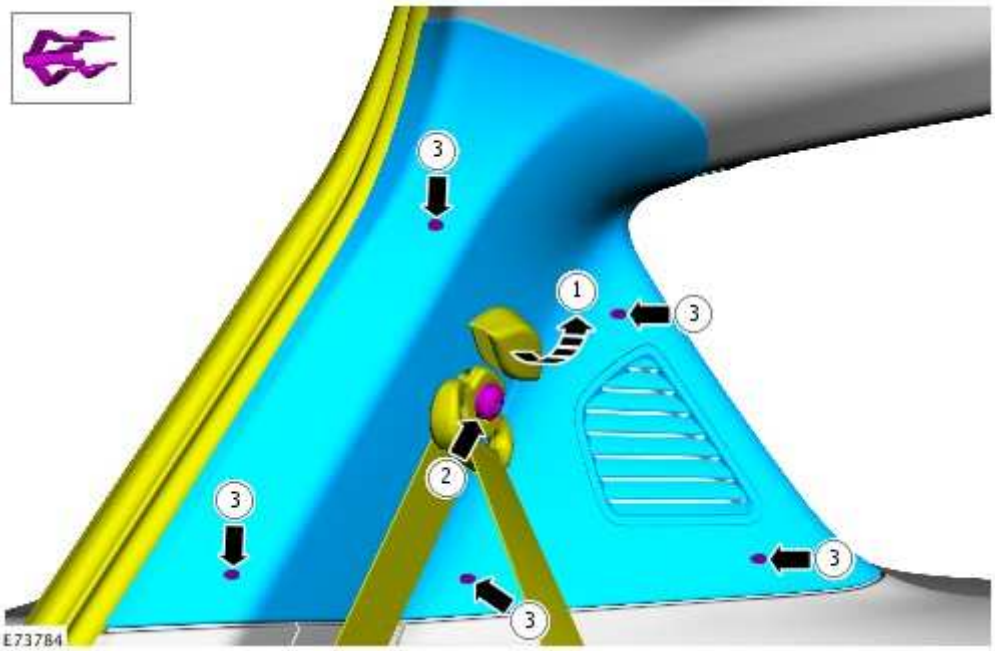
Removal

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

1. Remove the C-Pillar trim panel.

   Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).

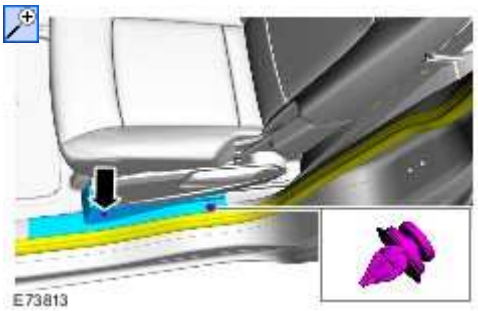
2.



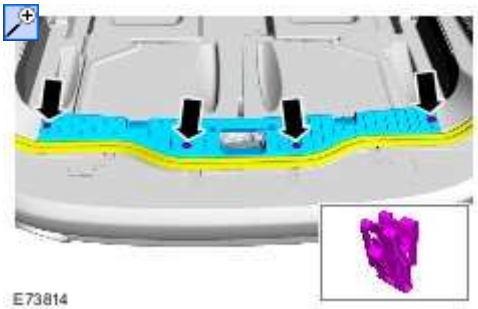
1. If equipp
2. If equipp

Torque
35 Nm

3.



4.



5.

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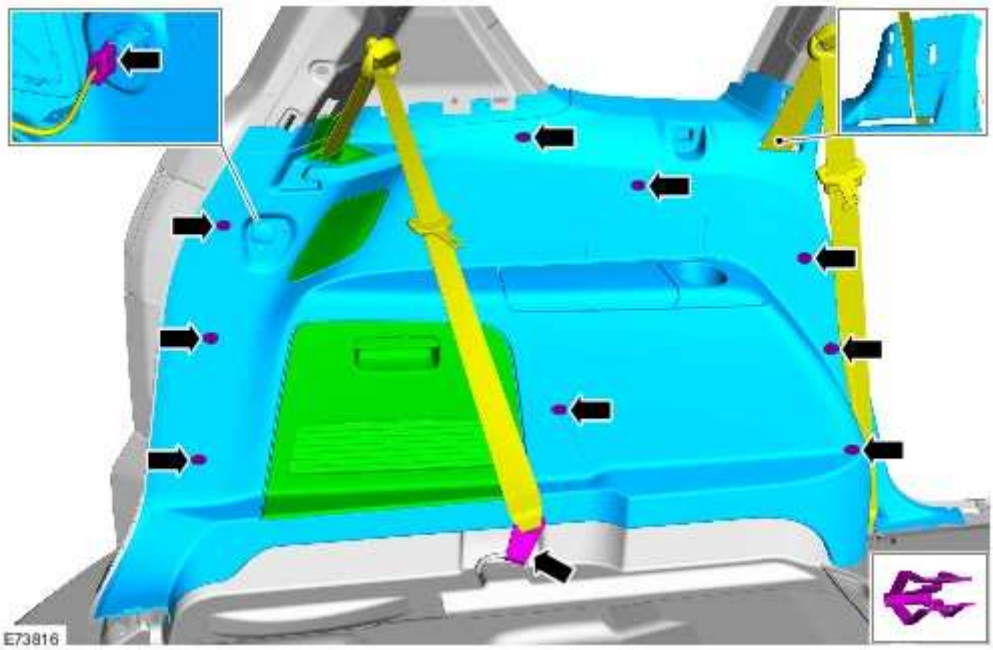

Installation

1. To install, reverse the removal procedure.

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Print

Removal and Installation

General Equipment

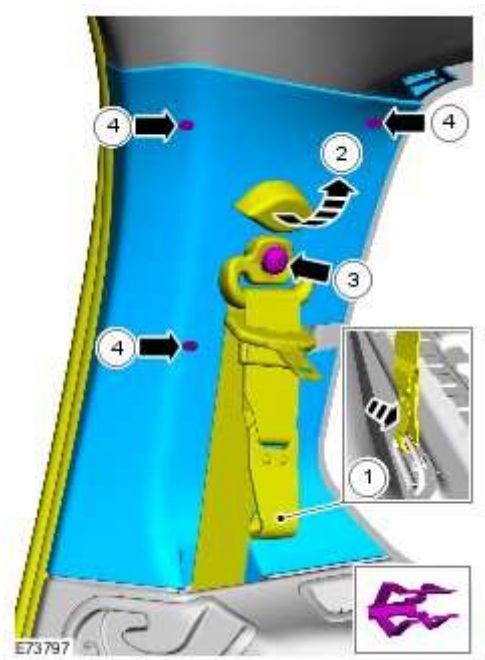
Flat-bladed screwdriver

Removal

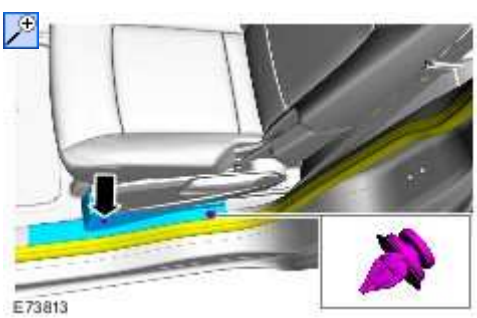
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the C-Pillar trim panel.

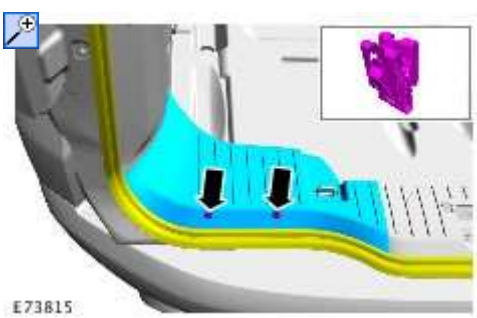
   Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. *Torque:* 35 Nm



3.



4.

5. *General*

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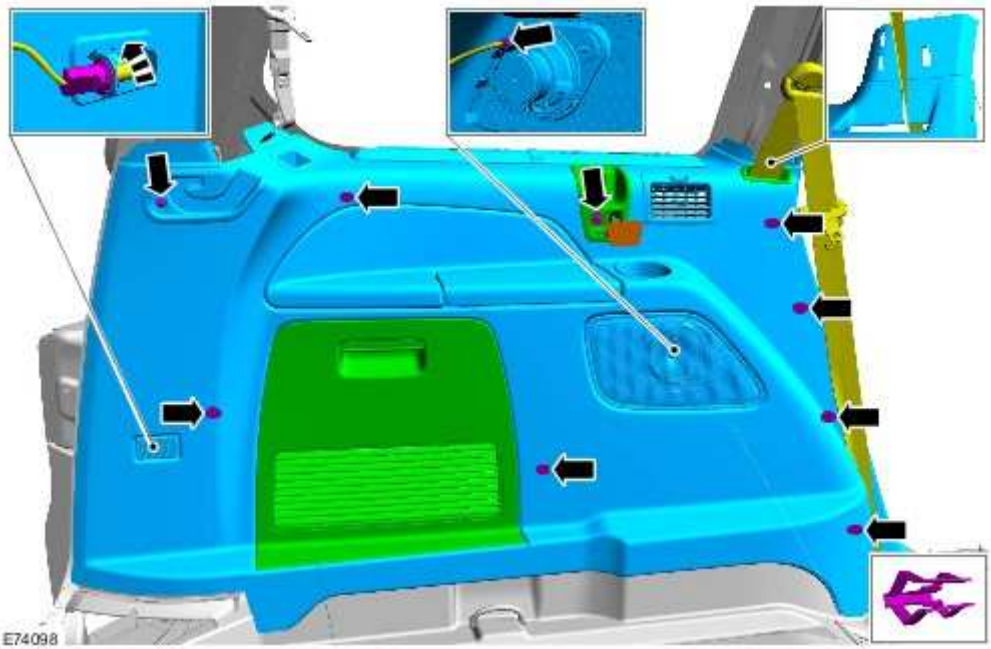
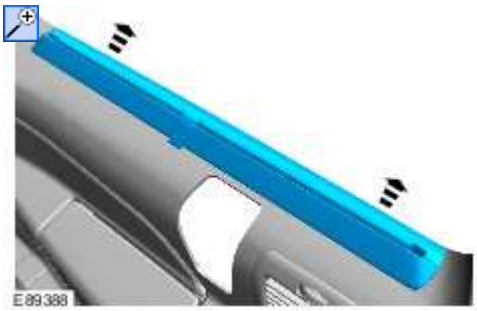


Equipment:
Flat-bladed screwdriver



6. NOTE: This step is only necessary when installing a new component.
   If equipped.

Installation

1. To install, reverse the removal procedure.

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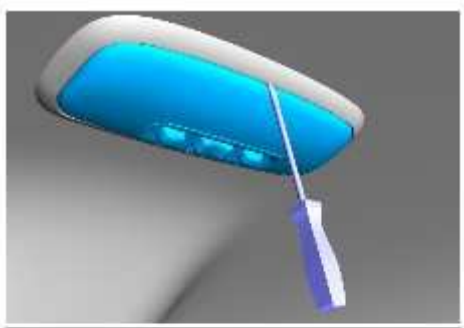
Removal and Installation

General Equipment

Flat-bladed screwdriver

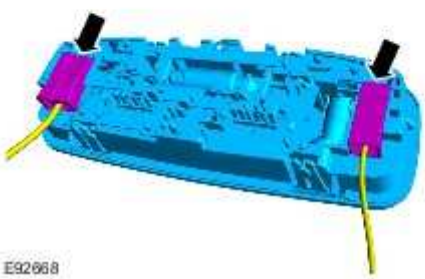
Removal

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

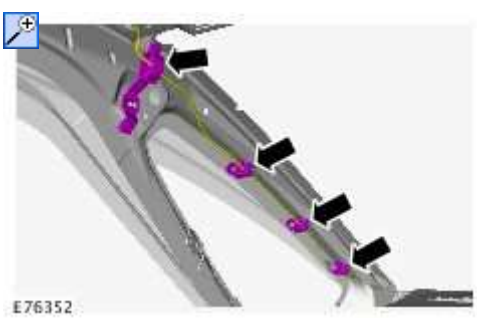


1. All.

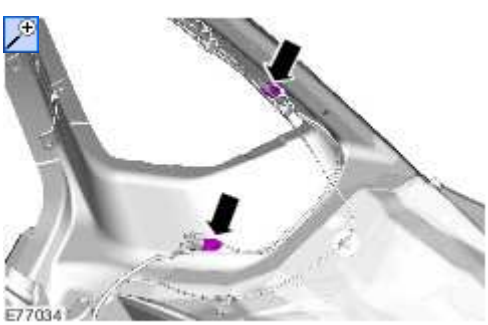
   General Equipment: Flat-bladed screwdriver



2. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3.



4.

5.

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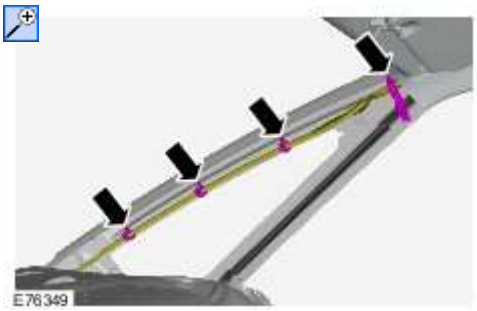
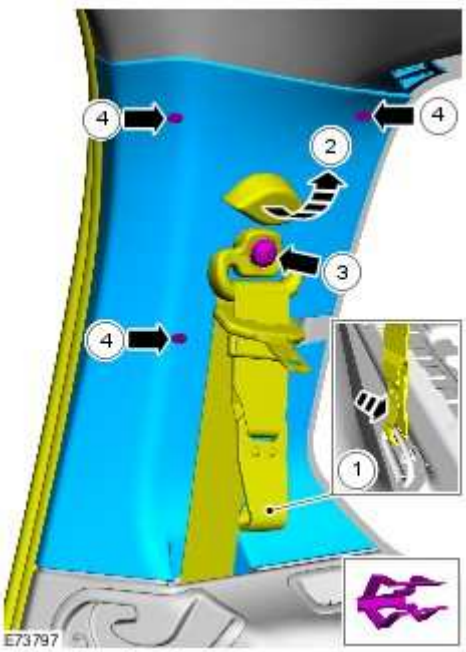
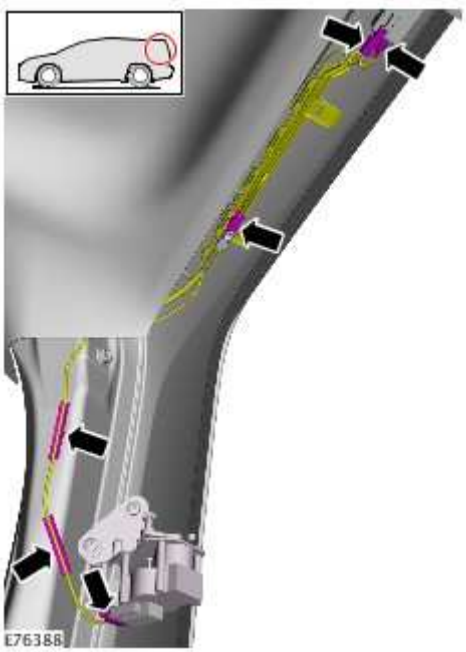


6. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
8. *Torque:* 35 Nm



9.



10.

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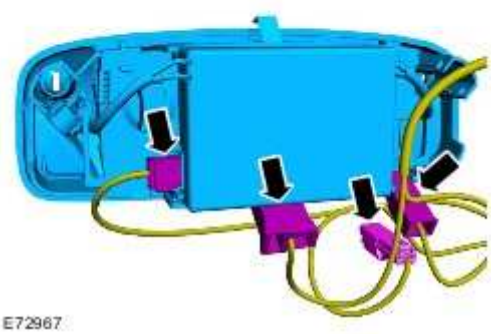
11. *General Equipment:* Flat-bladed screwdriver



12.

13. If equipped.

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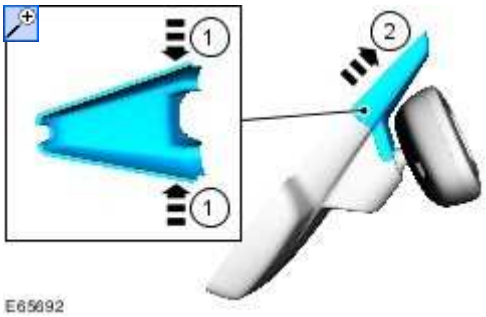
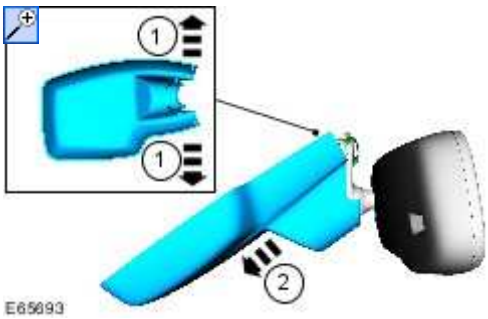
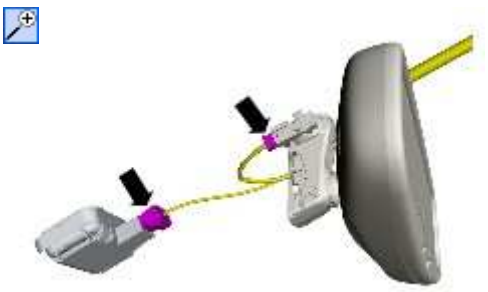


E65892

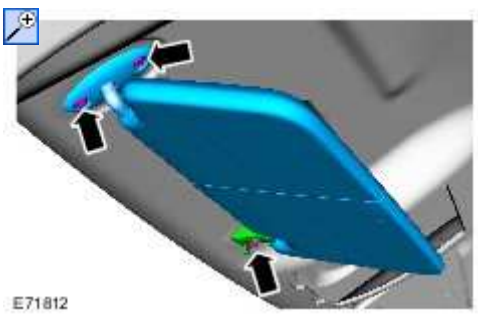


E65893

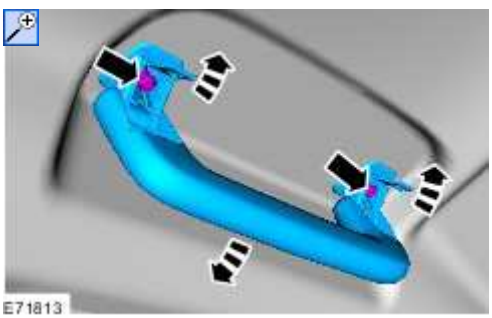
14. If equipped.


E74631

15. If equipped.


E71812

16. On both sides.


E71813

17. On both sides.

18.

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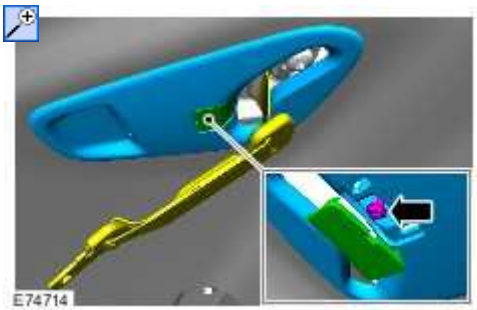
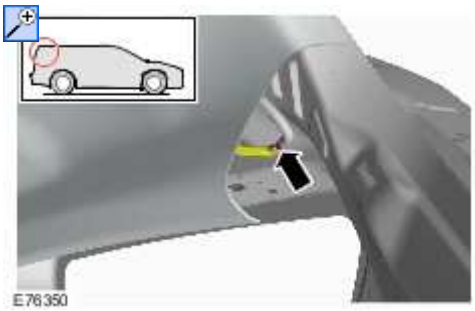
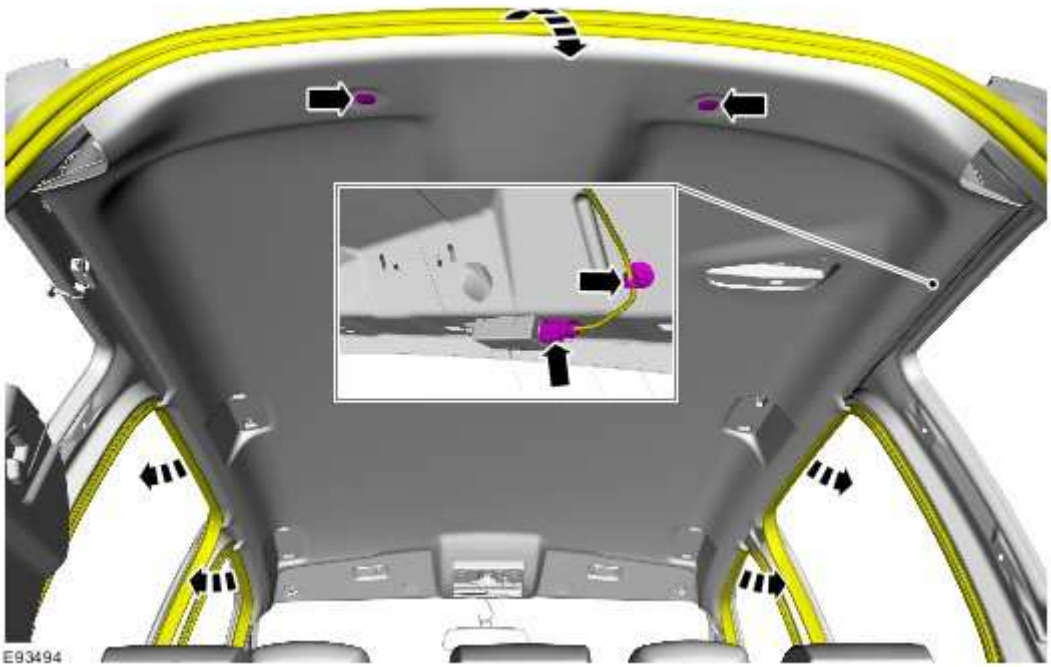




19.

20. Recline the front seats backrests.
21. Recline the rear seats backrests.
22. Support the headline



23.

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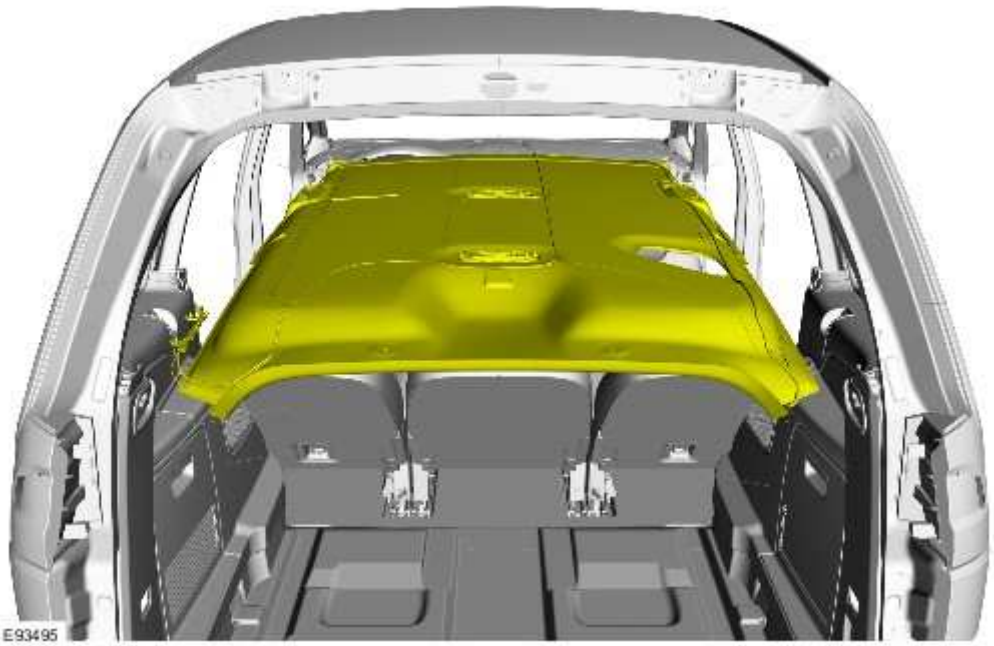
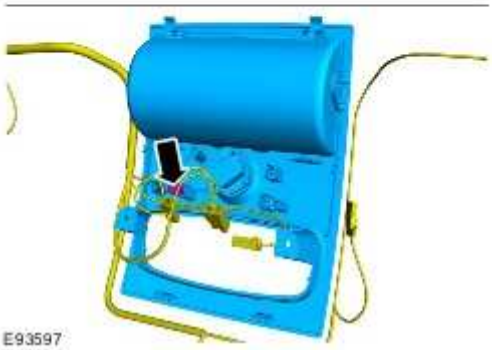
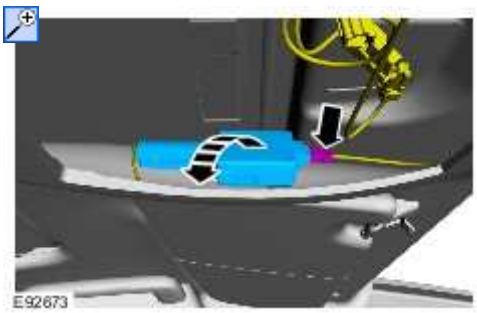


24.



25.



26. All.

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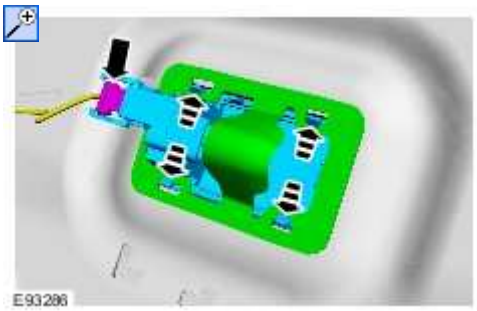

Left-hand drive vehicles

27. NOTE: Note the position of each component before removal.

Right-hand drive vehicles

28. NOTE: Note the position of each component before removal.

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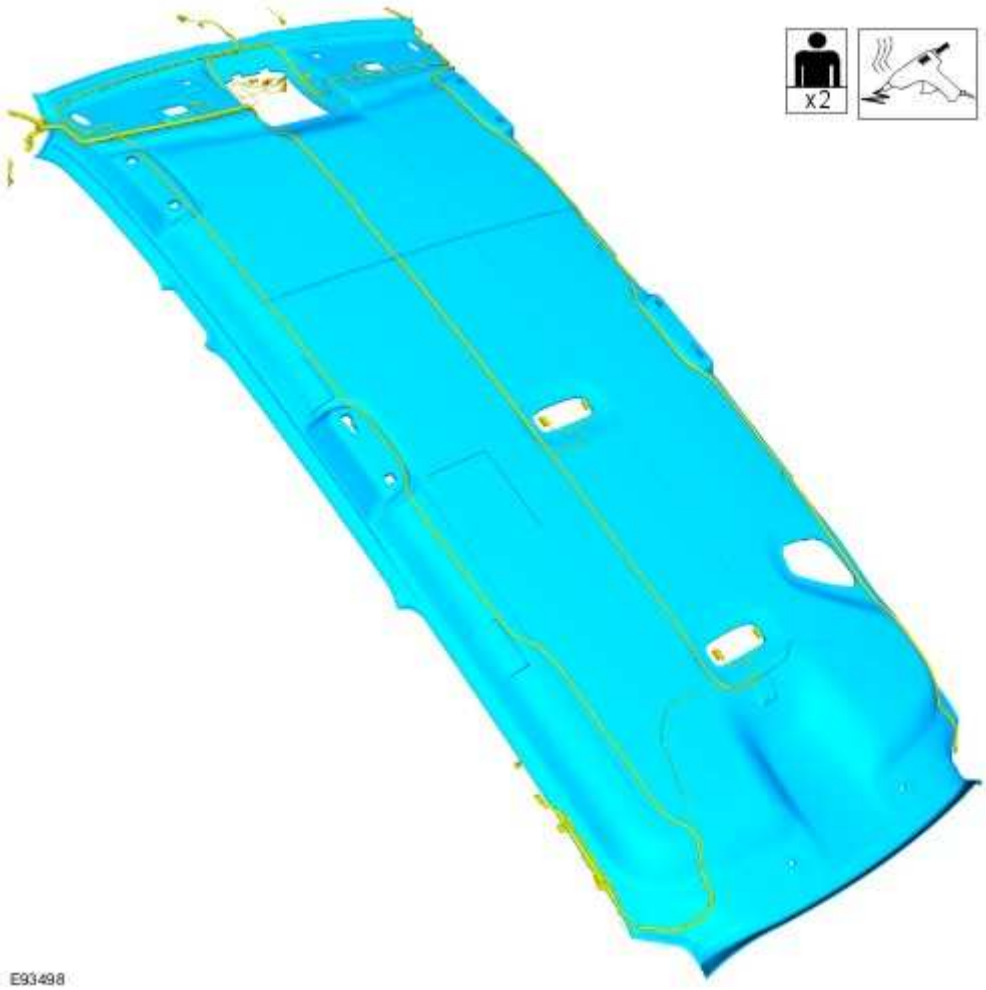
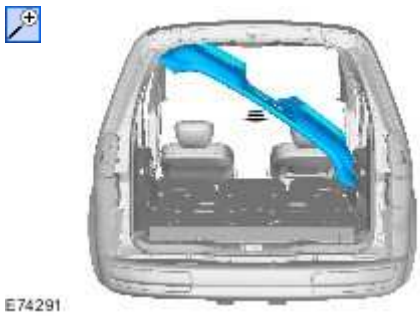


All vehicles



29. NOTE: This step requires the aid of another technician.

Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the roof wiring harness, the antenna cable and the washer tube to the headliner.
2. To install, reverse the removal procedure.

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Print

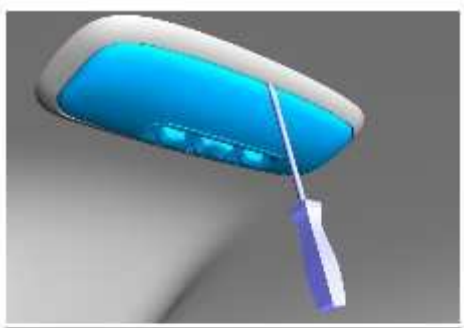
Removal and Installation

General Equipment

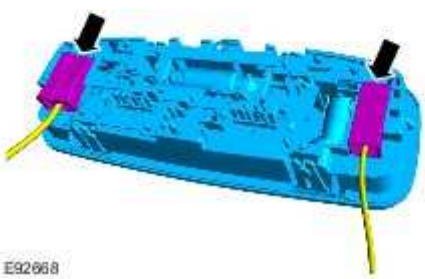
Flat-bladed screwdriver

Removal

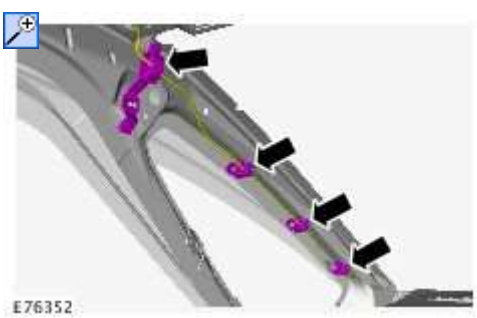
NOTE: Removal steps in this procedure may contain installation details.



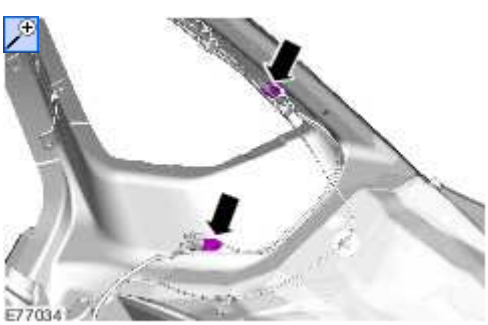
1. All.



2. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3.



4.

5.

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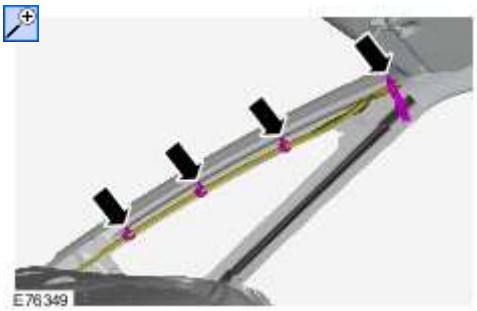
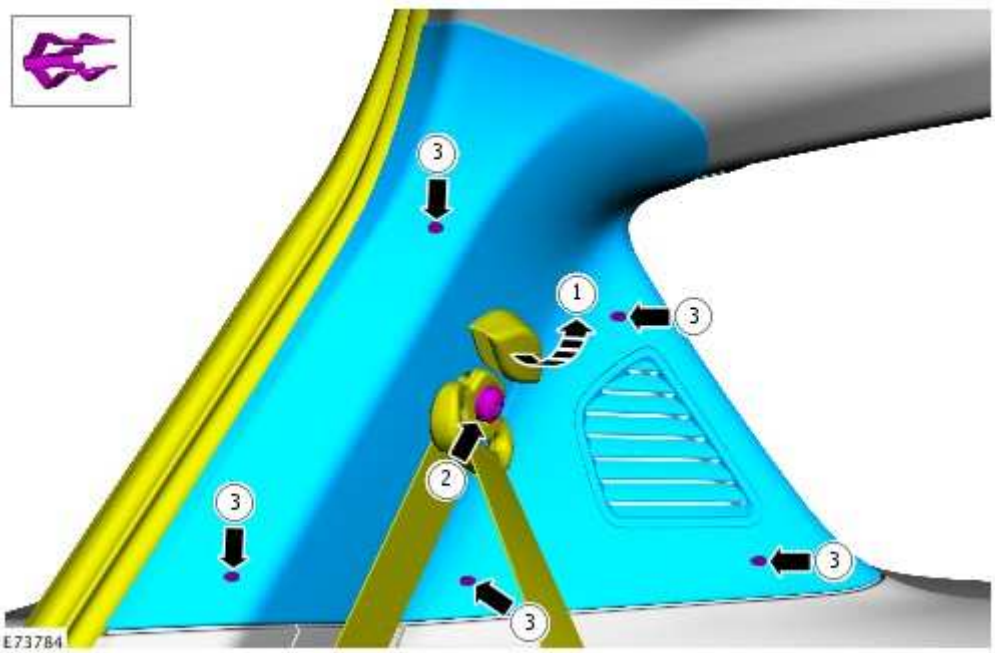
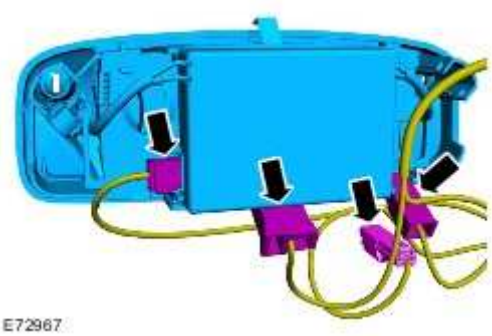


6. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).



8. *Torque:* 35 Nm

9. *General Equipment:* Flat-bladed screwdriver



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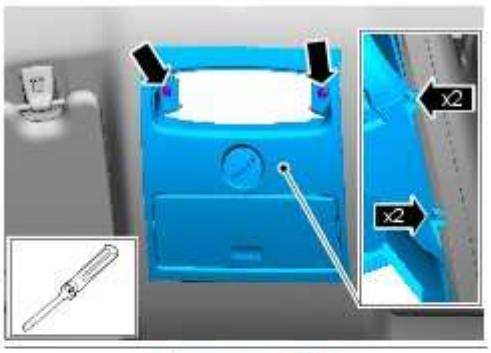
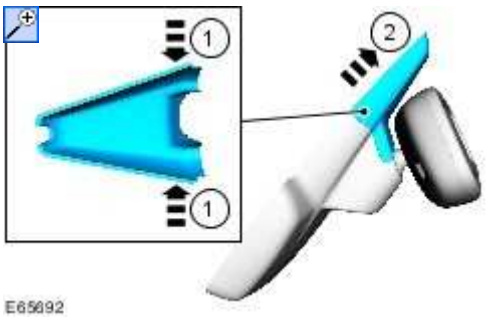
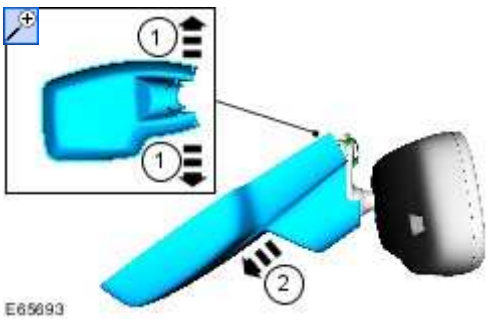
10.



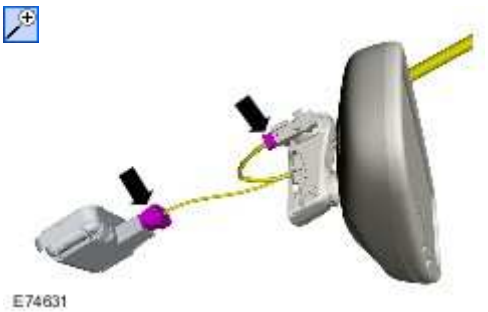
11. If equipped.



12. If equipped.



13. If equipped.



14. On both sides.

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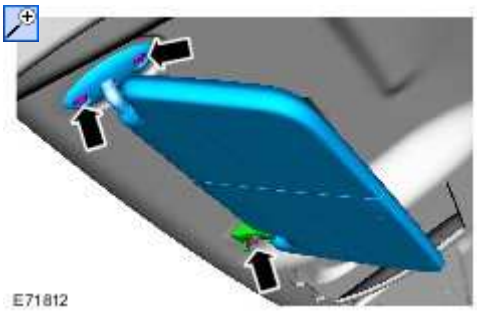
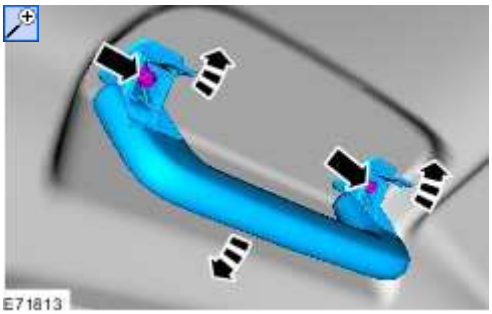
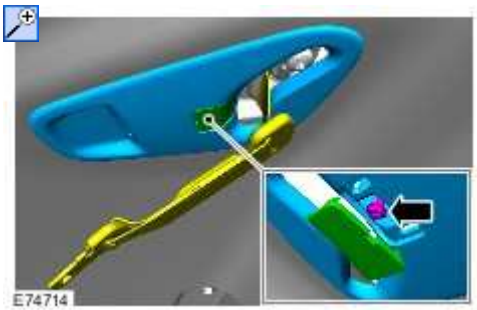
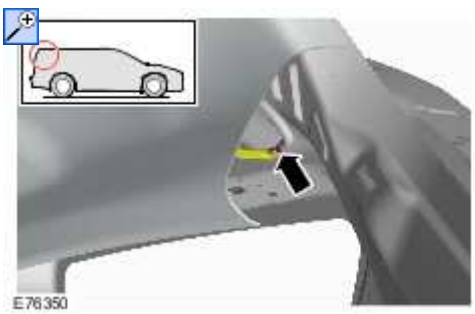




15. On both sides.



16.



17.

18.

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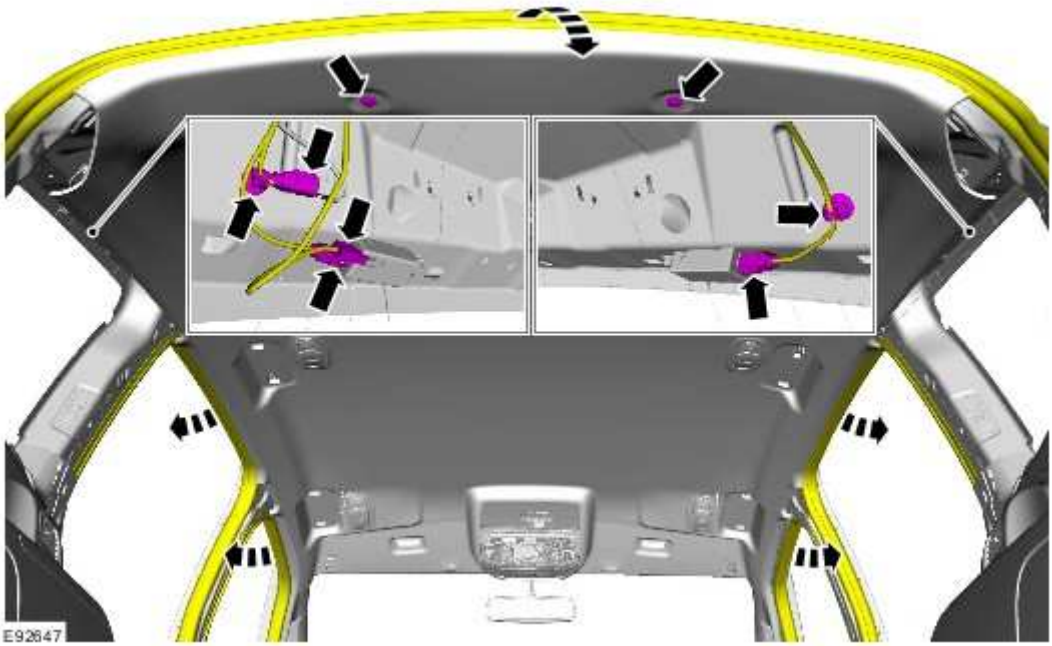
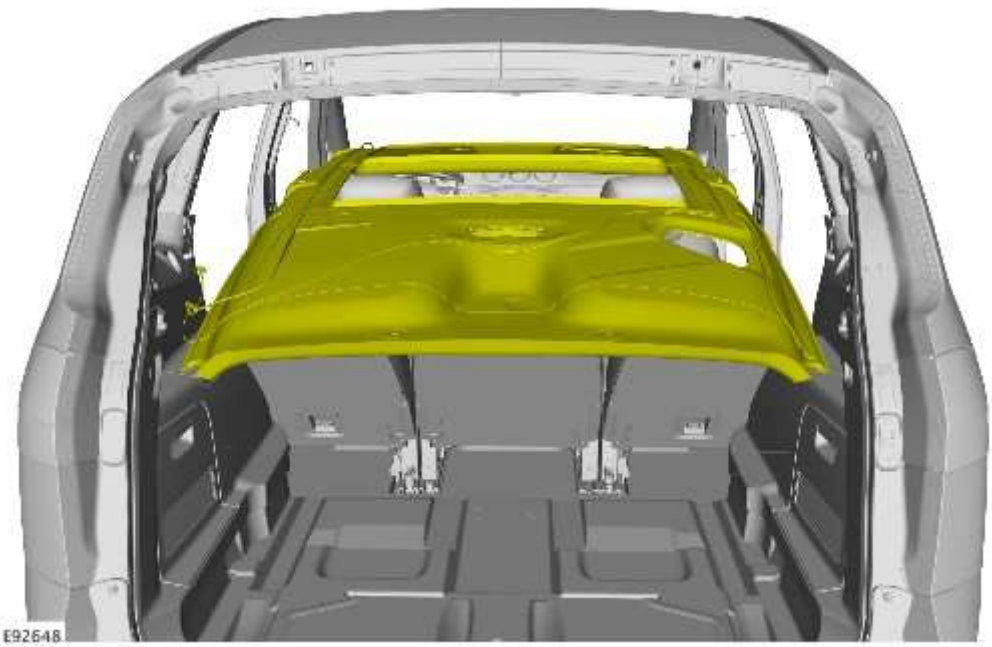
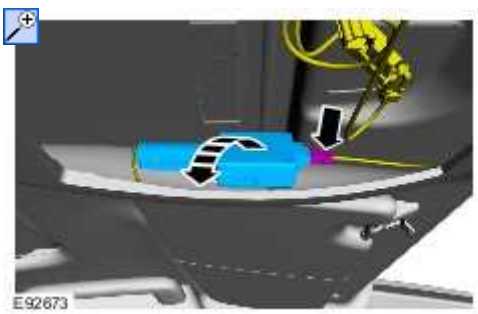


19. Recline the front seats backrests.
20. Recline the rear seats backrests.
21. Support the headliner.





22.

23. All.

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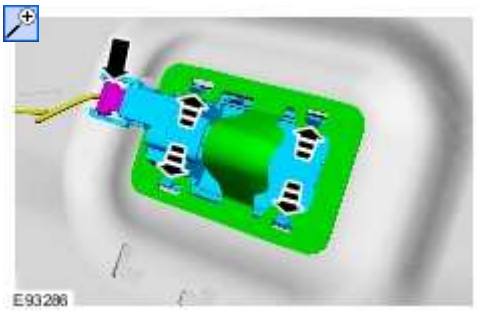

Left-hand drive vehicles

Right-hand drive vehicles

24. NOTE:
Note the position of each component before removal.

25. NOTE:
Note the position of each component before removal.

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All vehicles

26. NOTE:
Note the position of the component before removal.

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Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the roof wiring harness, the antenna cable and the washer tube to the headliner.
2. To install, reverse the removal procedure.

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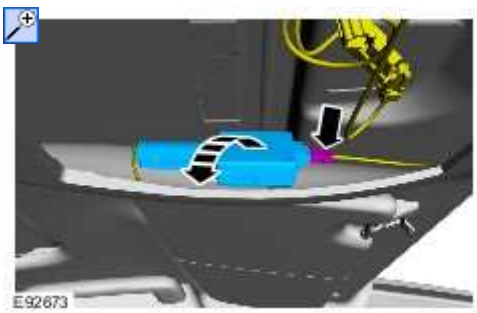
Removal and Installation

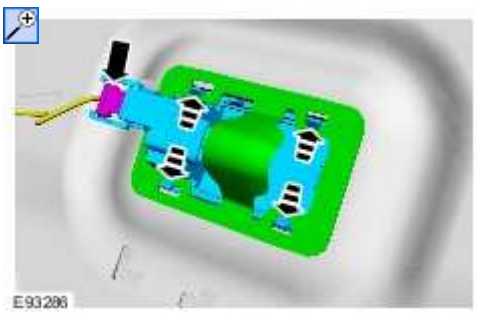
Removal

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

1. Refer to: Overhead Console - Vehicles With: Glass Roof Panel (501-12 Instrument Panel and Console, Removal and Installation).



2.



3. All.

Left-hand drive vehicles

4. NOTE: Note the position of each component before removal.

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Right-hand drive vehicles

5. NOTE:
   Note the position of each component before removal.

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All vehicles

6. NOTE: This step requires the aid of another technician.

Installation

1. NOTE: Make sure that these components are installed to the noted removal position.
   Using a suitable adhesive, bond the roof wiring harness, the antenna cable and the washer tube to the headliner.
2. To install, reverse the removal procedure.

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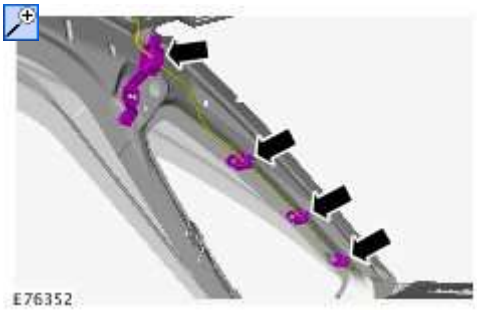
Prir

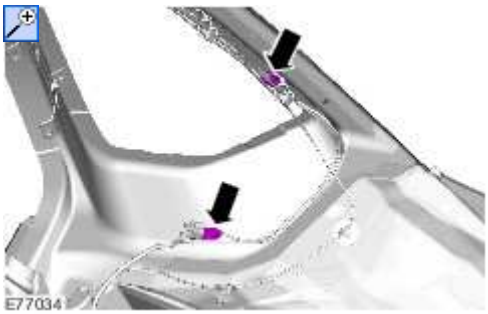
Removal and Installation

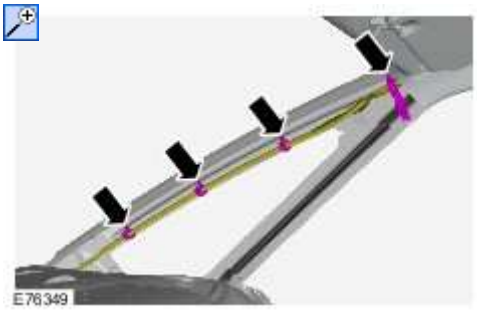
General Equipment

Flat-bladed screwdriver

Removal

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

3. 

4. 

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

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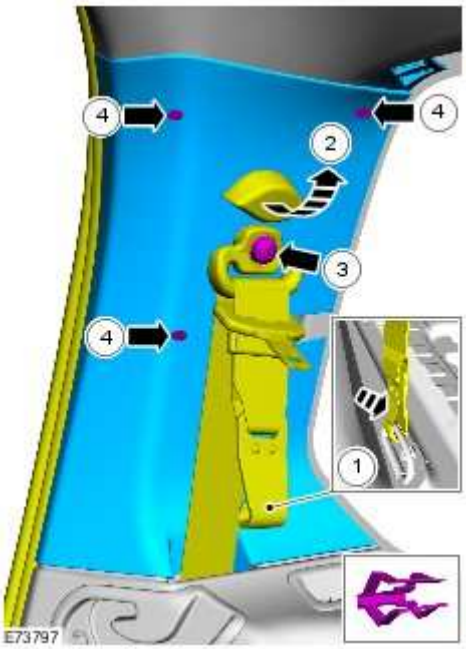

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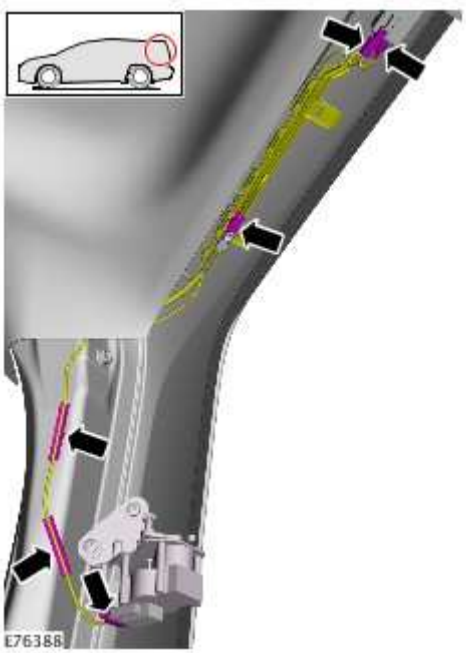

9.

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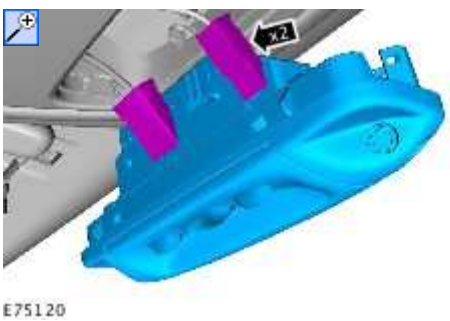
10. *General Equipment:* Flat-bladed screwdriver



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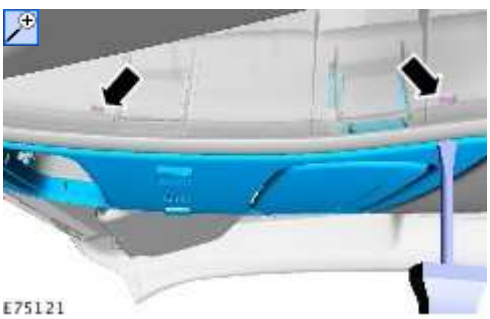

12. *General Equipment:* Flat-bladed screwdriver

13.

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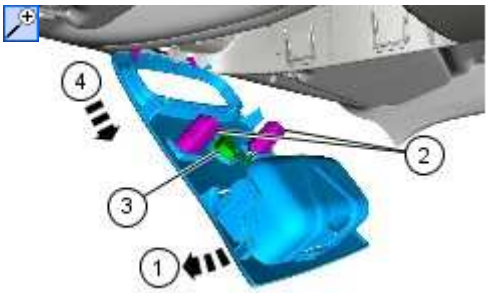
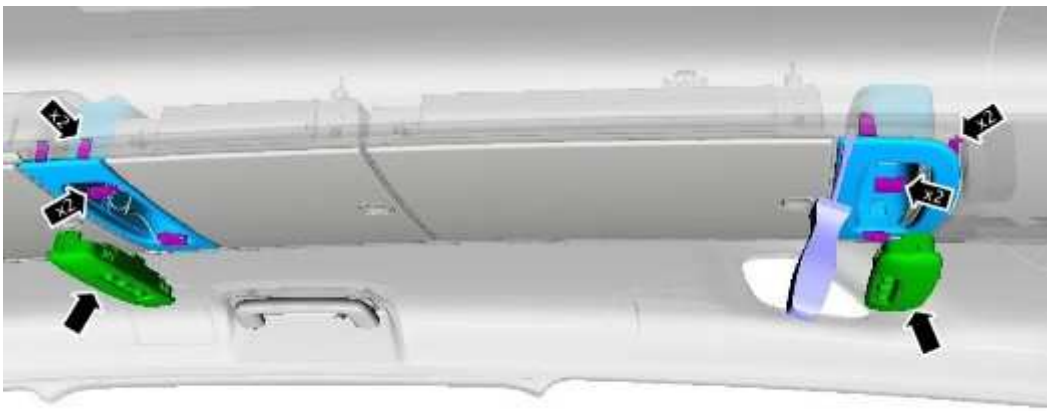
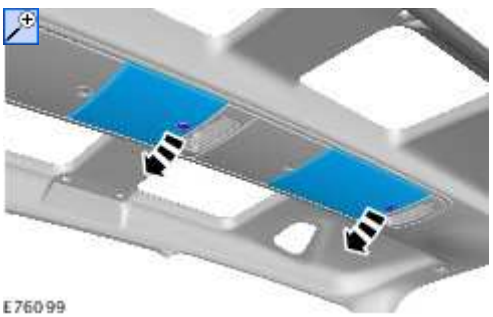


E75122



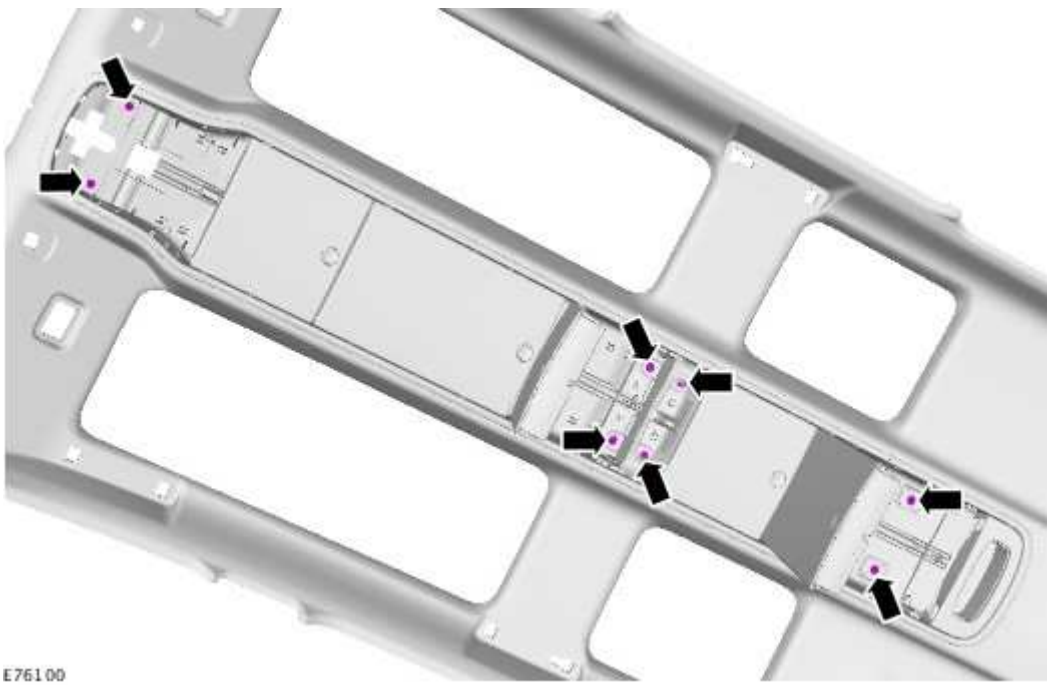
E75123

14. *General Equipment* Flat-blade screwdrive



E76099

15.



E76100

16.

17. If equipped.

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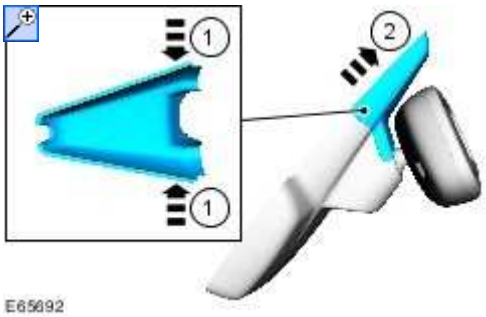
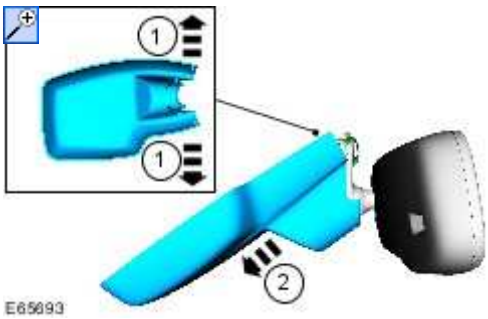
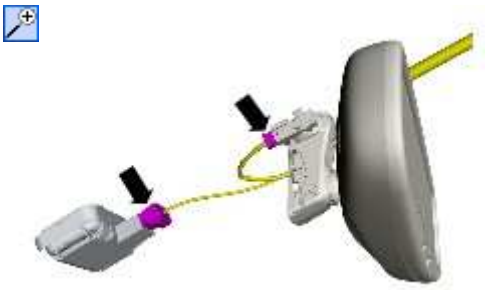


E65892

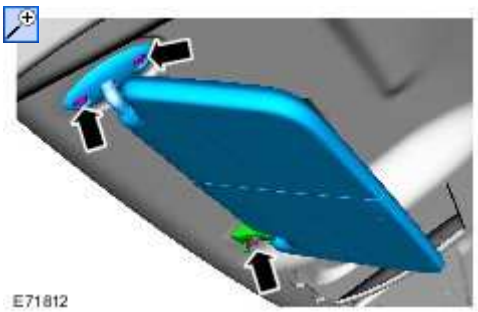


E65893

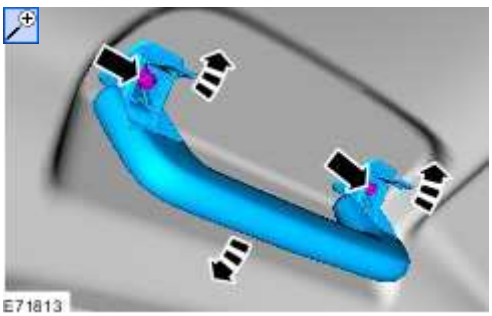
18. If equipped.


E74631

19. If equipped.


E71812

20. On both sides.


E71813

21. On both sides.

22.

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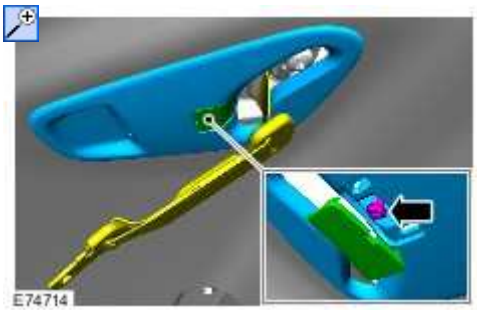

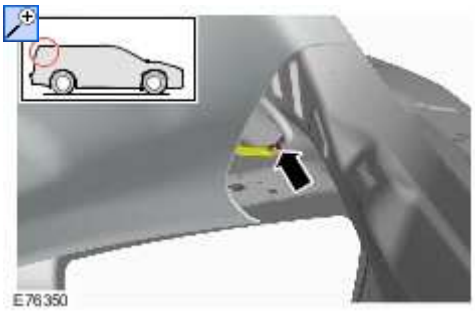

23.

24. Recline the front seats backrests.
25. Recline the rear seats backrests.
26. Support the headliner.

27.

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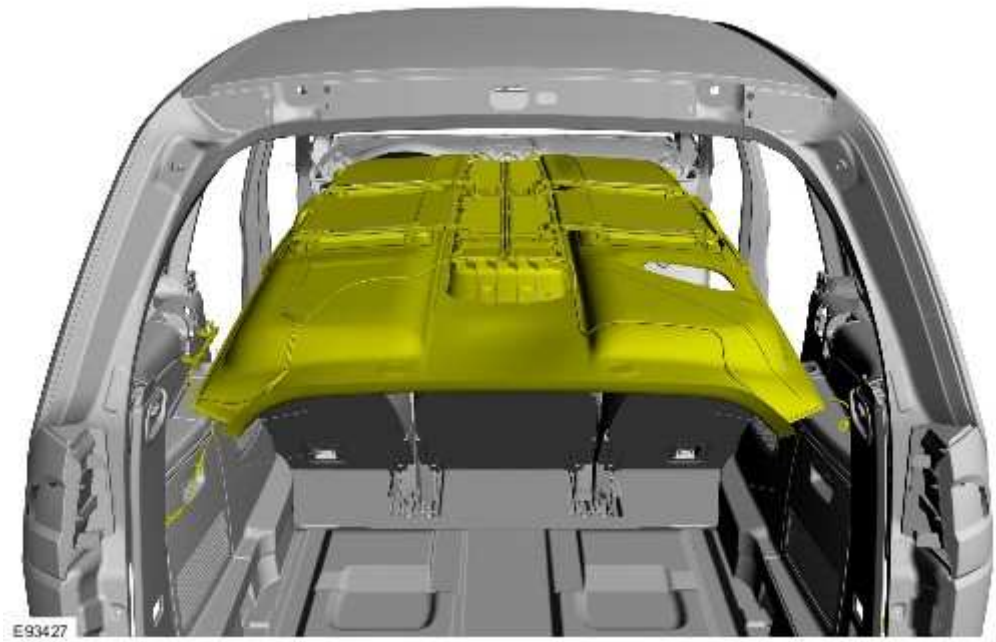

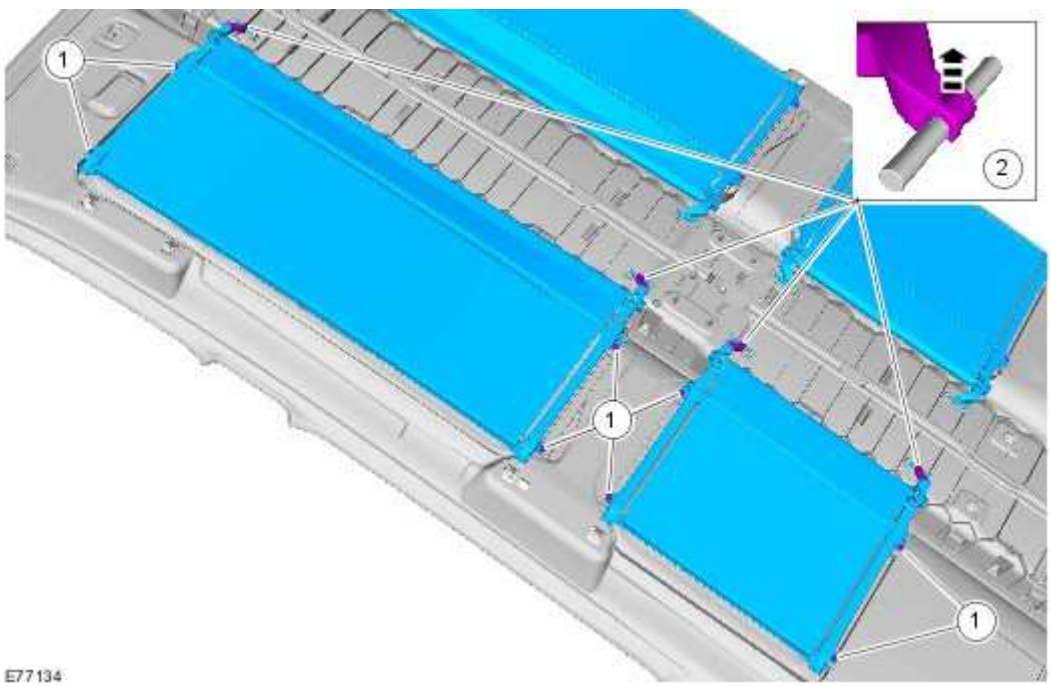

28. On both sides.

Installation

1. On both sides.

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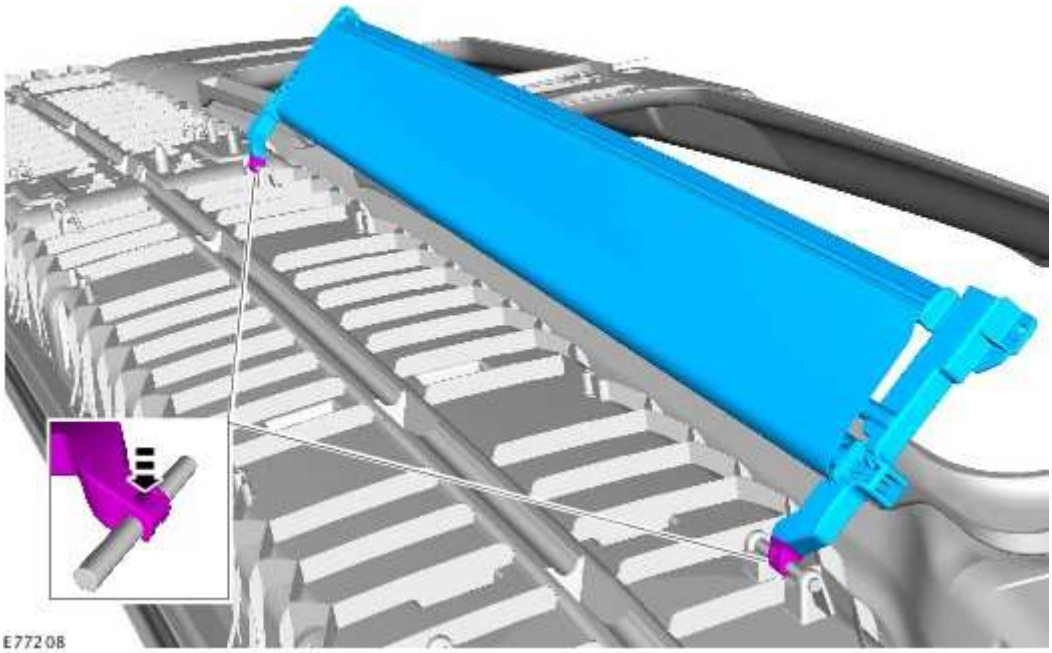
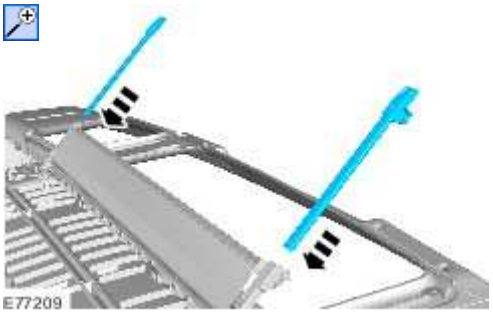
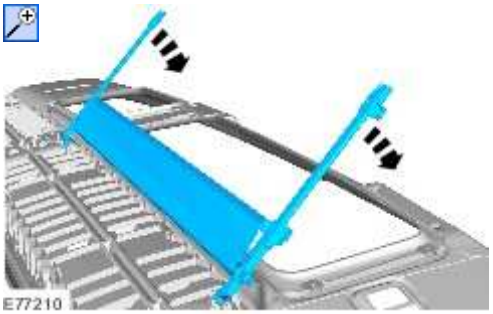


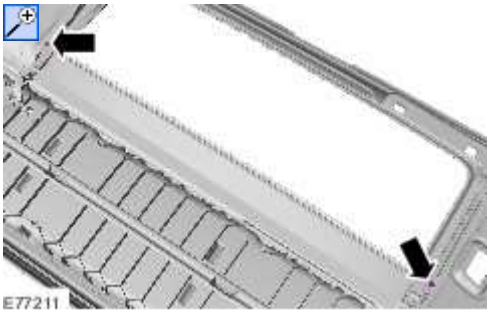
2. On both sides.



3. On both sides.



4. On both sides.



5. On both sides.

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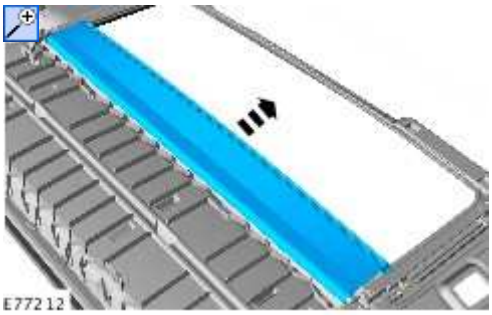

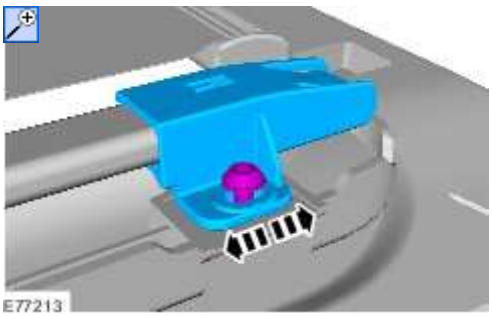

6. Adjust the roof sun blind so that equal tension is on both sides before tightening the screws.

7. Install the headliner.

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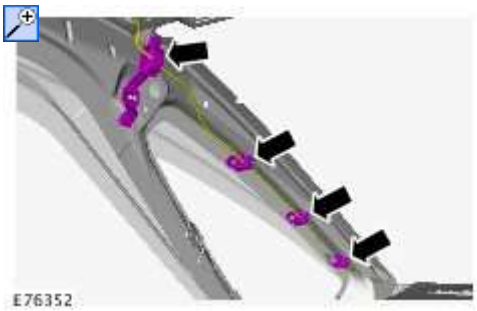
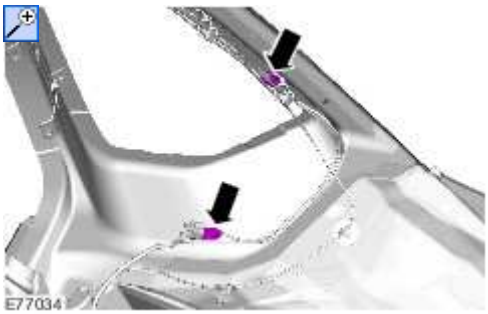
Removal and Installation

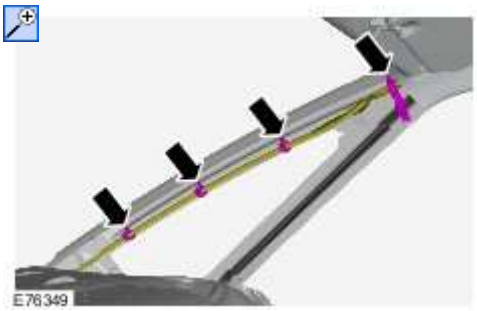
General Equipment

Flat-bladed screwdriver

Removal

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

3. 

4. 

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

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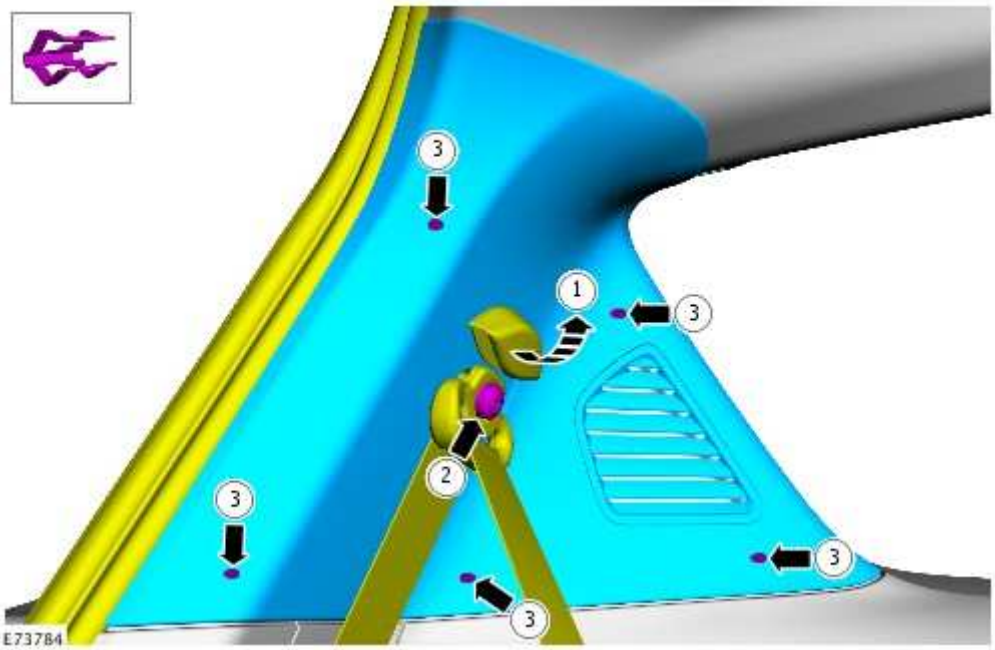
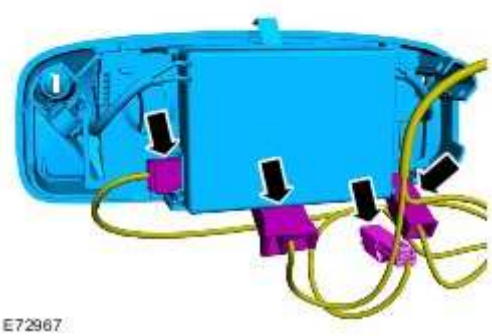


8. *General Equipment:* Flat-bladed screwdriver



9.

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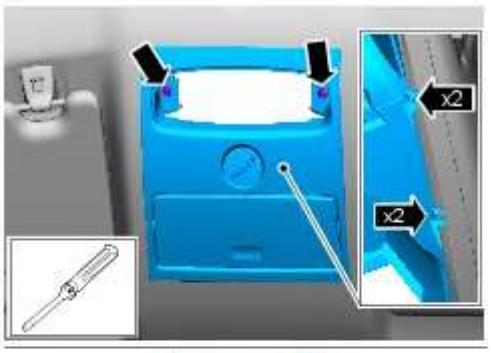
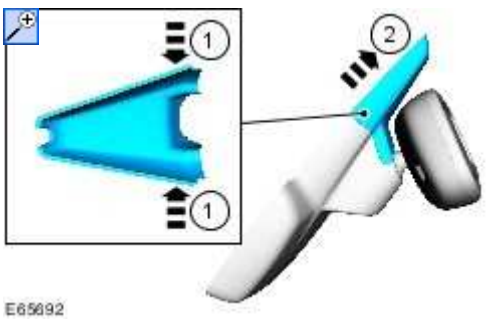
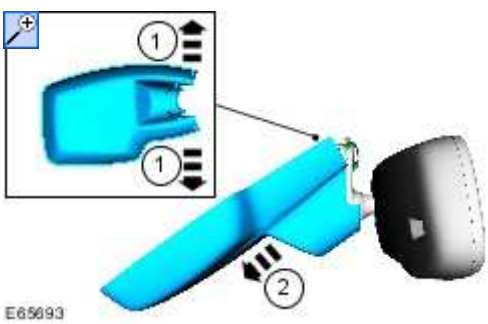
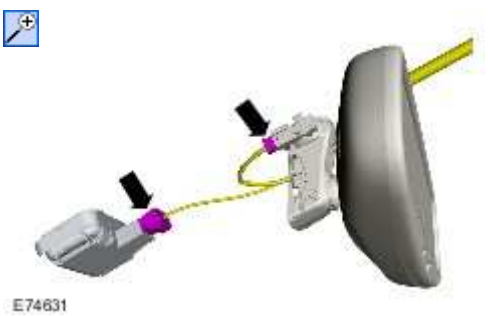




10. If equipped.



11. If equipped.



12. If equipped.

13. On both sides.

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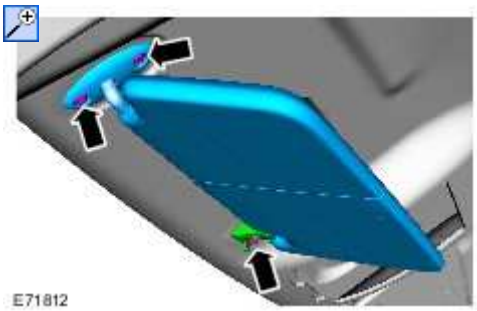
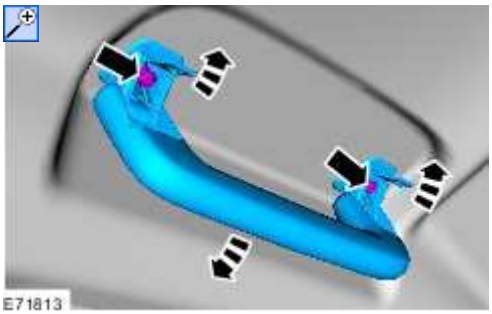
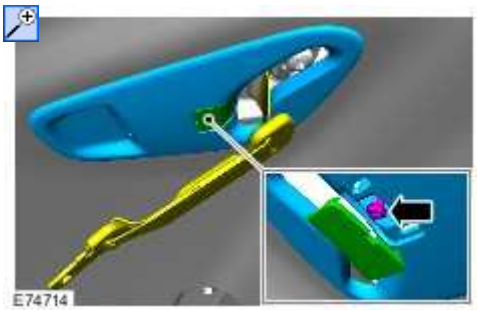
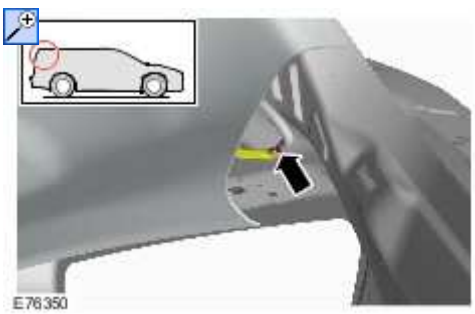




14. On both sides.



15.



16.

17.

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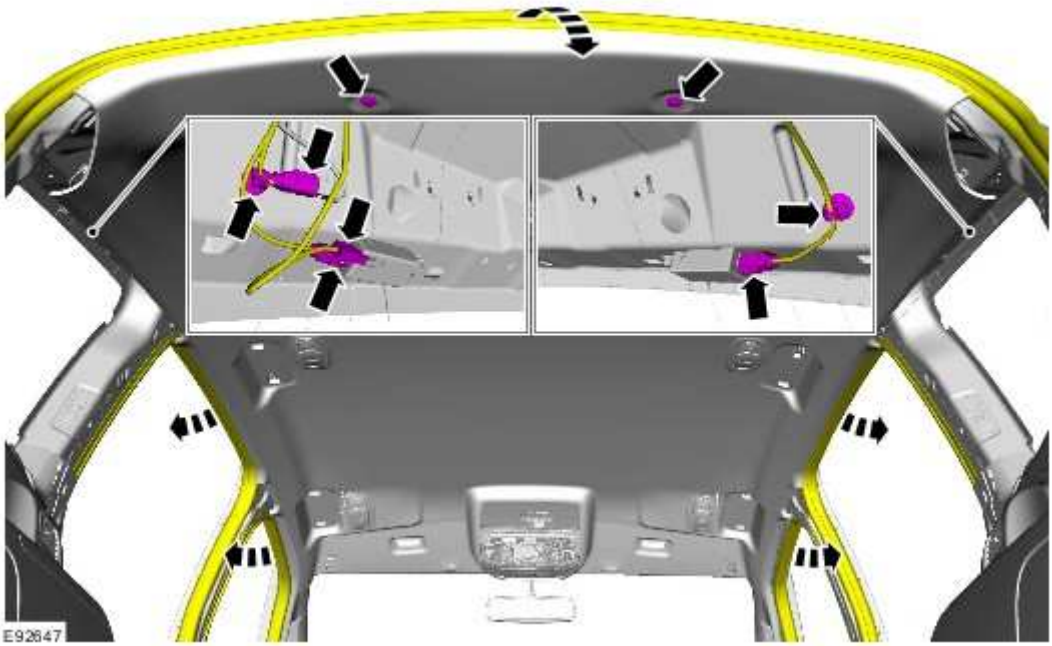
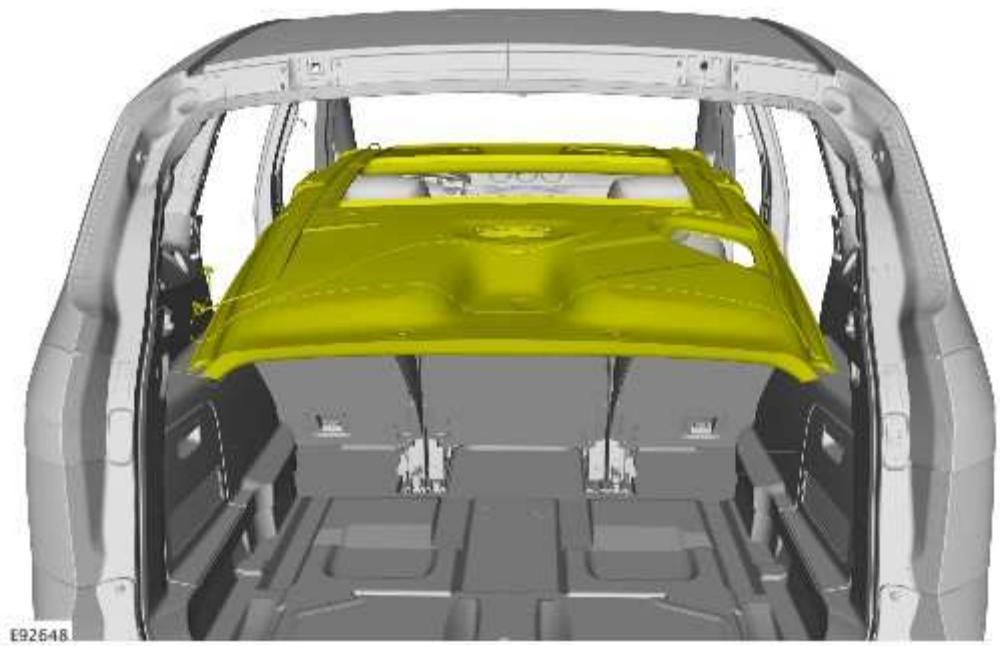


18. Recline the front seats backrests.
19. Recline the rear seats backrests.
20. Support the headliner.



21.

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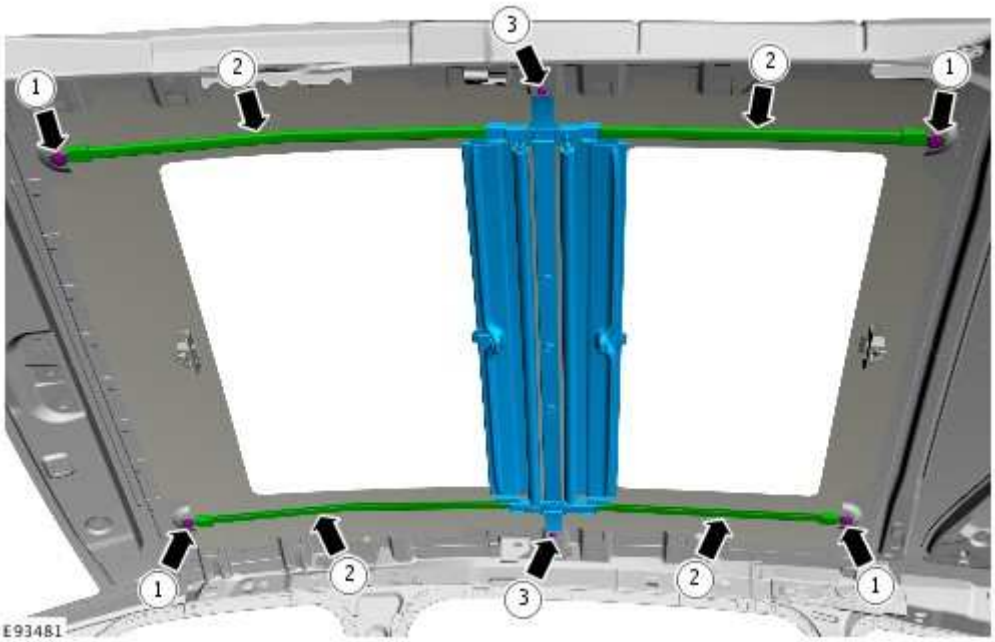

Installation

1. To install, reverse the removal procedure.

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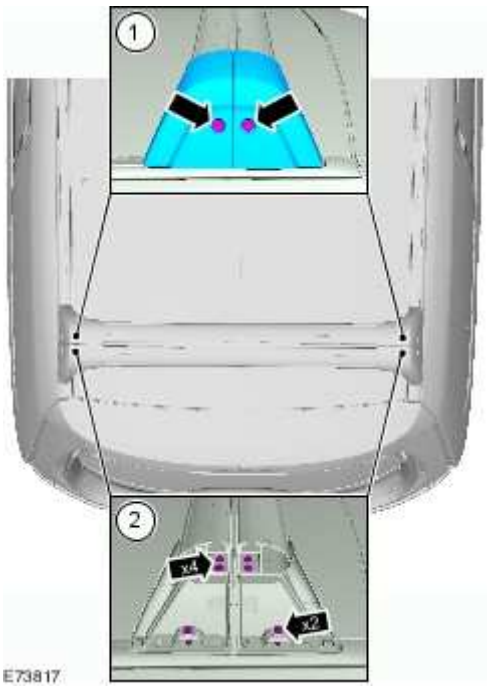
Removal and Installation

Removal

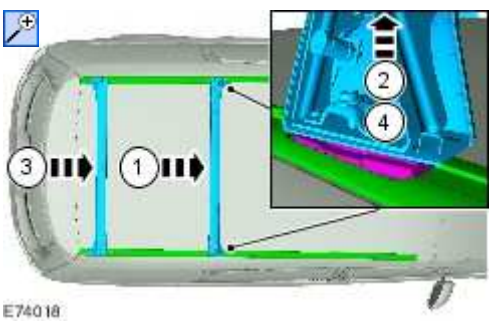
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the headliner.

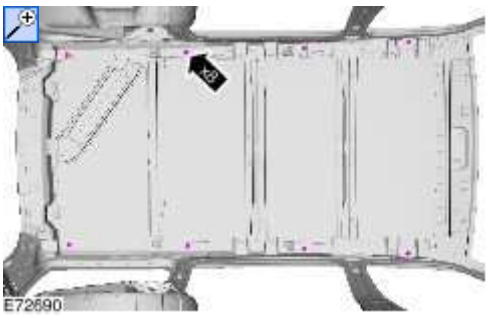
   Refer to: Headliner - Vehicles With: Metal Roof Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   Refer to: Headliner - Wagon, Vehicles With: Glass Roof Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.
   2. *Torque:* 5 Nm



3.



4. *Torque:* 9 Nm

5.

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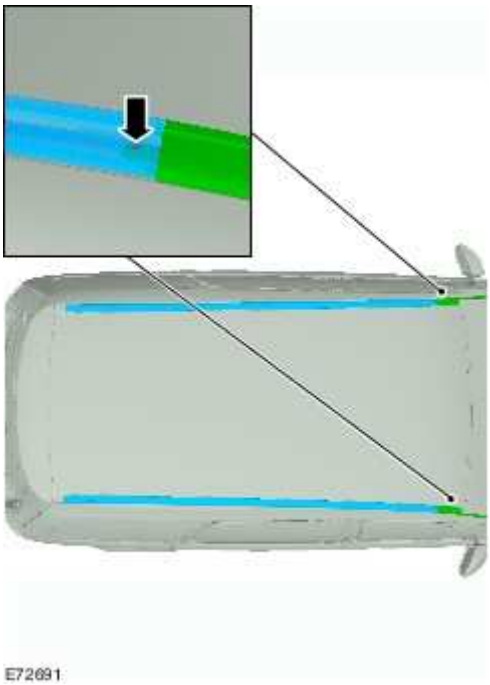

Installation

1. To install, reverse the removal procedure.

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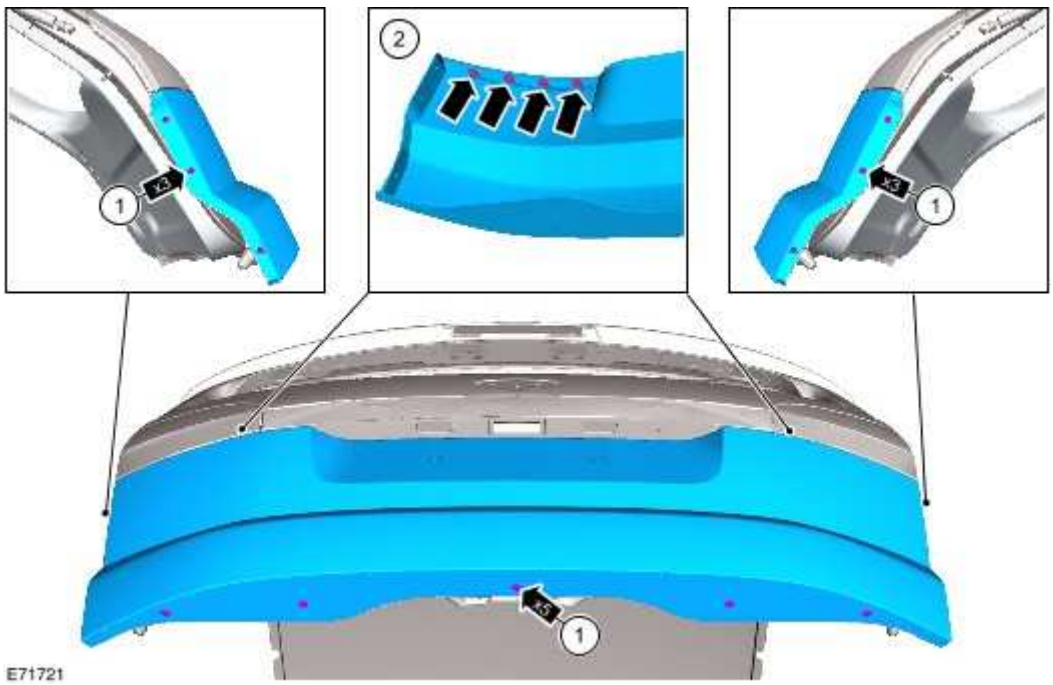
Removal and Installation

Removal



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Installation

1. To install, reverse the removal procedure.

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Description and Operation

Auto-dimming Interior Mirror

When the ignition is switched on the auto-dimming interior mirror will darken automatically depending on the amount of light shining into the vehicle through the rear window glass. The auto-dimming feature will turn off when reverse gear is selected.

The auto-dimming feature on the interior rear view mirror will not operate correctly if light through the rear window glass is obstructed.

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Diagnosis and Testing

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
Exterior mirror(s)	Fuse(s)
	Door module
	Electrical connector(s)
	Switch(es)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The mirrors are inoperative	* Exterior mirror switch. * LIN Bus.	* REFER to WDS.
A single mirror is inoperative	* Exterior mirror switch. * Door module. * LIN Bus.	* REFER to WDS.
	* Circuit(s).	* GO to Pinpoint Test A.
A single mirror does not function with switch logic	* Exterior mirror switch. * Door module. * LIN Bus.	* REFER to WDS.
	* Circuit(s). * Exterior mirror motor (s).	* GO to Pinpoint Test B.
The heated exterior mirror is inoperative	* Heated rear window switch. * Door module. * LIN Bus.	* REFER to WDS.
	* Circuit(s). * Heated mirror element (s).	* GO to Pinpoint Test C.
The auto dimming mirror does not operate correctly	* Auto-dimming interior mirror. * Circuit(s).	* GO to Pinpoint Test D.
The power folding mirrors do not operate/ do not operate correctly	* Exterior mirror switch. * Power fold mirror switch. * Door module. * Central junction box (CJB). * LIN Bus.	* REFER to WDS.
	* Power fold mirror(s).	* GO to Pinpoint

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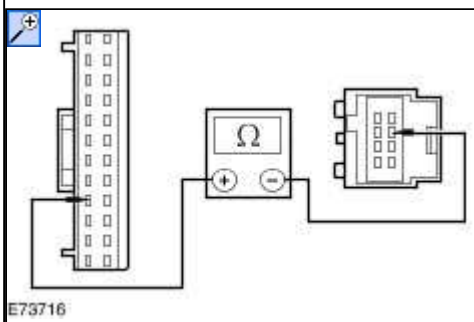
	* Circuit(s).	Test E.

Pinpoint Tests

PINPOINT TEST A : A SINGLE MIRROR IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE EXTERIOR MIRROR AND THE DOOR MODULE	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Disconnect Inoperative Exterior Mirror C5PM26 or C5PM31.
	2 Disconnect Driver Door Module C5PL01-B or Passenger Door Module C6PL01-B.
	3 Measure the resistance between the: Driver Exterior Mirror • Driver door module C5PL01-B pin 9, circuit CPM03A (BU/WH), harness side and the driver side exterior mirror C5PM26 pin A-2, circuit CPM03A (BU/WH), harness side. Passenger Exterior Mirror • Passenger door module C6PL01-B pin 9, circuit CPM06A (GN/WH), harness side and the driver side exterior mirror C5PM26 pin A-2, circuit CPM06A (GN/WH), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit CPM03A (BU/WH) or circuit CPM06A (GN/WH). TEST the system for normal operation.

PINPOINT TEST B : A SINGLE MIRROR DOES NOT FUNCTION WITH SWITCH LOGIC	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE EXTERIOR MIRROR FUNCTIONS WITH SWITCH LOGIC	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Operate the exterior mirror switch.
	Does the exterior mirror function with switch logic? **Yes** VERIFY the customer concern. **No** Driver side exterior mirror UP/DOWN inoperative - GO to B2. Driver side exterior mirror LEFT/RIGHT inoperative - GO to B4. Passenger side exterior mirror UP/DOWN inoperative - GO to B6. Passenger side exterior mirror LEFT/RIGHT inoperative - GO to B8.
B2: CHECK THE DRIVER SIDE EXTERIOR MIRROR UP/DOWN CIRCUIT	
	1 Ignition switch in position 0.

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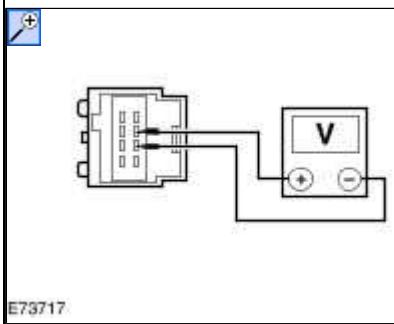
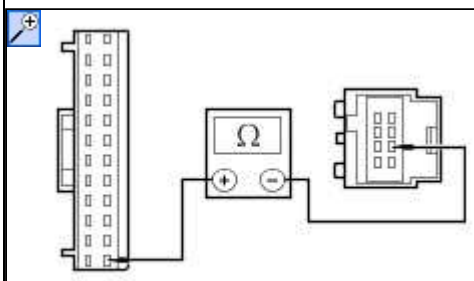
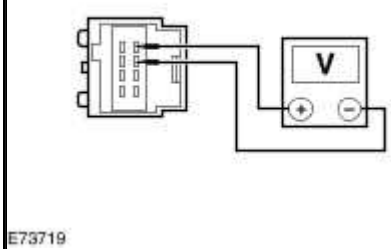
	2 Disconnect Driver Side Exterior Mirror C5PM26-A.
	3 Ignition switch in position II.
 E73717	4 Select the driver side exterior mirror. While operating the exterior mirror switch UP and DOWN, measure the voltage between the driver side exterior mirror C5PM26-A pin 2, circuit CPM03A (BU/WH), harness side and the driver side exterior mirror C5PM26-A pin 3, circuit CPM28A (BU/BN), harness side.
	Is the voltage greater than 10 volts when the exterior mirror switch is moved to the UP position and is the polarity reversed when moved to the DOWN position? **Yes** INSTALL a new driver side exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** GO to B3.
B3: CHECK THE DRIVER SIDE EXTERIOR MIRROR UP/DOWN CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Driver Door Module C5PL01-B.
 E73718	3 Measure the resistance between the driver door module C5PL01-B pin 24, circuit CPM29A (GN), harness side and the driver side exterior mirror C5PM26-A pin 3, circuit CPM28A (BU/BN), harness side.
	Is the resistance less than 5 ohms? **Yes** VERIFY the customer concern. TEST the system for normal operation. **No** REPAIR circuit CPM28A (BU/BN). TEST the system for normal operation.
B4: CHECK THE DRIVER SIDE EXTERIOR MIRROR LEFT/RIGHT CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Driver Side Exterior Mirror C5PM26-A.
	3 Ignition switch in position II.
 E73719	4 Select the driver side exterior mirror. While operating the exterior mirror switch LEFT and RIGHT, measure the voltage between the driver side exterior mirror C5PM26-A pin 1, circuit CPM29A (GN), harness side and the driver side exterior mirror C5PM26-A pin 2, circuit CPM29A (GN), harness side.
	Is the voltage greater than 10 volts when the exterior

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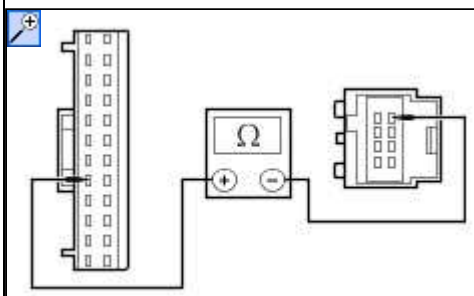
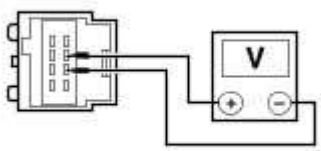
	mirror switch is moved to the LEFT position and is the polarity reversed when moved to the RIGHT position? **Yes** INSTALL a new driver side exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** GO to B5.
B5: CHECK THE DRIVER SIDE EXTERIOR MIRROR LEFT/RIGHT CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Driver Door Module C5PL01-B.
 E73720	3 Measure the resistance between the driver door module C5PL01-B pin 8, circuit CPM29A (GN), harness side and the driver side exterior mirror C5PM26-A pin 1, circuit CPM29A (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** VERIFY the customer concern. TEST the system for normal operation. **No** REPAIR circuit CPM29A (GN). TEST the system for normal operation.
B6: CHECK THE PASSENGER SIDE MIRROR UP/DOWN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Side Exterior Mirror C5PM31-A.
	3 Ignition switch in position II.
 E73717	4 Select the passenger side exterior mirror. While operating the exterior mirror switch UP and DOWN, measure the voltage between the passenger side exterior mirror C5PM31-A pin 2, circuit CPM06A (GN/WH), harness side and the passenger side exterior mirror C5PM31-A pin 3, circuit CPM33A (VT/BK), harness side.
	Is the voltage greater than 10 volts when the exterior mirror switch is moved to the UP position and is the polarity reversed when moved to the DOWN position? **Yes** INSTALL a new passenger side exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** GO to B7.
B7: CHECK THE PASSENGER SIDE MIRROR UP/DOWN CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Door Module C6PL01-B.
	3 Measure the resistance between the passenger door

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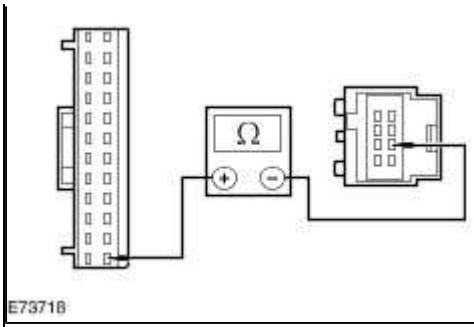
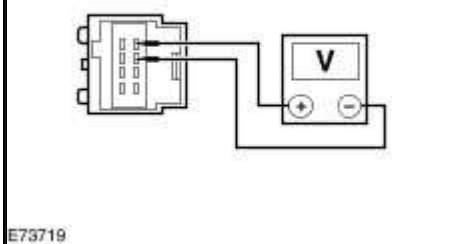
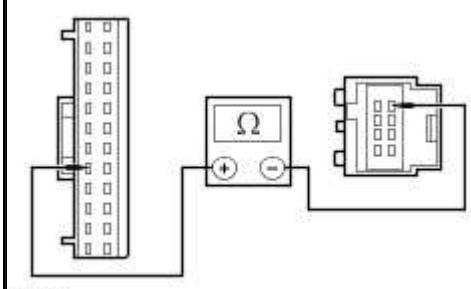
 E73718	module C6PL01-B pin 24, circuit CPM33A (VT/BK), harness side and the passenger side exterior mirror C5PM31-A pin 3, circuit CPM33A (VT/BK), harness side.
	Is the resistance less than 5 ohms? **Yes** VERIFY the customer concern. TEST the system for normal operation. **No** REPAIR circuit CPM33A (VT/BK). TEST the system for normal operation.
B8: CHECK THE PASSENGER SIDE EXTERIOR MIRROR LEFT/RIGHT CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Side Exterior Mirror C5PM31-A.
	3 Ignition switch in position II.
 E73719	4 Select the passenger side exterior mirror. While operating the exterior mirror switch LEFT and RIGHT, measure the voltage between the passenger side exterior mirror C5PM31-A pin 1, circuit CPM34A (WH/BN), harness side and the passenger side exterior mirror C5PM31-A pin 2, circuit CPM06A (GN/WH), harness side.
	Is the voltage greater than 10 volts when the exterior mirror switch is moved to the LEFT position and is the polarity reversed when moved to the RIGHT position. **Yes** INSTALL a new passenger side exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** GO to B9.
B9: CHECK THE PASSENGER SIDE EXTERIOR MIRROR LEFT/RIGHT CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Door Module C6PL01-B.
 E73720	3 Measure the resistance between the passenger door module C6PL01-B pin 8, circuit CPM34A (WH/BN), harness side and the passenger side exterior mirror C5PM31-A pin 1, circuit CPM34A (WH/BN), harness side.
	Is the resistance less than 5 ohms? **Yes** VERIFY the customer concern. TEST the system for normal operation.

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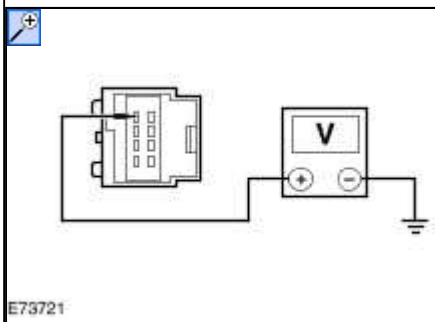
	No REPAIR circuit CPM34A (WH/BN). TEST the system for normal operation.

PINPOINT TEST C : THE HEATED EXTERIOR MIRROR IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE OPERATION OF THE HEATED REAR WINDOW	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position III.
	2 Ignition switch in position II.
	3 Operate the heated rear window switch.
	Does the heated rear window function correctly? **Yes** GO to C2. **No** REPAIR the heated rear window. REFER to: Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms, Diagnosis and Testing). TEST the system for normal operation.
C2: CHECK THE VOLTAGE TO THE INOPERATIVE EXTERIOR MIRROR	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Exterior Mirror C5PM26-A or C5PM31-A.
	3 Ignition switch in position III.
	4 Ignition switch in position II.
	5 Operate the heated rear window switch.
 E73721	6 Measure the voltage between the: • Driver side exterior mirror C5PM26-A pin 5, circuit CRD13A (GN/VT), harness side and ground. • Passenger side exterior mirror C5PM31-A pin 5, circuit CRD14A (WH/OG), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to C3. **No** REPAIR circuit CRD13A (GN/VT) or circuit CRD14A (WH/OG). TEST the system for normal operation.
C3: CHECK THE INOPERATIVE EXTERIOR MIRROR GROUND CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Mirror Door Module C5PL01-B or C6PL01-B.
	3 Measure the resistance between the: • Driver side exterior mirror C5PM26-A pin 5, circuit CRD13A (GN/VT), harness side and the driver side door module C5PL01-B pin 10, circuit CRD13A (GN/VT). • Passenger side exterior mirror C5PM31-A pin 5, circuit CRD14A (WH/OG), harness side and the passenger side door module C6PL01-B pin 10,

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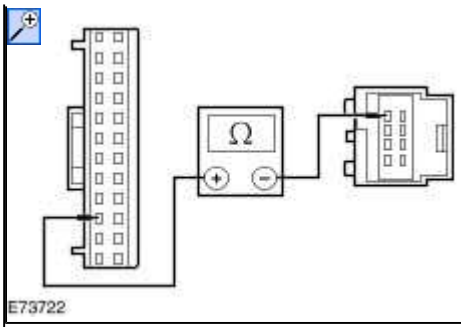
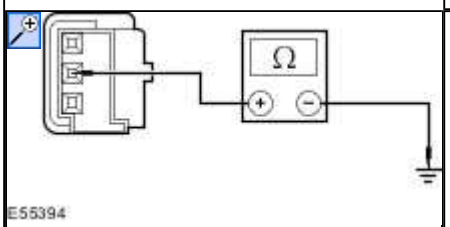
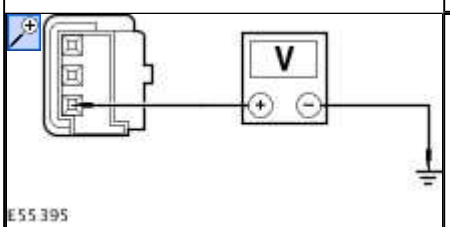
	circuit CRD14A (WH/OG).
	Is the resistance less than 5 ohms? operation. **Yes** INSTALL a new heated exterior mirror glass. TEST the system for normal operation. **No** REPAIR circuit CRD13A (GN/VT) or circuit CRD14A (WH/OG). TEST the system for normal operation.

PINPOINT TEST D : THE AUTO DIMMING MIRROR DOES NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK FOR CONTINUITY BETWEEN THE AUTO-DIMMING INTERIOR MIRROR AND GROUND	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Disconnect Auto-dimming Interior Mirror C9PM05.
	2 Measure the resistance between the auto-dimming interior mirror C9PM05 pin 2, circuit GD138AA (BK/WH), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to D2. **No** REPAIR circuit 91-AD15 (BK/OG). TEST the system for normal operation.
D2: CHECK THE VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
	1 Ignition switch in position II.
	2 Measure the voltage between the auto-dimming interior mirror C9PM05 pin 1, circuit B_CBP04A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D3. **No** REPAIR circuit B_CBP04A (VT). TEST the system for normal operation.
D3: CHECK THE REVERSE CUT-OUT VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
	1 Select N (NEUTRAL).
	2 Measure the voltage between the auto-dimming interior mirror C9PM05 pin 3, circuit RRD12A (BN), harness side

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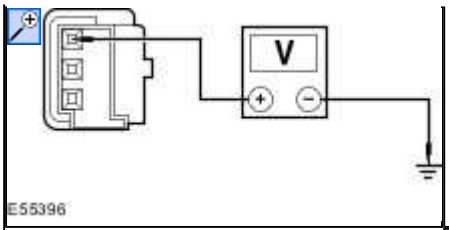
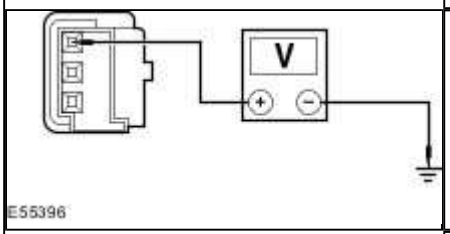
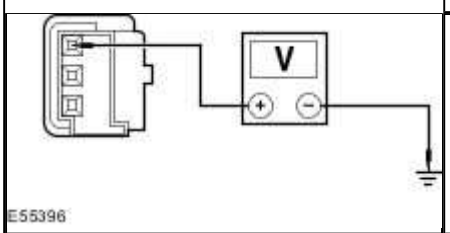
 E55396	and ground.
	Is any voltage present? **Yes** GO to D4. **No** GO to D5.
D4: CHECK FOR VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
	1 Ignition switch in position 0.
	2 Disconnect Transmission Switch C1ET47-A-1 or Transmission Switch C1ET47-C-1.
	3 Ignition switch in position II.
 E55396	4 Measure the voltage between the auto-dimming interior mirror C9PM05 pin 3, circuit RRD12A (BN), harness side and ground.
	Is any voltage present? **Yes** INSTALL a new transmission switch. TEST the system for normal operation. **No** REPAIR circuit RRD12A (BN). TEST the system for normal operation.
D5: CHECK THE REVERSE CUT-OUT VOLTAGE TO THE AUTO-DIMMING INTERIOR MIRROR	
	1 Select R (REVERSE).
 E55396	2 Measure the voltage between the auto-dimming interior mirror C9PM05 pin 3, circuit RRD12A (BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new auto-dimming interior mirror. REFER to: Interior Rear View Mirror - Vehicles With: Rain Sensor/Autolamps (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit RRD12A (BN). TEST the system for normal operation.

PINPOINT TEST E : THE POWER FOLDING MIRRORS DO NOT OPERATE/DO NOT OPERATE CORRECTLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE POWER FOLDING MIRRORS FOLD CIRCUIT	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Disconnect Driver Door Module C5PL01-B or

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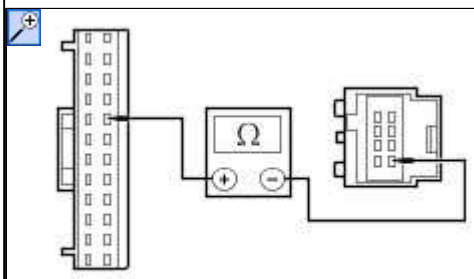
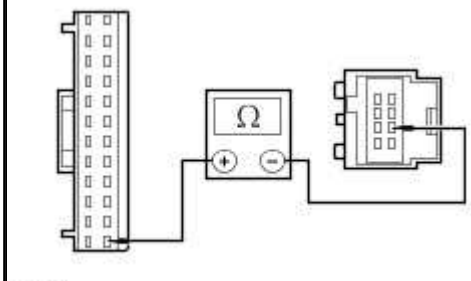
	Passenger Door Module C6PL01-B.
	2 Disconnect Driver Side Exterior Mirror C5PM26-A or Passenger Side Exterior Mirror C5PM31-A.
 E73723	3 Measure the resistance between the: • Driver door module C5PL01-B pin 17, circuit CPM04A (VT/BN), harness side and the power folding mirror motor C5PM26-A pin 4, circuit CPM04A (VT/BN), harness side. • Passenger door module C6PL01-B pin 17, circuit CPM07A (BN), harness side and the power folding mirror motor C5PM31-A pin 4, circuit CPM07A (BN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to E2. **No** Driver side - REPAIR circuit CPM04A (VT/BN). TEST the system for normal operation. Passenger side - REPAIR circuit CPM07A (BN). TEST the system for normal operation.
E2: CHECK THE POWER FOLDING MIRRORS UNFOLD CIRCUIT	
 E73718	1 Measure the resistance between the: • Driver door module C5PL01-B pin 24, circuit CPM28A (BU/BN), harness side and the power folding mirror motor C5PM26-A pin 3, circuit CPM28A (BU/BN), harness side. • Passenger door module C6PL01-B pin 24, circuit CPM33A (VT/BK), harness side and the power folding mirror motor C5PM31-A pin 3, circuit CPM33A (VT/BK), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new power folding exterior mirror. REFER to: Exterior Mirror (501-09 Rear View Mirrors, Removal and Installation). TEST the system for normal operation. **No** Driver side - REPAIR circuit CPM28A (BU/BN). TEST the system for normal operation. Passenger side - REPAIR circuit CPM33A (VT/BK). TEST the system for normal operation.

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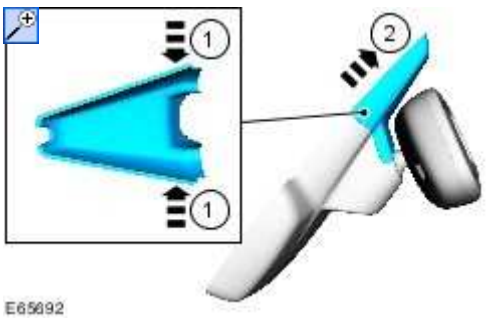
Removal and Installation

Removal

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

All vehicles



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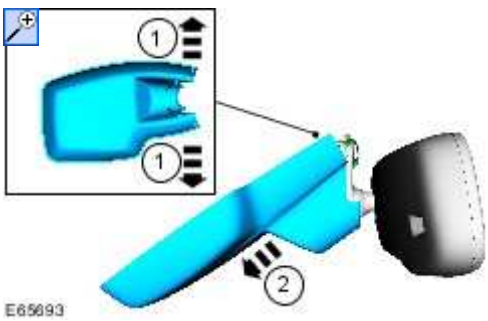
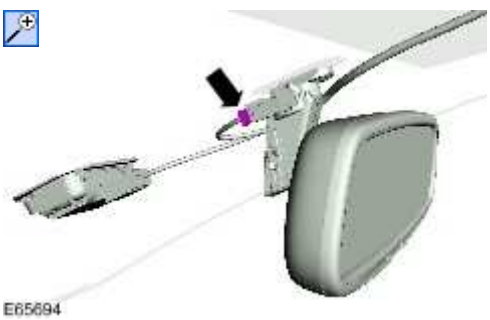


2.

Vehicles with auto-dimming interior mirror



3.

All vehicles

4.

Installation

1. To install, reverse the removal procedure.

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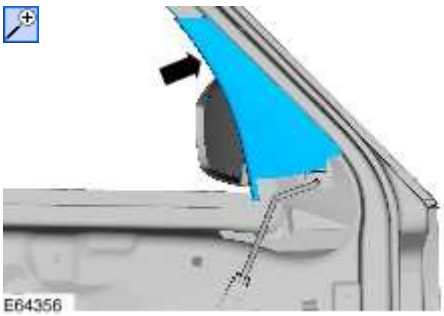
Removal and Installation

Removal

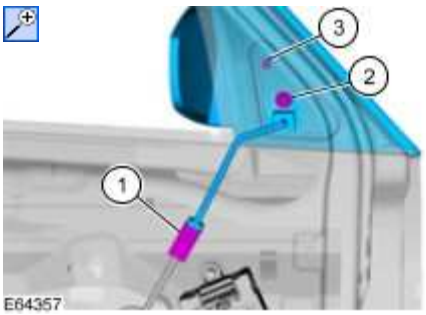
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.



3.
   2. *Torque:* 20 Nm

Installation

1. To install, reverse the removal procedure.

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Description and Operation

The front seats have a side air bag and height adjustable head restraint. Depending on the vehicle specification, either 2-way or 4-way adjustable head restraints are installed as an option. Multimedia display screens may be installed as an option on 4-way head restraints only.

Depending on the vehicle specification, the front seats may be equipped with any one or combination of the following:

- manual or power seat height adjustment
- forward and rearward track movement
- backrest recline
- backrest rear mounted picnic tray
- manually adjustable lumbar mat
- armrest
- heated cushion and backrest
- heated and ventilated cushion and backrest
- stowage tray, CD or DVD changer located under the seat

Depending on the specification, vehicles may have 3 rows of seats, the second row of seats have forward/rearward and recline adjustment. The outer seats of the 2nd row have easy vehicle entry functionality. Forward/rearward and recline adjustment of the 3rd row seats is dependant on vehicle specification.

All vehicle 2nd row outer seats each have ISOFIX child seat mountings and a top tether.

Rear seat head restraints must be raised when the seats are occupied and must be lowered for seat stowage.

The vehicle owner's guide provides detailed information on the movement sequence and retaining features for the seats.

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Description and Operation

General

Side airbags and height adjustable head restraints are installed as standard equipment. Depending on the vehicle specification, either 2-way or 4-way adjustable head restraints are installed as an option. Multimedia display screens may be installed as an option on 4-way head restraints only.

Depending on the vehicle specification, the front seats may be equipped with any one or combination of the following:

- manual or power seat height adjustment
- Seat rails, forward and rearward motion
- backrest recline
- backrest rear mounted picnic tray
- manually adjustable lumbar mat
- armrest
- heated cushion and backrest
- heated and ventilated cushion and backrest
- stowage tray, CD or DVD changer located under the seat

Depending on the specification, vehicles may have 3 rows of seats, the second row of seats have forward/rearward and recline adjustment. The outer seats of the 2nd row have easy vehicle entry functionality. Forward/rearward and recline adjustment of the 3rd row seats is dependant on vehicle specification.

All vehicle 2nd row outer seats each have ISOFIX child seat mountings and a top tether.

Always move the head restraints to the raised position if the rear seat is occupied by a passenger or is used for a child restraint system. The rear head restraints must be lowered to allow the seat to be folded down.

Driver's seat with 8-way seat adjustment

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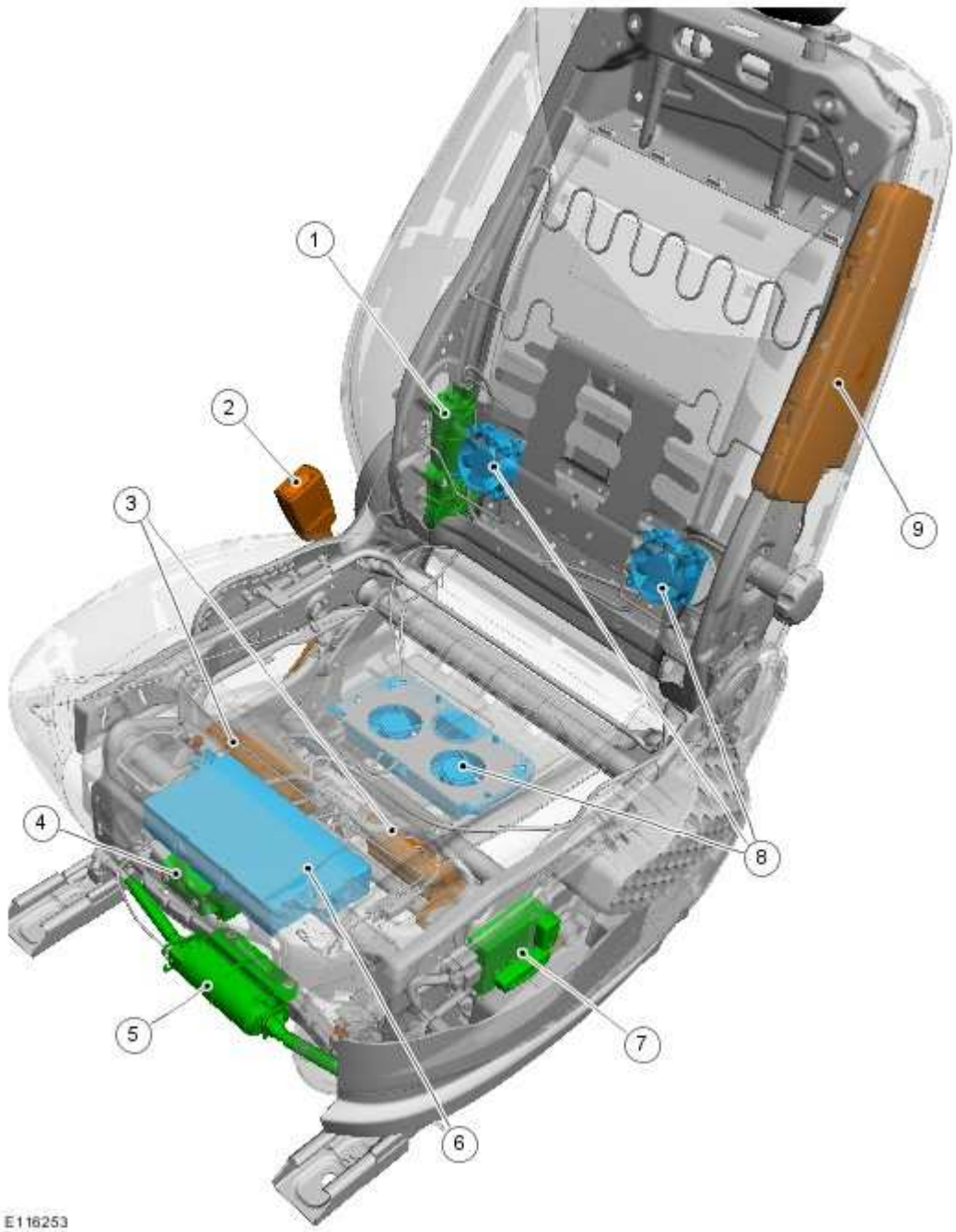

Item	Description
1	Servo motor, electrically adjustable backrest
2	Front belt buckle Refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).
3	Servo motors, seat height and seat angle electric adjustment
4	Heated Seat Module
5	Servo motor, forward and rearward motion
6	Power seat module
7	Switch group for electrically adjustable driver's seat
8	Blower motors, front seat
9	Side airbag Refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS)

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(501-20B Supplemental Restraint System, Description and Operation).

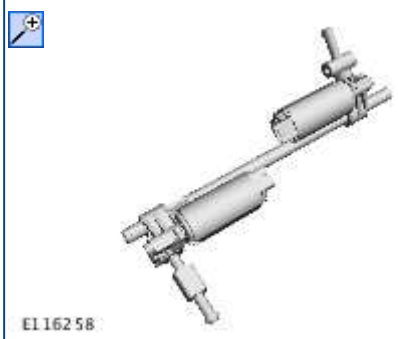
Servo motor, electrically adjustable backrest

The electrically adjustable backrest servo motor consists of a DC motor with integral gearing (worm gear) and thermal cutout. If the servo motor stops under braking or jams, an internal thermal cut-out is tripped to interrupt the power supply to the servo motor.

Servo motor, seat rails, forward and rearward motion

The forward/back servo motor for the seat comprises a DC motor with thermal cutout. If the servo motor stops under braking or jams, an internal thermal cut-out is tripped to interrupt the power supply to the servo motor.

Servo motors, seat height and seat angle electric adjustment



The electrically adjustable seat height and seat angle servo motors consist of two DC motors with integral gearing (worm gear) and thermal cutout. If one of the servo motors stops under braking or jams, an internal thermal cut-out is tripped to interrupt the power supply to the servo motor.

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Diagnosis and Testing

For Wiring Schematics and Connector Information, refer to the Wiring Diagram Cell 501-10.

Principals of Operation

The vehicle is equipped with either manually adjusted seats, bidirectional power height adjusted seats or full eight-way power adjusted seats for both driver and passenger. Vehicles equipped with the full eight-way power seat functionality are controlled by a single multifunction switch. In each power seat the switch is mounted onto the seat base panel within easy reach of the occupant.

Seats with power height adjustment retain manual adjustment controls to attain seat adjustment. The bidirectional switch controls the operation of a single motor which depending on switch operation will either raise or lower the seat height through a series of mechanical linkages.

Seats with full eight-way adjustment are able to adjust the seat position through any one of four different motors. Each seat function is controlled by a single multifunction switch, which in turn controls the operation of the bidirectional motor of the selected adjustment feature to achieve:

- Vertical adjustment of the front of the seat cushion;
- Vertical adjustment of the rear of the seat cushion;
- Horizontal seat movement along the seat track through a mechanical worm drive;
- Seat backrest position adjustment of the backrest rake angle.

The driver seat with full eight-way power adjusted seats may have an option of driver seat memory. This option has an eight-way memory seat switch, additional memory motors and a memory module.

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Damaged switch(es). • Obstruction of ventilated seat air intake.	• Fuse(s). • Wiring harness. • Electrical connector(s). • Motor(s). • Switch(es).

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
The power seat is inoperative	* Seat switch.	* CARRY OUT the Seat Switch Component Test. REFER to the Wiring

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		Diagrams.
	* Circuit(s). * Motor(s).	* GO to Pinpoint Test A.
The power seat does not move horizontally	* Seat switch.	* CARRY OUT the Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s). * Motor(s).	* GO to Pinpoint Test B.
The power seat does not move vertically	* Seat switch.	* CARRY OUT the Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s). * Motor(s)	* GO to Pinpoint Test C.
The power seat does not recline	* Seat switch.	* CARRY OUT the Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit. * Motor.	* GO to Pinpoint Test D.
The heated seats are inoperative	* Heated seat switch(es).	* CARRY OUT the Heated Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test E.
The heated seat is inoperative	* Heated seat switch(es).	* CARRY OUT the Heated Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test F.
All climate controlled seats are inoperative/do not operate correctly	* Heated seat switch(es).	* CARRY OUT the Heated Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test G.
A single climate controlled seat is inoperative/does not operate correctly	* Heated seat switch(es).	* CARRY OUT the Heated Seat Switch Component Test. REFER to the Wiring Diagrams.
	* Circuit(s).	* GO to Pinpoint Test H.

Pinpoint Tests

PINPOINT TEST A : THE POWER SEAT IS INOPERATIVE - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK WHETHER DRIVER SEAT MEMORY INSTALLED	
	1 Ignition switch in position 0.
	Does the vehicle have driver seat memory? **Yes** GO to A2. **No** GO to A4.
A2: CHECK THE VOLTAGE TO THE DRIVER SEAT MEMORY SWITCH	
	1 Disconnect Driver Seat Memory Switch C3HS03 or C3HS08.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the voltage between the: • Driver seat memory switch C3HS03 pin 11, circuit C_SBR07A (WH/RD) harness side and ground.

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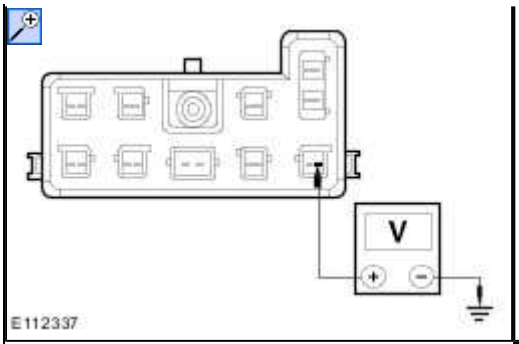
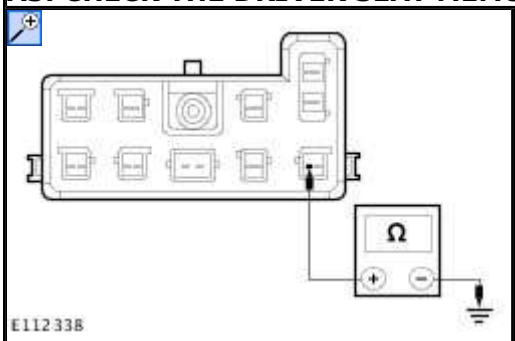
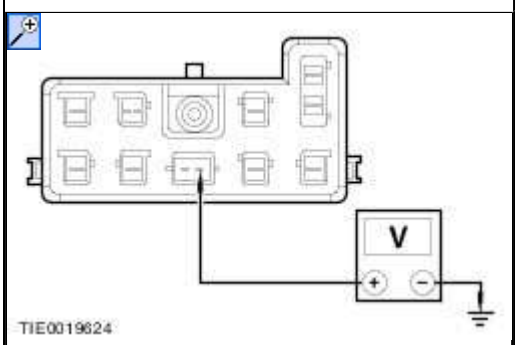
 E112337	• or • Driver seat memory switch C3HS08 pin 11, circuit VR212A (YE/GN) harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** REPAIR circuit C_SBR07A (WH/RD) or circuit VR212A (YE/GN). TEST the system for normal operation.
A3: CHECK THE DRIVER SEAT MEMORY SWITCH GROUND CIRCUIT FOR CONTINUITY	
 E112338	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Driver seat memory switch C3HS03 pin 12, circuit GD135R (BK/GY) harness side and ground. • or • Driver seat memory switch C3HS08 pin 12, circuit RR155B (GY) harness side and ground.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new driver seat memory switch. TEST the system for normal operation. **No** REPAIR circuit GD135R (BK/GY) or circuit RR155B (GY). TEST the system for normal operation.
A4: CHECK THE VOLTAGE TO THE POWER SEAT SWITCH	
	1 Disconnect Inoperative Power Seat Switch C3HS03 or C3HS08.
 TIE0019624	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the voltage between the: • Left-hand power seat switch C3HS03 pin 15, circuit SBR10A (YE/RD) harness side and ground. • or • Right-hand power seat memory switch C3HS08 pin 15, circuit B_SBR09A (RD) harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A5. **No** REPAIR circuit SBR10A (YE/RD) or circuit B_SBR09A (RD). TEST the system for normal operation.
A5: CHECK THE POWER SEAT SWITCH GROUND CIRCUIT FOR CONTINUITY	
	1 Ignition switch in position 0.
	NOTE: Carry out the measurements on the

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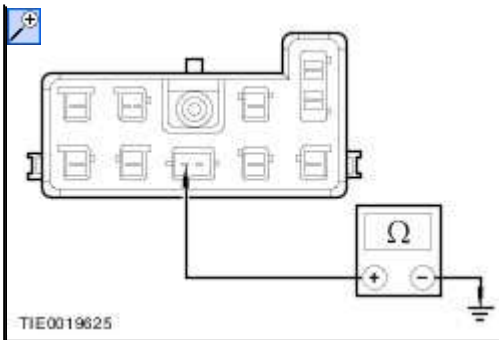
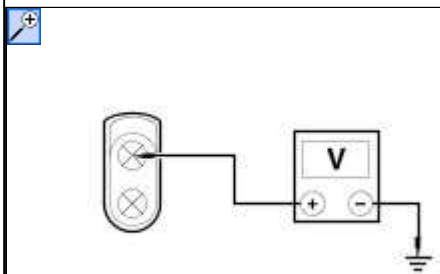
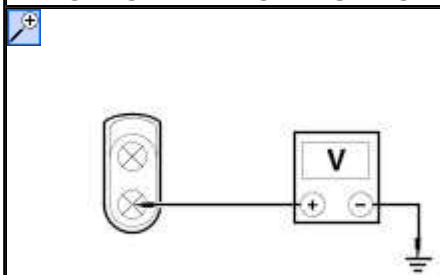
 TIE0019625	inoperative seat. 2 Measure the resistance between the: • Left-hand power seat switch C3HS03 pin 16, circuit GD134A (BK/VT) (LHD) or circuit GD140C (BK/GN) (RHD) harness side and ground. • or • Right-hand power seat switch C3HS08 pin 16, circuit GD140Q (BK/GN) (LHD) or circuit GD134G (BK/VT) (RHD) harness side and ground.
	Is the resistance less than 5 ohms? **Yes** Eight-way power seat - INSTALL a new power seat switch. Two-way power seat - INSTALL a new power seat switch and motor. **No** REPAIR circuit GD134A (BK/VT), circuit GD140C (BK/GN), circuit GD140Q (BK/GN) or circuit GD134G (BK/VT). TEST the system for normal operation.

PINPOINT TEST B : THE POWER SEAT DOES NOT MOVE HORIZONTALLY - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE VOLTAGE TO THE SEAT HORIZONTAL MOTOR	
	1 Detach the seat assembly from the floor.
	2 Disconnect Power Seat Horizontal Motor or Power Seat Horizontal Memory Motor.
 TIE0019632	NOTE: Carry out the measurements on the inoperative seat. 3 While operating the power seat switch, measure the voltage between the: • Power seat horizontal motor connector pin 1, harness side and ground. • or • Power seat horizontal memory motor connector pin 1, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to B2. **No** REPAIR circuit. TEST the system for normal operation.
B2: CHECK THE VOLTAGE TO THE SEAT HORIZONTAL MOTOR	
 TIE0019633	NOTE: Carry out the measurements on the inoperative seat. 1 While operating the power seat switch, measure the voltage between the: • Power seat horizontal motor connector pin 2, harness side and ground. • or • Power seat horizontal memory motor connector pin 2, harness side and ground.
	Is the voltage greater than 10 volts?

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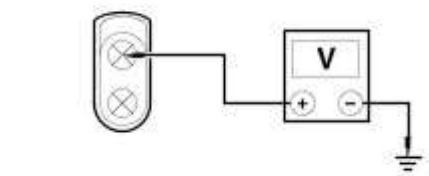
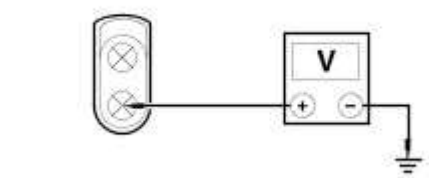
	Yes INSTALL a new seat horizontal motor. TEST the system for normal operation.orINSTALL a new seat horizontal memory module and motor. TEST the system for normal operation. **No** REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST C : THE POWER SEAT DOES NOT MOVE VERTICALLY	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE SEAT HEIGHT MOTORS - FRONT SEAT	
	1 Adjust the front seat height up and down.
	Do both seat height motors operate? **Yes** VERIFY the customer concern. **No** If the front seat front height motor is inoperative - GO to C2. If the front seat rear height motor is inoperative - GO to C4.
C2: CHECK THE VOLTAGE TO THE SEAT FRONT HEIGHT MOTOR	
	1 Detach the seat assembly from the floor.
	2 Disconnect Power Seat Front Height Motor or Power Seat Front Height Memory Motor.
 TIE0019632	NOTE: Carry out the measurements on the inoperative seat. 3 While operating the power seat switch to the DOWN position, measure the voltage between the: • Power seat switch pin 9, harness side and ground. • or • Power seat memory switch pin 9, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to C3. **No** REPAIR circuit. TEST the system for normal operation.
C3: CHECK THE VOLTAGE TO THE SEAT FRONT HEIGHT MOTOR	
 TIE0019633	NOTE: Carry out the measurements on the inoperative seat. 1 While operating the power seat switch to the UP position, measure the voltage between the: • Power seat switch pin 10, harness side and ground. • or • Power seat memory switch pin 10, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new seat front height motor. TEST the system for normal operation.orINSTALL a new seat front height memory motor and module. TEST the

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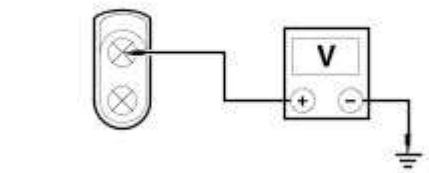
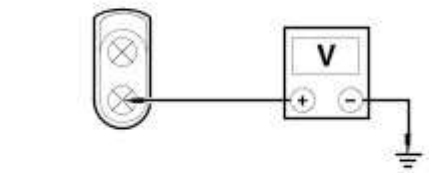
	system for normal operation. **No** REPAIR circuit. TEST the system for normal operation.
C4: CHECK THE VOLTAGE TO THE SEAT REAR HEIGHT MOTOR	
	1 Detach the seat assembly from the floor.
	2 Disconnect Power Seat Rear Height Motor or Power Seat Rear Height Memory Motor.
 TIE0019632	NOTE: Carry out the measurements on the inoperative seat. 3 While operating power seat switch to the DOWN position, measure the voltage between the: • Power seat switch pin 7, harness side and ground. • or • Power seat memory switch pin 7, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to C5. **No** REPAIR circuit. TEST the system for normal operation.
C5: CHECK THE VOLTAGE TO THE SEAT REAR HEIGHT MOTOR	
 TIE0019633	NOTE: Carry out the measurements on the inoperative seat. 1 While operating power seat switch to the UP position, measure the voltage between the: • Power seat switch pin 8, harness side and ground. • or • Power seat memory switch pin 8, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new seat rear height motor. TEST the system for normal operation.orINSTALL a new seat rear height memory motor and module. TEST the system for normal operation. **No** REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST D : THE POWER SEAT DOES NOT RECLINE - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE VOLTAGE TO THE SEAT BACKREST MOTOR	
	1 Detach the seat assembly from the floor.
	2 Disconnect Power Seat Backrest Motor.
	NOTE: Carry out the measurements on the inoperative seat. 3 While operating the power seat switch to the REARWARD position, measure the voltage between the:

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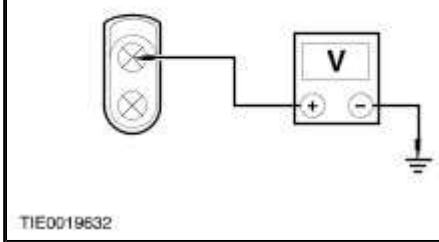
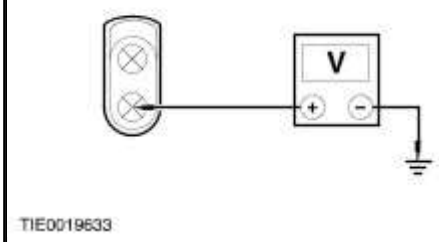
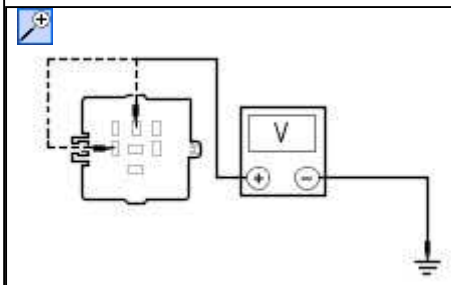
 TIE0019632	• Power seat switch pin 1, harness side and ground. • or • Power seat memory switch pin 1, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D2. **No** REPAIR circuit. TEST the system for normal operation.
D2: CHECK THE VOLTAGE TO THE SEAT BACKREST MOTOR	
 TIE0019633	NOTE: Carry out the measurements on the inoperative seat. 1 While operating the power seat switch to the FORWARD position, measure the voltage between the: • Power seat switch pin 6, harness side and ground. • or • Power seat memory switch pin 6, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new seat backrest motor. REFER to: Front Seat Backrest (501-10 Seating, Disassembly and Assembly). TEST the system for normal operation.orINSTALL a new seat backrest memory motor and module. REFER to: Front Seat Backrest (501-10 Seating, Disassembly and Assembly). TEST the system for normal operation. **No** REPAIR circuit. TEST the system for normal operation.

PINPOINT TEST E : THE HEATED SEATS ARE INOPERATIVE - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK FOR BATTERY VOLTAGE TO THE HEATED SEAT RELAY	
	1 Disconnect Rear Junction Box Relay RB1.
 E75688	2 Measure the voltage between the: • Rear junction box relay RB1 pin 1, circuit SBB19A (BU/RD), harness side and ground. • and • Rear junction box relay RB1 pin 3, circuit SBB20P (GN/RD), harness side and ground.
	Is the voltage greater than 10 volts?

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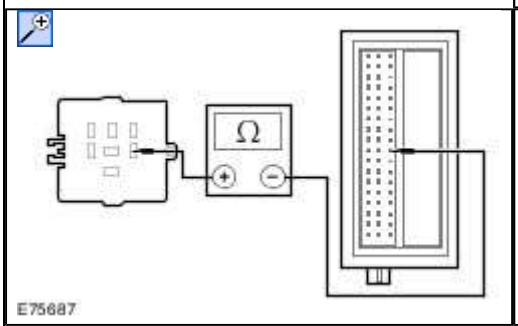
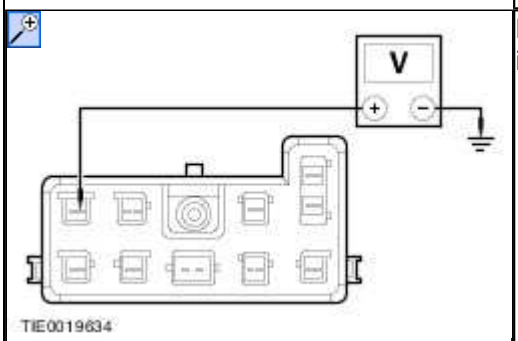
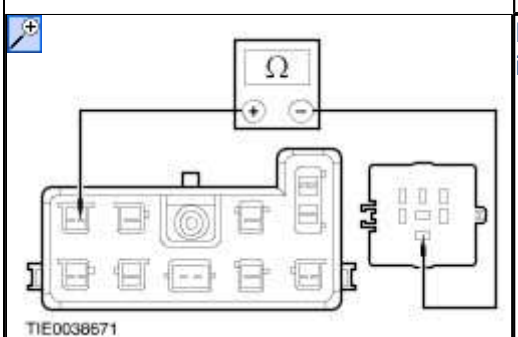
	Yes GO to E2. **No** REPAIR circuit SBB19A (BU/RD) or circuit SBB20P (GN/RD). TEST the system for normal operation.
E2: CHECK THE HEATED SEAT RELAY CONTROL CIRCUIT FOR OPEN CIRCUIT	
	1 Disconnect Central Junction Box (CJB) C1BP02-B.
	2 Measure the resistance between the rear junction box relay RB1 pin 2, circuit CDC03A (BU), harness side and the CJB pin 45, circuit CDC03A (BU), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new rear junction box relay RB1. If the problem persists, GO to E3. **No** REPAIR circuit CDC03A (BU). TEST the system for normal operation.
E3: CHECK FOR VOLTAGE TO THE INOPERATIVE HEATED SEAT	
	1 Disconnect Inoperative Power Seat C3HS03 or C3HS08.
	2 Ignition switch in position II.
	NOTE: Carry out the measurements on the inoperative seat. 3 Measure the voltage between the: • Front left heated seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side and ground. • or • Front right heated seat C3HS08 pin 9, circuit B_CBR04A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to E5. **No** GO to E4.
E4: CHECK FOR CONTINUITY BETWEEN THE HEATED SEAT RELAY AND THE HEATED SEAT MODULE	
	1 Ignition switch in position 0.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the resistance between the: • Rear junction box relay RB1 pin 5, circuit B_CBR03A (GY), harness side and the climate controlled seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side. • or • Rear junction box relay RB1 pin 5, circuit B_CBR04A (VT), harness side and the climate controlled seat C3HS08 pin 9, circuit B_CBR04A

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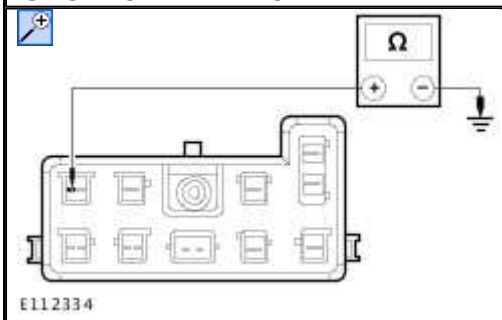
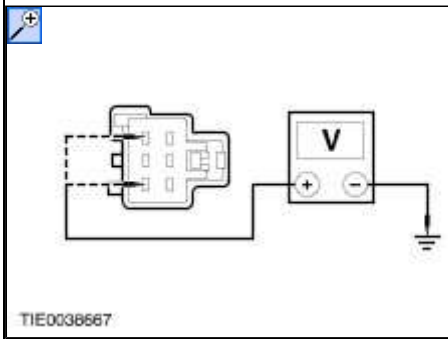
	(VT), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to E5. **No** REPAIR circuit B_CBR03A (GY) or circuit B_CBR04A (VT). TEST the system for normal operation.
E5: CHECK THE INOPERATIVE HEATED SEAT FOR GROUND	
	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Front left heated seat C3HS03 pin 10, circuit GD134C (BK/VT), harness side and ground (LHD). • and • Front left heated seat C3HS03 pin 10, circuit GD140B (BK/GN), harness side and ground (RHD). • or • Front right heated seat C3HS08 pin 10, circuit GD140T (BK/GN), harness side and ground (LHD). • and • Front right heated seat C3HS08 pin 10, circuit GD134J (BK/VT), harness side and ground (RHD).
	Is the resistance less than 5 ohms? **Yes** GO to E6. **No** REPAIR the relevant circuit
E6: CHECK FOR VOLTAGE TO THE HEATED SEAT SWITCH	
	1 Disconnect Heated Seat Switch C3HS29.
	2 Ignition switch in position II.
	3 Measure the voltage between the: • Heated seat switch C3HS29 pin 4, circuit CBP04F (VT), harness side and ground. • and • Heated seat switch C3HS29 pin 6, circuit SBP07D (WH/RD), harness side and ground.
	Are the voltages greater than 10 volts? **Yes** GO to E7. **No** REPAIR circuit CBP04F (VT) or circuit SBP07D (WH/RD). TEST the system for normal operation.
E7: CHECK THE HEATED SEAT SWITCH GROUND CIRCUIT	
	1 Measure the resistance between the heated seat switch C3HS29 pin 1, circuit GD133AP (BK), harness side and ground.

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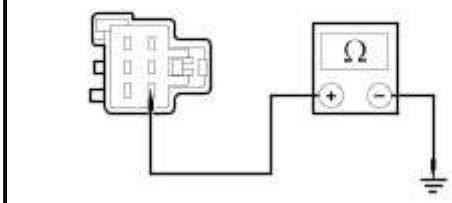
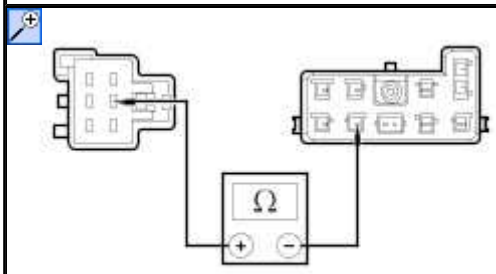
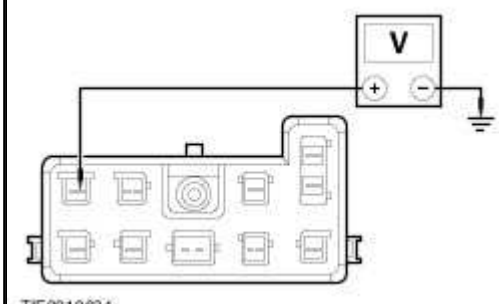
	
	Is the resistance less than 5 ohms? **Yes** GO to E8. **No** REPAIR circuit GD133AP (BK). TEST the system for normal operation.
E8: CHECK FOR CONTINUITY BETWEEN THE HEATED SEAT SWITCH AND THE HEATED SEAT	
	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Front left heated seat C3HS03 pin 17, circuit CHS32C (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side. • or • Front right heated seat C3HS08 pin 17, circuit CHS32A (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new front seat cushion heater mat. TEST the system for normal operation. **No** REPAIR circuit CHS32A (BN), circuit CHS32B (BN) or circuit CHS32C (BN). TEST the system for normal operation.

PINPOINT TEST F : THE HEATED SEAT IS INOPERATIVE - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK FOR VOLTAGE TO THE INOPERATIVE HEATED SEAT	
	1 Disconnect Inoperative Power Seat C3HS03 or C3HS08.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the voltage between the: • Front left heated seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side and ground. • or • Front right heated seat C3HS08 pin 9, circuit B_CBR04A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes**

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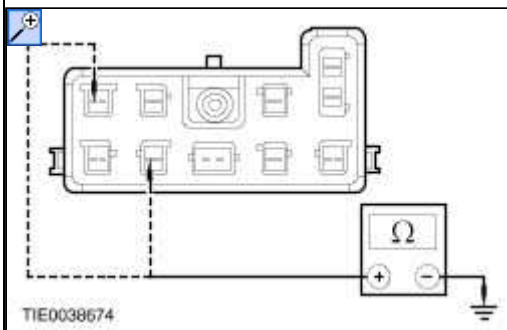
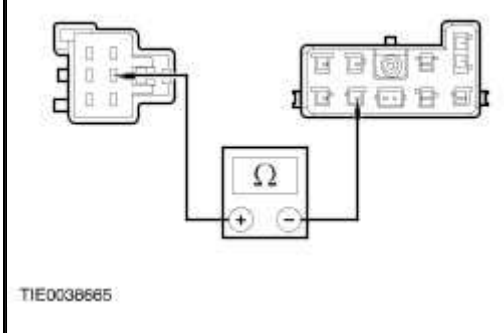
	GO to F2. **No** REPAIR circuit B_CBR03A (GY) or circuit B_CBR04A (VT). TEST the system for normal operation.
F2: CHECK THE INOPERATIVE HEATED SEAT GROUND CIRCUIT	
	1 Ignition switch in position 0.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the resistance between the: • Front left heated seat C3HS03 pin 10, circuit GD134C (BK/VT), harness side and ground (LHD). • and • Front left heated seat C3HS03 pin 10, circuit GD140B (BK/GN), harness side and ground (RHD). • and • Front left heated seat C3HS03 pin 18, circuit GD135J (BK/GY), harness side and ground (LHD). • or • Front right heated seat C3HS08 pin 10, circuit GD140T (BK/GN), harness side and ground (LHD). • and • Front right heated seat C3HS08 pin 10, circuit GD134J (BK/VT), harness side and ground (RHD). • and • Front right heated seat C3HS08 pin 18, circuit GD135S (BK/GY), harness side and ground (RHD).
	Is the resistance(s) less than 5 ohms? **Yes** GO to F3. **No** REPAIR circuit GD134C (BK/VT), circuit GD140B (BK/GN), circuit GD135J (BK/GY), circuit GD140T (BK/GN), circuit GD134J (BK/VT), or circuit GD145D (BK/BU). TEST the system for normal operation.
F3: CHECK CONTINUITY BETWEEN THE HEATED SEAT SWITCH AND THE HEATED SEAT	
	1 Disconnect Heated Seat Switch C3HS29.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the resistance between the: • Front left heated seat C3HS03 pin 17, circuit CHS32C (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side. • or • Front right heated seat C3HS08 pin 17, circuit CHS32A (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side.
	Is the resistance less than 5 ohms? **Yes**

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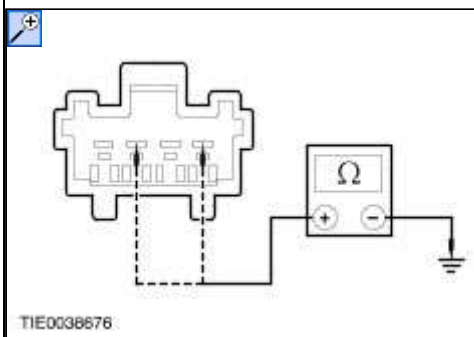
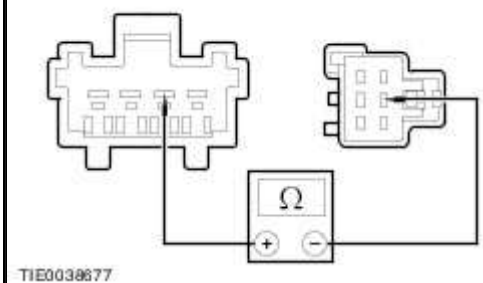
	GO to F4. **No** REPAIR circuit CHS32A (BN), or circuit CHS32B (BN), or circuit CHS32C (BN). TEST the system for normal operation.
F4: CHECK THE INOPERATIVE HEATED SEAT MODULE GROUND CIRCUIT	
	1 Disconnect Inoperative Heated Seat Module.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the resistance between the: • Front left heated seat module pin 2, circuit GD149R (BK/GY), harness side and ground. • and • Front left heated seat module pin 4, circuit GD149R (BK/GY), harness side and ground. • or • Front right heated seat module pin 2, circuit GD151D (BK/GN), harness side and ground. • and • Front right heated seat module pin 4, circuit GD151D (BK/GN), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** GO to F5. **No** INSTALL a new seat wiring sub-harness. TEST the system for normal operation.
F5: CHECK FOR CONTINUITY BETWEEN THE HEATED SEAT SWITCH AND THE INOPERATIVE HEATED SEAT MODULE	
	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Front left heated seat module pin 3, circuit CHS32A (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side. • or • Front right heated seat module pin 3, circuit CHS32A (BN), harness side and the heated seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to F6. **No** INSTALL a new seat wiring sub-harness. TEST the system for normal operation.
F6: CHECK FOR VOLTAGE TO THE INOPERATIVE HEATED SEAT MODULE	
	1 Ignition switch in position II.
	NOTE: Carry out the measurements on the inoperative seat. 2 Measure the voltage between the: • Front left heated heated seat module pin 1,

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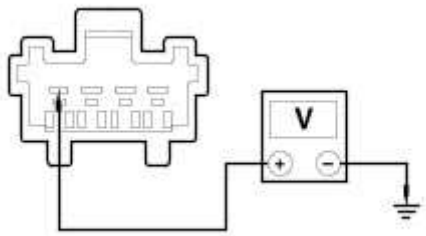
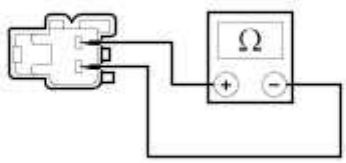
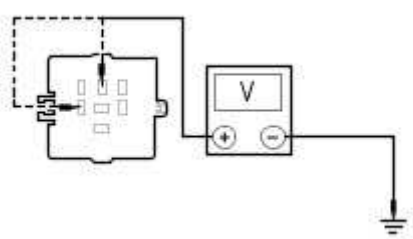
 TIE0038678	harness side and ground. • Front right heated seat module pin 1, harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to F7. **No** INSTALL a new seat wiring sub-harness. TEST the system for normal operation.
F7: CHECK THE INOPERATIVE HEATED SEAT BACKREST HEATER MAT FOR CONTINUITY	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Heated Seat Backrest.
 TIE0038679	NOTE: Carry out the measurements on the inoperative seat. 3 Measure the resistance between the: • Left front heated seat backrest pin 1 and pin 2, component side. • or • Right front heated seat backrest pin 1 and pin 2, component side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new heated seat module and cushion heater mat. TEST the system for normal operation. **No** INSTALL a new heated seat backrest heater mat. REFER to: Front Seat Backrest Heater Mat (501-10, Removal and Installation). TEST the system for normal operation.

PINPOINT TEST G : ALL CLIMATE CONTROLLED SEATS ARE INOPERATIVE/DO NOT OPERATE CORRECTLY - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK FOR BATTERY VOLTAGE TO THE CLIMATE CONTROLLED SEAT RELAY	
	1 Disconnect Rear Junction Box Relay RB1.
 E75688	2 Measure the voltage between the: • Rear junction box relay RB1 pin 1, circuit SBB19A (BU/RD), harness side and ground. • and • Rear junction box relay RB1 pin 3, circuit SBB20P (GN/RD), harness side and ground.
	Is the voltage greater than 10 volts?

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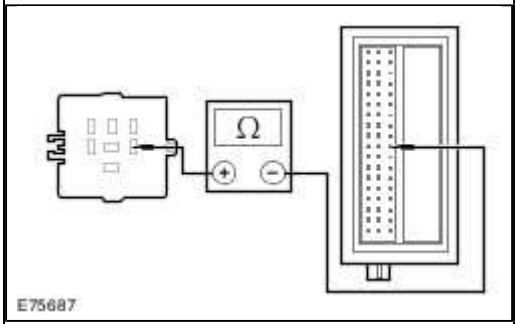
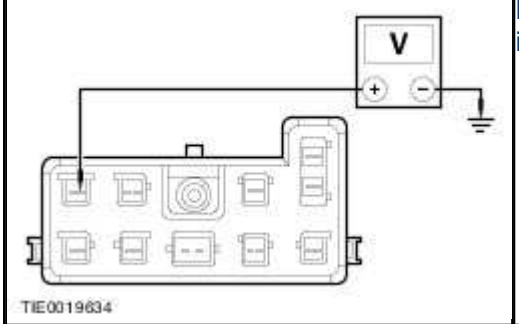
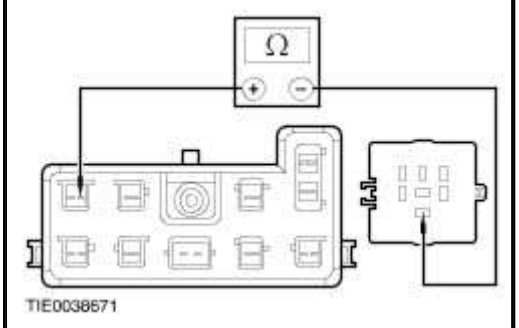
	Yes GO to G2. **No** REPAIR circuit SBB19A (BU/RD) or circuit SBB20P (GN/RD). TEST the system for normal operation.
G2: CHECK THE CLIMATE CONTROLLED SEAT RELAY GROUND CIRCUIT	
	1 Disconnect Central Junction Box (CJB) C1BP02-B.
	2 Measure the resistance between the rear junction box relay RB1 pin 2, circuit CDC03A (BU), harness side and the CJB pin 45, circuit CDC03A (BU), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new rear junction box relay RB1. If the problem persists, GO to G3. **No** REPAIR circuit CDC03A (BU). TEST the system for normal operation.
G3: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT	
	1 Disconnect Inoperative Power Seat C3HS03 or C3HS08.
	2 Ignition switch in position II.
	NOTE: Carry out the measurements on the inoperative seat. 3 While operating the climate controlled seat switch, measure the voltage between the: • Front left climate controlled seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side and ground. • or • Front right climate controlled seat C3HS08 pin 9, circuit B_CBR04A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to G5. **No** GO to G4.
G4: CHECK FOR CONTINUITY BETWEEN THE CLIMATE CONTROLLED SEAT RELAY AND THE CLIMATE CONTROLLED SEAT	
	1 Measure the resistance between the: • Rear junction box relay RB1 pin 5, circuit B_CBR03A (GY), harness side and the climate controlled seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side. • and • Rear junction box relay RB1 pin 5, circuit B_CBR04A (VT), harness side and the climate controlled seat C3HS08 pin 9, circuit B_CBR04A (VT), harness side.
	Is the resistance less than 5 ohms? **Yes**

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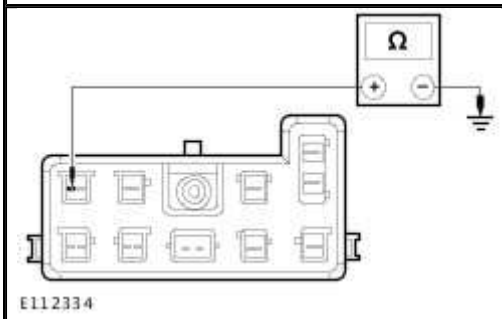
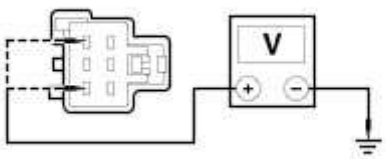
	GO to G5. **No** REPAIR circuit B_CBR03A (GY) or circuit B_CBR04A (VT). TEST the system for normal operation.
G5: CHECK THE INOPERATIVE CLIMATE CONTROLLED SEAT FOR GROUND	
	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Front left heated seat C3HS03 pin 10, circuit GD134C (BK/VT), harness side and ground (LHD). • and • Front left heated seat C3HS03 pin 10, circuit GD140B (BK/GN), harness side and ground (RHD). • or • Front right heated seat C3HS08 pin 10, circuit GD140T (BK/GN), harness side and ground (LHD). • and • Front right heated seat C3HS08 pin 10, circuit GD134J (BK/VT), harness side and ground (RHD).
	Is the resistance less than 5 ohms? **Yes** GO to G6. **No** REPAIR the relevant circuit
G6: CHECK FOR VOLTAGE TO THE CLIMATE CONTROLLED SEAT SWITCH	
	1 Disconnect Climate Controlled Seat Switch C3HS29.
	2 Ignition switch in position II.
	3 Measure the voltage between the: • Climate controlled seat switch C3HS29 pin 4, circuit CBP04F (VT), harness side and ground. • and • Climate controlled seat switch C3HS29 pin 6, circuit SBP07D (WH/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to G7. **No** REPAIR circuit CBP04F (VT) or circuit SBP07D (WH/RD). TEST the system for normal operation.
G7: CHECK THE CLIMATE CONTROLLED SEAT SWITCH GROUND CIRCUIT	
	1 Measure the resistance between the climate controlled seat switch C3HS29 pin 1, circuit GD133AP (BK), harness side and ground.

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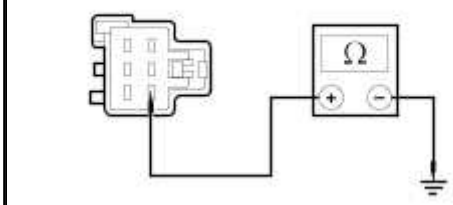
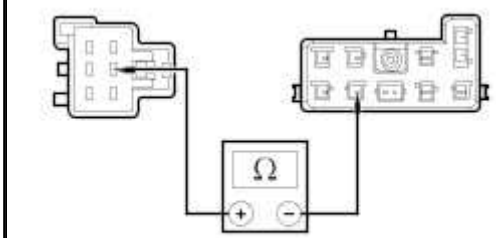
 TIE0038666	
	Is the resistance less than 5 ohms? **Yes** GO to G8. **No** REPAIR circuit GD133AP (BK). TEST the system for normal operation.
G8: CHECK FOR CONTINUITY BETWEEN THE CLIMATE CONTROLLED SEAT SWITCH AND THE CLIMATE CONTROLLED SEAT	
 TIE0038665	NOTE: Carry out the measurements on the inoperative seat. 1 Measure the resistance between the: • Front left climate controlled seat C3HS03 pin 17, circuit CHS32C (BN), harness side and the climate controlled seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side. • or • Front right climate controlled seat C3HS08 pin 17, circuit CHS32A (BN), harness side and the climate controlled seat switch C3HS29 pin 2, circuit CHS32B (BN), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new climate controlled seat module and cushion heater mat. **No** REPAIR circuit CHS32A (BN), circuit CHS32B (BN) or circuit CHS32C (BN). TEST the system for normal operation.

PINPOINT TEST H : A SINGLE CLIMATE CONTROLLED SEAT IS INOPERATIVE/DOES NOT OPERATE CORRECTLY - FRONT SEAT	
NOTE: Use a digital multimeter for all electrical measurements.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE CLIMATE CONTROLLED SEAT HEATER OPERATION	
	1 Ignition switch in position II.
	2 Operate the climate controlled seat switch.
	Do the climate controlled seat heater mats operate correctly? **Yes** GO to H2. **No** GO to H3.
H2: CHECK THE CLIMATE CONTROLLED SEAT FAN OPERATION	
	1 Operate the climate controlled seat fan switch.
	Does the climate controlled seat fan(s) operate correctly? **Yes**

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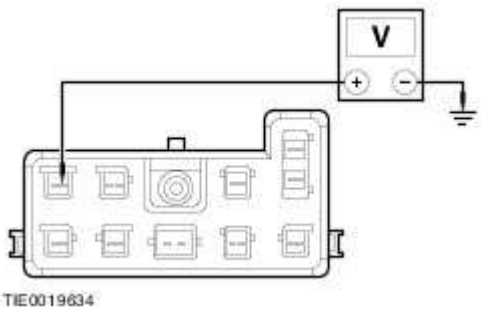
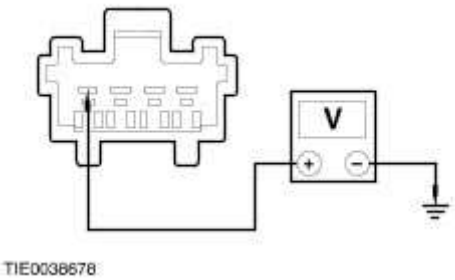
	VERIFY the customer concern. **No** For seat cushion fan inoperative GO to H8. For seat backrest fan inoperative GO to H10.
H3: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT	
	1 Disconnect Inoperative Power Seat C3HS03 or C3HS08.
	2 Ignition switch in position II.
	NOTE: Carry out the measurements on the inoperative seat. 3 While operating the climate controlled seat switch, measure the voltage between the: • Front left climate controlled seat C3HS03 pin 9, circuit B_CBR03A (GY), harness side and ground. • or • Front right climate controlled seat C3HS08 pin 9, circuit B_CBR04A (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to H4. **No** REPAIR circuit B_CBR03A (GY) or circuit B_CBR04A (VT). TEST the system for normal operation.
H4: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT HEATER MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Seat Heater Module.
	3 Ignition switch in position II.
	4 While operating the climate controlled seat switch, measure the voltage between the inoperative seat heater module electrical connector pin 1, (GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to H5. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.
H5: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Climate Controlled Seat Module.
	3 Ignition switch in position II.
	4 While operating the climate controlled seat switch, measure the voltage between the inoperative climate controlled seat module pin 9, (GN), harness side and ground.

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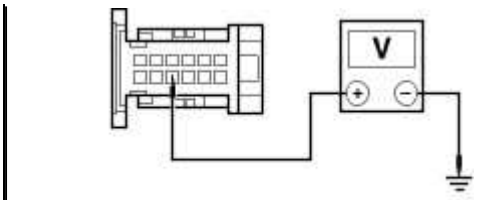
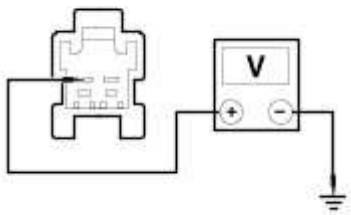
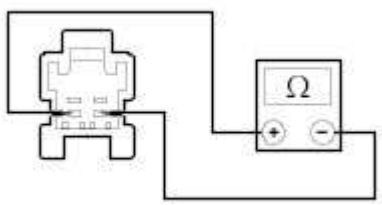
 E0038681	
	Is the voltage greater than 10 volts? **Yes** GO to H6. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.
H6: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT BACKREST HEATER MAT	
	1 Ignition switch in position 0.
	2 Connect Inoperative Climate Contolled Seat Module.
	3 Disconnect Inoperative Front Seat Backrest Heater Mat.
	4 Ignition switch in position II.
 TIE0038707	5 While operating the climate controlled seat switch, measure the voltage between the front seat backrest heater mat connector pin 1, (RD/BK), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to H7. **No** INSTALL a new heated seat module and cushion heater mat. TEST the system for normal operation.
H7: CHECK THE INOPERATIVE CLIMATE CONTROLLED SEAT HEATED SEAT BACKREST HEATER MAT FOR CONTINUITY	
	1 Ignition switch in position 0.
 TIE0038708	2 Measure the resistance between the front seat backrest connector pin 1 (RD/BK), component side and connector pin 2 (BK), component side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new heated seat module and cushion heater mat. TEST the system for normal operation. **No** INSTALL a new front seat backrest heater mat. REFER to: Front Seat Backrest Heater Mat (501-10,

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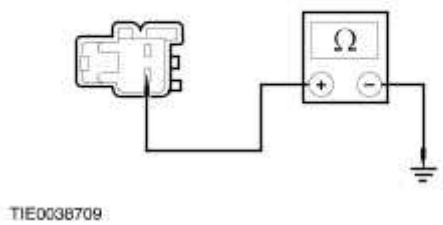
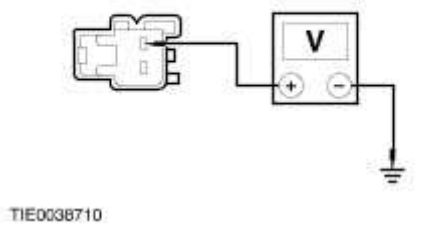
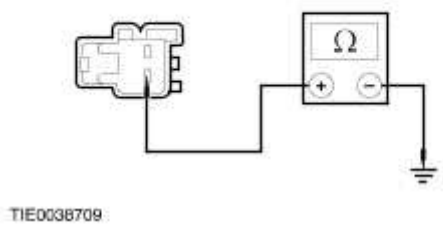
	Removal and Installation). TEST the system for normal operation.
H8: CHECK THE INOPERATIVE CLIMATE CONTROLLED SEAT FRONT SEAT CUSHION FAN GROUND CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Front Seat Cushion Fan.
	3 Measure the resistance between the front seat cushion fan connector pin 2, (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to H9. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.
H9: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT FRONT SEAT CUSHION FAN	
	1 Ignition switch in position II.
	2 While operating the climate controlled seat switch, measure the voltage between the front seat cushion fan connector pin 1, (RD), harness side and ground.
	Is the voltage greater than 6 volts? **Yes** INSTALL new climate controlled front seat cushion fan. TEST the system for normal operation. **No** GO to H12.
H10: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT HEATER MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Front Seat Backrest Fan.
	3 Measure the resistance between the front seat backrest fan connector pin 2, (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes**

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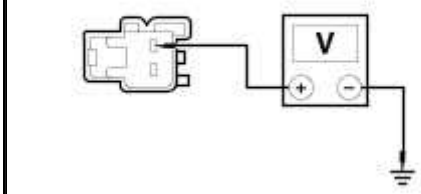
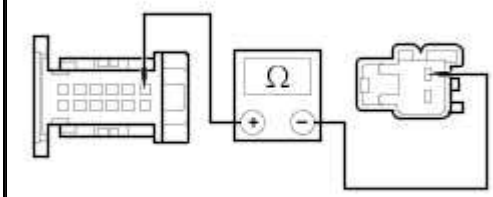
	GO to H11. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.
H11: CHECK FOR VOLTAGE TO THE INOPERATIVE CLIMATE CONTROLLED SEAT FRONT SEAT BACKREST FAN	
	1 Ignition switch in position II.
 TIE0038710	2 While operating the climate controlled seat switch, measure the voltage between the front seat backrest fan connector pin 1, (RD/BK), harness side and ground.
	Is the voltage greater than 6 volts? **Yes** INSTALL new climate controlled front seat backrest fan. REFER to: Front Seat Backrest (501-10 Seating, Disassembly and Assembly). TEST the system for normal operation. **No** GO to H13.
H12: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE CLIMATE CONTROLLED SEAT CUSHION FANS AND THE CLIMATE CONTROLLED SEAT MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Climate Controlled Seat Module.
 E0038711	3 Measure the resistance between the climate controlled seat module connector pin 6, (RD), harness side and the front seat cushion fan connector pin 1, (RD), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new climate controlled seat module. TEST the system for normal operation. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.
H13: CHECK FOR CONTINUITY BETWEEN THE INOPERATIVE CLIMATE CONTROLLED SEAT BACKREST FANS AND THE CLIMATE CONTROLLED SEAT MODULE	
	1 Ignition switch in position 0.
	2 Disconnect Inoperative Climate Controlled Seat Module.
	3 Measure the resistance between the climate controlled seat control module connector pin 1, (BK/RD), harness side and the front seat backrest fan connector pin 1, (RD/BK), harness side.

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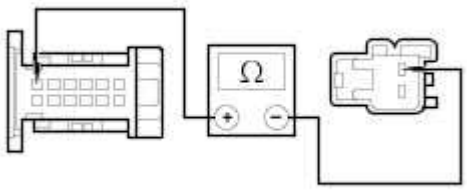 TIE0038712	
	Is the resistance less than 5 ohms? **Yes** INSTALL a new climate controlled seat module. TEST the system for normal operation. **No** INSTALL a new climate controlled seat wiring harness. TEST the system for normal operation.

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Removal and Installation

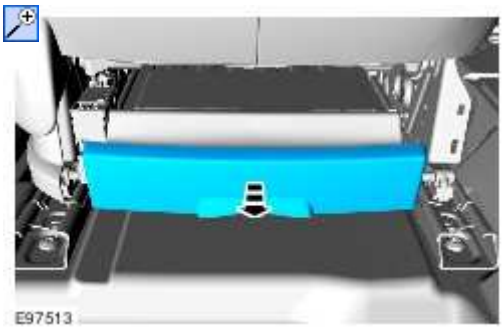
Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

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



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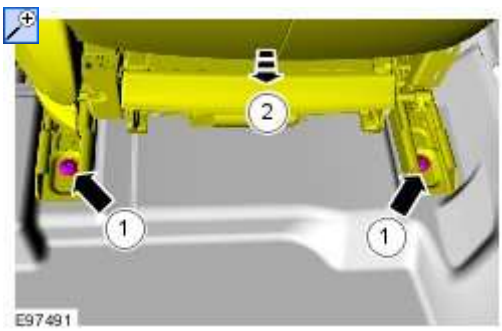
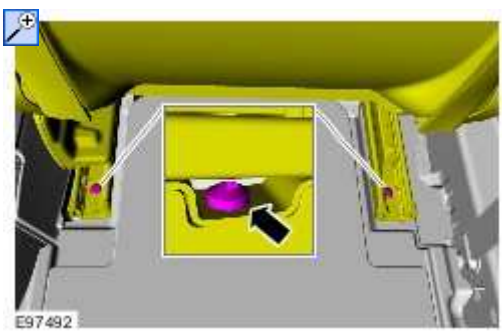


2. *Torque:* 40 Nm

3. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



4. *Torque:* 40 Nm

5.

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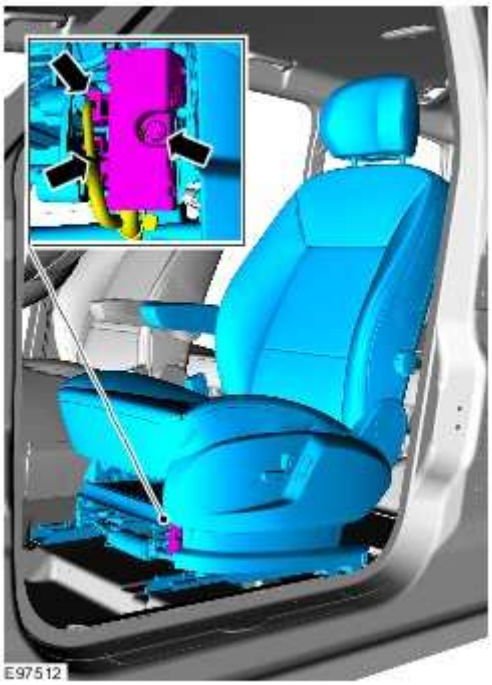

Installation

1. To install, reverse the removal procedure.

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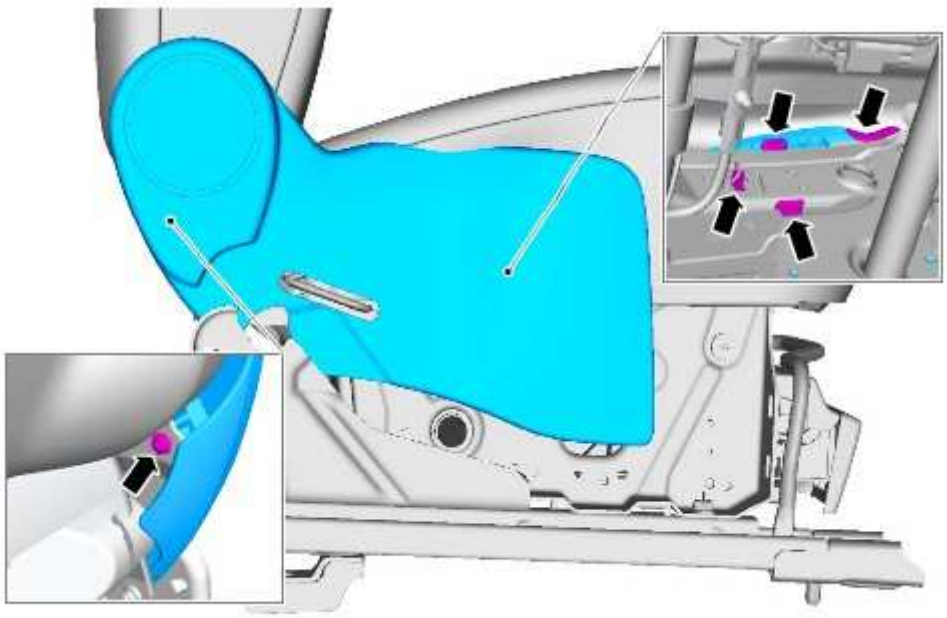
Removal and Installation

Removal

1. Refer to: Front Seat (501-10 Seating, Removal and Installation).

2.



E72293

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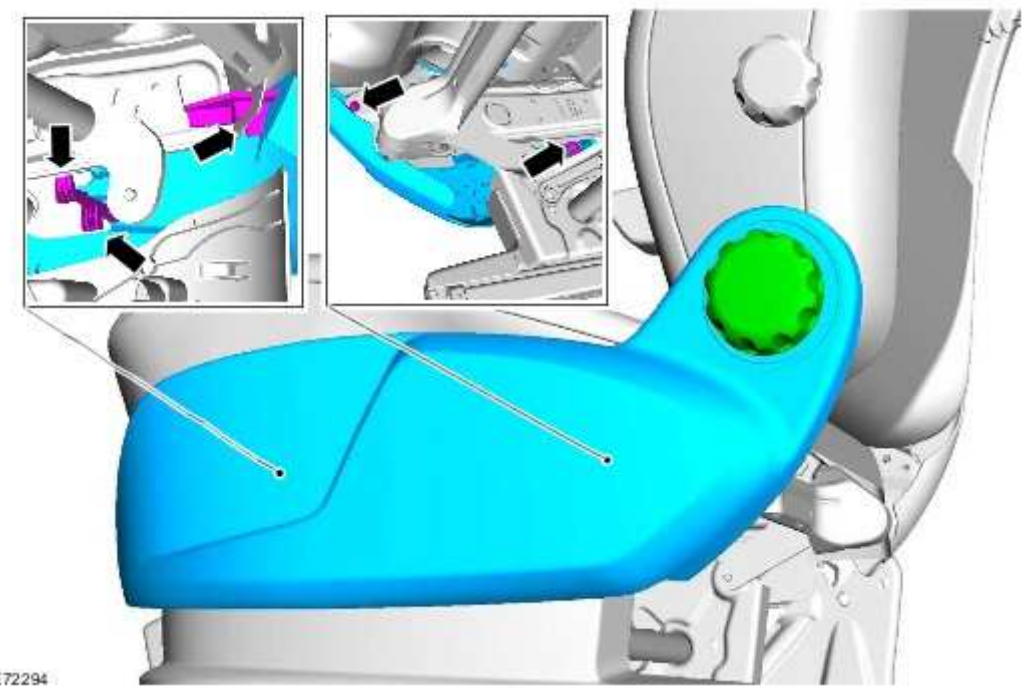


E72294

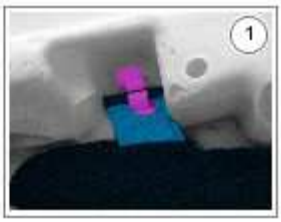
4.

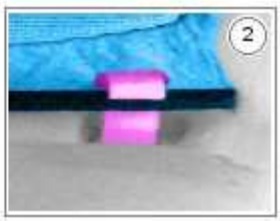
http://vnx.su

E72760

5.

E95751





Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

1.

E118570

Installation

1. To install, reverse the removal procedure.

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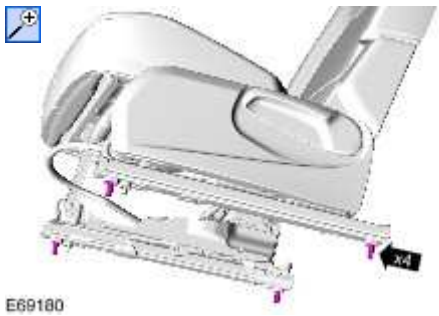
Removal and Installation

Removal



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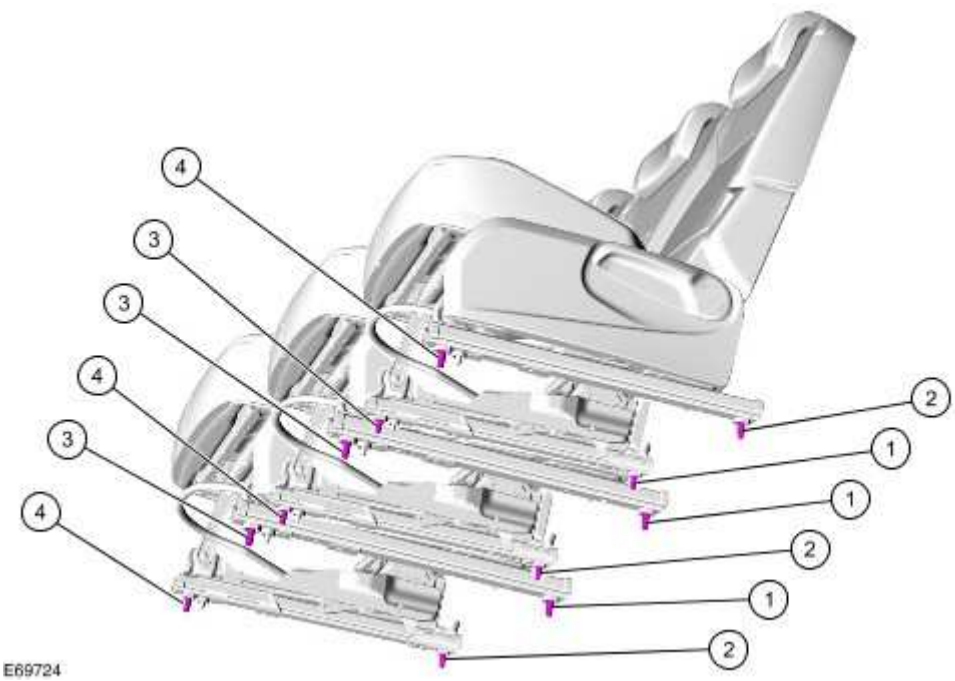
Installation



1. *Torque:* 40 Nm

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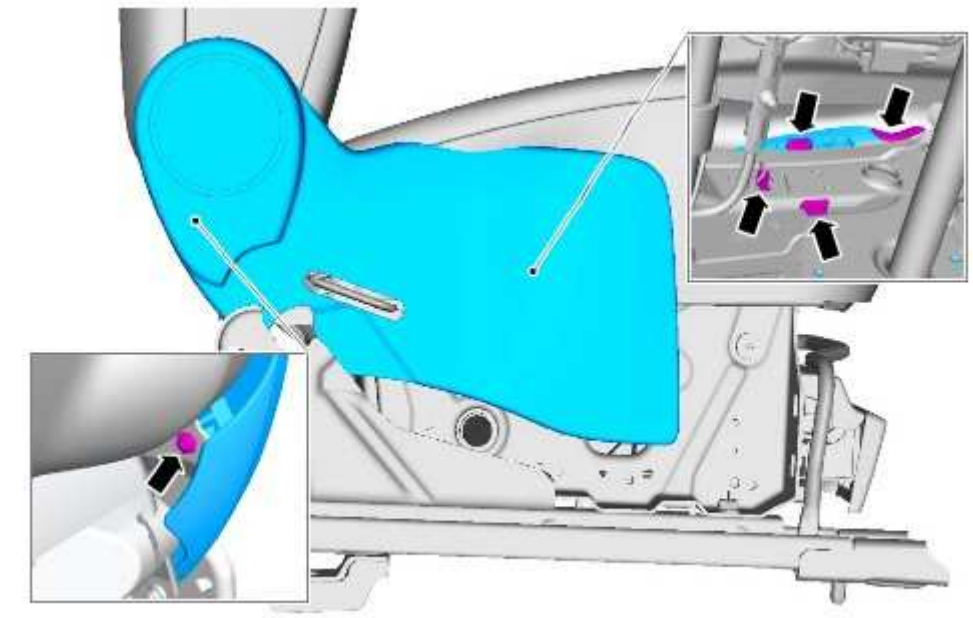
Removal and Installation

Removal

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

1. Refer to: Front Seat (501-10 Seating, Removal and Installation).

2.



E72293

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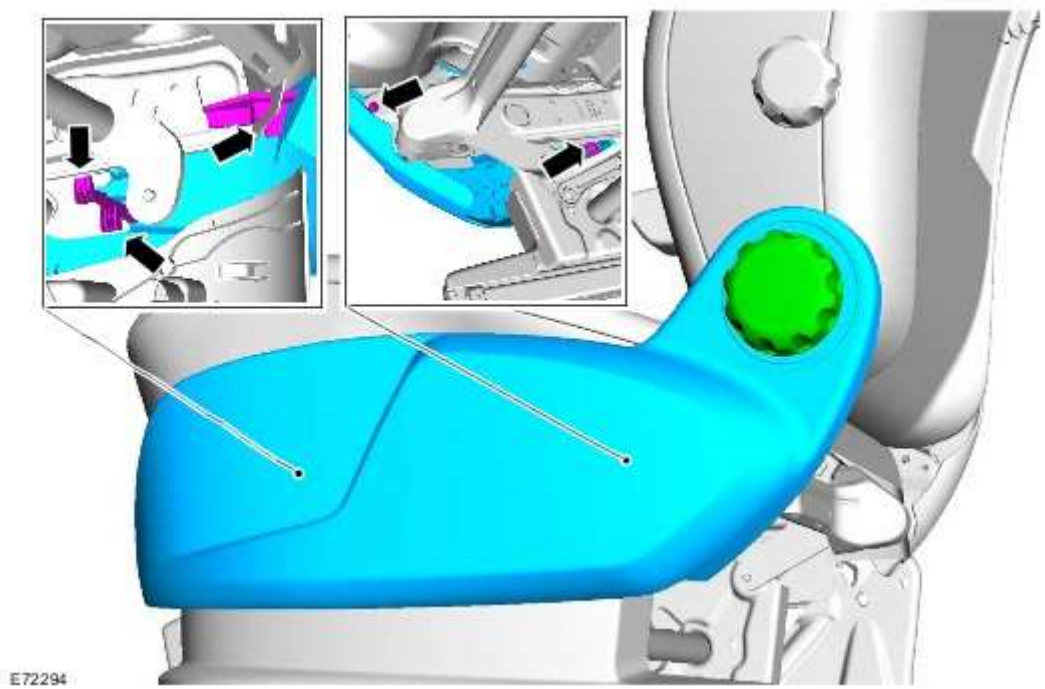

E72294

4.

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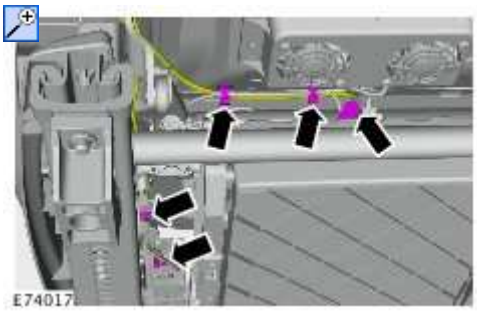

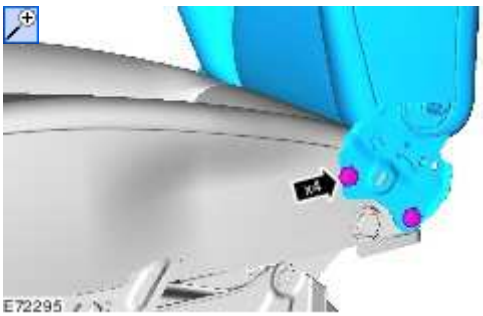

5. *Torque:* 45 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

6 mm drill bit
Blind rivet gun

Removal

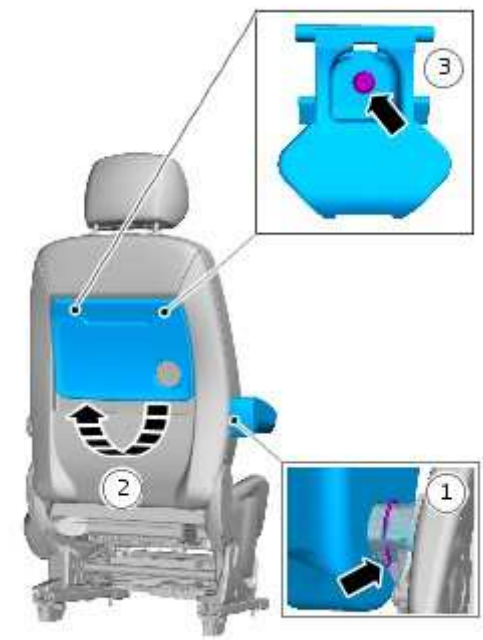
WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

1. Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3.
   1. If equipped.
   3. *General Equipment:* 6 mm drill bit
      General Equipment: Blind rivet gun



4.
   3. If equipped.

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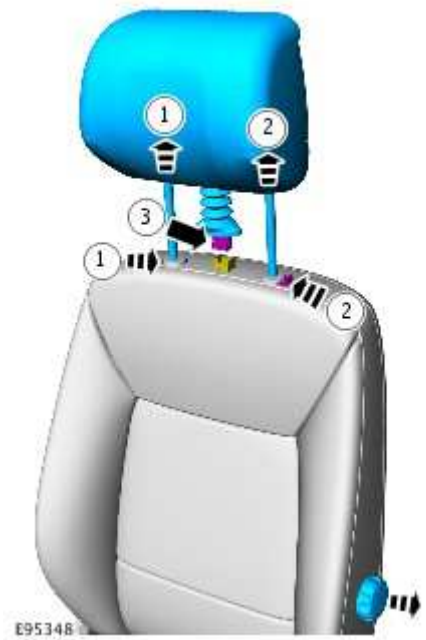

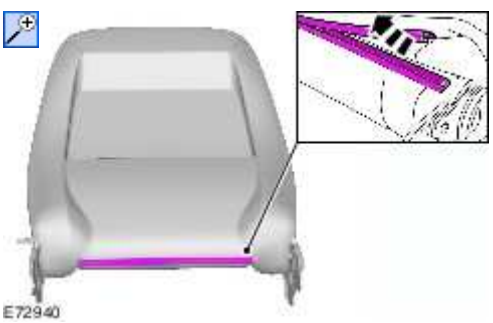

5.

6.

7.

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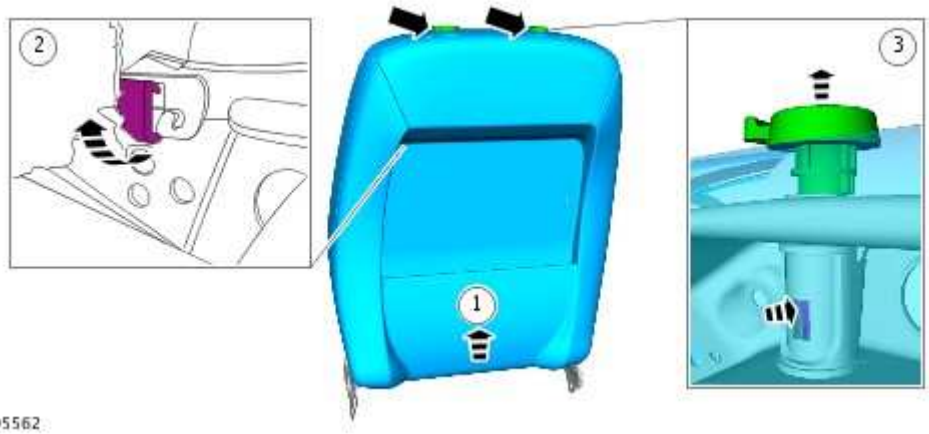

E95562

Installation

1. To install, reverse the removal procedure.

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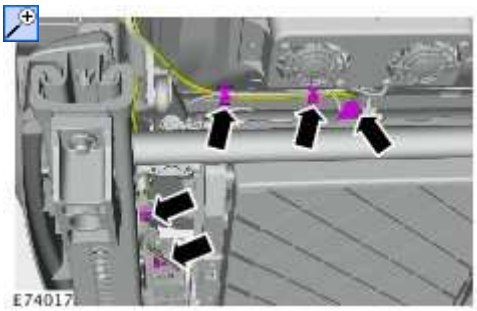
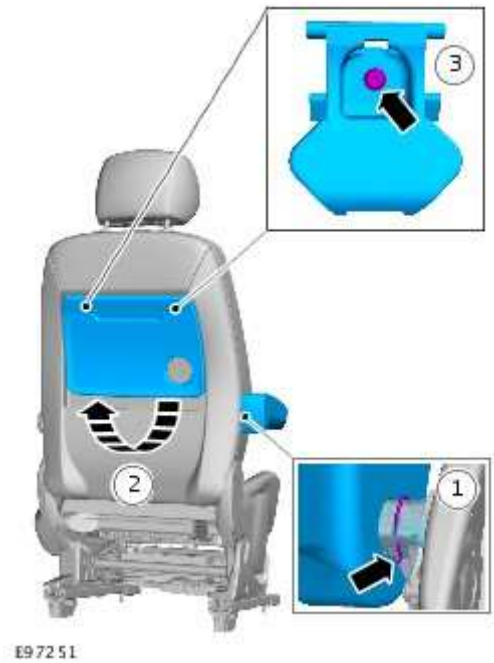
Removal and Installation

General Equipment

6 mm drill bit
Blind rivet gun

Removal

1. Refer to: Front Seat (501-10 Seating, Removal and Installation).
2. 

3. 

   1. If equipped.
   3. *General Equipment:* 6 mm drill bit
      General Equipment: Blind rivet gun
4. 3. If equipped.

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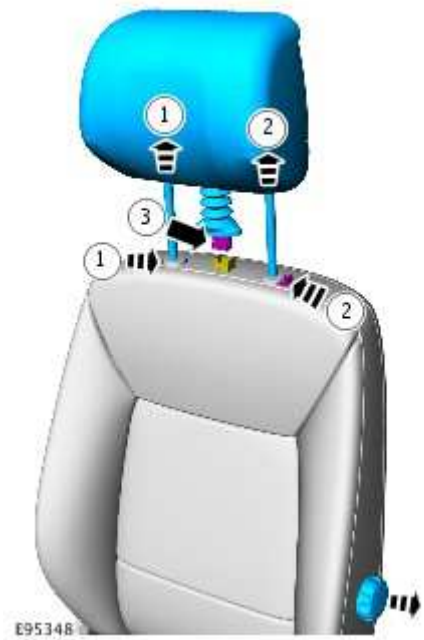

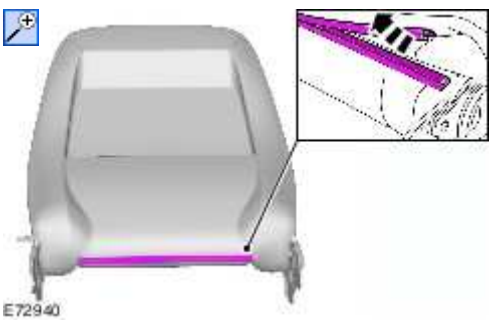

5.

6.

7.

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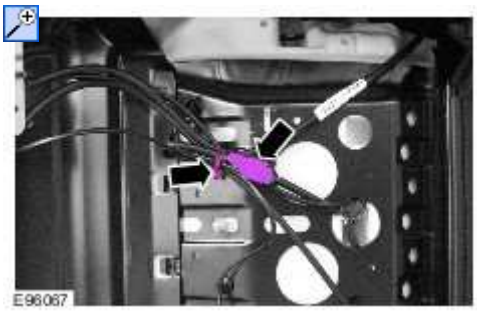

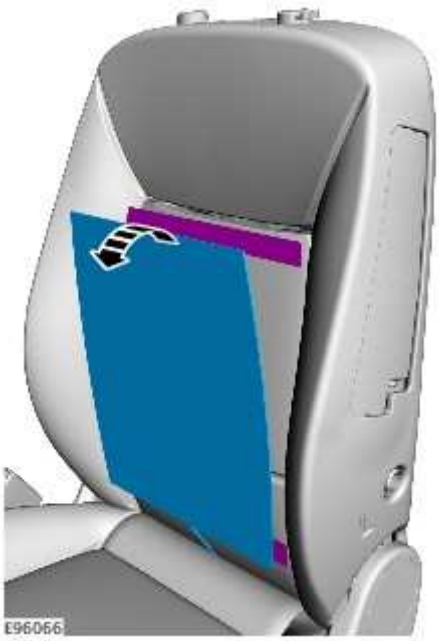

8. CAUTION: Touching the adhesive surface will impair rebonding.

Installation

1. To install, reverse the removal procedure.

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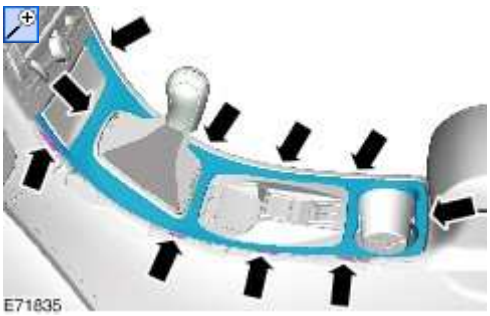
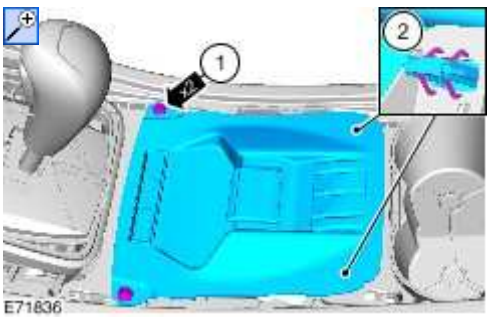
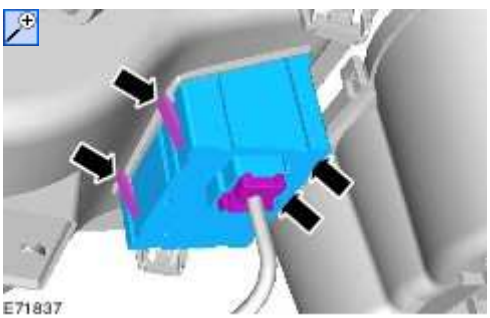
Removal and Installation

Removal

1. 

2. 

3. 

Installation

1. To install, reverse the removal procedure.

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Disassembly and Assembly

General Equipment

5 mm drill bit
Blind rivet gun
Electric drill

Disassembly

NOTE: Disassembly steps in this procedure may contain assembly details.

1. Remove the seat backrest.

   Refer to: Front Seat Backrest (501-10 Seating, Removal and Installation).

E72760

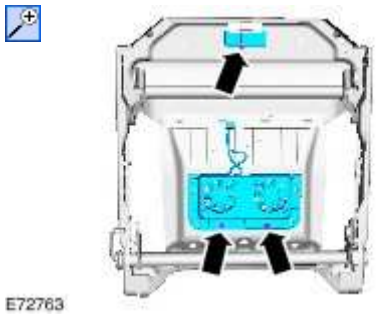
2.

E72761

3.

E72762

4.


E72763

5. *General Equipment:* Electric drill
   General Equipment: 5 mm drill bit

Assembly

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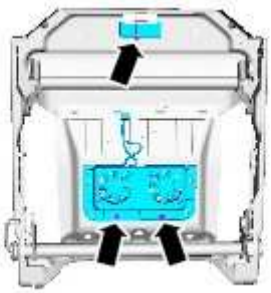

E72763

6. To assemble, reverse the disassembly procedure.

   General Equipment: Blind rivet gun

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Disassembly and Assembly

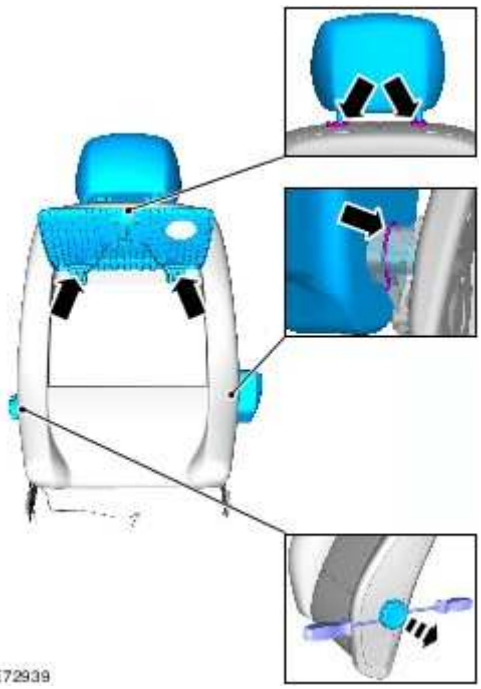
Disassembly

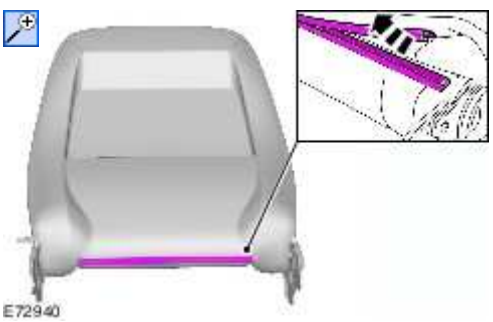
NOTE: Disassembly steps in this procedure may contain assembly details.

1. Remove the front seat backrest.

   Refer to: Front Seat Backrest (501-10 Seating, Removal and Installation).

2. WARNING: Take extra care when handling supplemental restraint system (SRS) components.
   Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

3. 

4. 

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6.

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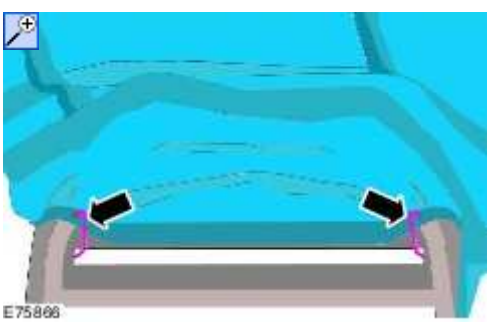
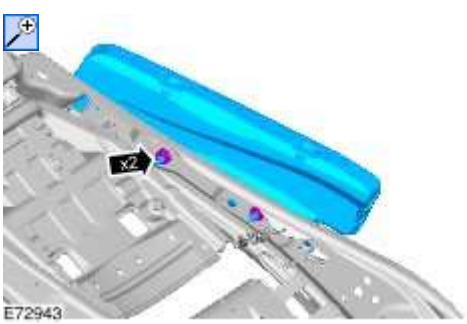


8. *Torque:* 7 Nm



Assembly

9. WARNING: Take extra care when handling supplemental restraint system (SRS) components.
To assemble, reverse the disassembly procedure.

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Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

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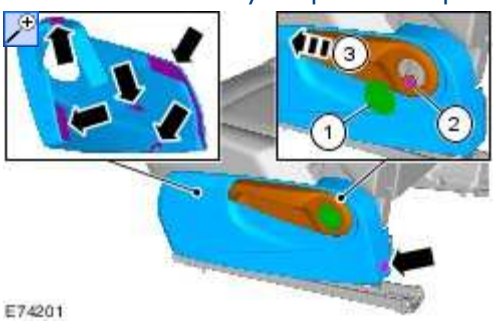
Disassembly and Assembly

Disassembly

NOTE: Disassembly steps in this procedure may contain assembly details.



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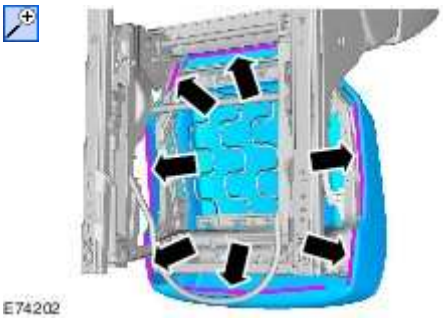

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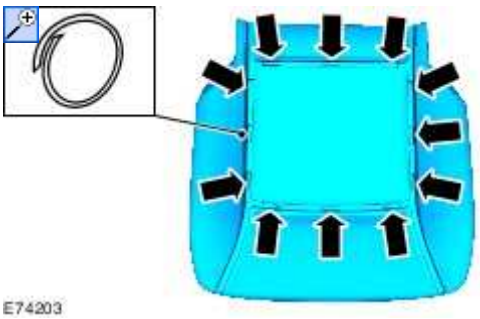

3.

Assembly

4. To assemble, reverse the disassembly procedure.

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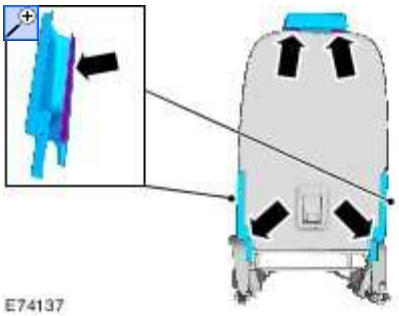
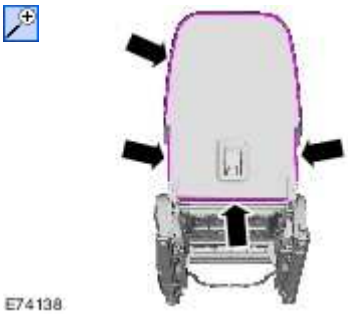
Disassembly and Assembly

Disassembly

NOTE: Disassembly steps in this procedure may contain assembly details.



1.



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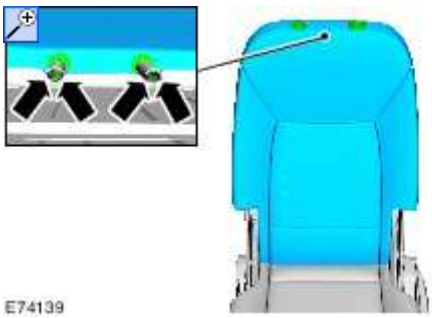

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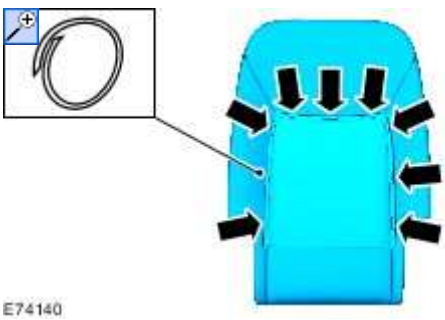

4.

Assembly

5. To assemble, reverse the disassembly procedure.

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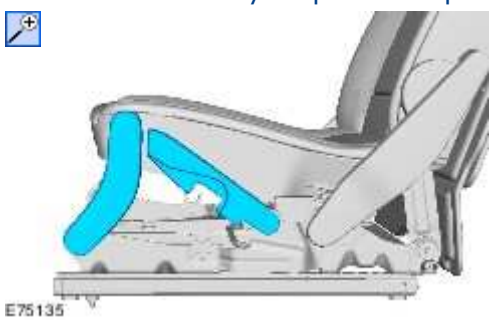
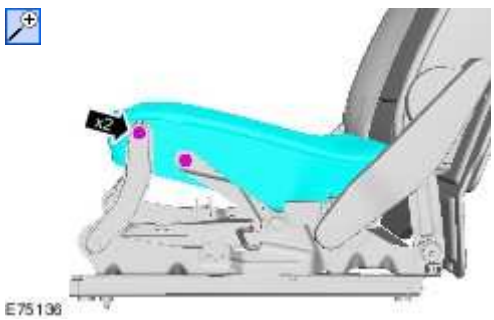
Disassembly and Assembly

Disassembly

NOTE: Disassembly steps in this procedure may contain assembly details.


E75135

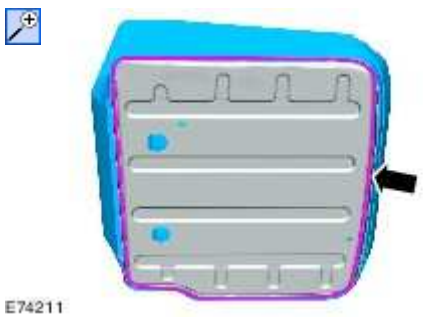
1. On both sides.



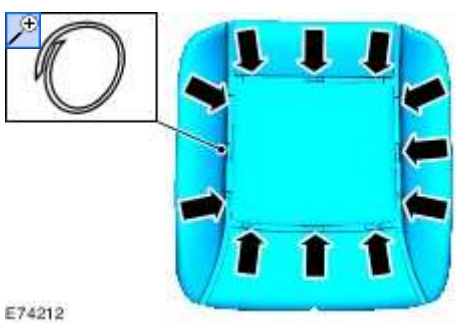
E75136

2. On both sides.

   Torque: 25 Nm


E74211

3.


E74212

4.

Assembly

5. To assemble, reverse the disassembly procedure.

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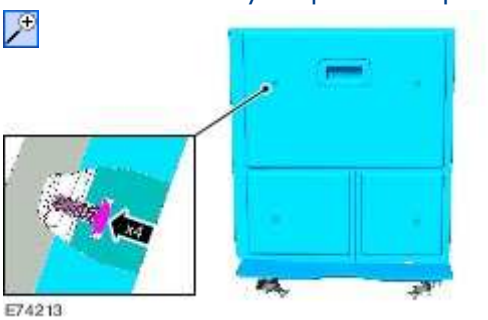
Disassembly and Assembly

Disassembly

NOTE: Disassembly steps in this procedure may contain assembly details.



E74213

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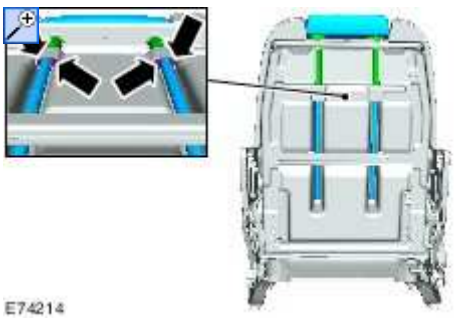
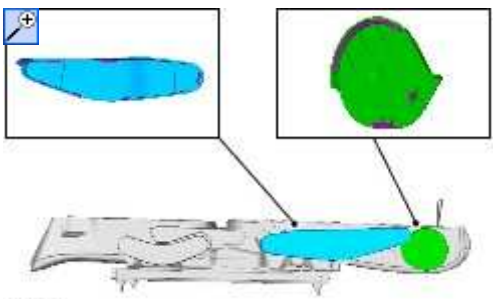

E74214

2.

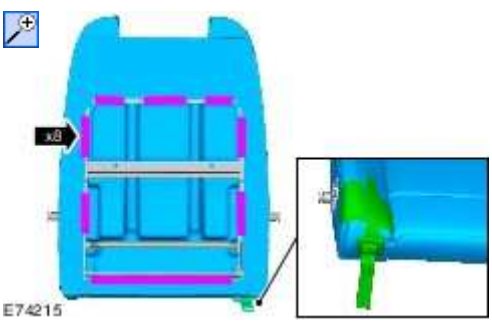

E75217

3. On both sides.

E75218

4. On both sides.

Torque: 25 Nm



E74215

5.

6.

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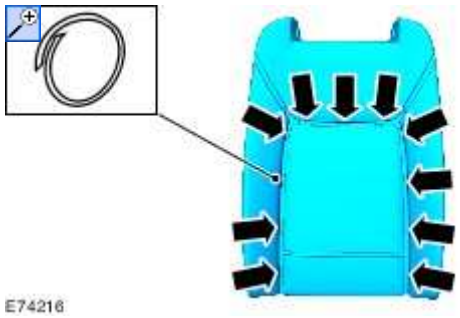

Assembly

7. To assemble, reverse the disassembly procedure.

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Description and Operation

Fixed Glass

Fixed window glass is directly glazed to the window opening flange by means of a polyurethane (PU) adhesive bead. In addition to fixing the glass to the opening flange, the adhesive bead also forms a water tight seal around the inner edge of the glass.

All vehicles have a heated rear window, a heated windshield is available as an option.

Privacy glass is an option on all glass installed rear of the B-pillar.

Moving Glass

Power windows have a one-touch down and a one-touch up function, combined with anti-trap protection, which is active whenever the window is closing. The anti-trap function will automatically deactivate if operated more than twice consecutively. The anti-trap function will reset automatically when the window is closed, after 10 seconds, or if the ignition is switched OFF then ON.

Front power windows are installed as standard.

Global closing of front and rear electrically operated power windows is standard on vehicles equipped with front and rear power windows. Global closing can only be operated by using the remote key.

Vehicles equipped with electrically operated front and rear windows require an initialization process to be carried out on each window motor. The initialization is carried out before the vehicle leaves the production plant. However, the initialization process will need to be carried out again whenever the power supply has been disconnected.

The multiple switch on the driver door incorporates a safety switch which, when operated, prevents the rear windows from being opened by the rear door window switches. However, the rear windows can still be operated from the driver switch.

An opening rear quarter window glass with the option of manual or power operation is available. Rear quarter windows do not have anti-trap functionality and are not part of global closing.

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Diagnosis and Testing

Principles of Operation

Inspection and Verification

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

Visual Inspection Chart

Mechanical	Electrical
Window seal	Fuse(s)
Door window frame	Door module(s)
	Electrical connector(s)
	Switch(es)
	Grid wire(s)
	Circuit(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Sources	Action
A single power window is inoperative - Driver side	* Driver side front door switch. * Door module. * LIN bus.	* REFER to WDS.
	* Door window regulator motor. * Circuit(s).	* GO to Pinpoint Test A.
A single power window is inoperative - Passenger side	* Door module. * LIN bus.	* REFER to WDS.
	* Passenger power window switch. * Door window regulator motor. * Circuit(s).	* GO to Pinpoint Test B.
The one-touch down feature is inoperative	* Driver side front door switch. * Door module.	* REFER to WDS.
	* Passenger power window switch.	* CARRY OUT the Passenger Power Window Switch component test. REFER to the Wiring Diagrams.
The defrost system is inoperative	* Central junction box (CJB). * Engine junction box (EJB). * Rear junction box (RJB).	* REFER to WDS.

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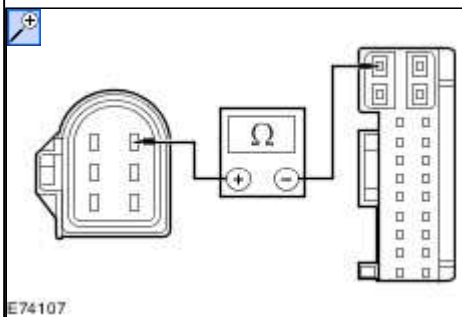
	* Heated windshield glass switch.	* CARRY OUT the Heated Windshield Glass Switch component test. REFER to the Wiring Diagrams.
	* Heated rear window glass switch.	* CARRY OUT the Heated Rear Window Glass Switch component test. REFER to the Wiring Diagrams.
	* Heated rear window grid wire.	* CARRY OUT the Heated Rear Window Grid Wire component test in this procedure.
	* Heated windshield grid wire. * Circuit(s)	* GO to Pinpoint Test D.
The defrost system will not shut off automatically	* Central junction box (CJB).	* REFER to WDS.
	* Circuit(s)	* GO to Pinpoint Test E.
The global open/closing function is inoperative/does not operate correctly	* Central junction box (CJB). * LIN bus.	* REFER to WDS.

Pinpoint Tests

PINPOINT TEST A : A SINGLE POWER WINDOW IS INOPERATIVE - DRIVER SIDE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE DRIVER SIDE FRONT DOOR SWITCH	
	1 Ignition switch in position II.
	2 Operate the power mirror switch.
	Do the power mirrors operate? **Yes** GO to A2. **No** GO to A8.
A2: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - DOWN CIRCUIT	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0.
	2 Disconnect Driver Door Module C5PL01-A.
	3 Disconnect Driver Door Window Regulator Motor C5PW11.
	4 Measure the resistance between the driver door module C5PL01-A pin 1, circuit CPW35A (GN), harness side and the driver side front door window regulator motor C5PW11 pin 5, circuit CPW35B (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to A3. **No** REPAIR circuit CPW35A (GN) or circuit CPW35B (GN). TEST the system for normal operation.
A3: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER	

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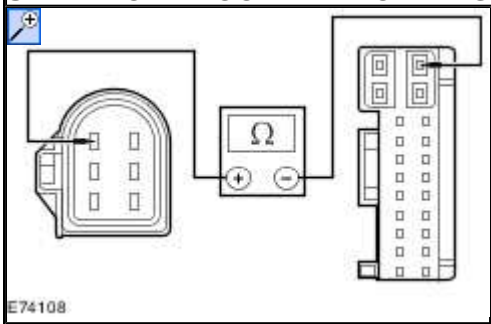
SIDE FRONT DOOR WINDOW REGULATOR MOTOR - UP CIRCUIT



1 Measure the resistance between the driver door module C5PL01-A pin 12, circuit CPW34A (BU), harness side and the driver side front door window regulator motor C5PW11 pin 6, circuit CPW34B (BU), harness side.

Is the resistance less than 5 ohms?

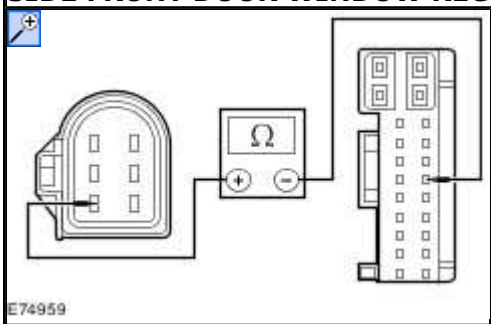
Yes

GO to A4.

No

REPAIR circuit CPW34A (BU) or circuit CPW34B (BU). TEST the system for normal operation.

A4: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR SUPPLY CIRCUIT



1 Measure the resistance between the driver door module C5PL01-A pin 17, circuit LPW36A (WH/BN), harness side and the driver side front door window regulator motor C5PW11 pin 2, circuit LPW36B (WH/BN), harness side.

Is the resistance less than 5 ohms?

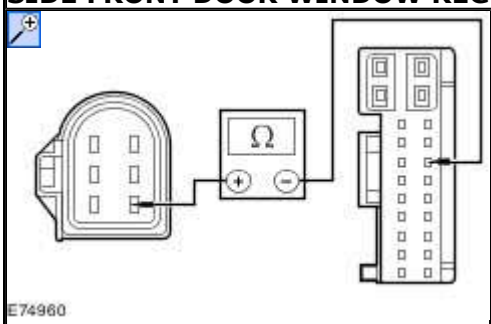
Yes

GO to A5.

No

REPAIR circuit LPW36A (WH/BN) or circuit LPW36B (WH/BN). TEST the system for normal operation.

A5: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR GROUND CIRCUIT



1 Measure the resistance between the driver door module C5PL01-A pin 16, circuit RPW37A (VT/GN), harness side and the driver side front door window regulator motor C5PW11 pin 1, circuit RPW37B (VT/GN), harness side.

Is the resistance less than 5 ohms?

Yes

GO to A6.

No

REPAIR circuit RPW37A (VT/GN) or circuit RPW37B (VT/GN). TEST the system for normal operation.

A6: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR 1 CIRCUIT

1 Measure the resistance between the driver door module C5PL01-A pin 6, circuit VPW38A (YE/BU), harness side and the driver side front door window regulator motor C5PW11 pin 3, circuit VPW38B

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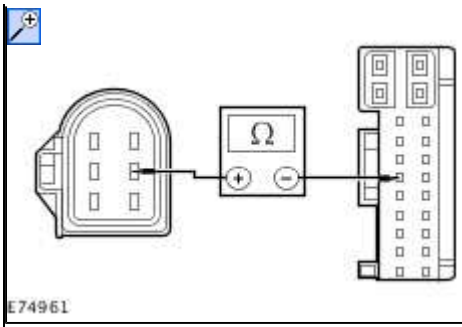
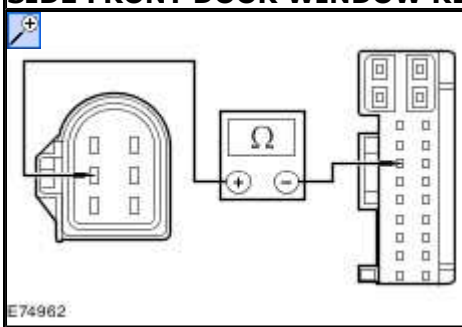
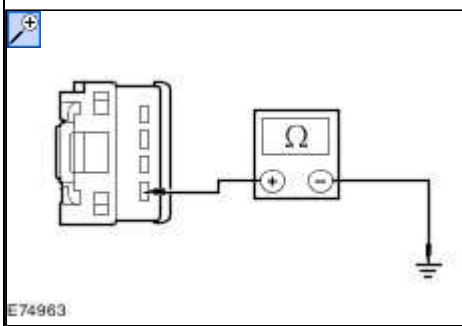
 E74961	(YE/BU), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to A7. **No** REPAIR circuit VPW38A (YE/BU) or circuit VPW38B (YE/BU). TEST the system for normal operation.
A7: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR 2 CIRCUIT	
 E74962	1 Measure the resistance between the driver door module C5PL01-A pin 5, circuit VPW39A (BU/WH), harness side and the driver side front door window regulator motor C5PW11 pin 4, circuit VPW39B (BU/WH), harness side.
	Is the resistance less than 5 ohms? **Yes** Install a new driver side front door window regulator motor. REFER to: Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. **No** REPAIR circuit VPW39A (BU/WH) or circuit VPW39B (BU/WH). TEST the system for normal operation.
A8: CHECK FOR CONTINUITY BETWEEN THE DRIVER SIDE FRONT DOOR SWITCH AND GROUND	
	1 Ignition switch in position 0. 2 Disconnect Driver Side Front Door Switch C5PL22.
 E74963	3 Measure the resistance between the driver side front door switch C5PL22 pin 4, circuit GD135H (BK/GY), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to A9. **No** REPAIR circuit GD135H (BK/GY). TEST the system for normal operation.

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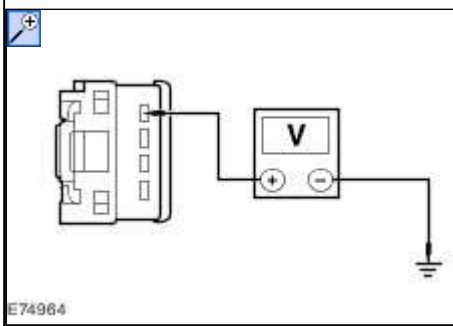
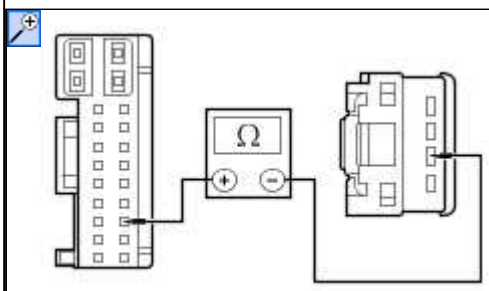
A9: CHECK FOR VOLTAGE TO THE DRIVER SIDE FRONT DOOR SWITCH	
	1 Ignition switch in position II.
 E74964	2 Measure the voltage between the driver side door switch C5PL22 pin 1, circuit A_CBP17H (BN/GN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A10. **No** REPAIR circuit A_CBP17H (BN/GN). TEST the system for normal operation.
A10: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR SWITCH	
	1 Ignition switch in position 0.
	2 Disconnect Driver Door Module C5PL01-A.
 E74965	3 Measure the resistance between the driver door module C5PL01-A pin 20, circuit VPW32D (GY/BU), harness side and the driver side front door switch C5PL22 pin 3, circuit VPW32D (GY/BU), harness side.
	Is the resistance less than 5 ohms? **Yes** CHECK the driver door module. REFER to WDS. CHECK the driver side front door switch. REFER to WDS. **No** REPAIR circuit VPW32D (GY/BU). TEST the system for normal operation.

PINPOINT TEST B : A SINGLE POWER WINDOW IS INOPERATIVE - PASSENGER SIDE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: DOES THE PASSENGER WINDOW OPERATE FROM THE DRIVER SIDE FRONT DOOR SWITCH	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position II.
	2 Operate the passenger power window from the driver side front door switch.
	Does the passenger power window operate? **Yes** GO to B2. **No** GO to B5.
B2: CHECK FOR CONTINUITY BETWEEN THE PASSENGER POWER WINDOW SWITCH AND THE PASSENGER DOOR MODULE SWITCH GROUND CIRCUIT	
	1 Ignition switch in position 0.

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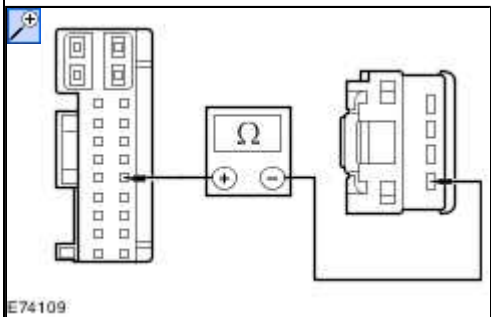
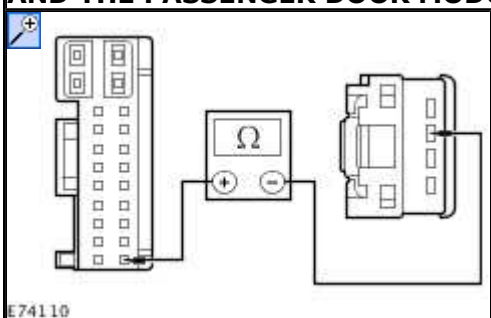
	2 Disconnect Passenger Power Window Switch C6PW19 or C7PW21 or C8PW23.
	3 Disconnect Passenger Door Module C6PL01-A or C7PL01 or C8PL01.
	4 Measure the resistance between the: • Inoperative front passenger power window - passenger power window switch C6PW19 pin 4, circuit RPW05A (GN/BN), harness side and the passenger door module C6PL01-A pin 18, circuit RPW05A (GN/BN), harness side. • Inoperative left-hand rear passenger power window - passenger power window switch C8PW23 pin 4, circuit RPW07A (GY/OG), harness side and the passenger door module C7PL01 pin 18, circuit RPW07A (GY/OG), harness side. • Inoperative right-hand rear passenger power window - passenger power window switch C7PW21 pin 4, circuit RPW09A (BN/WH), harness side and the passenger door module C8PL01 pin 18, circuit RPW09A (BN/WH), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B3. **No** Inoperative front passenger power window - REPAIR circuit RPW05A (GN/BN). TEST the system for normal operation. Inoperative left-hand rear passenger power window - REPAIR circuit RPW07A (GY/OG). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit RPW09A (BN/WH). TEST the system for normal operation.
B3: CHECK FOR CONTINUITY BETWEEN THE PASSENGER POWER WINDOW SWITCH AND THE PASSENGER DOOR MODULE UP CIRCUIT	
	1 Measure the resistance between the: • Inoperative front passenger power window - passenger power window switch C6PW19 pin 2, circuit RPW13A (BN/YE), harness side and the passenger door module C6PL01-A pin 22, circuit RPW13A (BN/YE), harness side. • Inoperative left-hand rear passenger power window - passenger power window switch C8PW23 pin 2, circuit RPW16A (BU/OG), harness side and the passenger door module C7PL01 pin 22, circuit RPW16A (BU/OG), harness side. • Inoperative right-hand rear passenger power window - passenger power window switch C7PW21 pin 2, circuit RPW18A (GY/VT), harness side and the passenger door module C8PL01 pin 22, circuit RPW18A (GY/VT), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B4. **No** Inoperative front passenger power window - REPAIR circuit RPW13A (BN/YE). TEST the system for normal operation.

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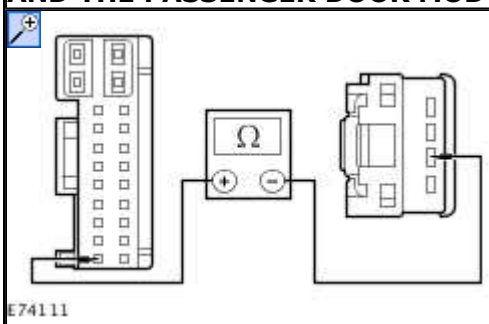
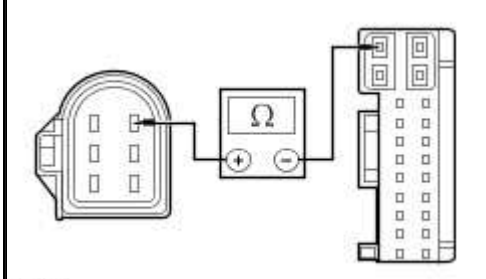
	Inoperative left-hand rear passenger power window - REPAIR circuit RPW16A (BU/OG). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit RPW18A (GY/VT). TEST the system for normal operation.
B4: CHECK FOR CONTINUITY BETWEEN THE PASSENGER POWER WINDOW SWITCH AND THE PASSENGER DOOR MODULE DOWN CIRCUIT	
 E74111	1 Measure the resistance between the: • Inoperative front passenger power window - passenger power window switch C6PW19 pin 3, circuit RPW12A (GN/OG), harness side and the passenger door module C6PL01-A pin 11, circuit RPW12A (GN/OG), harness side. • Inoperative left-hand rear passenger power window - passenger power window switch C8PW23 pin 3, circuit RPW15A (YE), harness side and the passenger door module C7PL01 pin 11, circuit RPW15A (YE), harness side. • Inoperative right-hand rear passenger power window - passenger power window switch C7PW21 pin 3, circuit RPW17A (BN/GN), harness side and the passenger door module C8PL01 pin 11, circuit RPW17A (BN/GN), harness side.
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the Passenger Power Window Switch component test. REFER to the Wiring Diagrams. CHECK the passenger door module. REFER to WDS. **No** Inoperative front passenger power window - REPAIR circuit RPW12A (GN/OG). TEST the system for normal operation. Inoperative left-hand rear passenger power window - REPAIR circuit RPW15A (YE). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit RPW17A (BN/GN). TEST the system for normal operation.
B5: CHECK FOR CONTINUITY BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER WINDOW REGULATOR MOTOR DOWN CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Door Module C6PL01-A or C7PL01 or C8PL01.
	3 Disconnect Passenger Door Window Regulator Motor C6PW20 or C7PW22 or C8PW24.
 E74107	4 Measure the resistance between the: • Inoperative front passenger power window - passenger door module C6PL01-A pin 1, circuit CPW41A (GY/YE), harness side, harness side and the door window regulator motor C6PW20 pin 5, circuit CPW41B (GY/YE), harness side. • Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 1, circuit CPW47A (VT/OG), harness side and the door window regulator motor C7PW22 pin 5, circuit CPW47A (VT/OG), harness side.

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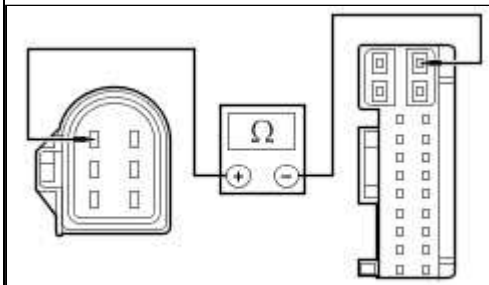
	• Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 1, circuit CPW53A (YE/OG), harness side and the door window regulator motor C8PW24 pin 5, circuit CPW53A (YE/OG), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B6. **No** Inoperative front passenger power window - REPAIR circuit CPW41A (GY/YE) or circuit CPW41B (GY/YE). TEST the system for normal operation. Inoperative left-hand rear passenger power window - REPAIR circuit CPW47A (VT/OG). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit CPW53A (YE/OG). TEST the system for normal operation.
B6: CHECK FOR CONTINUITY BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER WINDOW REGULATOR MOTOR UP CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Door Module C6PL01-A or C7PL01 or C8PL01.
 E74108	3 Measure the resistance between the: • Inoperative front passenger power window - passenger door module C6PL01-A pin 12, circuit CPW40A (WH), harness side, harness side and the door window regulator motor C6PW20 pin 6, circuit CPW40B (WH), harness side. • Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 12, circuit CPW46A (GY/BN), harness side and the door window regulator motor C7PW22 pin 6, circuit CPW46A (GY/BN), harness side. • Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 12, circuit CPW52A (VT/WH), harness side and the door window regulator motor C8PW24 pin 6, circuit CPW52A (VT/WH), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to B7. **No** Inoperative front passenger power window - REPAIR circuit CPW40A (WH) or circuit CPW40B (WH). TEST the system for normal operation. Inoperative left-hand rear passenger power window - REPAIR circuit CPW46A (GY/BN). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit CPW52A (VT/WH). TEST the system for normal operation.
B7: CHECK FOR CONTINUITY BETWEEN THE PASSENGER DOOR MODULE AND THE PASSENGER WINDOW REGULATOR MOTOR - HALL SENSOR SUPPLY CIRCUIT	
	1 Measure the resistance between the: • Inoperative front passenger power window - passenger door module C6PL01-A pin 17, circuit

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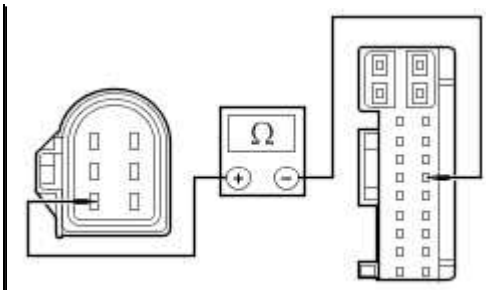


LPW42A (VT/GY), harness side, harness side and the door window regulator motor C6PW20 pin 2, circuit LPW42B (VT/GY), harness side.
- Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 17, circuit LPW48A (YE/GY), harness side and the door window regulator motor C7PW22 pin 2, circuit LPW48A (YE/GY), harness side.
- Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 17, circuit LPW54A (BN/GN), harness side and the door window regulator motor C8PW24 pin 2, circuit LPW54A (BN/GN), harness side.

Is the resistance less than 5 ohms?

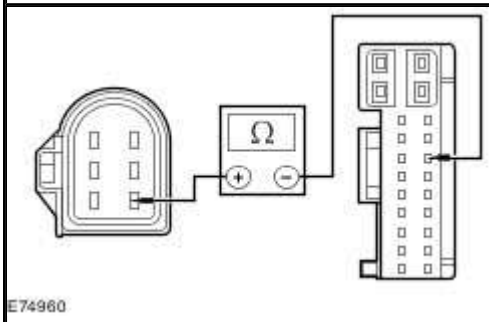
Yes

GO to B8.

No

Inoperative front passenger power window - REPAIR circuit LPW42A (VT/GY) or circuit LPW42B (VT/GY). TEST the system for normal operation.
Inoperative left-hand rear passenger power window - REPAIR circuit LPW48A (YE/GY). TEST the system for normal operation.
Inoperative right-hand rear passenger power window - REPAIR circuit LPW54A (BN/GN). TEST the system for normal operation.

B8: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR GROUND CIRCUIT



1 Measure the resistance between the:

- Inoperative front passenger power window - passenger door module C6PL01-A pin 16, circuit RPW43A (YE/GN), harness side, harness side and the door window regulator motor C6PW20 pin 1, circuit RPW43B (YE/GN), harness side.
- Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 16, circuit RPW49A (BU/BN), harness side and the door window regulator motor C7PW22 pin 1, circuit RPW49A (BU/BN), harness side.
- Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 16, circuit RPW55A (GY/VT), harness side and the door window regulator motor C8PW24 pin 1, circuit RPW55A (GY/VT), harness side.

Is the resistance less than 5 ohms?

Yes

GO to B9.

No

Inoperative front passenger power window - REPAIR circuit RPW43A (YE/GN) or circuit RPW43B (YE/GN). TEST the system for normal operation.
Inoperative left-hand rear passenger power window - REPAIR circuit RPW49A (BU/BN). TEST the system for normal operation.
Inoperative right-hand rear passenger power window - REPAIR circuit RPW55A (GY/VT). TEST the system for normal operation.

B9: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR 1 CIRCUIT

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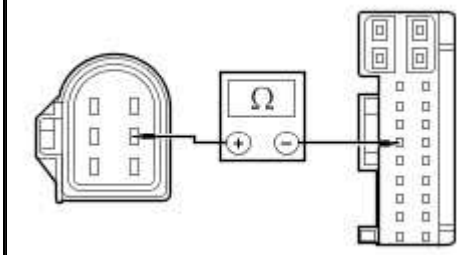


1 Measure the resistance between the:

- Inoperative front passenger power window - passenger door module C6PL01-A pin 6, circuit VPW44A (BU/OG), harness side, harness side and the door window regulator motor C6PW20 pin 3, circuit VPW44B (BU/OG), harness side.
- Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 6, circuit VPW50A (GN/OG), harness side and the door window regulator motor C7PW22 pin 3, circuit VPW50A (GN/OG), harness side.
- Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 6, circuit VPW56A (BN/BU), harness side and the door window regulator motor C8PW24 pin 3, circuit VPW56A (BN/BU), harness side.

Is the resistance less than 5 ohms?

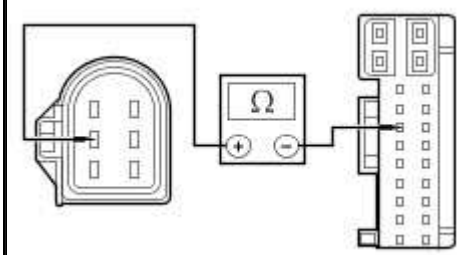
Yes

GO to B10.

No

Inoperative front passenger power window - REPAIR circuit VPW44A (BU/OG) or circuit VPW44B (BU/OG). TEST the system for normal operation.
Inoperative left-hand rear passenger power window - REPAIR circuit VPW50A (GN/OG). TEST the system for normal operation.
Inoperative right-hand rear passenger power window - REPAIR circuit VPW56A (BN/BU). TEST the system for normal operation.

B10: CHECK FOR CONTINUITY BETWEEN THE DRIVER DOOR MODULE AND THE DRIVER SIDE FRONT DOOR WINDOW REGULATOR MOTOR - HALL SENSOR 2 CIRCUIT



1 Measure the resistance between the:

- Inoperative front passenger power window - passenger door module C6PL01-A pin 5, circuit VPW45A (GN/WH), harness side, harness side and the door window regulator motor C6PW20 pin 4, circuit VPW45B (GN/WH), harness side.
- Inoperative left-hand rear passenger power window - passenger door module C7PL01-A pin 5, circuit VPW51A (BN/YE), harness side and the door window regulator motor C7PW22 pin 4, circuit VPW51A (BN/YE), harness side.
- Inoperative right-hand rear passenger power window - passenger door module C8PL01-A pin 5, circuit VPW57A (BU/GY), harness side and the door window regulator motor C8PW24 pin 4, circuit VPW57A (BU/GY), harness side.

Is the resistance less than 5 ohms?

Yes

Install a new driver side front door window regulator motor.
REFER to: Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
TEST the system for normal operation.

No

Inoperative front passenger power window - REPAIR circuit VPW45A (GN/WH) or circuit VPW45B

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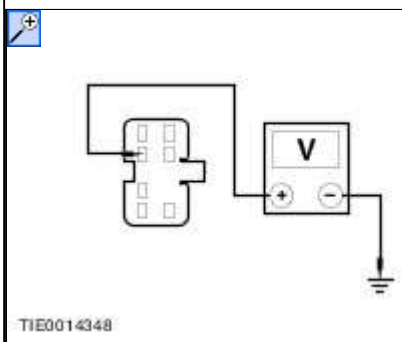
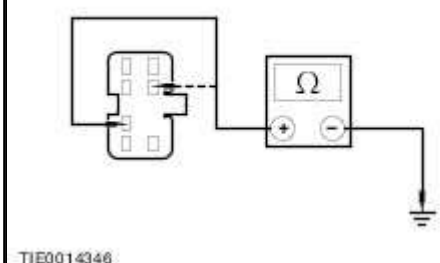
	(GN/WH). TEST the system for normal operation. Inoperative left-hand rear passenger power window - REPAIR circuit VPW51A (BN/YE). TEST the system for normal operation. Inoperative right-hand rear passenger power window - REPAIR circuit VPW57A (BU/GY). TEST the system for normal operation.

PINPOINT TEST C : A SINGLE POWER WINDOW IS INOPERATIVE - REAR QUARTER WINDOW	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FOR VOLTAGE TO THE REAR QUARTER POWER WINDOW SWITCH	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Disconnect Rear Quarter Power Window Switch C7PW25-B or C8PW27-B.
	2 Ignition switch in position II.
 TIE0014348	3 Measure the voltage between the: • Inoperative left-hand rear quarter power window - quarter power window switch C7PW25-B pin 2, circuit CPW30C (GY/YE), harness side and ground. • Inoperative right-hand rear quarter power window - quarter power window switch C8PW27-B pin 2, circuit CPW30A (GY/YE), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to C2. **No** Inoperative left-hand rear quarter power window - REPAIR circuit CPW30C (GY/YE). TEST the system for normal operation. Inoperative right-hand rear quarter power window - REPAIR circuit CPW30A (GY/YE). TEST the system for normal operation.
C2: CHECK FOR CONTINUITY BETWEEN THE REAR QUARTER POWER WINDOW SWITCH AND GROUND	
	1 Ignition switch in position 0.
 TIE0014346	2 Measure the resistance between the: Inoperative left-hand rear quarter power window • Rear quarter power window switch C7PW25-B pin 3, circuit GD152BN (BK/BU), harness side and ground. • Rear quarter power window switch C7PW25-B pin 6, circuit GD152BF (BK/BU), harness side and ground. Inoperative right-hand rear quarter power window • Rear quarter power window switch C8PW27-B pin 3, circuit GD152BL (BK/BU), harness side and ground. • Rear quarter power window switch C8PW27-B pin 6, circuit GD152BJ (BK/BU), harness side and

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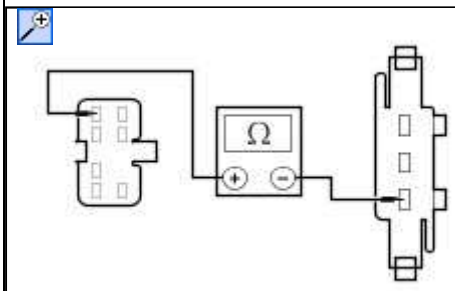
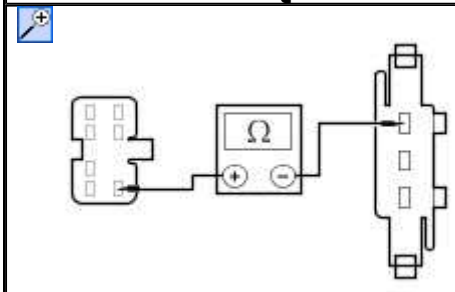
	ground.
	Is the resistance less than 5 ohms? **Yes** GO to C3. **No** Inoperative left-hand rear quarter power window - REPAIR circuit GD152AR (BK/BU). TEST the system for normal operation. Inoperative right-hand rear quarter power window - REPAIR circuit GD152AU (BK/BU). TEST the system for normal operation.
C3: CHECK FOR CONTINUITY BETWEEN THE REAR QUARTER POWER WINDOW SWITCH AND THE QUARTER POWER WINDOW MOTOR	
	1 Disconnect Rear Quarter Power Window Motor C7PW26 or C8PW28.
 E74112	2 Measure the resistance between the: • Inoperative left-hand rear quarter power window - rear quarter power window switch C7PW25-B pin 1, circuit CPW25B (YE/BU), harness side and the rear quarter power window motor C7PW26 pin 3, circuit CPW25B (YE/BU), harness side. • Inoperative right-hand rear quarter power window - rear quarter power window switch C8PW27-B pin 1, circuit CPW27A (GN), harness side and the rear quarter power window motor C8PW28 pin 3, circuit CPW27A (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to C4. **No** Inoperative left-hand rear quarter power window - REPAIR circuit CPW25B (YE/BU). TEST the system for normal operation. Inoperative right-hand rear quarter power window - REPAIR circuit CPW27A (GN). TEST the system for normal operation.
C4: CHECK FOR CONTINUITY BETWEEN THE REAR QUARTER POWER WINDOW SWITCH AND THE QUARTER POWER WINDOW MOTOR	
 E74113	1 Measure the resistance between the: • Inoperative left-hand rear quarter power window - rear quarter power window switch C7PW25-B pin 7, circuit CPW26B (BU/BN), harness side and the rear quarter power window motor C7PW26 pin 1, circuit CPW26B (BU/BN), harness side. • Inoperative right-hand rear quarter power window - rear quarter power window switch C8PW27-B pin 7, circuit CPW28A (WH/BN), harness side and the rear quarter power window motor C8PW28 pin 1, circuit CPW28A (WH/BN), harness side.
	Is the resistance less than 5 ohms? **Yes** Install a new rear quarter window regulator motor. REFER to: Rear Quarter Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

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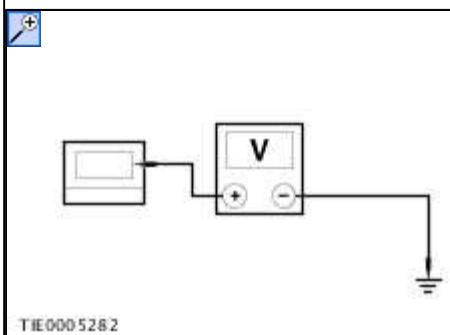
	TEST the system for normal operation. **No** Inoperative left-hand rear quarter power window - REPAIR circuit CPW26B (BU/BN). TEST the system for normal operation. Inoperative right-hand rear quarter power window - REPAIR circuit CPW28A (WH/BN). TEST the system for normal operation.

PINPOINT TEST D : THE DEFROST SYSTEM IS INOPERATIVE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE OPERATION OF THE HEATED REAR WINDOW	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position III.
	2 Ignition switch in position II.
	3 Operate the heated rear window switch.
	Does the heated rear window function correctly? **Yes** GO to D2. **No** GO to D3.
D2: CHECK THE OPERATION OF THE HEATED WINDSHIELD	
	1 Operate the heated windshield control switch.
	Does the heated windshield operate correctly? **Yes** VERIFY the customer concern. **No** GO to D6.
D3: CHECK THE OPERATION OF THE HEATED REAR WINDOW SWITCH LED	
	1 Operate the heated rear window switch.
	Does the heated rear window switch ON LED illuminate? **Yes** GO to D4. **No** GO to D10.
D4: CHECK FOR VOLTAGE TO THE HEATED REAR WINDOW GRID WIRES	
	1 Ignition switch in position 0.
	2 Disconnect Heated Rear Window Grid Wires C4RD02-A.
	3 Ignition switch in position III.
	4 Ignition switch in position II.
	5 Operate the heated rear window switch.
	6 Measure the voltage between the heated rear window grid wire CC4RD02-A pin 1, circuit CRD06C (BN/YE), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D5. **No**

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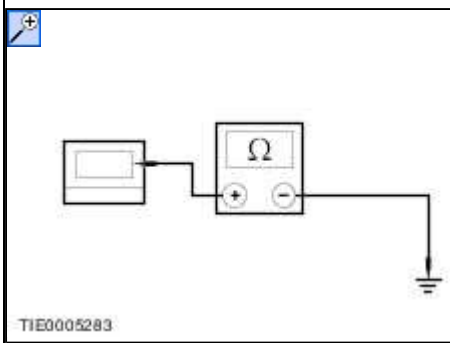
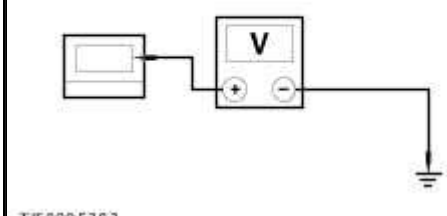
	GO to D13.
D5: CHECK THE HEATED REAR WINDOW GRID GROUND CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Heated Rear Window Grid Wires C4RD02-B.
 TIE0005283	3 Measure the resistance between the heated rear window C4RD02-B pin 1, circuit GD150AE (BK/WH), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the Heated Rear Window Grid Wire Component Test in this procedure. TEST the system for normal operation. **No** REPAIR circuit GD150AE (BK/WH). TEST the system for normal operation.
D6: CHECK THE OPERATION OF THE HEATED WINDSHIELD SWITCH LED	
	1 Operate the heated windshield switch.
	Does the heated windshield switch ON LED illuminate? **Yes** GO to D7. **No** GO to D16.
D7: CHECK FOR VOLTAGE TO THE HEATED WINDSHIELD GRID WIRES	
	1 Ignition switch in position 0.
	2 Disconnect Heated Windshield Grid Wires C2RD03 and C2RD04-A.
	3 Ignition switch in position III.
	4 Ignition switch in position II.
	5 Operate the heated windshield control switch.
 TIE0005282	6 Measure the voltage between the: • heated windshield left-hand grid wire C2RD03 pin 1, circuit CBB35A (YE/GY), harness side and ground. • heated windshield right-hand grid wire C2RD04-A pin 1, circuit CBB34B (VT/BN), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D8. **No** GO to D18.
D8: CHECK THE HEATED WINDSHIELD GRID WIRE GROUND CIRCUITS	
	1 Ignition switch in position 0.
	2 Measure the resistance between the heated windshield ground circuits and ground.

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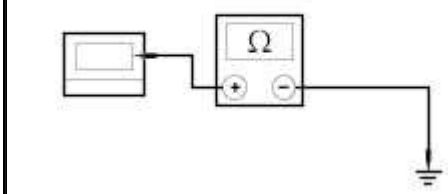
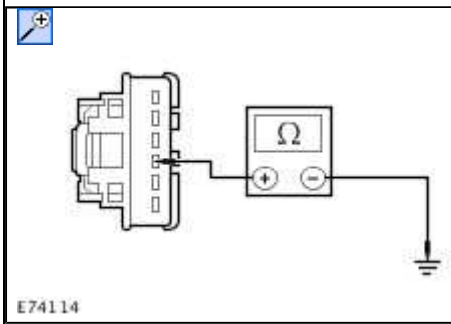
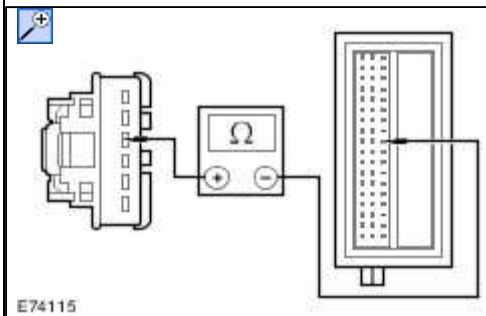
	Are the resistances less than 5 ohms? **Yes** GO to D9. **No** REPAIR the heated windshield ground circuit(s). TEST the system for normal operation.
D9: CHECK THE HEATED WINDSHIELD GRID WIRES	
 TIE0005283	1 Measure the resistance between the: • heated windshield left-hand grid wire C2RD03 pin 1, circuit CBB35A (YE/GY), harness side and ground. • heated windshield right-hand grid wire C2RD04-A pin 1, circuit CBB34B (VT/BN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new windshield glass. REFER to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation). TEST the system for normal operation. **No** VERIFY the customer concern.
D10: CHECK THE HEATED REAR WINDOW SWITCH GROUND CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Heated Rear Window Switch C2RD09-B.
 E74114	3 Measure the resistance between the heated rear window switch C2RD09-B pin 4, circuit GD133BN (BK), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** GO to D11. **No** REPAIR circuit GD133BN (BK). TEST the system for normal operation.
D11: CHECK FOR CONTINUITY BETWEEN THE CENTRAL JUNCTION BOX (CJB) AND THE HEATED REAR WINDOW SWITCH LED	
	1 Disconnect CJB C1BP02-C.
 E74115	2 Measure the resistance between the CJB C1BP02-C pin 46, circuit CRD04A (BN/GN), harness side and the heated rear window control switch C2RD09-B pin 3, circuit CRD04A (BN/GN), harness side.
	Is the resistance less than 5 ohms?

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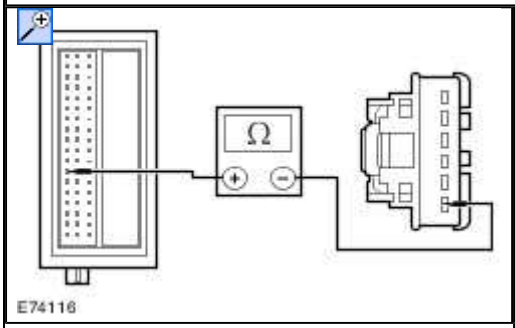
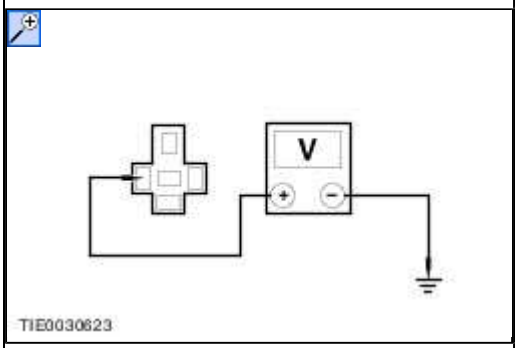
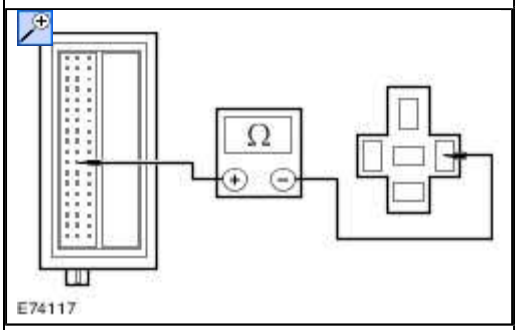
	Yes GO to D12. **No** Repair circuit CRD04A (BN/GN). TEST the system for normal operation.
D12: CHECK FOR CONTINUITY BETWEEN THE CENTRAL JUNCTION BOX (CJB) AND THE HEATED REAR WINDOW SWITCH	
	**1** Measure the resistance between the CJB C1BP02-C pin 7, circuit CRD09A (BU/GY), harness side and the heated rear window control switch C2RD09-B pin 6, circuit CRD09A (BU/GY), harness side.
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the CJB self-test. REFER to WDS. CARRY OUT the Heated Rear Window Glass Switch component test. REFER to the Wiring Diagrams. **No** Repair circuit CRD09A (BU/GY). TEST the system for normal operation.
D13: CHECK FOR VOLTAGE TO THE HEATED REAR WINDOW RELAY	
	1 Ignition switch in position 0.
	2 Disconnect Heated Rear Window Relay RA2.
	**3** Measure the voltage between the heated rear window relay RA2 pin 1 circuit SBB19F (BU/RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D14. **No** REPAIR circuit SBB19F (BU/RD). TEST the system for normal operation.
D14: CHECK FOR CONTINUITY BETWEEN THE CJB AND THE HEATED REAR WINDOW RELAY	
	1 Disconnect CJB C1BP02-B.
	**2** Measure the resistance between the CJB C1BP02-B pin 26, circuit CRD02A (BN/BU), harness side and the heated rear window relay RA2 pin 2, circuit CRD02A (BN/BU), harness side.
	Is the resistance less than 5 ohms?

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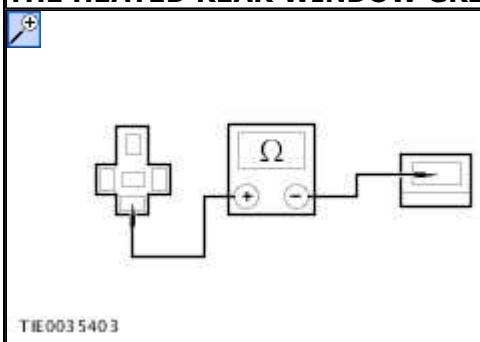
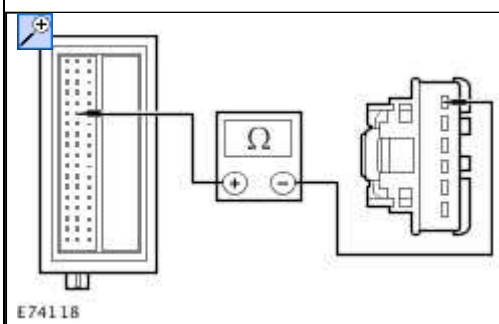
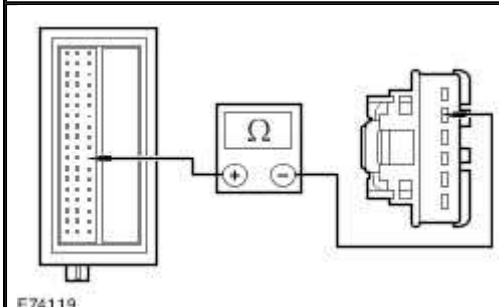
	Yes GO to D15. **No** Repair circuit CRD02A (BN/BU). TEST the system for normal operation.
D15: CHECK FOR CONTINUITY BETWEEN THE HEATED REAR WINDOW RELAY AND THE HEATED REAR WINDOW GRID WIRE	
 TIE0035403	1 Measure the resistance between the heated rear window relay RA2 pin 5, circuit CRD06B (BN/YE), harness side and the heated rear window grid wire C4RD02-A pin 1, circuit CRD06B (BN/YE), harness side.
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the CJB self-test. REFER to WDS. CARRY OUT the Heated Rear Window Glass Relay component test. REFER to the Wiring Diagrams. **No** REPAIR circuit CRD06B (BN/YE). TEST the system for normal operation.
D16: CHECK FOR CONTINUITY BETWEEN THE HEATED WINDSHIELD SWITCH AND THE CENTRAL JUNCTION BOX (CJB)	
	1 Ignition switch in position 0. 2 Disconnect CJB C1BP02-C. 3 Disconnect Heated Windshield Switch C2RD09-B.
 E74118	4 Measure the resistance between the CJB C1BP02-C pin 31, circuit CRD08A (GN/OG), harness side and the heated windshield switch C2RD09-B pin 1, circuit CRD08A (GN/OG), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to D17. **No** REPAIR circuit CRD08A (GN/OG). TEST the system for normal operation.
D17: CHECK FOR CONTINUITY BETWEEN THE HEATED WINDSHIELD SWITCH LED AND THE CJB	
 E74119	1 Measure the resistance between the CJB C1BP02-C pin 44, circuit CRD03A (BU/GN), harness side and the heated windshield switch C2RD09-B pin 2, circuit CRD03A (BU/GN), harness side.

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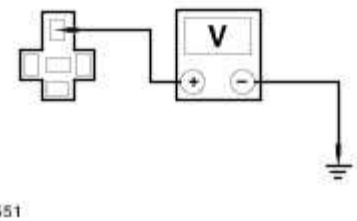
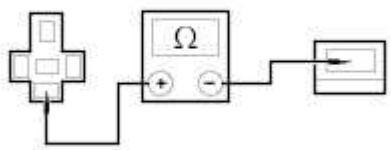
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the CJB self-test. REFER to WDS. CARRY OUT the Heated Windshield Glass Switch component test. REFER to the Wiring Diagrams. **No** REPAIR circuit CRD03A (BU/GN). TEST the system for normal operation.
D18: CHECK FOR VOLTAGE TO THE HEATED WINDSHIELD GLASS RELAY	
	1 Ignition switch in position 0.
	2 Disconnect Heated Windshield Glass Relay R6.
 TIE0014551	3 Measure the voltage between the heated windshield glass relay R6 pin 3, circuit SDC02A (RD), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** GO to D19. **No** REPAIR circuit SDC02A (RD). TEST the system for normal operation.
D19: CHECK FOR CONTINUITY BETWEEN THE HEATED WINDSHIELD GLASS RELAY AND THE HEATED WINDSHIELD GRID WIRE	
	1 Disconnect Heated Windshield Grid Wires C2RD03 and C2RD04-A.
 TIE0035403	2 Measure the resistance between the heated windshield glass relay R6 pin 5, circuit CRD06B (BN/YE), harness side and the: • Left-hand heated windshield grid wire C2RD03 pin 1, circuit CBB34B (VT/BN), harness side. • Right-hand heated windshield grid wire C2RD04-A pin 1, circuit CRD35A (YE/GY), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to D20. **No** REPAIR circuit CBB34B (VT/BN) or circuit CRD35A (YE/GY). TEST the system for normal operation.
D20: CHECK FOR CONTINUITY BETWEEN THE HEATED WINDSHIELD GLASS RELAY AND THE CENTRAL JUNCTION BOX (CJB)	
	1 Disconnect CJB C1BP02-A.
	2 Measure the resistance between the CJB C1BP02-A pin 30, circuit CRD01A (VT/OG), harness side and the heated windshield glass relay R6 pin 2, circuit CRD01A (VT/OG), harness side.

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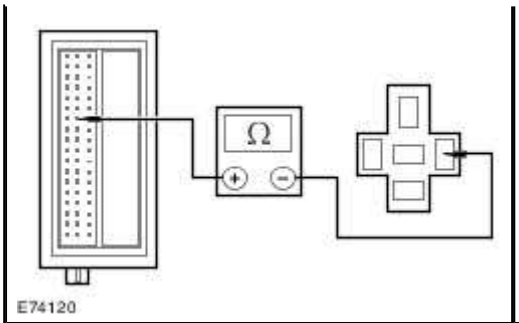
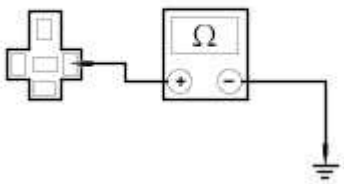
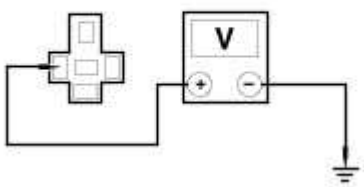
	
	Is the resistance less than 5 ohms? **Yes** CARRY OUT the CJB self-test. REFER to WDS. CARRY OUT the Heated Windshield Glass Relay component test. REFER to the Wiring Diagrams. **No** REPAIR circuit CRD01A (VT/OG). TEST the system for normal operation.

PINPOINT TEST E : THE DEFROST SYSTEM WILL NOT SHUT OFF AUTOMATICALLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK FOR CONTINUITY BETWEEN THE HEATED WINDSHIELD GLASS RELAY AND GROUND	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Disconnect CJB C1BP02-C.
	2 Disconnect Heated Windshield Glass Relay R6.
	3 Measure the resistance between the heated windshield glass relay R6 pin 2, circuit CRD01A (VT/OG), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit CRD01A (VT/OG). TEST the system for normal operation. **No** GO to E2.
E2: CHECK THE HEATED WINDSHIELD GLASS RELAY CIRCUIT FOR A SHORT TO POWER	
	1 Ignition switch in position II.
	2 Measure the voltage between the heated windshield glass relay R6 pin 5, harness side and ground.
	Is the voltage greater than 10 volts?

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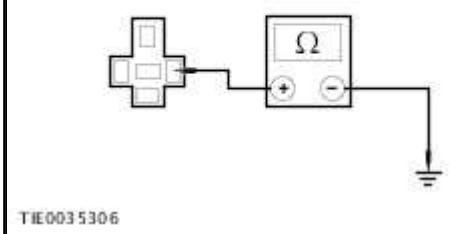
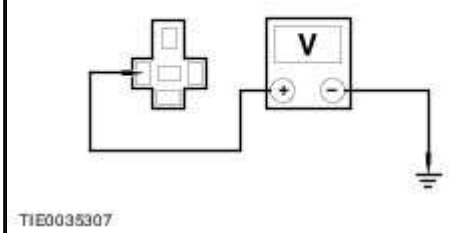
	Yes REPAIR circuit CBB34B (VT/BN) or circuit CBB35A (YE/GY). TEST the system for normal operation. **No** GO to E3.
E3: CHECK FOR CONTINUITY BETWEEN THE HEATED REAR WINDOW RELAY AND GROUND	
	1 Ignition switch in position 0.
	2 Disconnect Heated Rear Window Relay RA2.
	3 Measure the resistance between the heated rear window relay RA2 pin 2, circuit CRD02A (BN/BU), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit CRD02A (BN/BU). TEST the system for normal operation. **No** GO to E4.
E4: CHECK THE HEATED REAR WINDOW RELAY CIRCUIT FOR A SHORT TO POWER	
	1 Ignition switch in position II.
	2 Measure the voltage between the heated rear window relay RA2 pin 5, circuit CRD06B (BN/YE), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** REPAIR circuit CRD06B (BN/YE). TEST the system for normal operation. **No** VERIFY the customer concern.

Component Tests

Heated Rear Window Grid Wire Test

1. **1.** Using a bright lamp inside the vehicle, visually inspect the grid wire from the outside. A broken grid conductor line will appear as a brown spot.

2. **2.** Run the engine at idle. Set the heated rear window switch and lights to ON. The heated rear window indicator light should illuminate.

3. **3.** Working inside the vehicle with a multimeter, contact the broad red/brown strips on the heated rear window positive lead to battery side and negative lead to ground side. The meter should read 10-13 volts. A lower voltage reading indicates a loose heated rear window ground wire connection at the heated rear window ground wire

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screw.

4. **4.** Contact a ground point with the negative lead of the multimeter. The voltage reading should not change.

5. **5.** With the negative lead of the multimeter grounded, touch each grid line of the heated rear window at its pinpoint with the positive lead. A reading of approximately six volts indicates that the line is OK. A reading of zero volts indicates that the line is broken between the midpoint and the battery side of the grid line. A reading of 12 volts indicates that the circuit is broken between the midpoint of the grid line and ground.

6. **6.** INSTALL a new heated rear window glass.
   REFER to: Liftgate Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

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Print

General Procedures

WARNING: The window anti-trap function will not operate during the window motor initialization procedure.
NOTE: Make sure that the window runs are correctly installed and free of foreign material.
NOTE: If the power to a window regulator motor has been disconnected, that window regulator motor must be initialized.
NOTE: Wait for a minimum of 1 minute before connecting the battery, fuse or electrical connector.

1. Start the engine.
2. Press and hold the power window control switch close button until the door window is fully closed.
3. Release the power window control switch close button.
4. Press the power window control switch close button three times for one second.
5. Briefly press the power window control switch open button to the 2nd detent and release the button. The door window should open automatically.
6. Briefly press the power window control switch close button to the 2nd detent and release the button. If the door window does not close automatically, repeat the complete procedure.
7. Repeat the door window motor initialization for each door window motor.
8. Switch off the engine.

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Removal and Installation

Materials

Name	Specification
Windscreen Adhesive Kit - 1 Component	WSK-M11P57-A3 / 7U7J-T03863-AA
Windshield Adhesive Kit	WSS-M11P57-A5

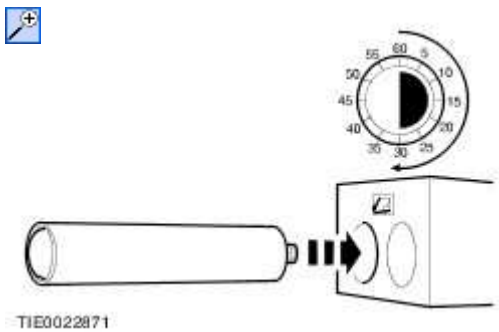
General Equipment

Adhesive tape
Direct glazing removal/replacement equipment
Knife

Removal

1. Refer to: Window Glass Health and Safety Precautio General Information, Description and Operation).

All vehicles



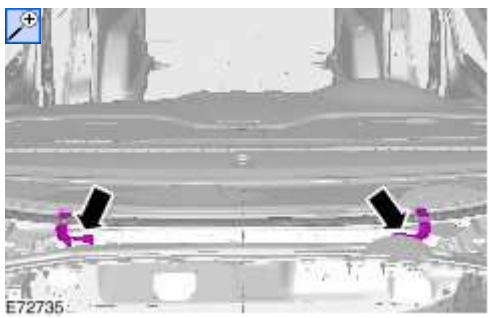
2.
   1. *Material:* Windshield Adhesive Kit (WSS-M11P
   2. Remove the polyurethane (PU) adhesive cap a PU adhesive for a minimum of 30 minutes.

      General Equipment: Direct glazing removal/re equipment
   3. Repairs under warranty:

      Material: Windscreen Adhesive Kit - 1 Compor M11P57-A3 / 7U7J-T03863-AA)

3. Refer to: Cowl Panel Grille (501-02 Front End Body and Installation).

Vehicles with heated windshield



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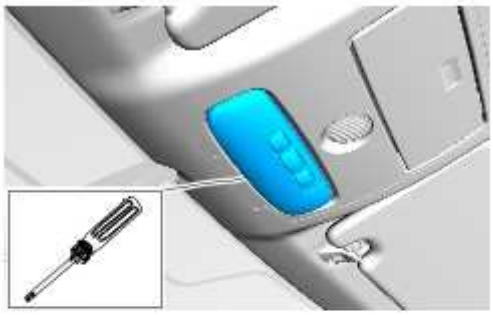

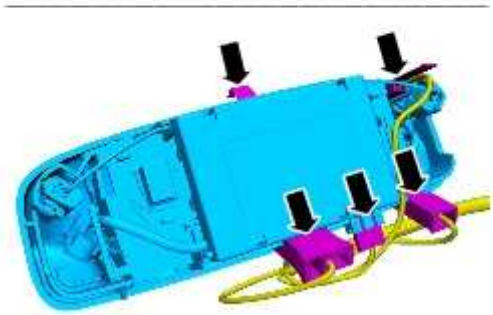

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Vehicles with manual dimming interior mirror

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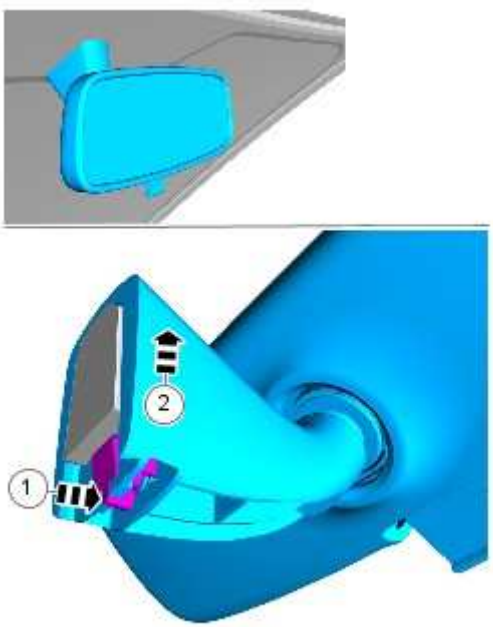

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Vehicles with autolamps and rain sensor

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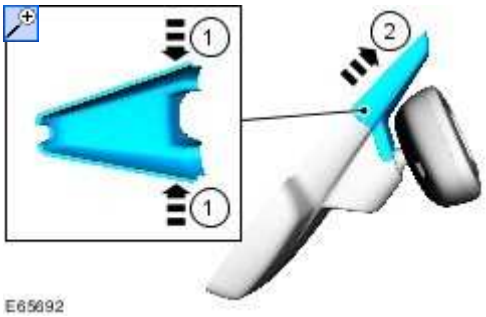

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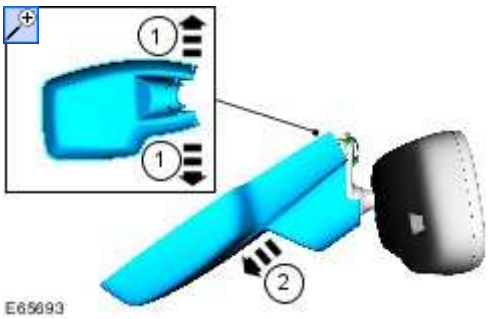

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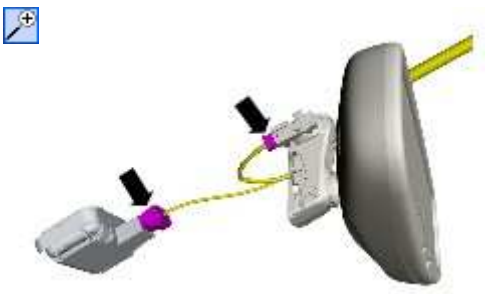

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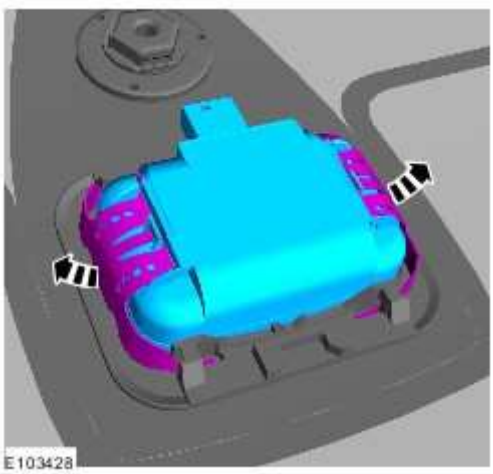

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All vehicles

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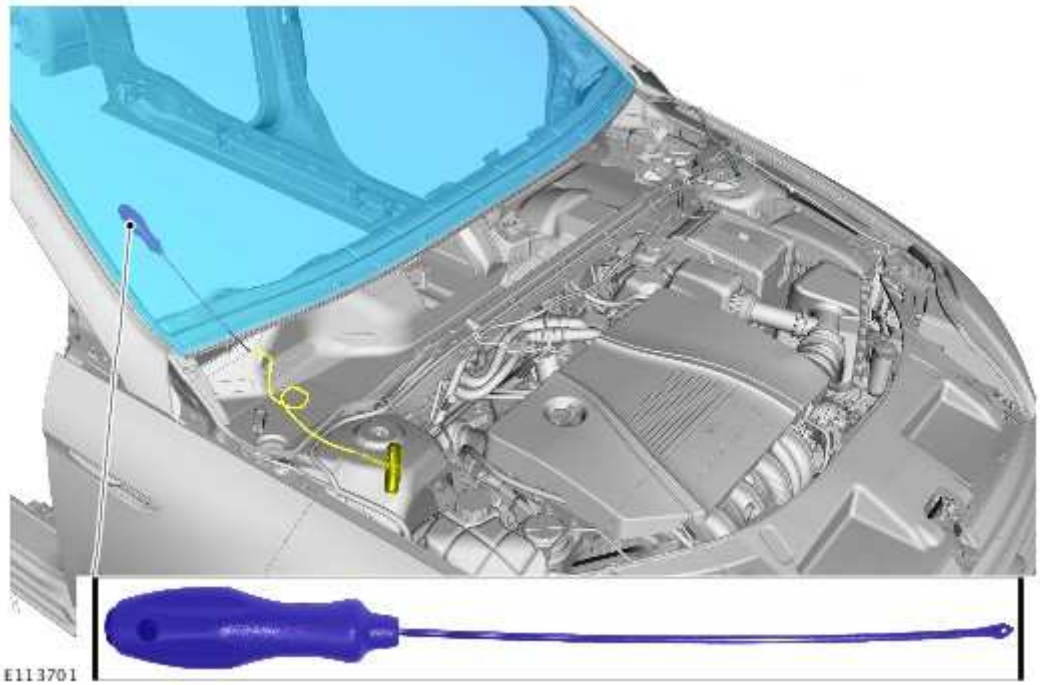

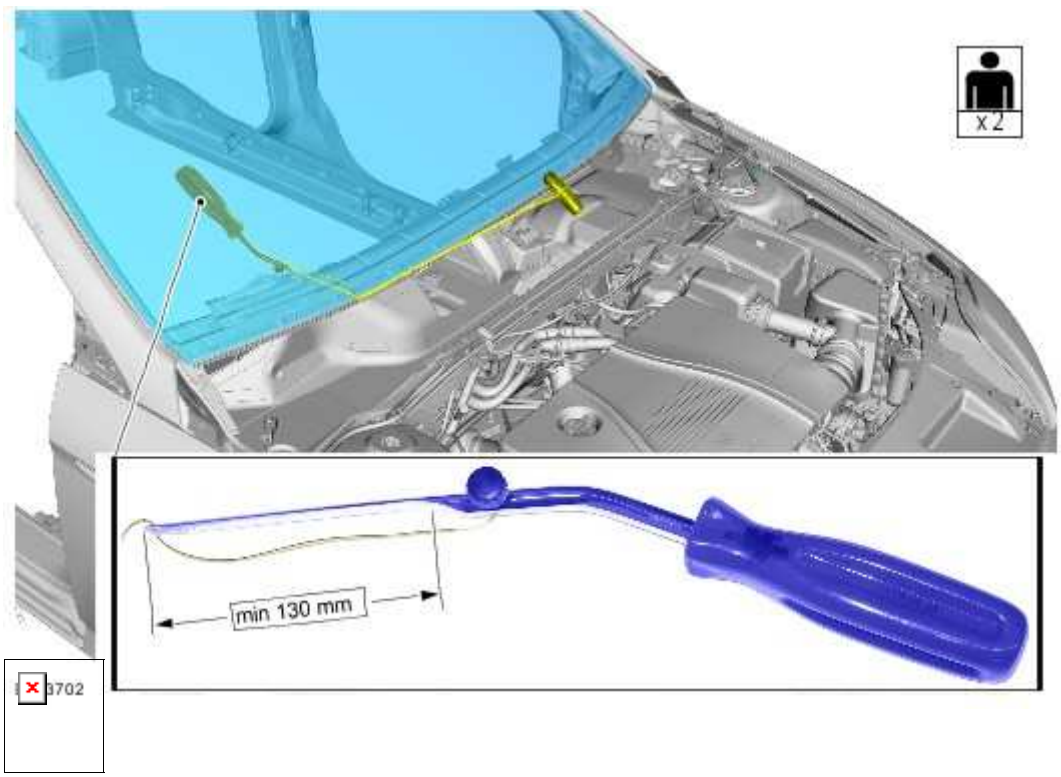

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Installation

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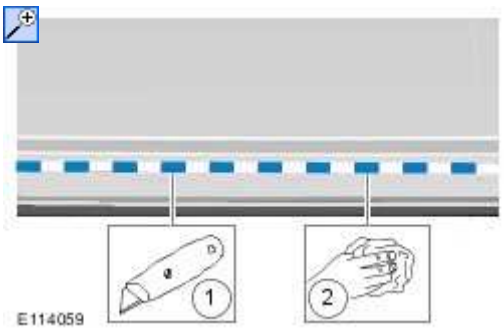
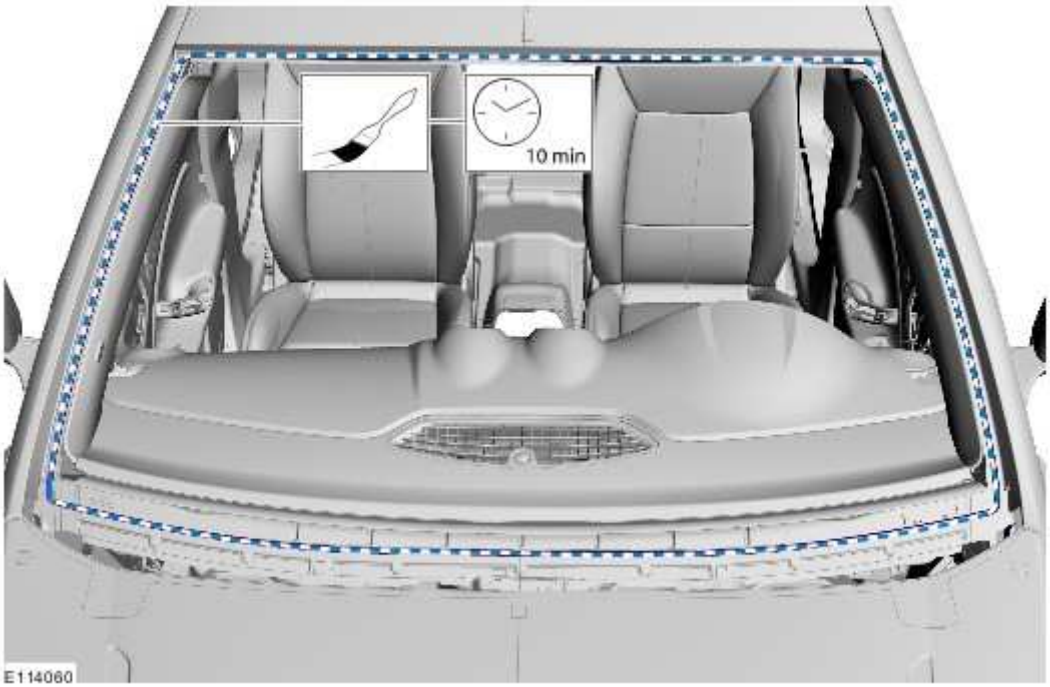
All vehicles

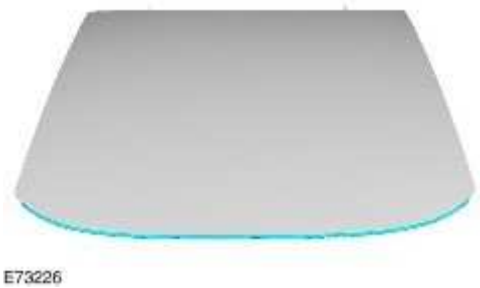


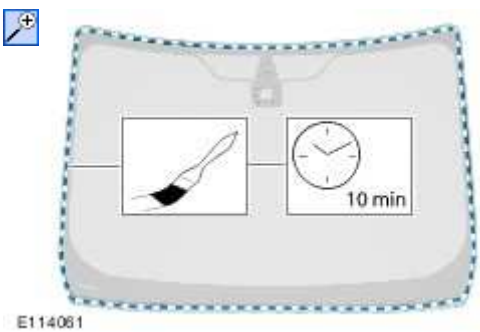
1.
   1. NOTE: Minimum 1 mm bead thickness.
      General Equipment: Knife
   2. NOTE: Make sure that the mating faces are free of foreign material.
   3. NOTE: Touching the adhesive surface will in rebonding.
      Prepare the windshield glass, windshield glass trimmed PU adhesive in accordance with the i supplied with the glass adhesive kit.



2. Apply th primer ir with the supplied adhesive

3. NOTE: Touching the adhesive surface will impair re
   NOTE: Make sure that the mating faces are clean a foreign material.





4. Apply the activator/ primer in accordance with the i supplied with the glass adhesive kit.

5. NOTE: Discard the first 100 mm of adhesive as th reduced working time.
   NOTE: Make sure that any breakage in the contin

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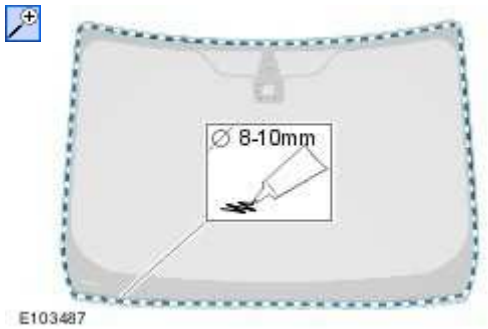
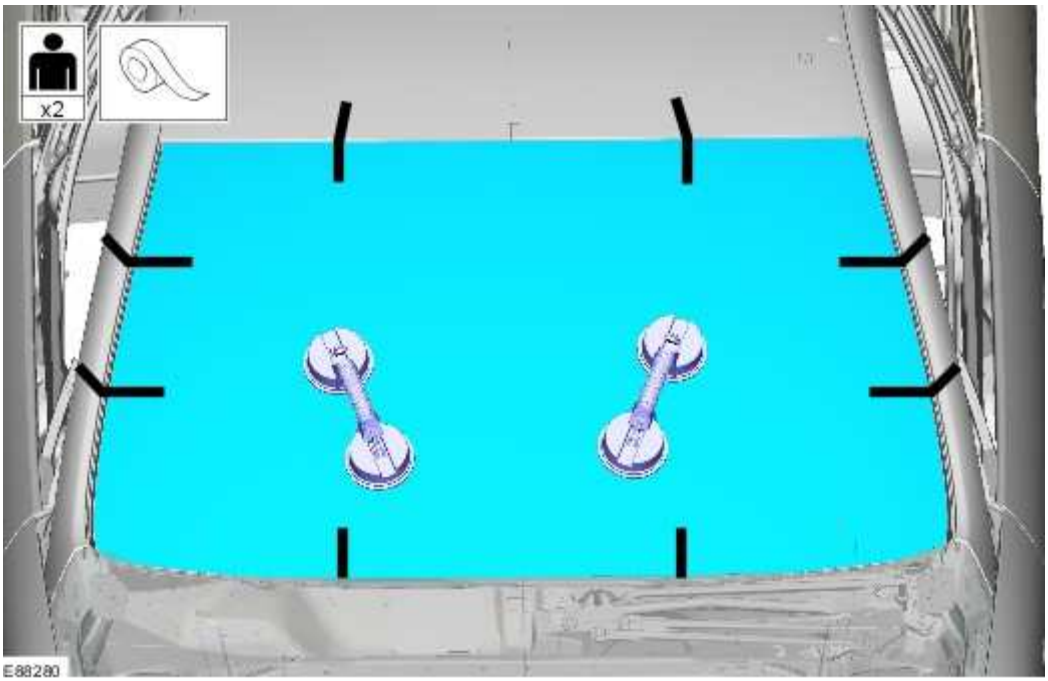


adhesive is overlapped by 20 mm.
General Equipment: Direct glazing removal/replacer
Material: Windshield Adhesive Kit (WSS-M11P57-A5
Material: Windscreen Adhesive Kit - 1 Component (
A3 / 7U7J-T03863-AA)



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Vehicles with heated windshield

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  M8 26 Nm

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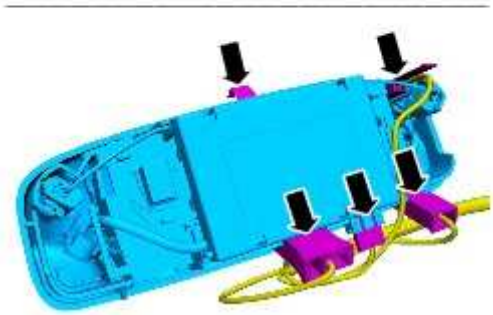

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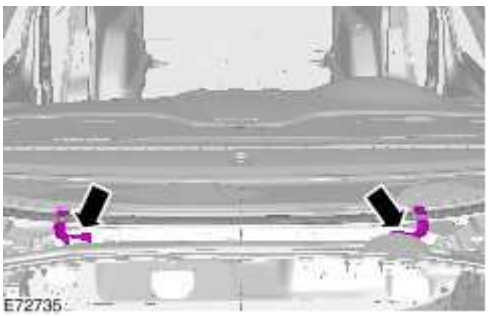

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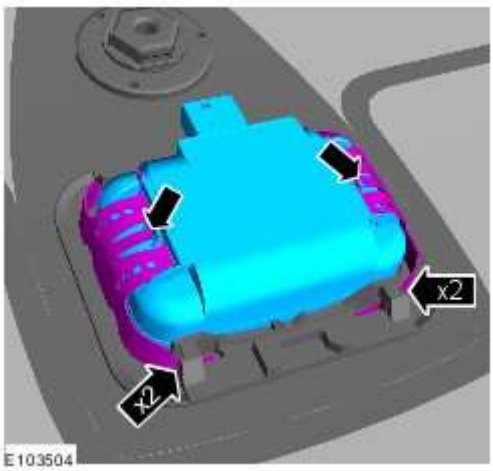
Vehicles with autolamps and rain sensor

10.



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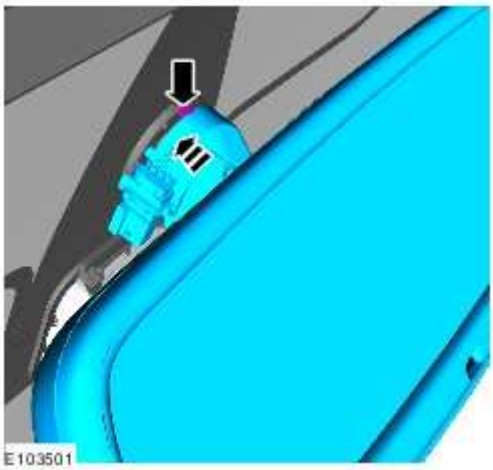

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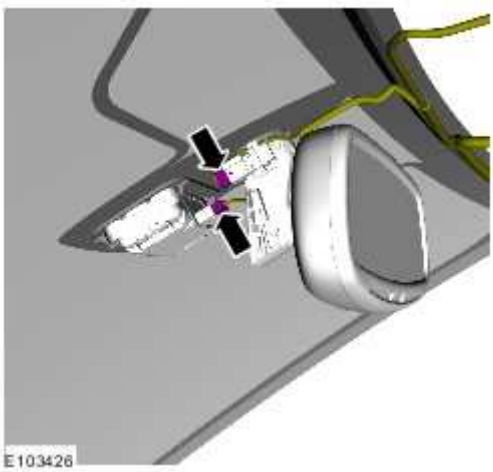

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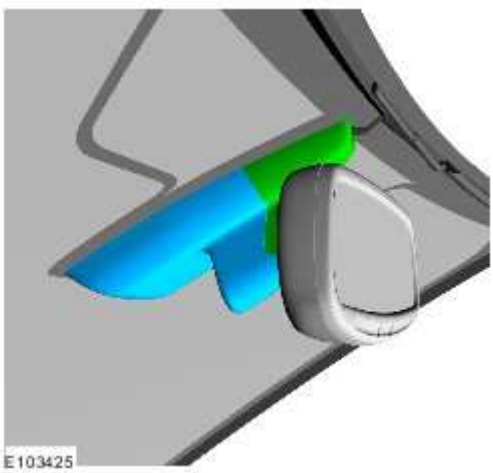

Vehicles with manual dimming interior mirror

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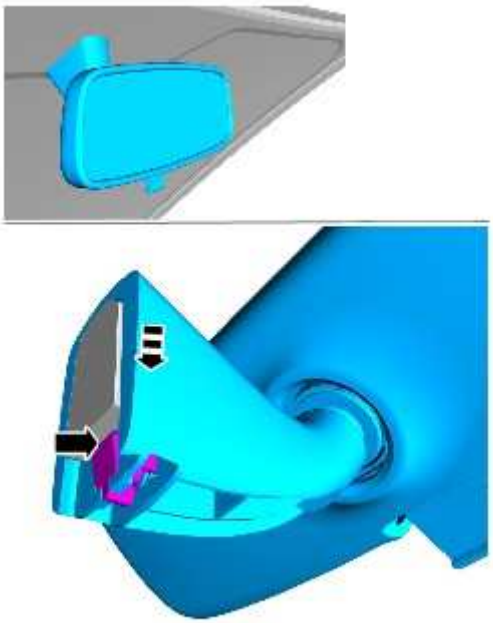

E103502

All vehicles

E103458

15. Refer to: Cowl Panel Grille (501-02 Front End Body and Installation).

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Removal and Installation

Materials

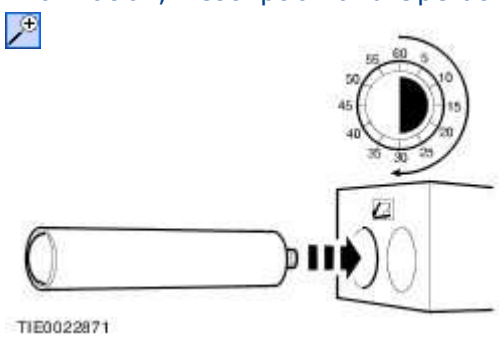
Name	Specification
Windshield Adhesive Kit	WSS-M11P57-A5

General Equipment

5 mm drill bit
Direct glazing removal/replacement equipment
Electric drill
Hot air gun
Knife
Laminated card

Removal

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

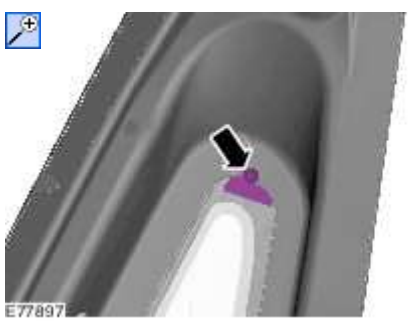


1. Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.

   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)

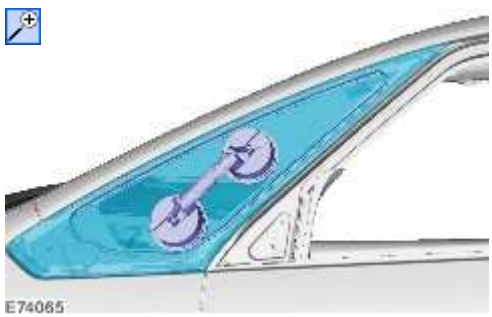
2. Remove the A-pillar trim panel.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. Break off or drill out the front quarter window glass spacer pin.

   General Equipment: Electric drill
   General Equipment: 5 mm drill bit



4. NOTE: This step requires the aid of another technician.
   - From inside the vehicle, cut the PU adhesive.

     General Equipment: Direct glazing removal/replacement equipment
     General Equipment: Laminated card

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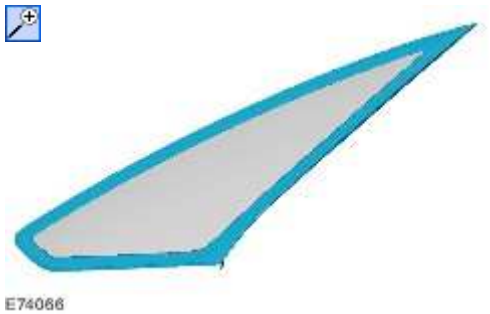

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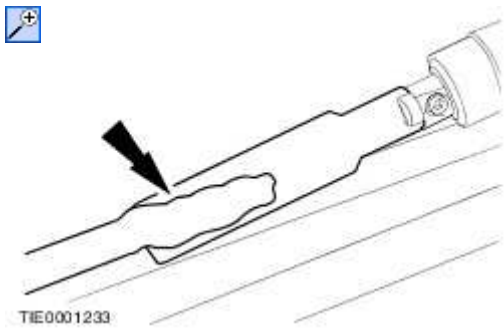
5.

Installation



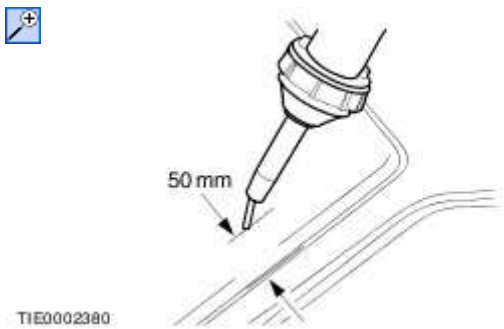
TIE0001233

1. NOTE: Minimum 1 mm bead thickness.
NOTE: Make sure that the mating faces are clean and free of foreign material.
Carefully trim the remaining PU adhesive from the front quarter window glass flange.

General Equipment: Knife

E74066

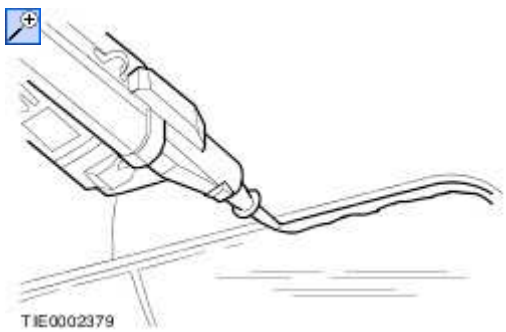
2.



TIE0002380

3. CAUTION: Make sure that all bonding surfaces are free of moisture.
NOTE: Touching the adhesive surface will impair rebonding.
Prepare the front quarter window glass, front quarter window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

General Equipment: Hot air gun
Material: Windshield Adhesive Kit (WSS-M11P57-A5)



TIE0002379

4. NOTE: Discard the first 100 mm of adhesive as this may have a reduced working time.
NOTE: Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.
Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the front quarter window glass flange along the bond line.

General Equipment: Direct glazing removal/replacement equipment
Material: Windshield Adhesive Kit (WSS-M11P57-

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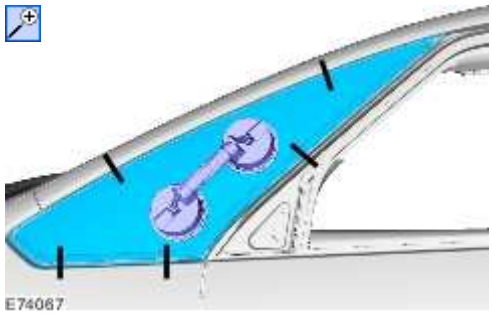
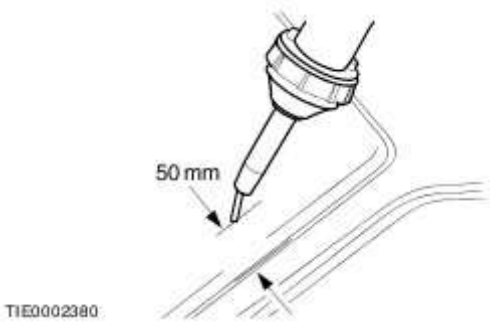
A5)



5. NOTE: This step requires the aid of another technician.
   - Press firmly and evenly into position.

     General Equipment: Direct glazing removal/replacement equipment
   - Using tape, secure the front quarter window glass in the correct position until the PU adhesive has cured.



6. If the ambient temperature falls below 10°C, apply warm air (25°C) continuously for 15 minutes.

   General Equipment: Hot air gun

7. Install the A-pillar trim panel.

   Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

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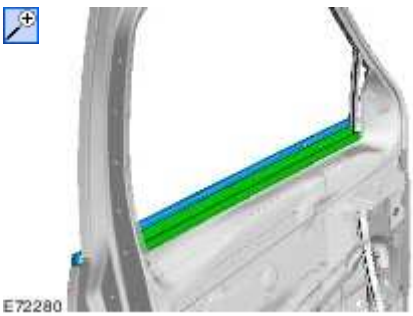
Removal and Installation

Removal

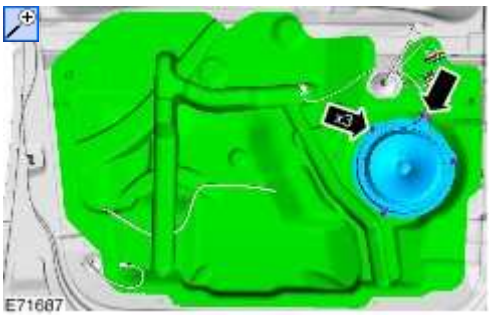
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front door trim panel.

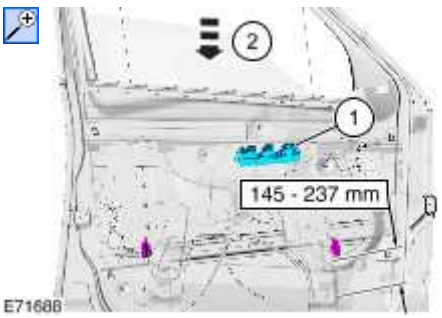
   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



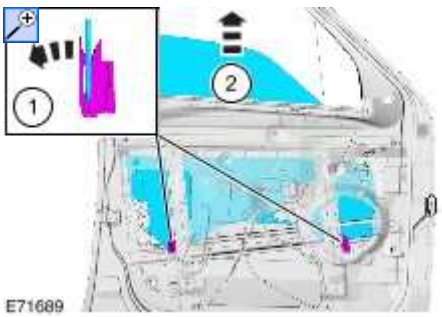
2.



3. *Torque:* 7 Nm



4.



5.

2. Remove the front door window glass towards the outside of the window opening.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

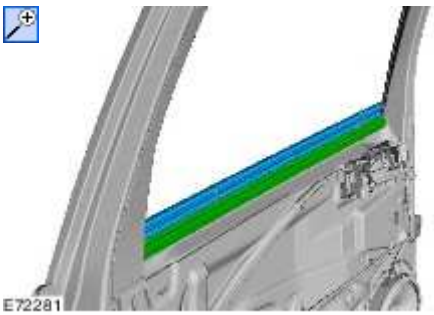
Removal

All vehicles

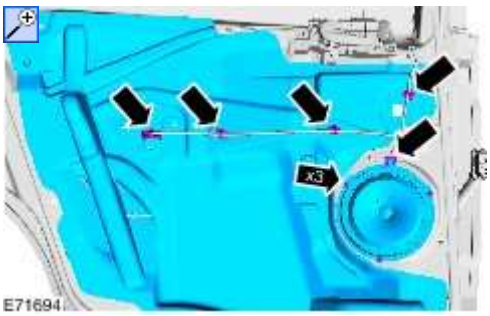
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

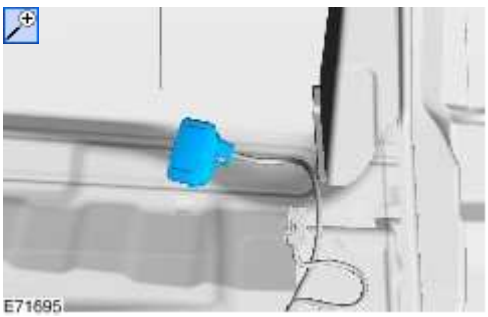


2.



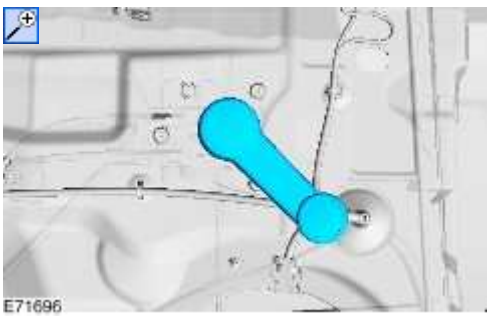
3. *Torque:* 7 Nm

Vehicles with power windows



4.

Vehicles with manual windows



5.

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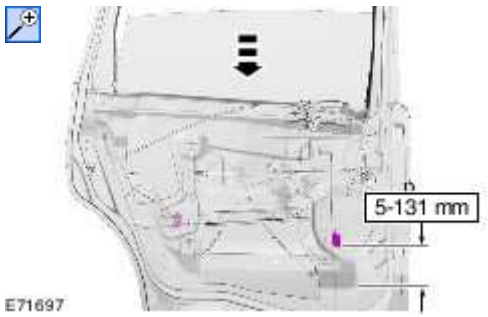
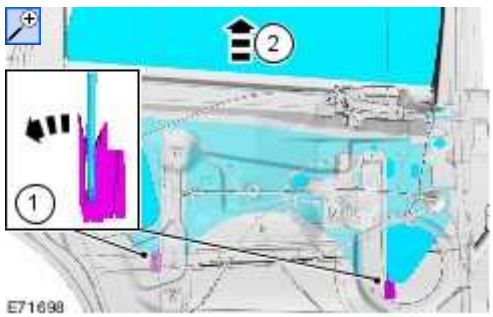
All vehicles

6.



7.



2. Remove the rear door window glass towards the outside of the window opening.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

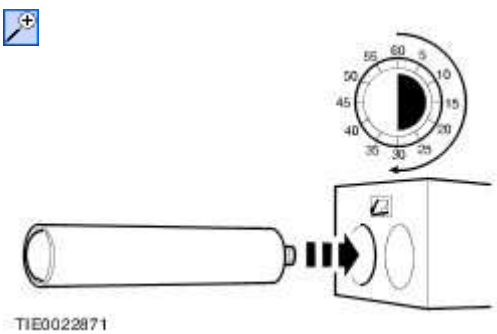
Materials

Name	Specification
Windshield Adhesive Kit	WSS-M11P57-A5

General Equipment

Direct glazing removal/replacement equipment
Hot air gun
Knife
Laminated card

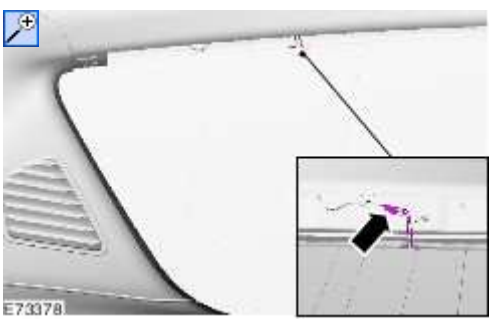
Removal



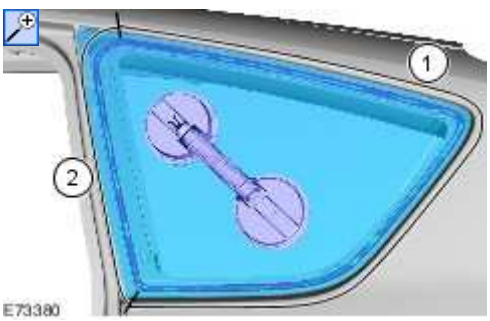
1. Refer to: Window Glass Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.

   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)
3. Remove the C-pillar trim panel.

   Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).



4.



5. CAUTION: If the original window glass is to be installed, take care not to damage the electrical connectors and the weatherstrip.
   NOTE: This step requires the aid of another technician.
   1. From outside the vehicle, cut the PU adhesive.

      General Equipment: Direct glazing removal/replacement equipment

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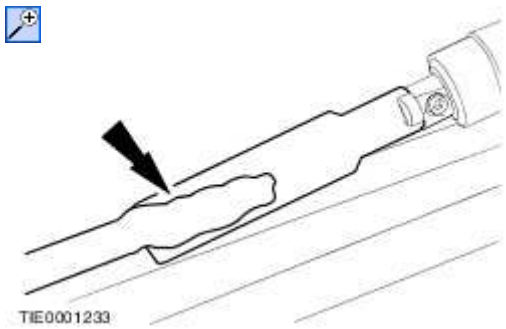
General Equipment: Laminated card

2. NOTE: Some resistance may be encountered when cutting through the glass locating spacers.
   From inside the vehicle, cut the PU adhesive to a maximum depth of 50 mm.

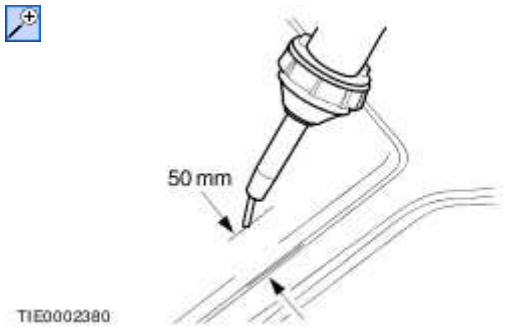
   General Equipment: Direct glazing removal/replacement equipment

Installation



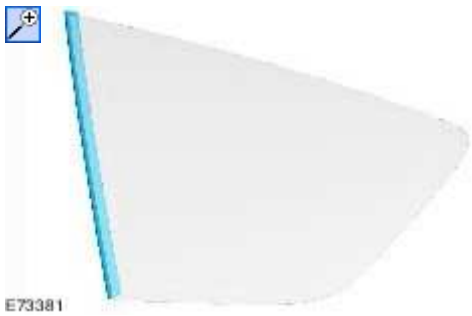
1. NOTE: Minimum 1 mm bead thickness.
   NOTE: Make sure that the mating faces are clean and free of foreign material.
   Carefully trim the remaining PU adhesive from the rear quarter window glass flange.

   General Equipment: Knife

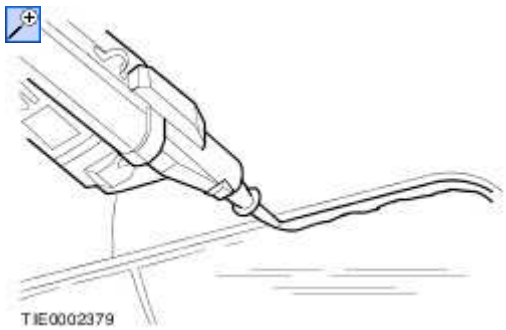


2. Prepare the rear quarter window glass, rear quarter window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

   General Equipment: Hot air gun
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)



3. NOTE: Make sure that the mating faces are clean and free of foreign material.



4. NOTE: Discard the first 100 mm of adhesive as this may have a reduced working time.
   NOTE: Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.
   Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the rear quarter window glass flange along the bond line.

   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)

5. NOTE: This step requires the aid of another technician.

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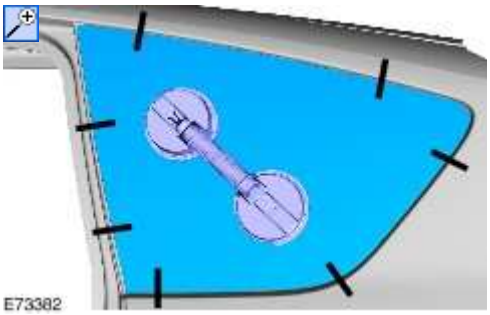
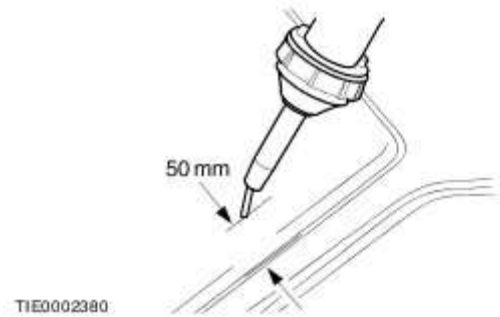


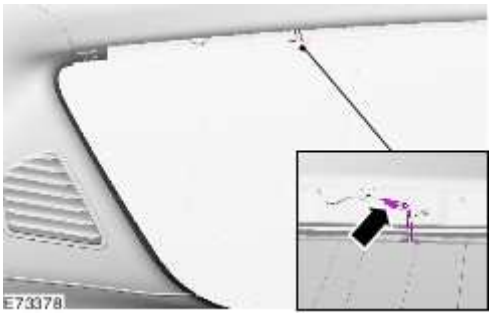
- Press firmly and evenly into position.

  General Equipment: Direct glazing removal/replacement equipment
- Using tape, secure the rear quarter window glass in the correct position until the PU adhesive has cured.



6. If the ambient temperature falls below 10°C, apply warm air (25°C) continuously for 15 minutes.

   General Equipment: Hot air gun



7.

8. Install the C-pillar trim panel.

   Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).

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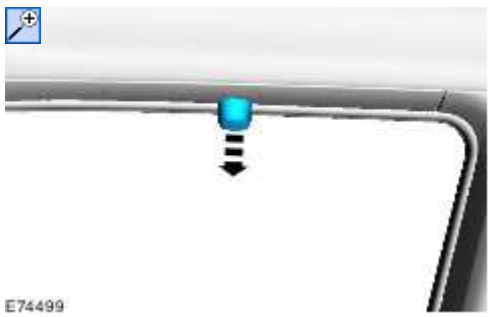
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

All vehicles


E74499

1.

E74500

2.

Vehicles with power windows

3. Remove the D-pillar trim panel.

   Refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

E74604

4. *Torque:* 6 Nm

Vehicles with manual windows

5. *Torque:* 6 Nm

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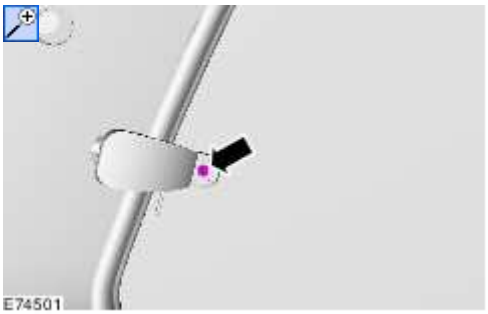
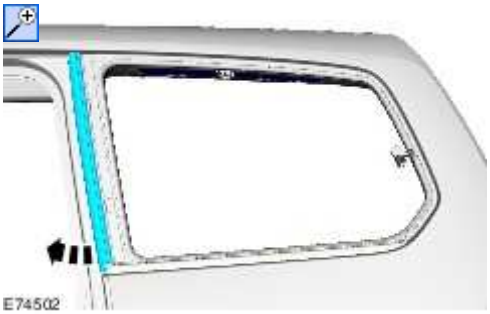
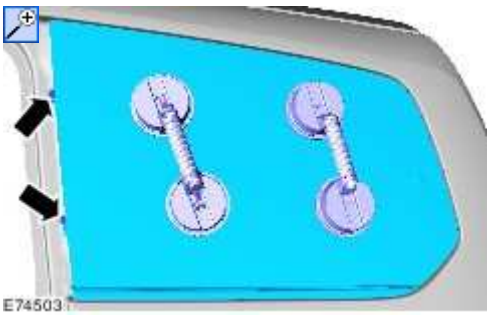


All vehicles

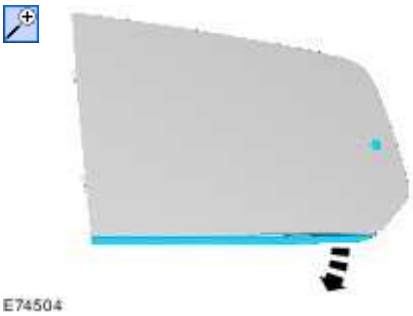
6.



7. *Torque:* 10 Nm



8.



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

Name	Specification
Windshield Adhesive Kit	WSS-M11P57-A5

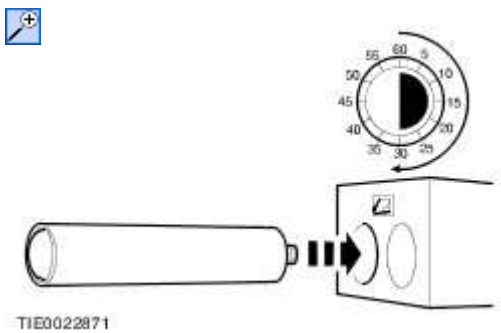
General Equipment

Direct glazing removal/replacement equipment
Hot air gun
Knife
Laminated card

Removal

All vehicles

1. Refer to: Window Glass Health and Safety Precautions (100-00 General Information, Description and Operation).

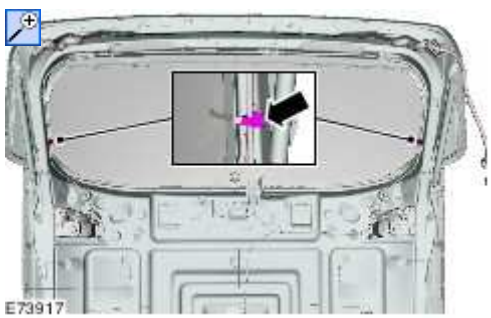


2. Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.

   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)

3. Remove the rear window wiper motor.

   Refer to: Rear Window Wiper Motor (501-16 Wipers and Washers, Removal and Installation).



4.

Vehicles with VIN plate body code: S

5. CAUTION: If the original window glass is to be installed, take care not to damage the electrical connectors and the weatherstrip. NOTE: This step requires the aid of another technician.
   - From outside the vehicle, cut the PU adhesive.

     General Equipment: Direct glazing

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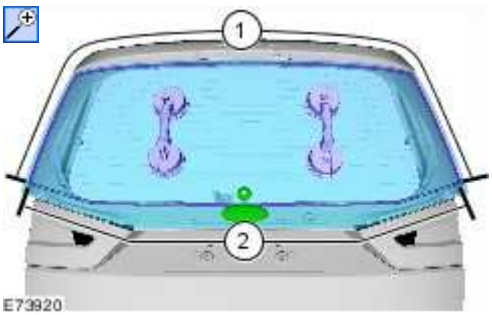
removal/replacement equipment
General Equipment: Laminated card

6. NOTE: Note the position of each component before removal.

Vehicles with VIN plate body code: M



7. CAUTION: If the original window glass is to be installed, take care not to damage the electrical connectors and the weatherstrip.
NOTE: This step requires the aid of another technician.
   1. From outside the vehicle, cut the PU adhesive.
      - Cut the PU adhesive securing the liftgate handle to the liftgate window glass.

      General Equipment: Direct glazing removal/replacement equipment
      General Equipment: Laminated card
   2. From inside the vehicle, cut the PU adhesive to a maximum depth of 25 mm.

      General Equipment: Direct glazing removal/replacement equipment

8. NOTE: Note the position of each component before removal.

9.

Installation

All vehicles

1. NOTE: Minimum 1 mm bead thickness.
NOTE: Make sure that the mating faces are

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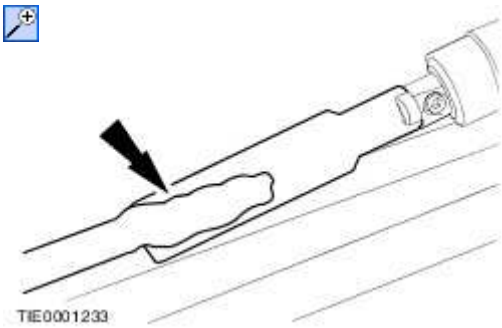
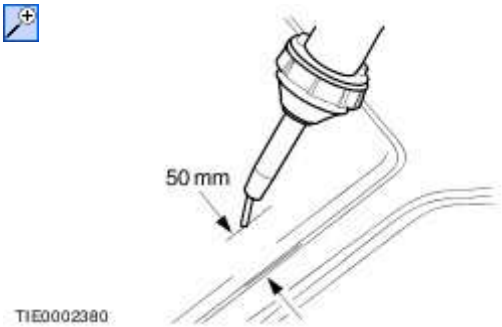


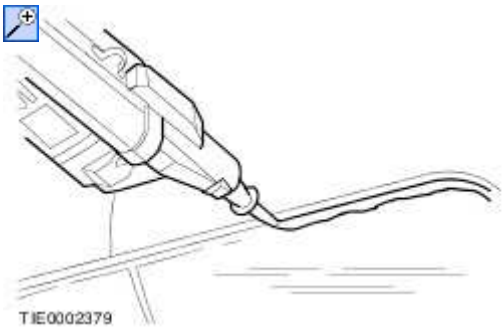
clean and free of foreign material.
Carefully trim the remaining PU adhesive from the liftgate window glass flange.

General Equipment: Knife



2. Prepare the liftgate window glass, liftgate window glass flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

General Equipment: Hot air gun
Material: Windshield Adhesive Kit (WSS-M11P57-A5)



3. NOTE: Discard the first 100 mm of adhesive as this may have a reduced working time.
NOTE: Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.
Apply the PU adhesive in a continuous bead of between 8 and 10 mm in height to the liftgate window glass flange along the bond line.

General Equipment: Direct glazing removal/replacement equipment
Material: Windshield Adhesive Kit (WSS-M11P57-A5)

Vehicles with VIN plate body code: M

4. NOTE: Make sure that the mating faces are clean and free of foreign material.

5. NOTE: Make sure that these components are installed to the noted removal position.

6. Apply PU adhesive to the liftgate handle.

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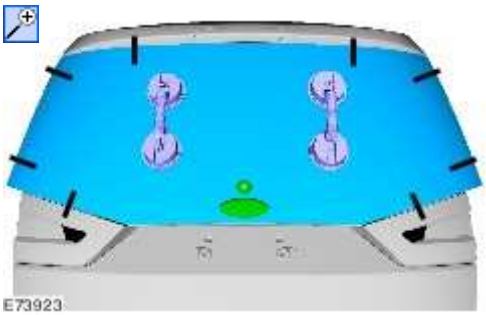
General Equipment: Direct glazing removal/replacement equipment
Material: Windshield Adhesive Kit (WSS-M11P57-A5)



7. NOTE: This step requires the aid of another technician.
   - Press firmly and evenly into position.

     General Equipment: Direct glazing removal/replacement equipment
     Material: Windshield Adhesive Kit (WSS-M11P57-A5)
   - Using tape, secure the liftgate window glass in the correct position until the PU adhesive has cured.

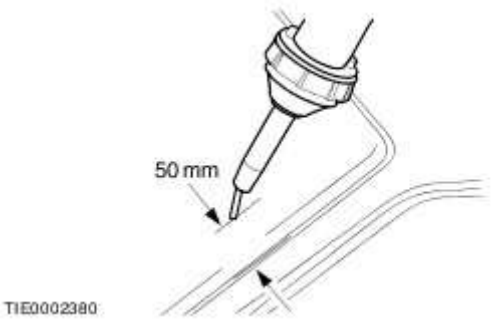
Vehicles with VIN plate body code: S

8. NOTE: Make sure that these components are installed to the noted removal position.

9. NOTE: This step requires the aid of another technician.
   - Press firmly and evenly into position.

     General Equipment: Direct glazing removal/replacement equipment
     Material: Windshield Adhesive Kit (WSS-M11P57-A5)
   - Using tape, secure the liftgate window glass in the correct position until the PU adhesive has cured.

All vehicles



10. If the ambient temperature falls below 10°C, apply warm air (25°C) continuously for 15 minutes.

    General Equipment: Hot air gun

11.

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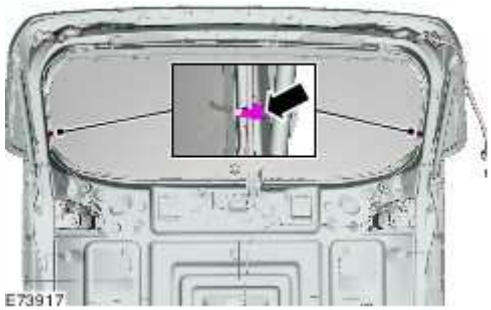

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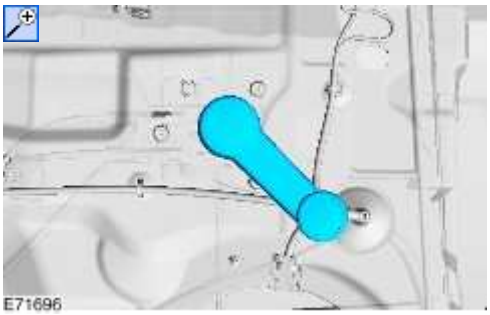
Removal and Installation

Removal

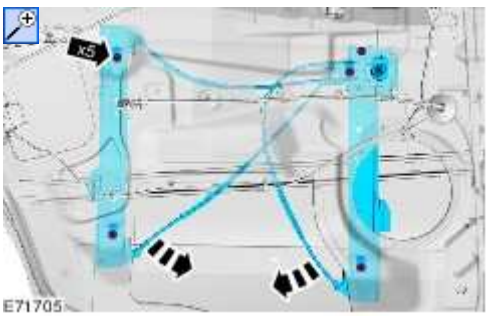
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the rear door window glass.

   Refer to: Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).



2.



3.

Installation

1. To install, reverse the removal procedure.

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Print

Removal and Installation

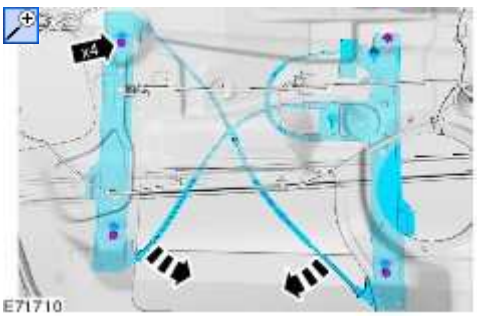
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the following items:
   1. Door window glass

      Refer to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
      Refer to: Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
   2. Door window regulator motor

      Refer to: Door Window Regulator Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).



2.

Installation

1. To install, reverse the removal procedure.

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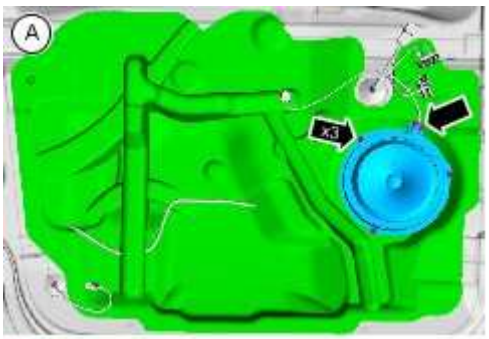
Removal and Installation

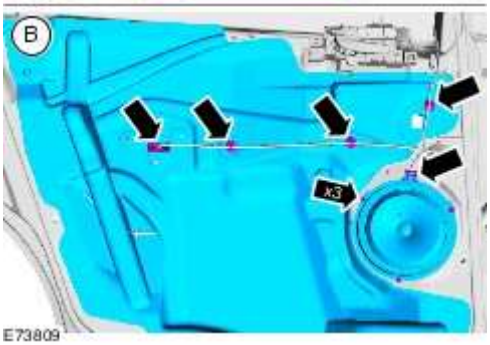
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
   Refer to: Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

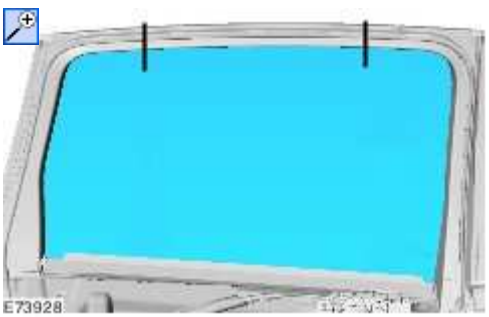




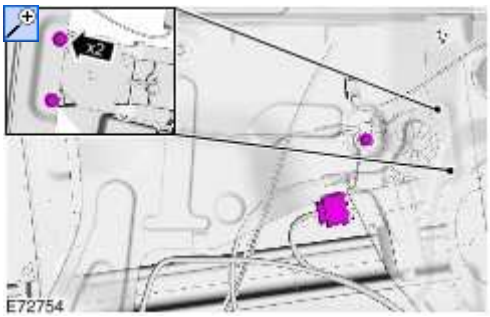
2.
   - A - Front door

     Torque: 7 Nm
   - B - Rear door

     Torque: 7 Nm



3. Using tape, secure the door window glass in the closed position.



4.

5.

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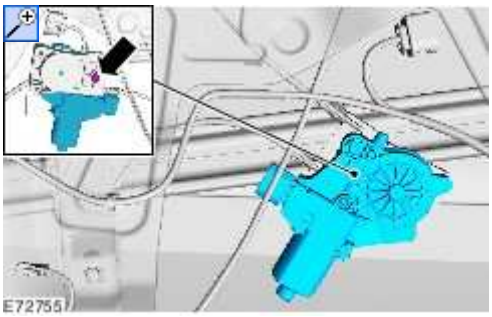

Installation

1. To install, reverse the removal procedure.

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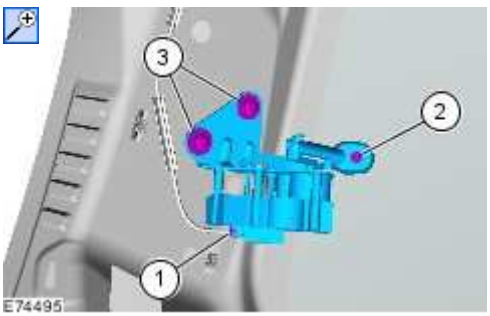
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the D-pillar trim panel.

   Refer to: D-Pillar Trim Panel - VIN Plate Body Style Code: S (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.
   2. *Torque:* 6 Nm
   3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Materials

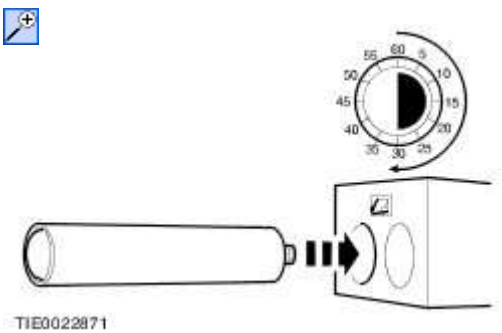
Name	Specification
Windshield Adhesive Kit	WSS-M11P57-A5

General Equipment

Direct glazing removal/replacement equipment
Hot air gun
Knife
Laminated card

Removal

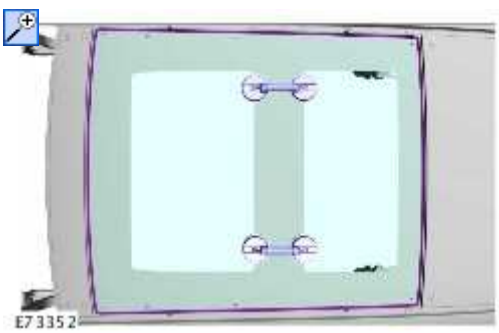
1. Refer to: Window Glass Health and Safety Precautions (100-00 General Information, Description and Operation).



2. Remove the polyurethane (PU) adhesive cap and heat the PU adhesive for a minimum of 30 minutes.

   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)

3.



4. NOTE: This step requires the aid of another technician.
   - From outside the vehicle, cut the PU adhesive.

     General Equipment: Direct glazing removal/replacement equipment
     General Equipment: Laminated card

5. NOTE: Note the position of each component before removal.

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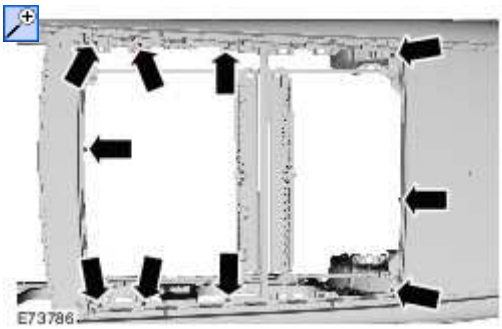
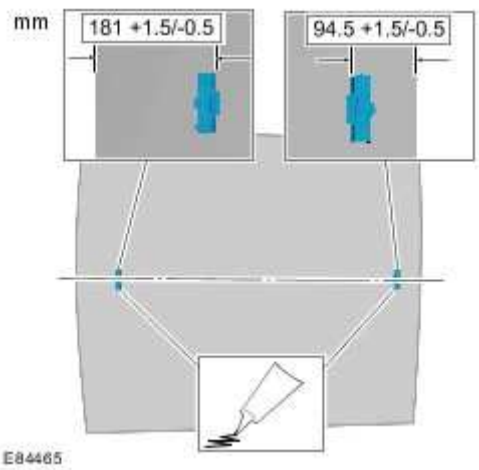


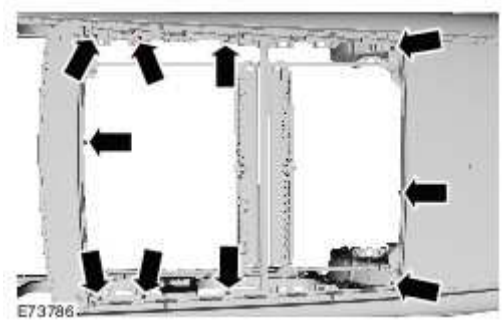
Installation



1. CAUTION: Primer must not be applied to the glass roof panel blind retaining hooks.
   NOTE: This step is only necessary when installing a new component.
   NOTE: Make sure that the mating faces are clean and free of foreign material.
   NOTE: Touching the adhesive surface will impair rebonding.
   Prepare the glass roof panel and glass roof panel blind retaining hooks in accordance with the instructions supplied with the PU adhesive kit.

   General Equipment: Hot air gun
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)

2. Place the glass roof panel on a clean surface with the blind retaining hooks facing upwards and allow the adhesive to cure in accordance with the manufacturers instructions.



3. NOTE: Make sure that these components are installed to the noted removal position.

4.
   1. NOTE: Minimum 1 mm bead thickness.
      General Equipment: Knife
   2. NOTE: Make sure that the mating faces are clean and free of foreign material.
   3. NOTE: Touching the adhesive surface will impair rebonding.
      Prepare the glass roof panel, glass roof

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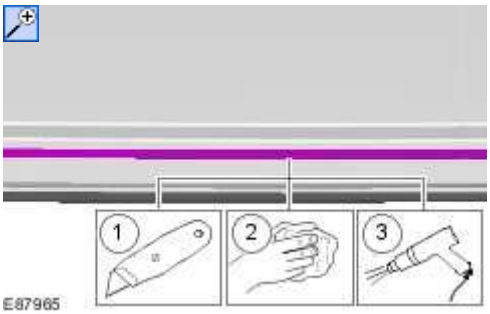
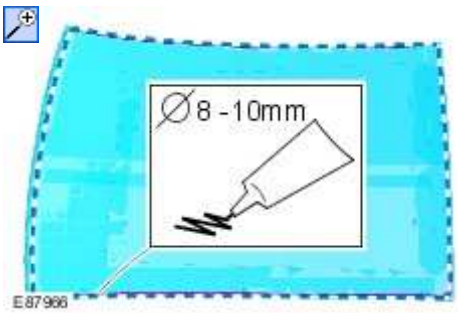
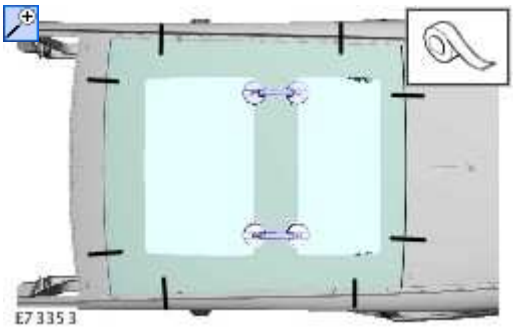


panel flange and trimmed PU adhesive in accordance with the instructions supplied with the PU adhesive kit.

General Equipment: Hot air gun
Material: Windshield Adhesive Kit (WSS-M11P57-A5)

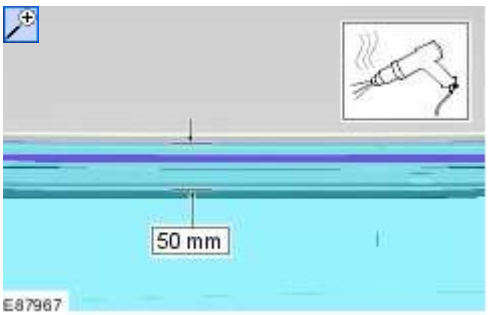


5. NOTE: Discard the first 100 mm of adhesive as this may have a reduced working time.
   NOTE: Make sure that any breakage in the continuous bead of adhesive is overlapped by 20 mm.
   General Equipment: Direct glazing removal/replacement equipment
   Material: Windshield Adhesive Kit (WSS-M11P57-A5)



6. NOTE: This step requires the aid of another technician.
   - Press firmly and evenly into position.

     General Equipment: Direct glazing removal/replacement equipment
   - Using tape, secure the glass roof panel in the correct position until the PU adhesive has cured.



7. If the ambient temperature falls below 10°C, apply warm air (25°C) continuously for 15 minutes.

   General Equipment: Hot air gun

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Removal and Installation

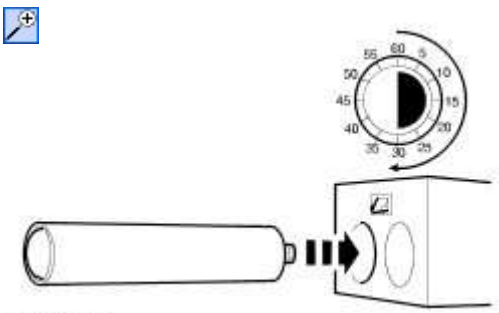
Materials

Name	Specification
Windshield Adhesive Kit	WSS-M11P57-A5

General Equipment

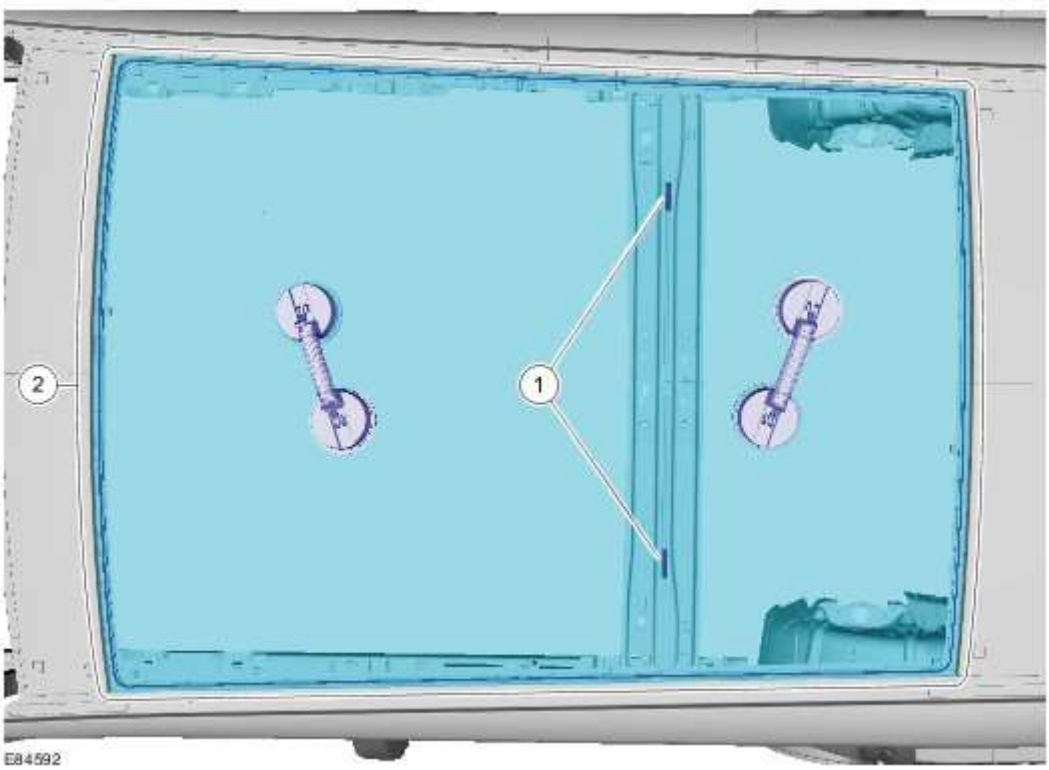
Direct glazing removal/replacement equipment
Hot air gun
Knife
Laminated card

Removal



1. Refer to: Window Glass Health and Safety Precautio
General Information, Description and Operation).
2. Remove the polyurethane (PU) adhesive cap and he
for a minimum of 30 minutes.

General Equipment: Direct glazing removal/replacer
Material: Windshield Adhesive Kit (WSS-M11P57-A5



3. NOTE: T
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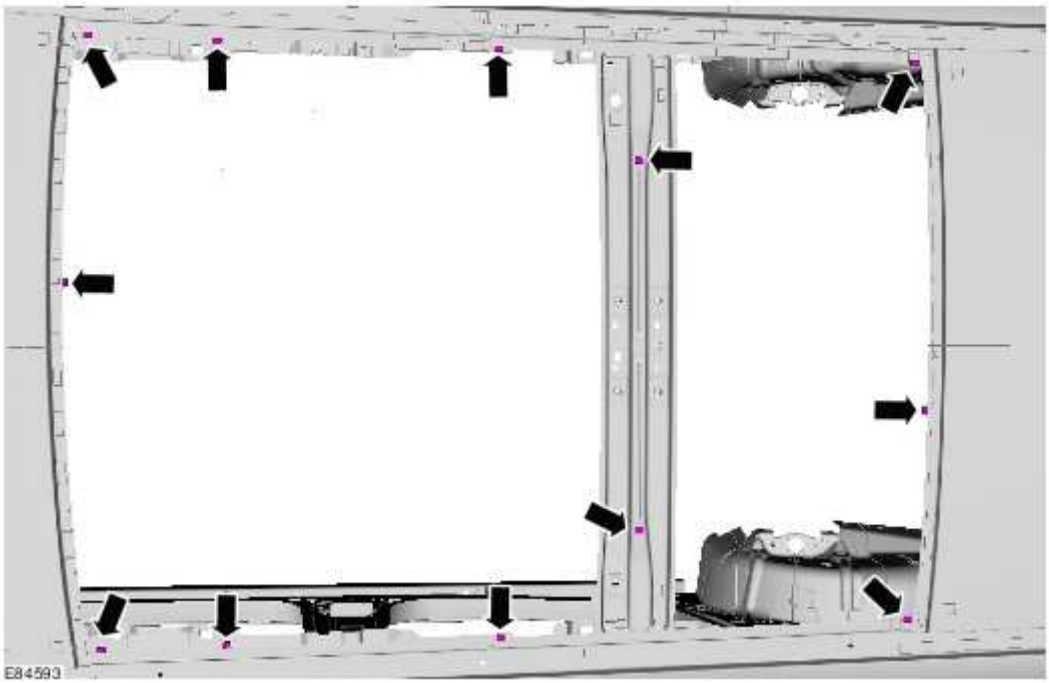
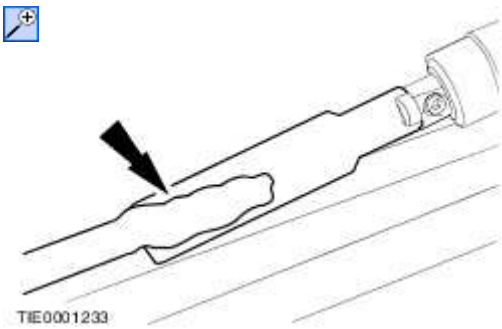
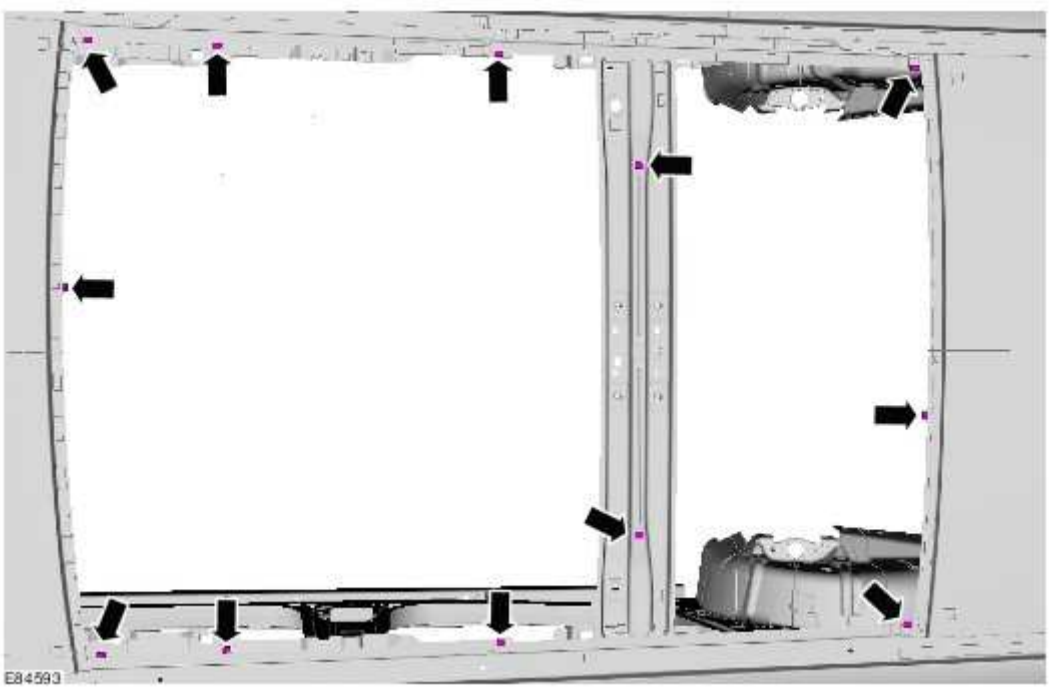


Installation



1. NOTE: Minimum 1 mm bead thickness.
   NOTE: Make sure that the mating faces are clean foreign material.
   Carefully trim the remaining PU adhesive from the g flange.

   General Equipment: Knife



2. NOTE: M these co installed removal

3. CAUTION: Make sure that all bonding surface

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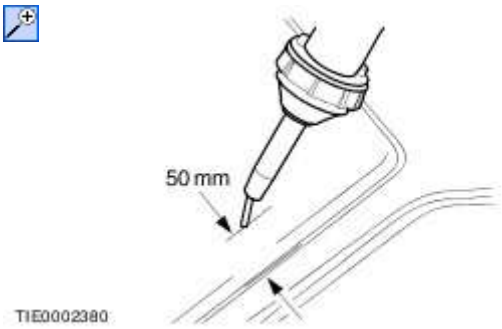
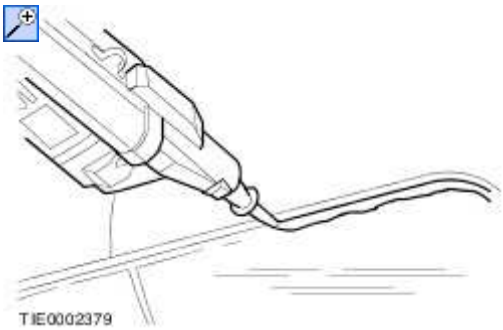


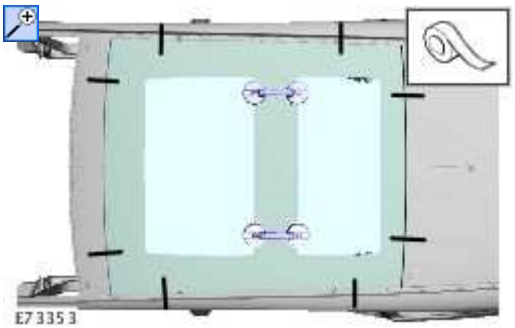
moisture.
NOTE: Touching the adhesive surface will impair r
Prepare the glass roof panel, glass roof panel flange
adhesive in accordance with the instructions supplie
adhesive kit.

General Equipment: Hot air gun
Material: Windshield Adhesive Kit (WSS-M11P57-A5



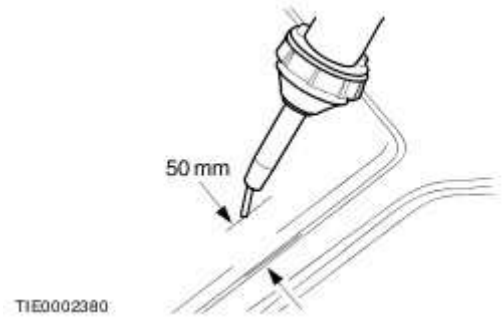
4. NOTE: Discard the first 100 mm of adhesive as thi
reduced working time.
NOTE: Make sure that any breakage in the continu
adhesive is overlapped by 20 mm.
Apply the PU adhesive in a continuous bead of betw
in height to the glass roof panel flange along the bo

General Equipment: Direct glazing removal/replacer
Material: Windshield Adhesive Kit (WSS-M11P57-A5



5. NOTE: This step requires the aid of another techn
   - Press firmly and evenly into position.

     General Equipment: Direct glazing removal/re
     equipment
   - Using tape, secure the glass roof panel in the
     until the PU adhesive has cured.



6. If the ambient temperature falls below 10°C, apply
continuously for 15 minutes.

General Equipment: Hot air gun

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Removal and Installation

General Equipment

Flat-bladed screwdriver
Round-ended steel rule

Removal

All vehicles

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the po supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or remo any SRS components.

Wear safety goggles.

Do not probe supplemental restraint system (SRS) electrical connectors.

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Supplemental Restraint System (SRS) Hea Safety Precautions (100-00 General Information, De and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).
3. Remove the following items:
    1. Refer to: Floor Console Upper Section - Vehicl Center Armrest/Manually Adjusted Parking Bra (501-12 Instrument Panel and Console, Remo Installation).
    2. Refer to: Floor Console Upper Section - Vehicl Manually Adjusted Parking Brake, Vehicles Wit Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).
    3. Refer to: Floor Console - Vehicles With: Electr Parking Brake (EPB), VIN Plate Body Style Coc (501-12 Instrument Panel and Console, Remo Installation).
    4. Refer to: Floor Console - Vehicles With: Electr Parking Brake (EPB), VIN Plate Body Style Coc (501-12 Instrument Panel and Console, Remo Installation).
    5. A-Pillar trim panels.

       Refer to: A-Pillar Trim Panel (501-05 Interior T Ornamentation, Removal and Installation).
    6. Audio unit.

       Refer to: Audio Unit - Vehicles Built Up To: 05 (415-01 Information and Entertainment Syste Removal and Installation).
       Refer to: Audio Unit - Vehicles With: Travel Pil (415-01 Information and Entertainment Syste Removal and Installation).
       Refer to: Audio Unit - Vehicles Built Up To: 05 Vehicles With: Digital Versatile Disc (DVD) Nav System (415-01 Information and Entertainme

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System, Removal and Installation).

7. Headlamp switch.

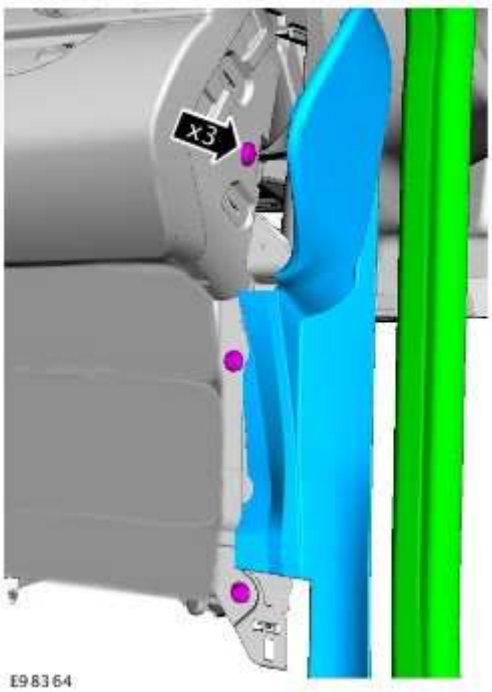
   Refer to: Headlamp Switch (417-01 Exterior Li
   Removal and Installation).

Vehicles with DVD navigation system with Touchscreen

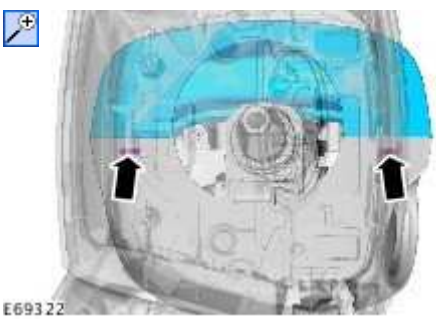
4. Remove the navigation system digital versatile disc (
   unit.

   Refer to: Navigation System Digital Versatile Disc (D
   Unit (415-01 Information and Entertainment System
   Removal and Installation).

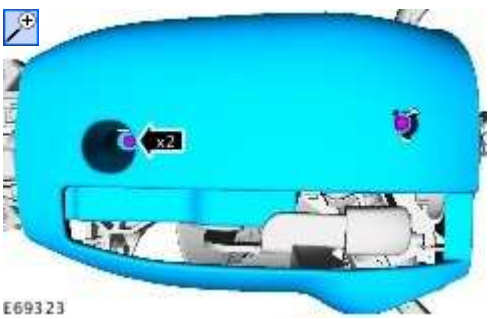
All vehicles



5. On both sides.



6.



7.

8.

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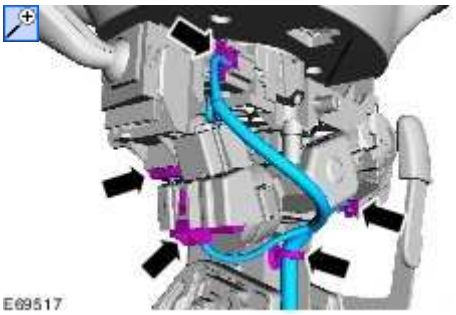
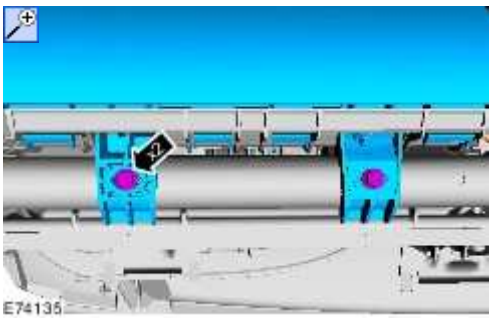
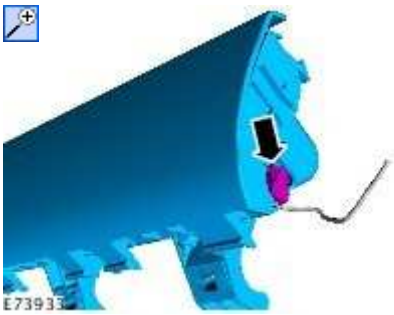




9. *Torque:* 8 Nm



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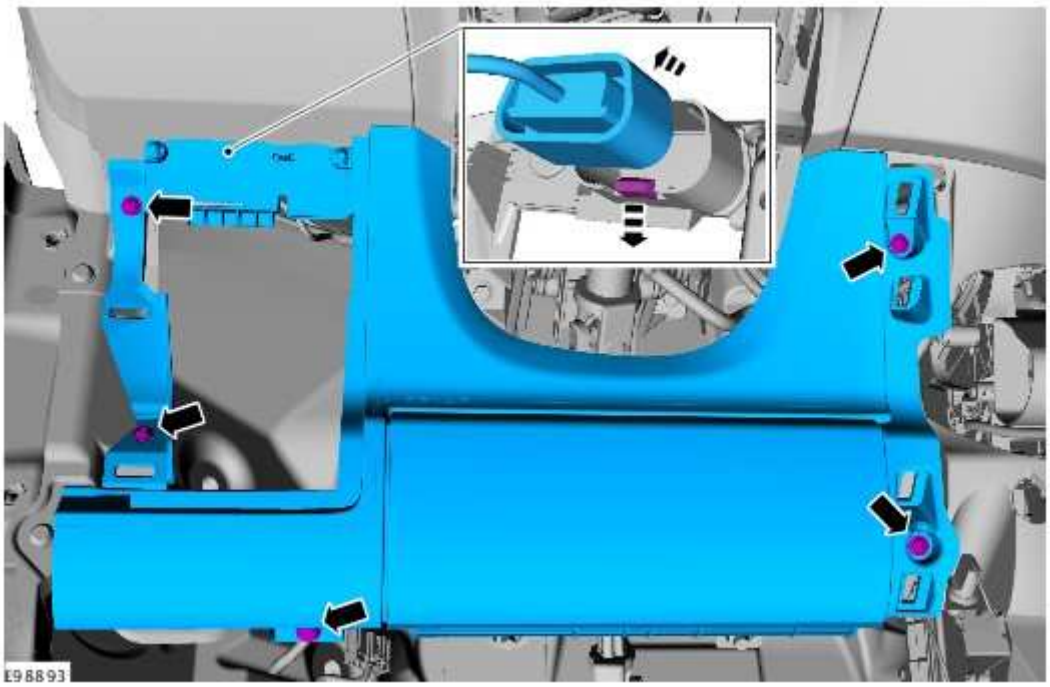

11.

12.

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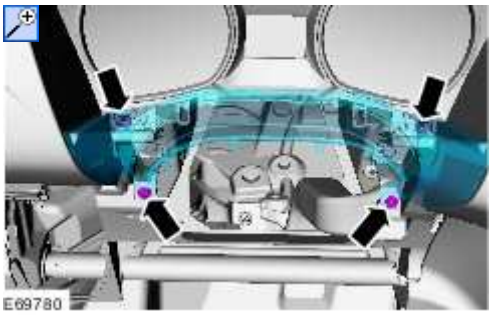
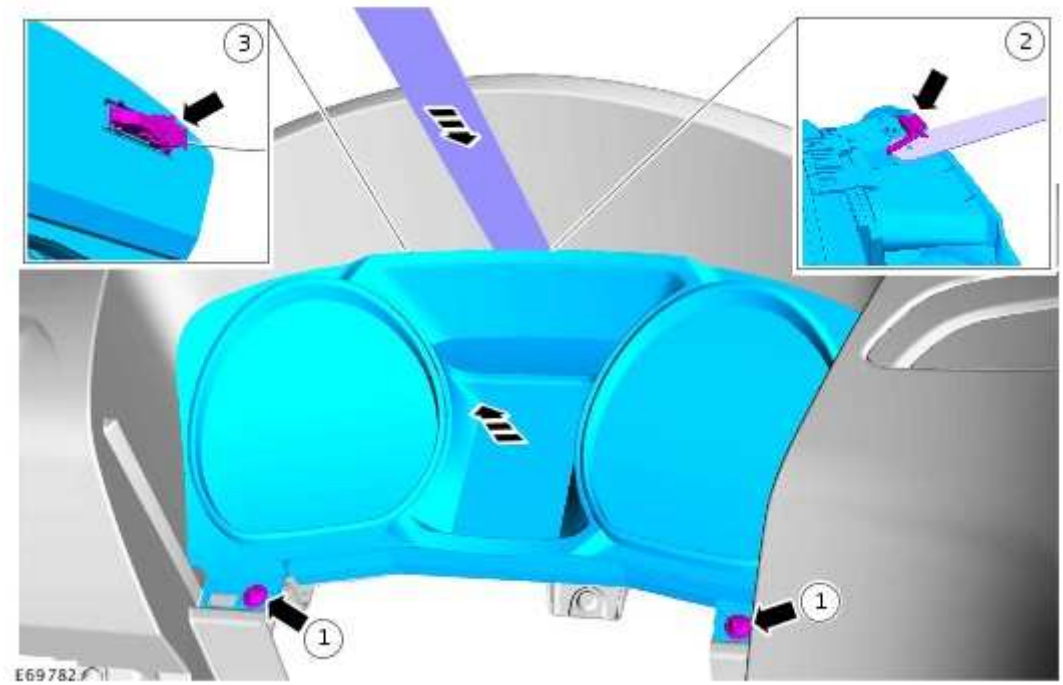
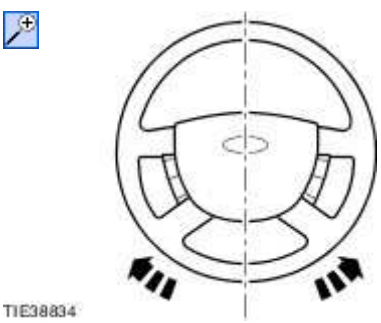
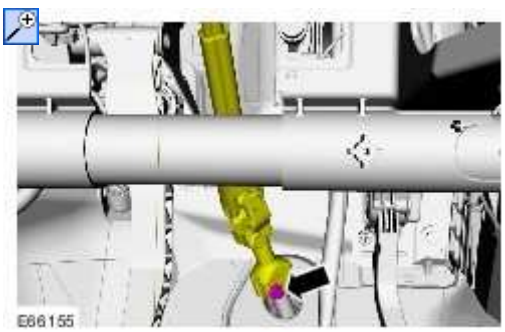




13. *General Equipme*
Round-e
steel rul



14. NOTE: Make sure that the road wheels are in the straight ahead position.



15. WARNING: Make sure that new bolts are inst
Torque: 30 Nm

16. *Torque:* 24 Nm

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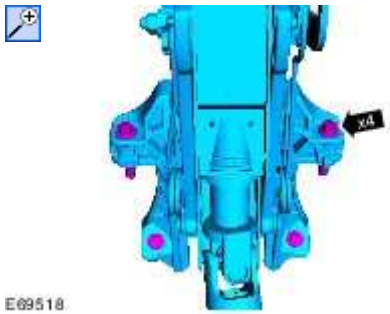
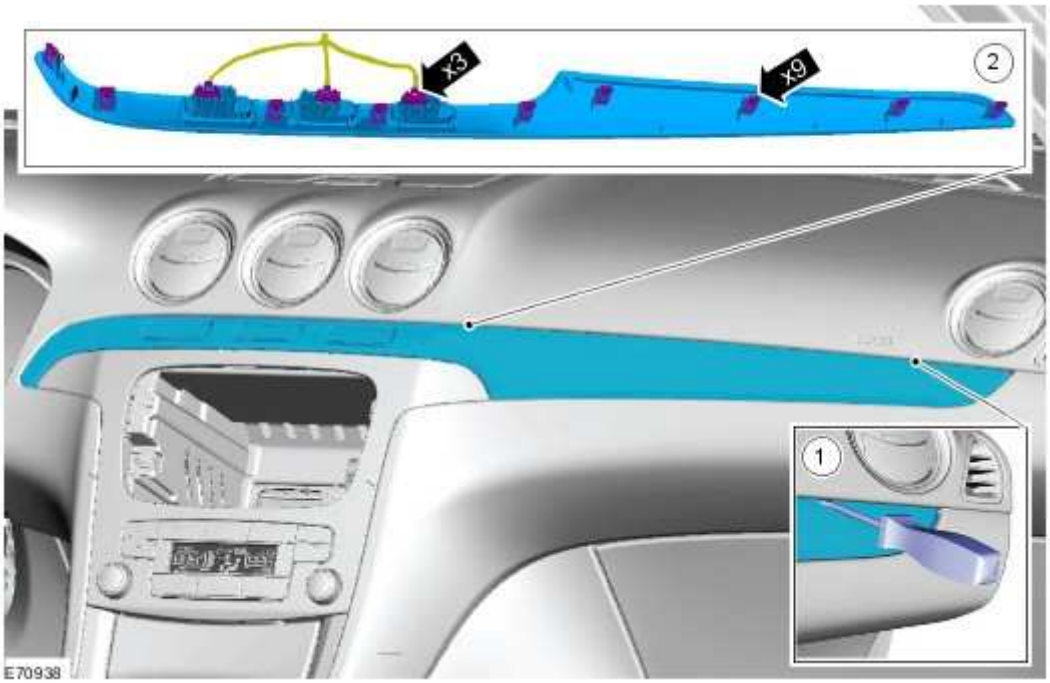
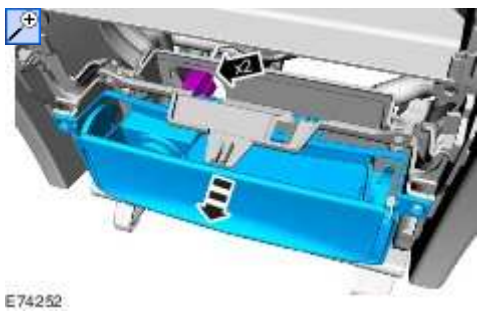




17. CAU
Use suit
packing
material
prevent
damage
compon
General
Equipme
bladed
screwdri

Vehicles with manual temperature control

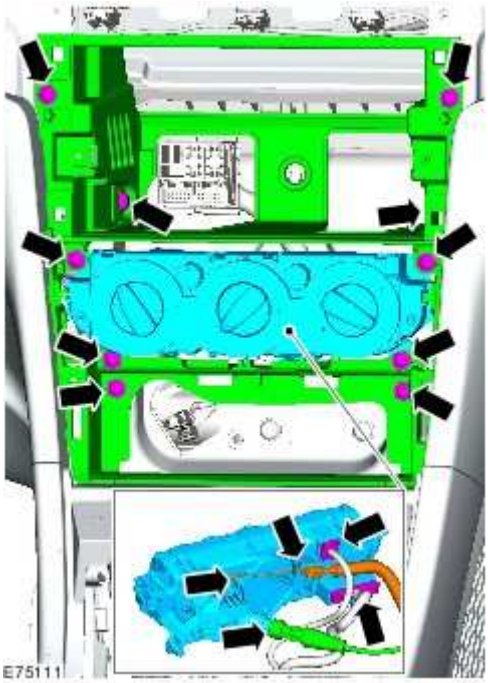
18.



19.

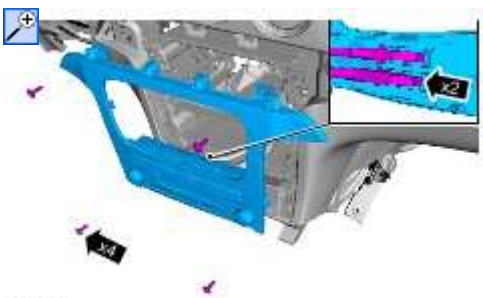
20.

http://vnx.su



Vehicles with electronic automatic temperature control (EA

21.



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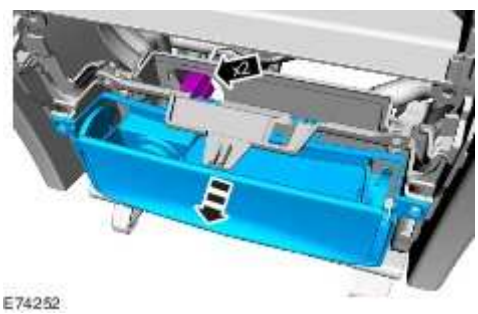

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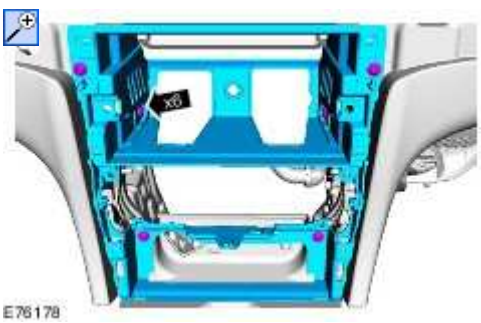
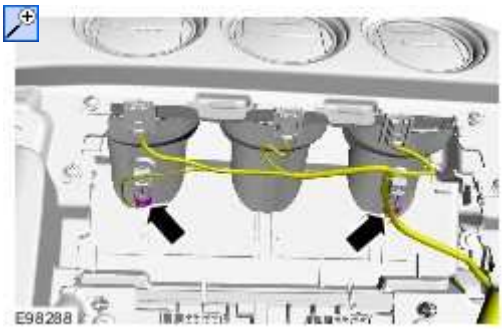


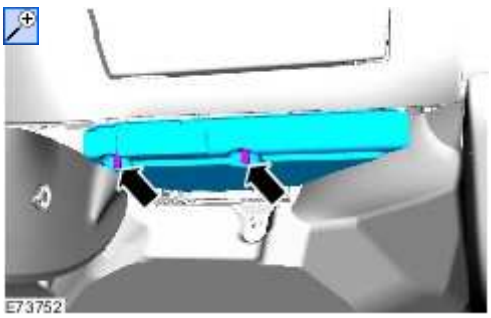
24.

http://vnx.su



Vehicles with glove compartment cooling

25.



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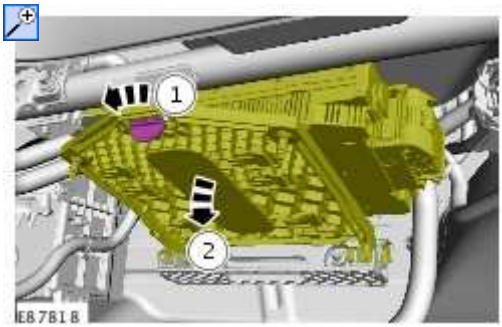

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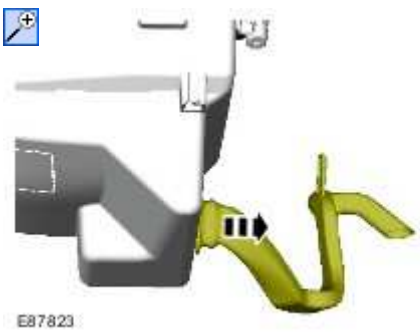
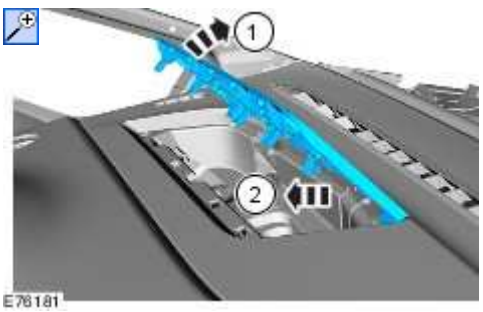


All vehicles

28.



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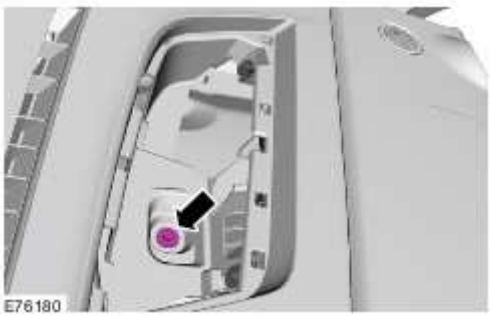
30.

31.



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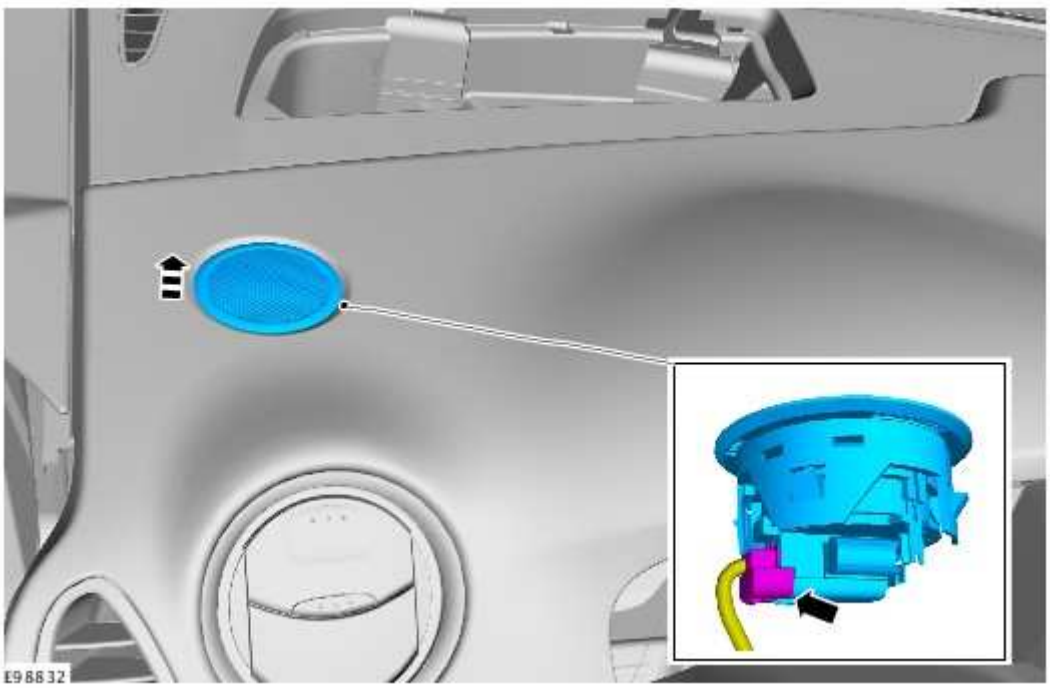

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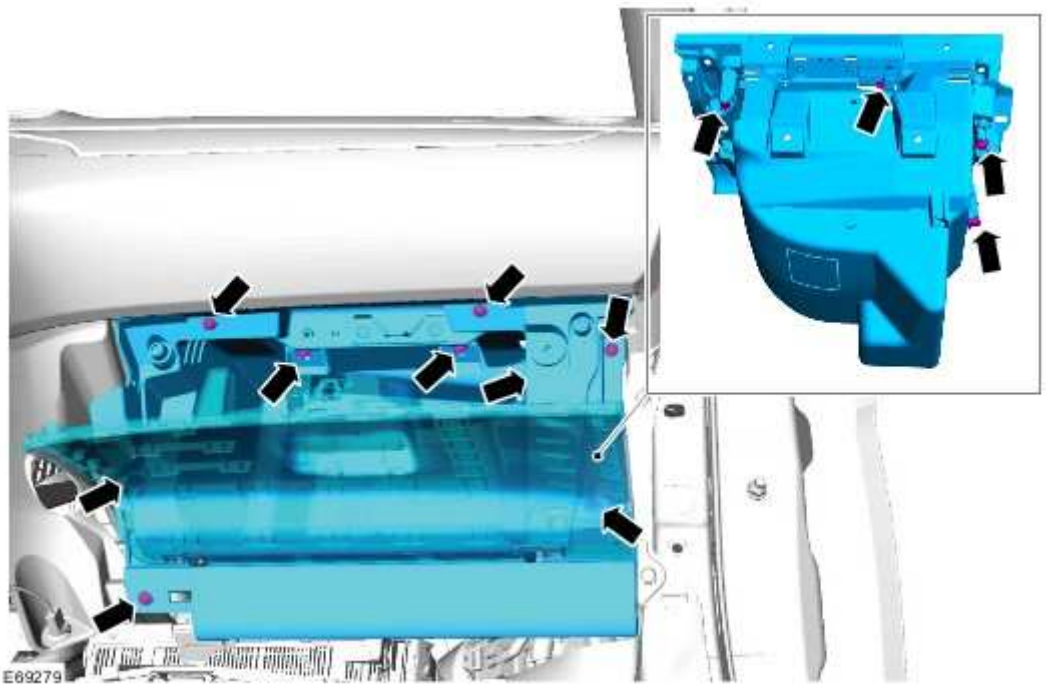
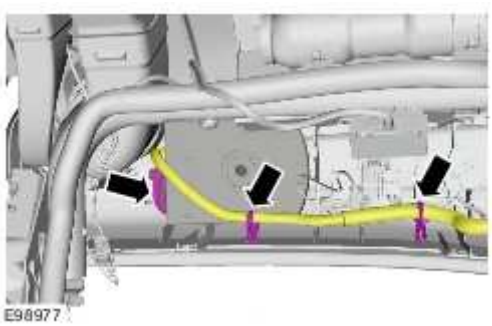
http://vnx.su



34.

35.



36. *Torque:*

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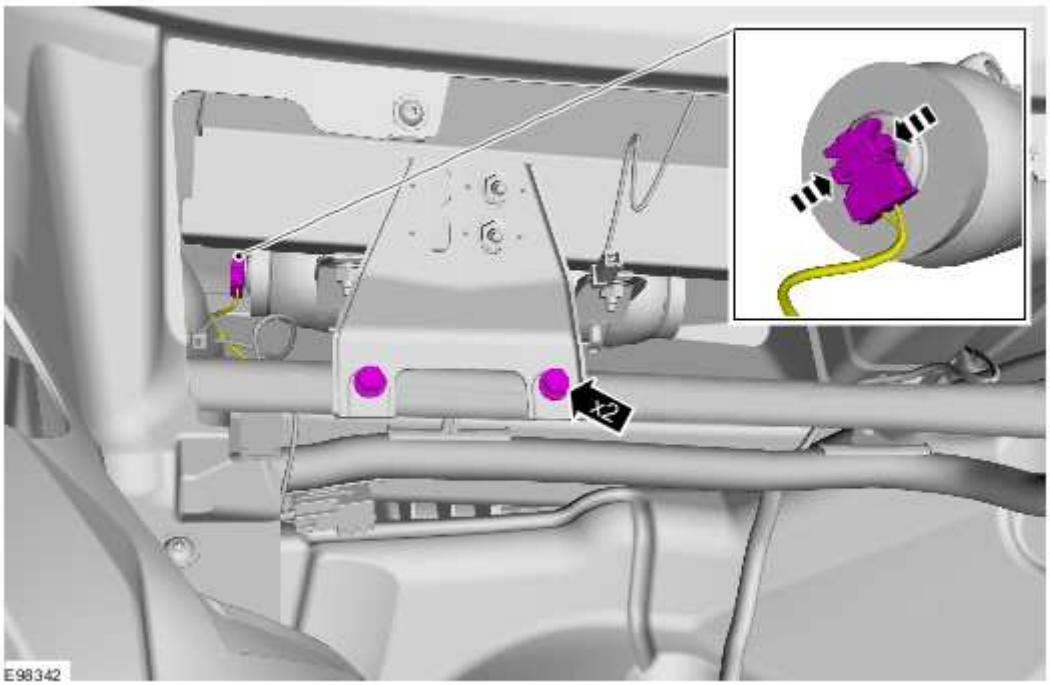
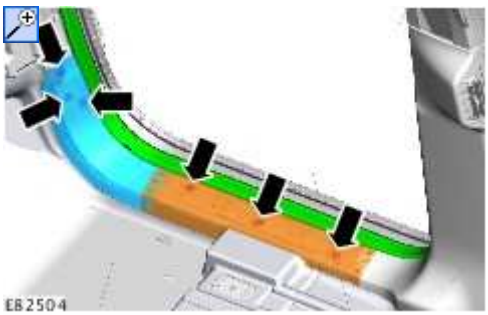
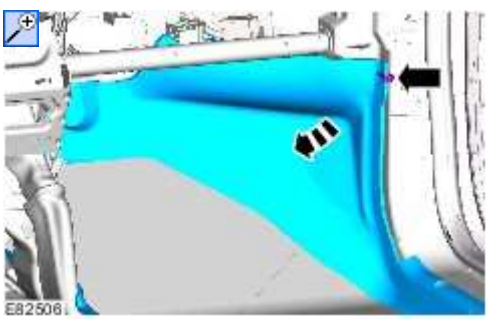




37. On both sides.

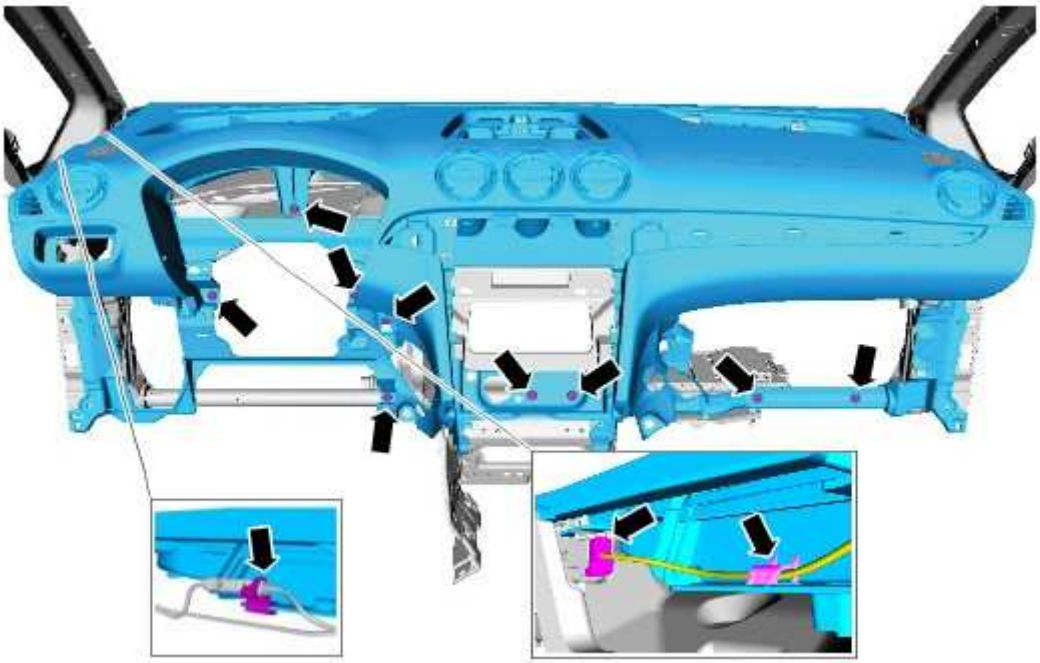


38. On both sides.

39.

40.

http://vnx.su



Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Round-ended steel rule

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting o removing any SRS components.

Wear safety goggles.

Do not probe supplemental restraint system (SRS) electrical connectors.

1. Refer to: Supplemental Restraint System (SRS) Hea and Safety Precautions (100-00 General Information Description and Operation).
2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. Remove the following items:
    1. Refer to: Floor Console Upper Section - Vehicl With: Center Armrest/Manually Adjusted Parki Brake (501-12 Instrument Panel and Console, Removal and Installation).
    2. Refer to: Floor Console Upper Section - Vehicl With: Manually Adjusted Parking Brake, Vehicl Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).
    3. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).
    4. Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
    5. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
    6. Refer to: Audio Unit - Vehicles Built From: 05/2007 (415-01 Information and Entertainme System, Removal and Installation).
       Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Informatior and Entertainment System, Removal and Installation).
    7. Refer to: Headlamp Switch (417-01 Exterior Lighting, Removal and Installation).
4. On both sides.

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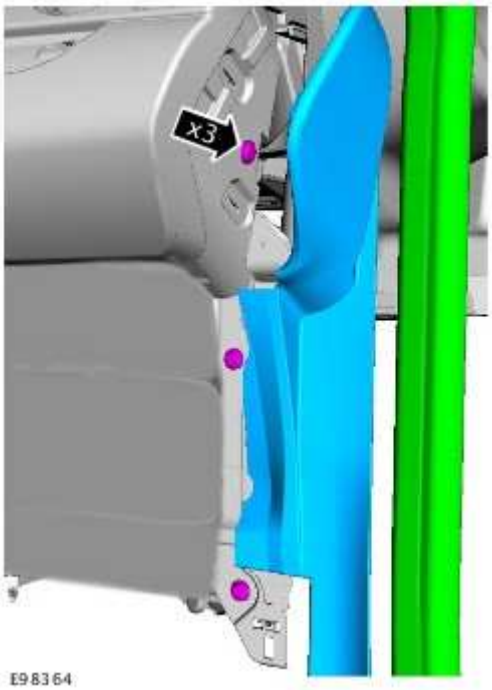
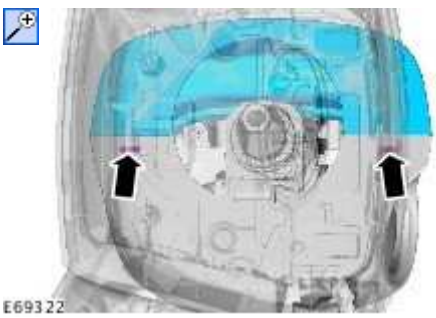
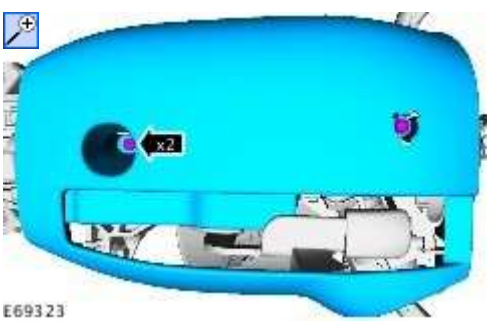
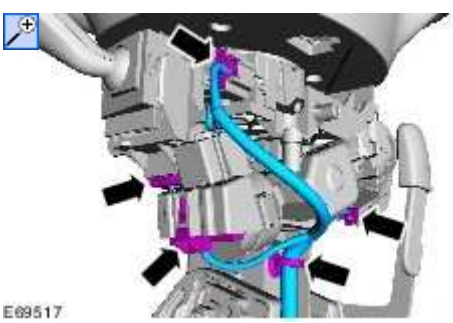


5. 

6. 

7. 

8. *Torque:* 8 Nm

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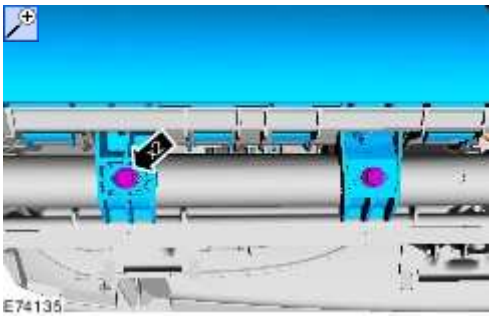

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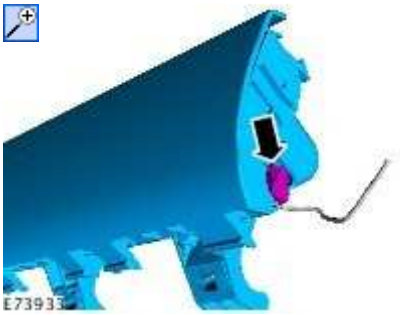

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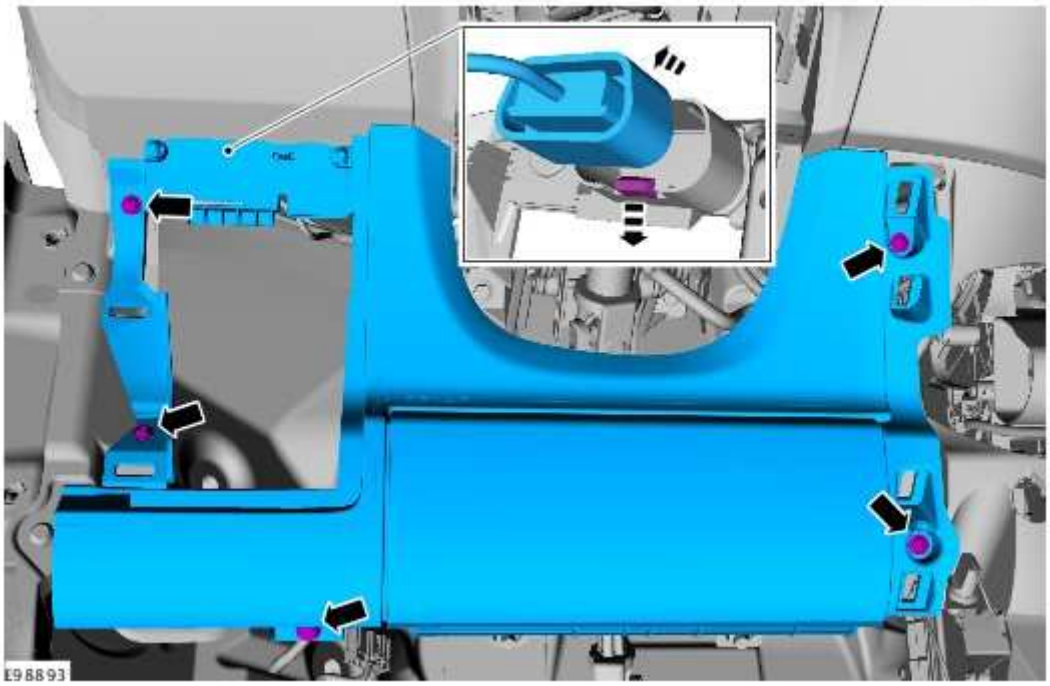

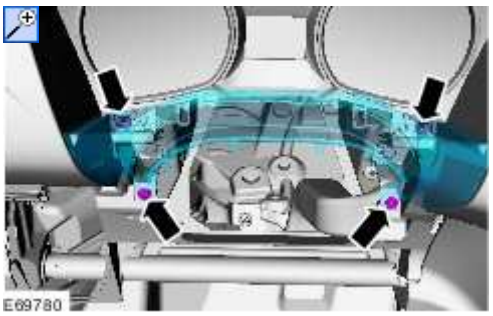

11.

12. *General Equipme*
Round-ended st rule

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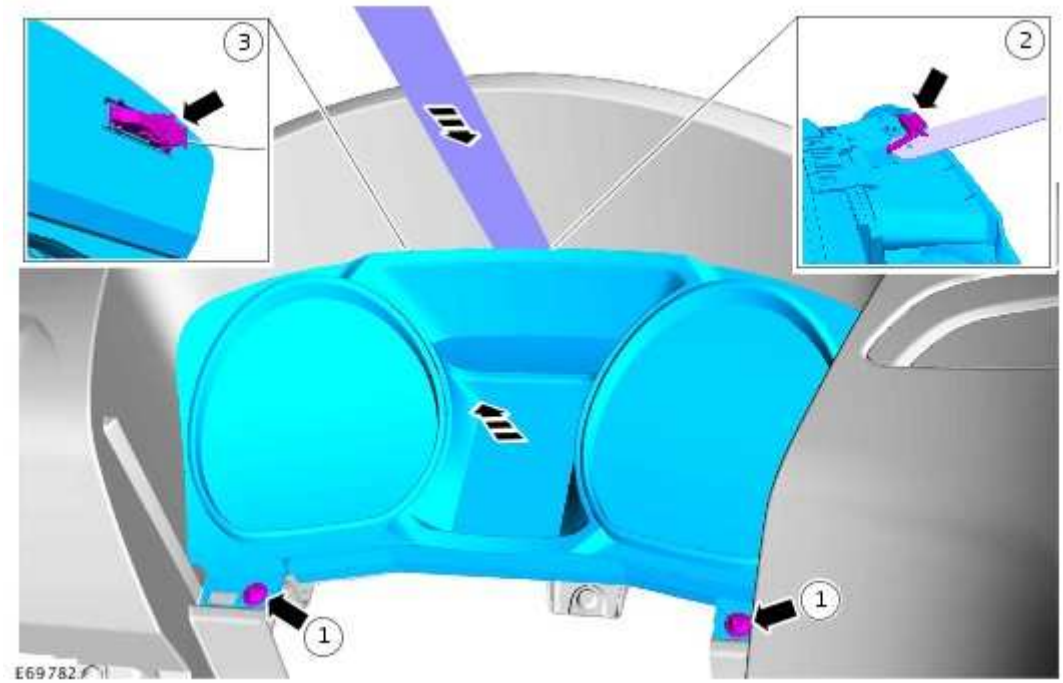
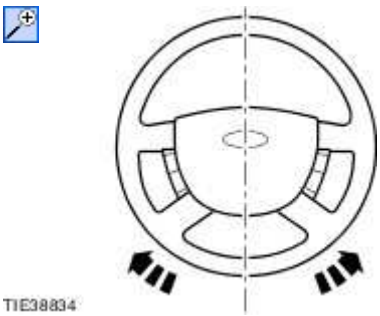
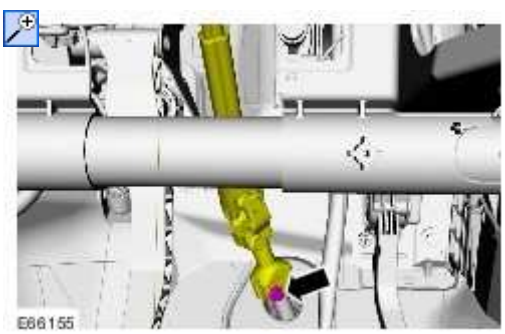
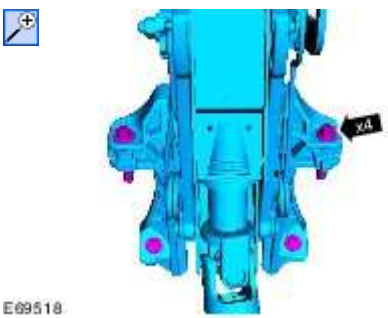




13. NOTE: Make sure that the road wheels are in the straight ahead position.



14. WARNING: Make sure that new bolts are installed.
Torque: 30 Nm



15. *Torque:* 24 Nm

16.

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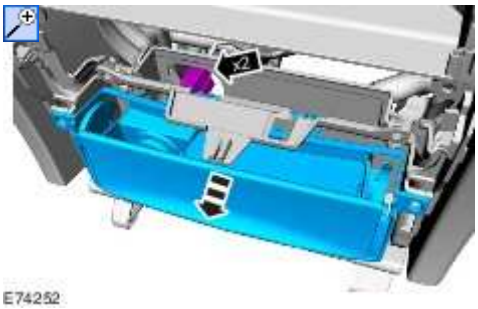
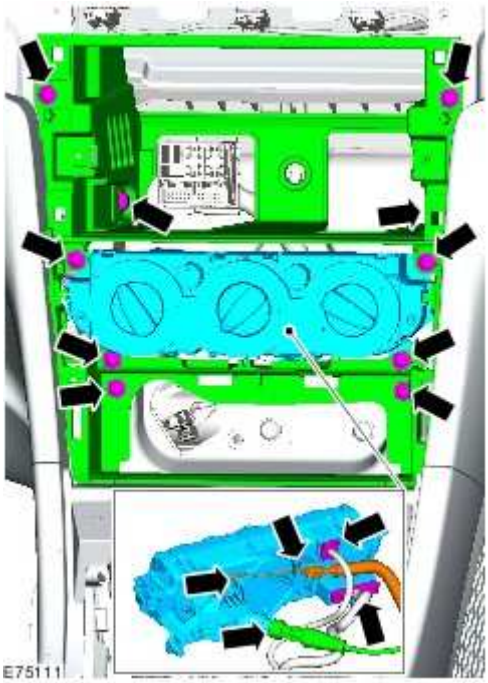


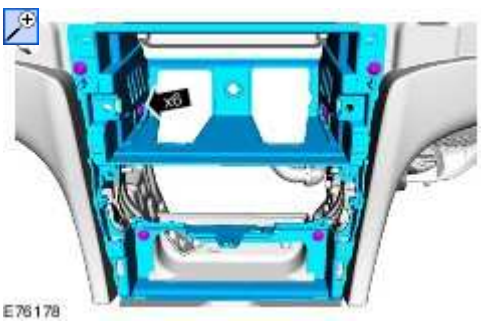
Vehicles with manual temperature control

17.



Vehicles with electronic automatic temperature control (EATC)

18.



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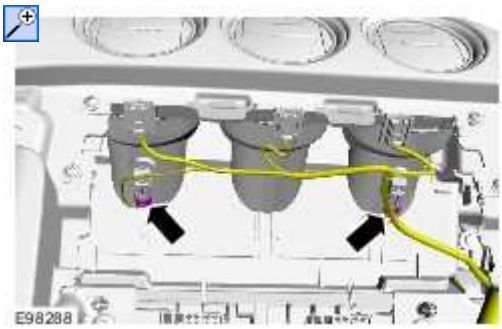

Vehicles with glove compartment cooling

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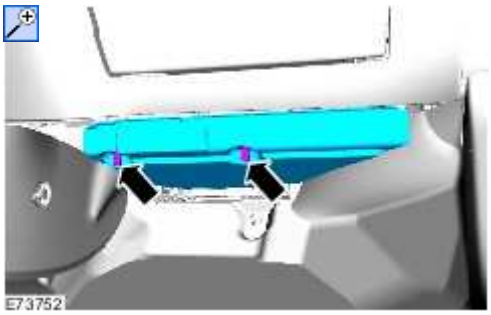
20.



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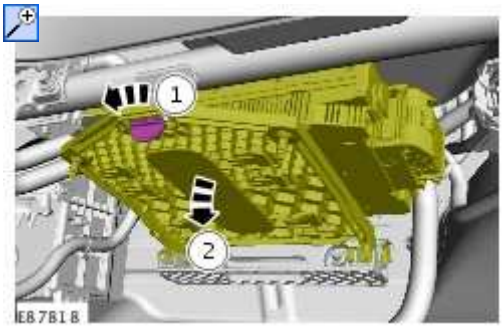

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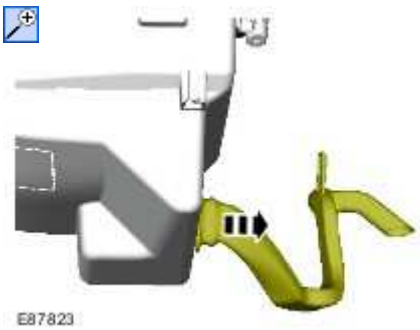
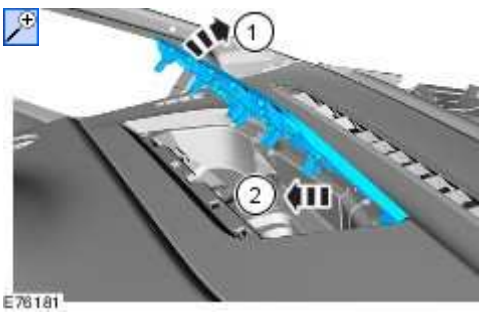


All vehicles

23.



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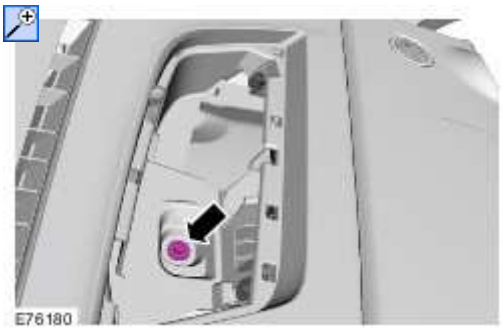
25.

http://vnx.su



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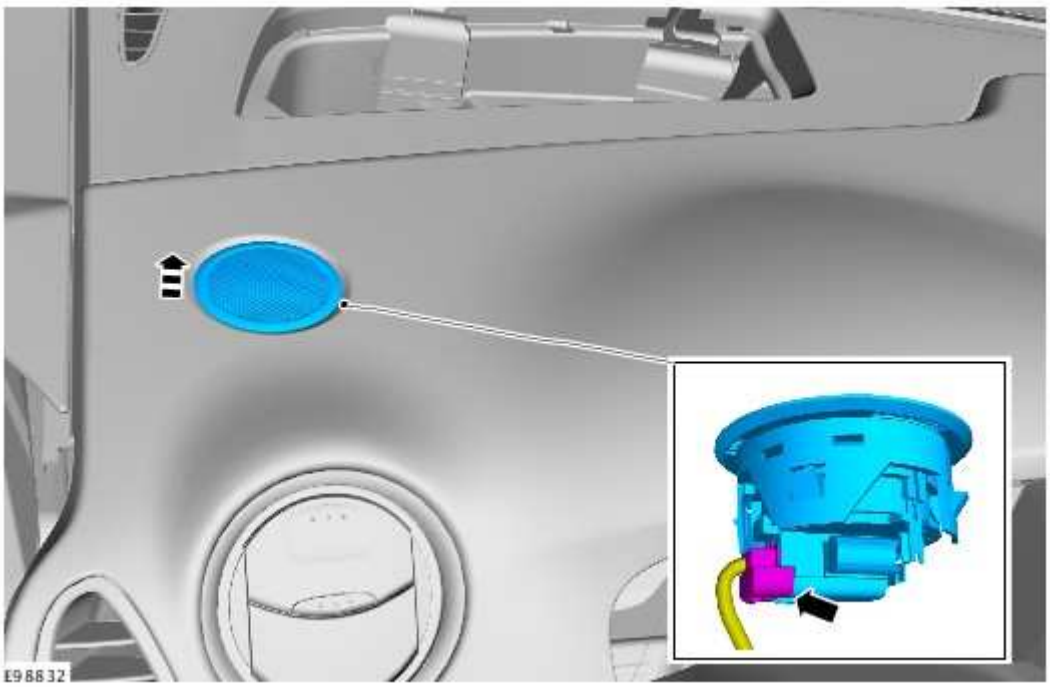

27.

28.

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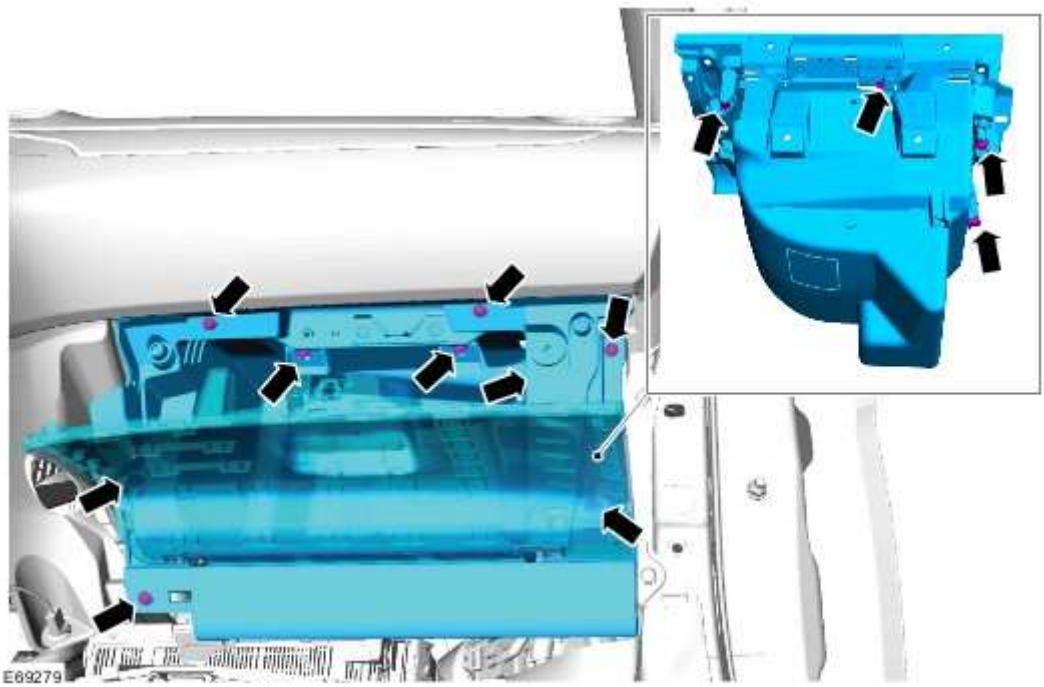

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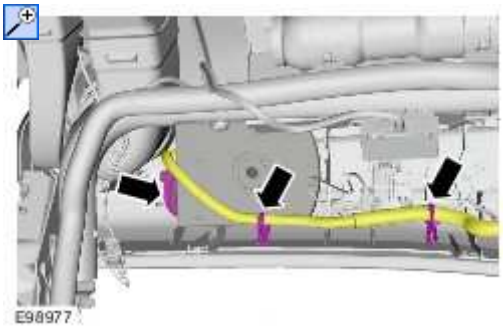

30.

31. *Torque:* Nm

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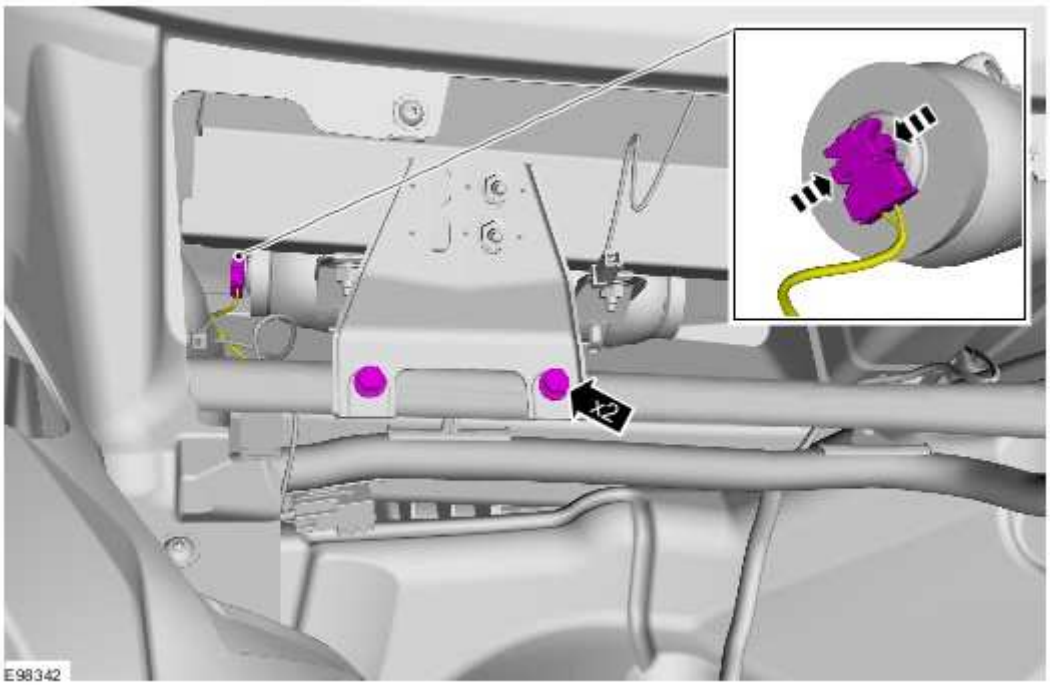
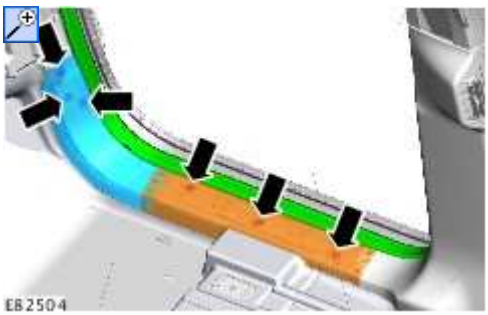
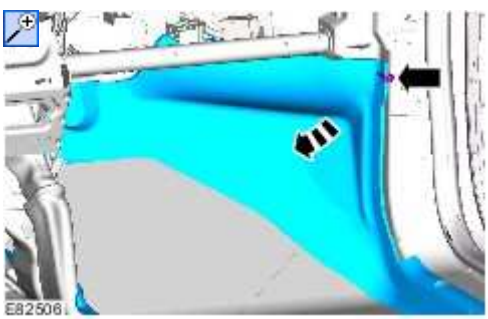
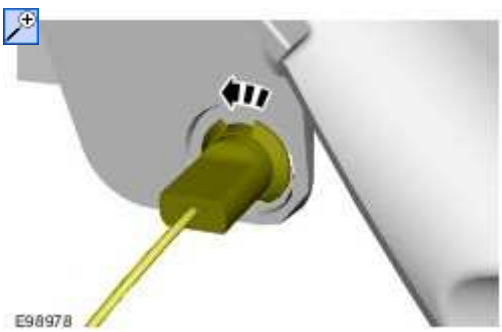




32. On both sides.



33. On both sides.



34.

35.

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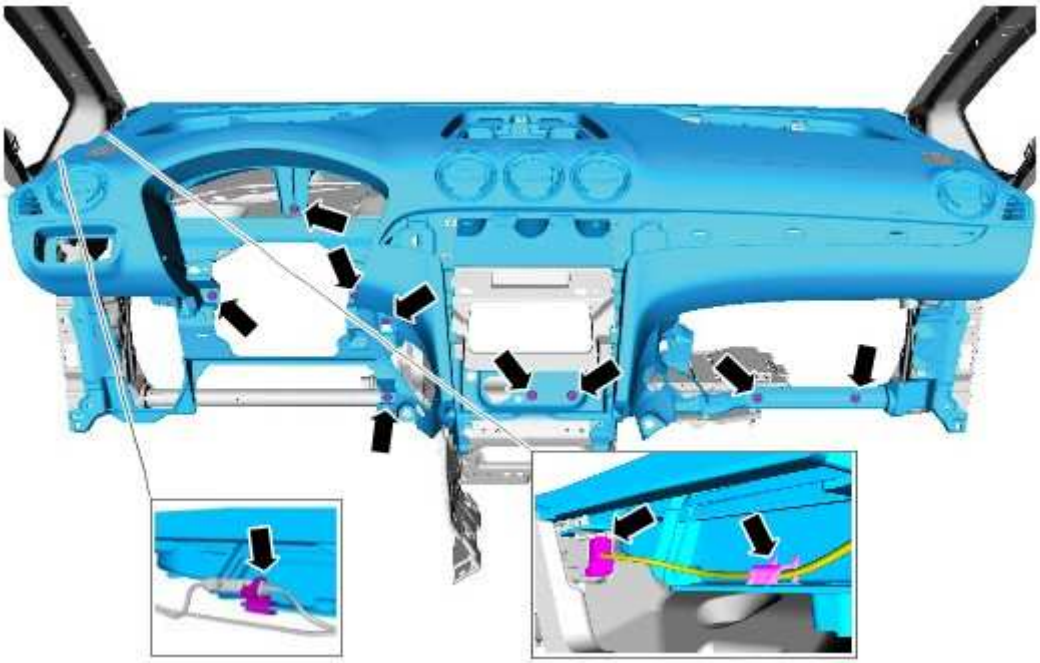

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

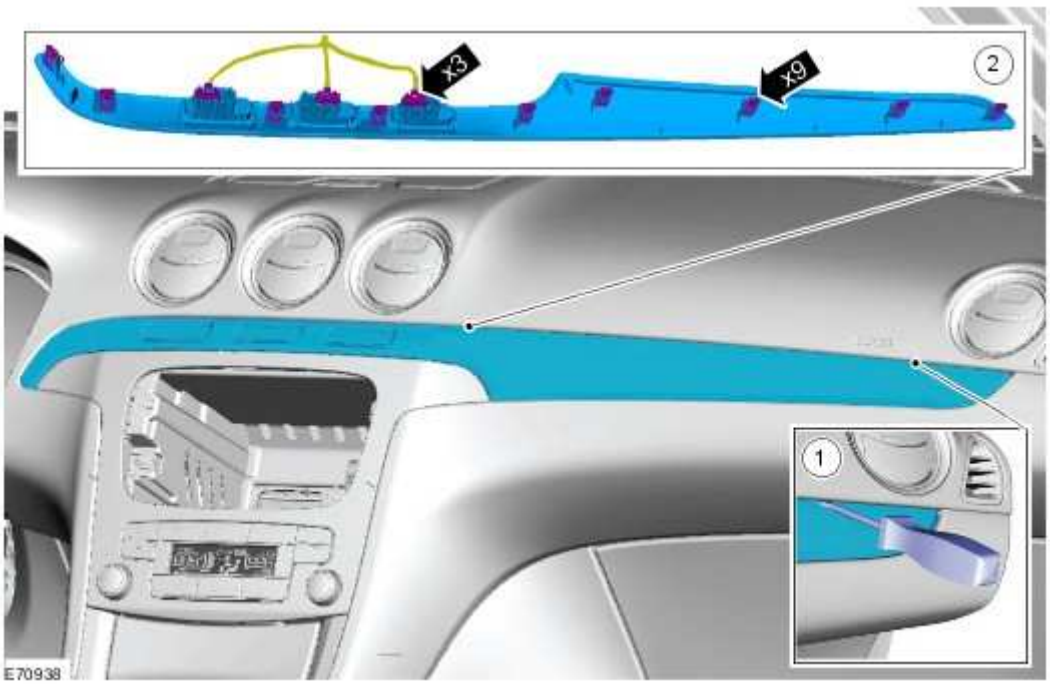
General Equipment

Flat-bladed screwdriver

Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007 Information and Entertainment System, Removal an Installation).
   Refer to: Navigation System Display Module - Vehicl Travel Pilot EX (415-01 Information and Entertainme System, Removal and Installation).



Vehicles with manual temperature control

2. CAU Use suit packing material prevent damage compon *General Equipme* bladed screwdri

3. CAUTION: Use suitable packing material to pr damage to the component.
   General Equipment: Flat-bladed screwdriver

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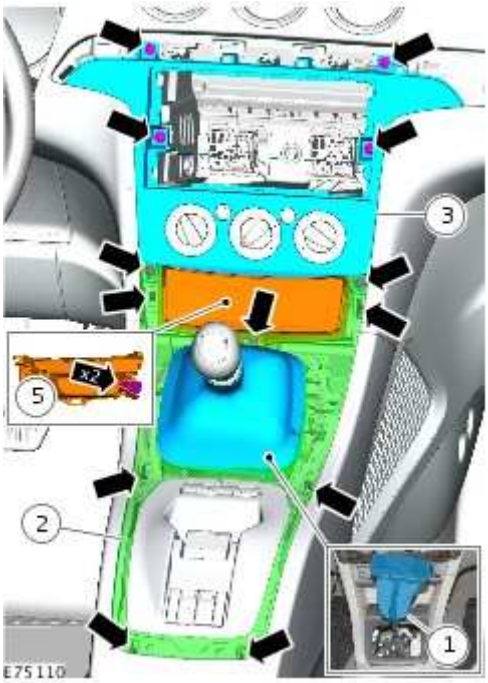
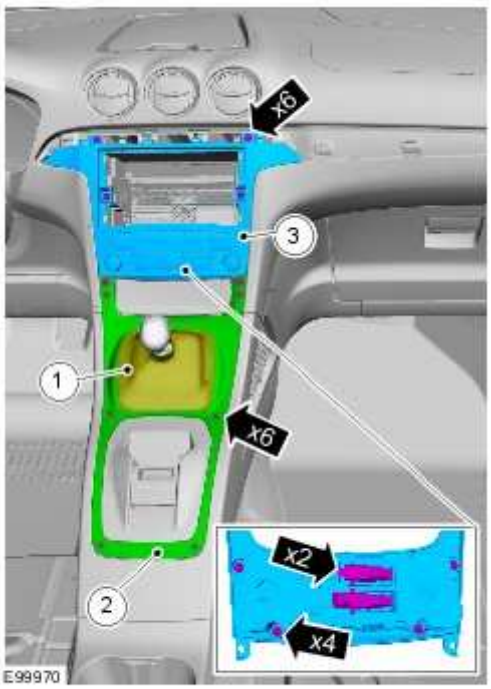


Vehicles with electronic automatic temperature control (EA



4. CAUTION: Use suitable packing material to pr damage to the component.
General Equipment: Flat-bladed screwdriver

Installation

1. To install, reverse the removal procedure.

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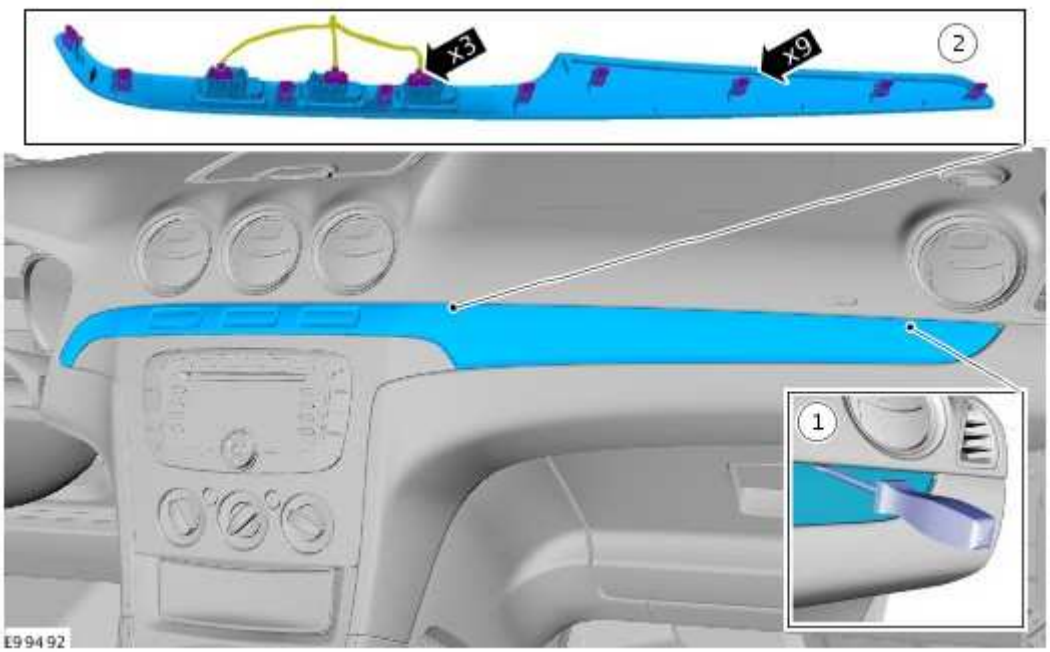
Removal and Installation

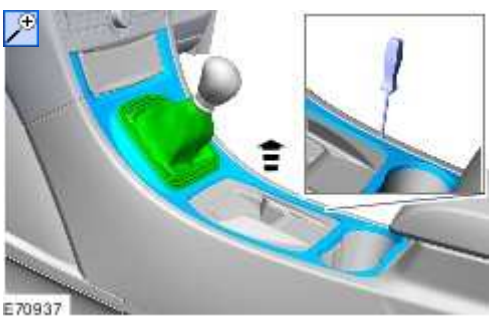
General Equipment

Flat-bladed screwdriver

Removal



1. CAU
Use suit
packing
material
prevent
damage
compon
General Equipme
bladed
screwdri



2. CAUTION: Use suitable packing material to pr
damage to the component.
General Equipment: Flat-bladed screwdriver

Vehicles with manual temperature control

3.

Vehicles with electronic automatic temperature control (EA

4.

http://vnx.su

Installation

1. To install, reverse the removal procedure.

http://vnx.su

Instrument Panel and Console - Instrument Panel Console—Vehicles With: Digital Versatile Disc (DVD) Navigation System	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

Removal

1. Remove the audio unit.

   Refer to: Audio Unit - Vehicles Built Up To: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).
   Refer to: Audio Unit - Vehicles Built From: 05/2007, Vehicles With: Digital Versatile Disc (DVD) Navigation System (415-01 Information and Entertainment System, Removal and Installation).

Installation

1. To install, reverse the removal procedure.

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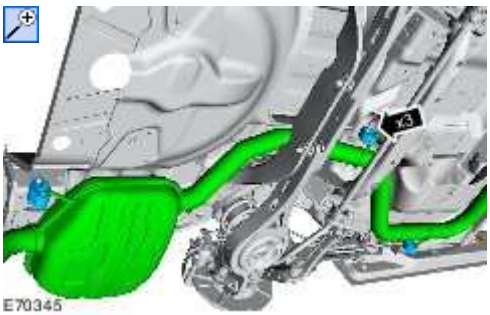
Print

Removal and Installation

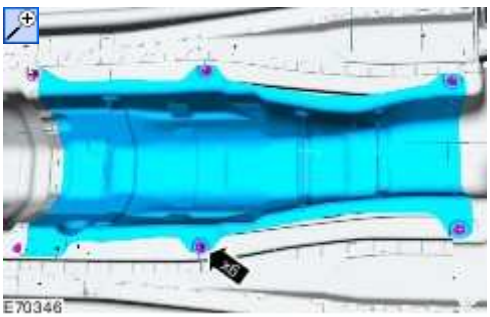
Removal

NOTE: Removal steps in this procedure may contain installation details.

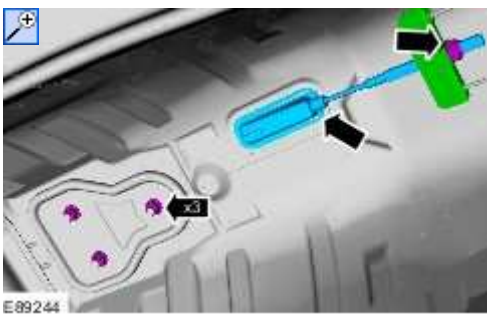
1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. Support the muffler and tailpipe assembly.



3.



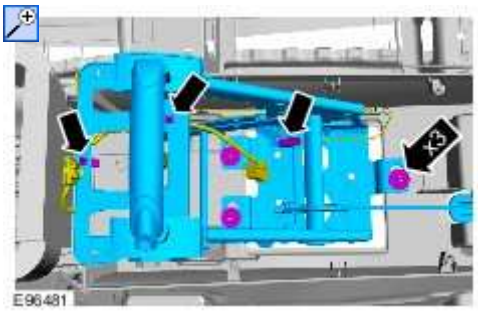
4. *Torque:* 25 Nm

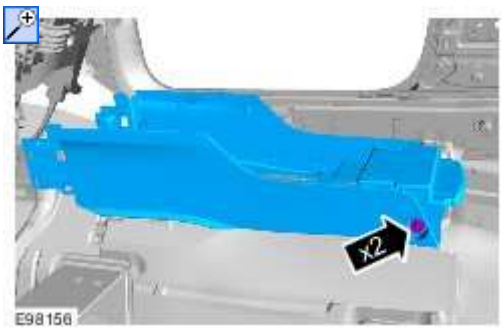
5. Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).

6.

7.

http://vnx.su





8.

Installation

1. To install, reverse the removal procedure.

http://vnx.su

Print

Removal and Installation

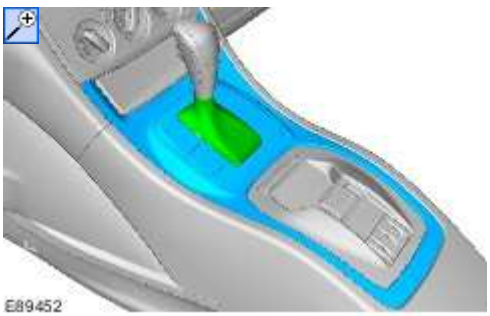
General Equipment

Ford diagnostic equipment

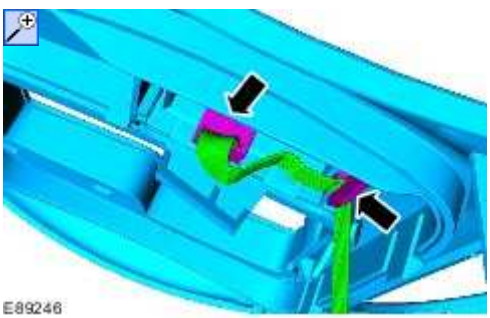
Removal

NOTE: Removal steps in this procedure may contain installation details.

Vehicles with automatic transaxle



1.

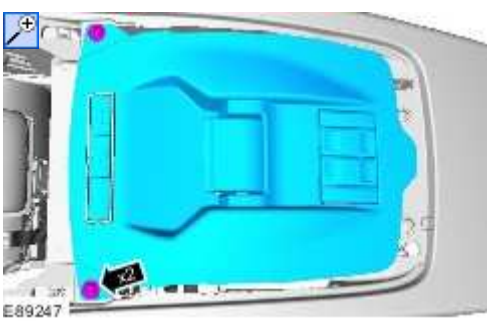


2.

Vehicles with manual transaxle

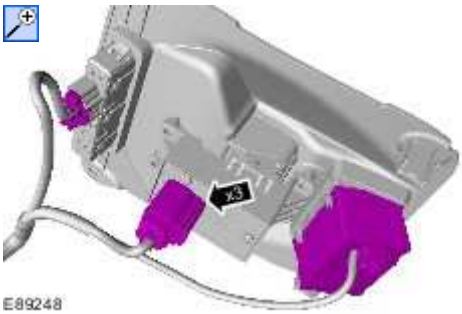
3.

All vehicles

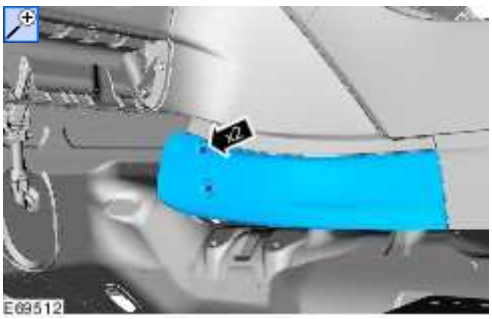


4.

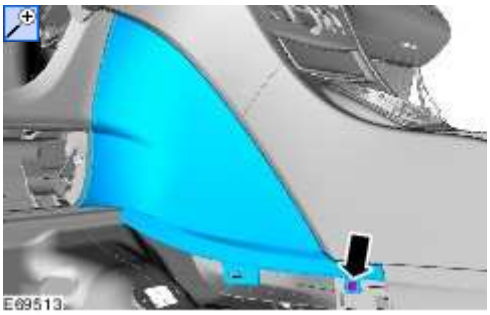
http://vnx.su



5.

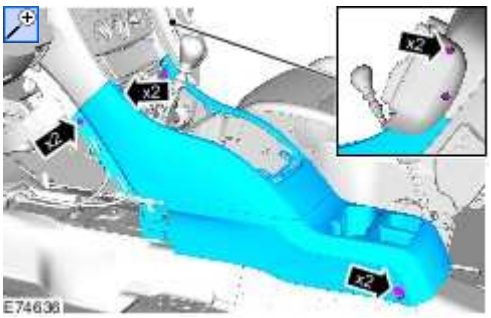


6. On both sides.



7.

8.



9.

Installation

1. To install, reverse the removal procedure.
2. Carry out a parking brake Function Test.

General Equipment: Ford diagnostic equipment

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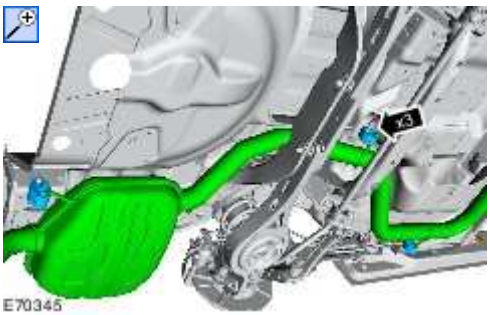
Print

Removal and Installation

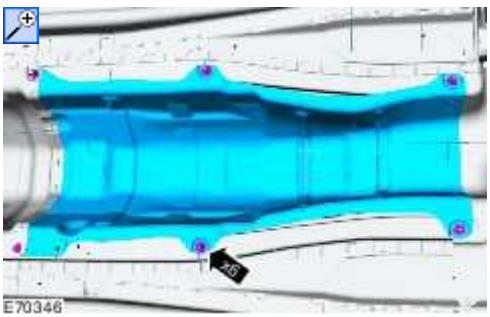
Removal

NOTE: Removal steps in this procedure may contain installation details.

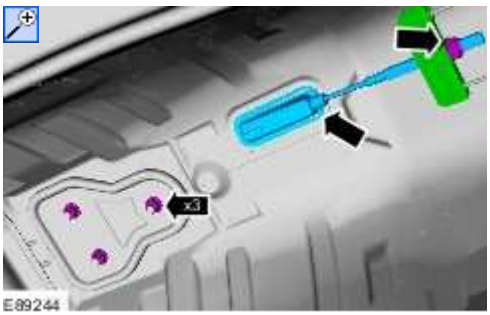
1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).



2. Support the muffler and tailpipe assembly.

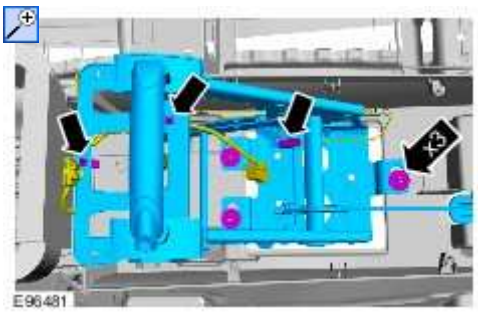


3.



4. *Torque:* 25 Nm

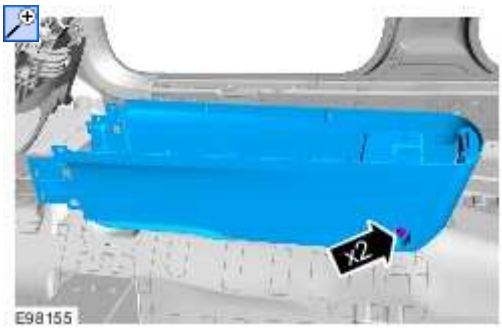
5. Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).



6.

7.

http://vnx.su



Installation

1. To install, reverse the removal procedure.

http://vnx.su

Instrument Panel and Console - Floor Console—Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S	S-MAX/Galaxy 2006.5 (02/2006-)

Print

Removal and Installation

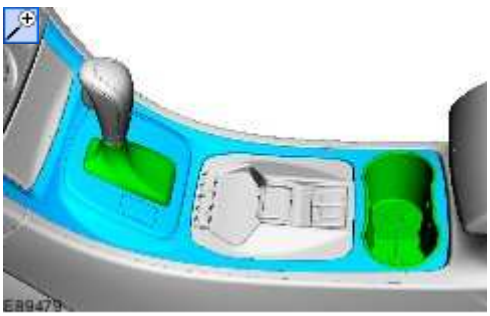
General Equipment

Ford diagnostic equipment

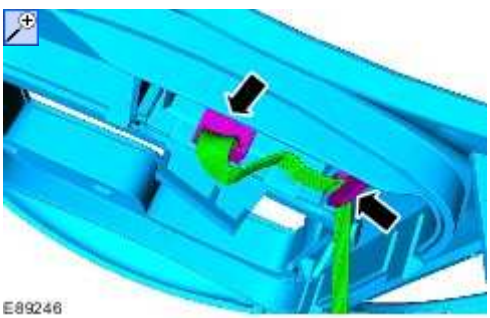
Removal

NOTE: Removal steps in this procedure may contain installation details.

Vehicles with automatic transaxle

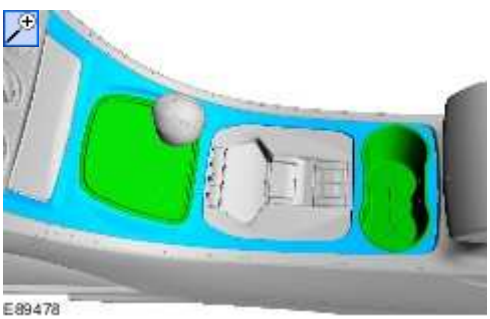


1.



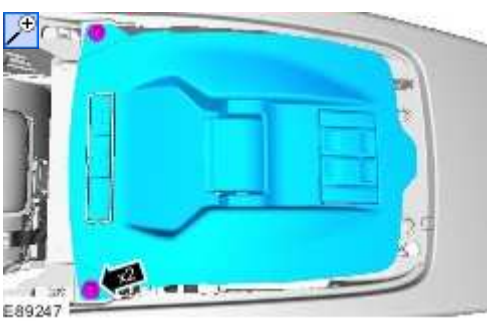
2.

Vehicles with manual transaxle



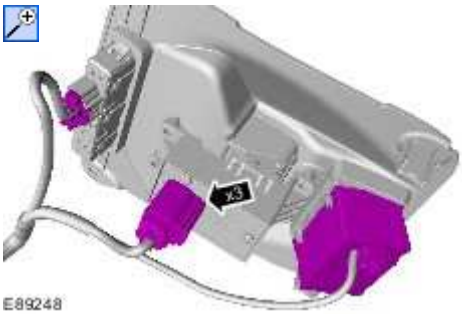
3.

All vehicles

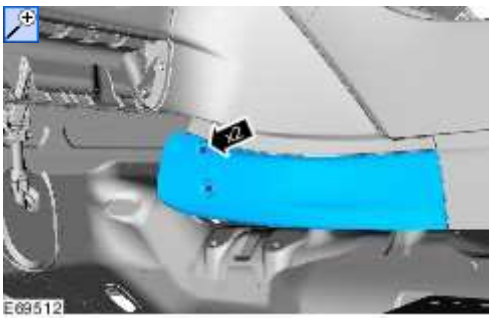


4.

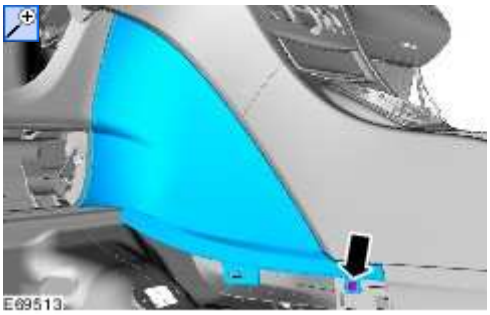
http://vnx.su



5.

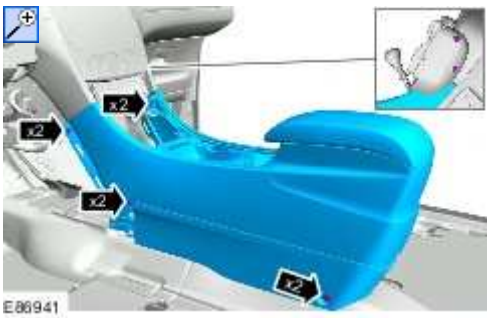


6. On both sides.



7.

8.



9.

Installation

1. To install, reverse the removal procedure.
2. Carry out a parking brake Function Test.

General Equipment: Ford diagnostic equipment

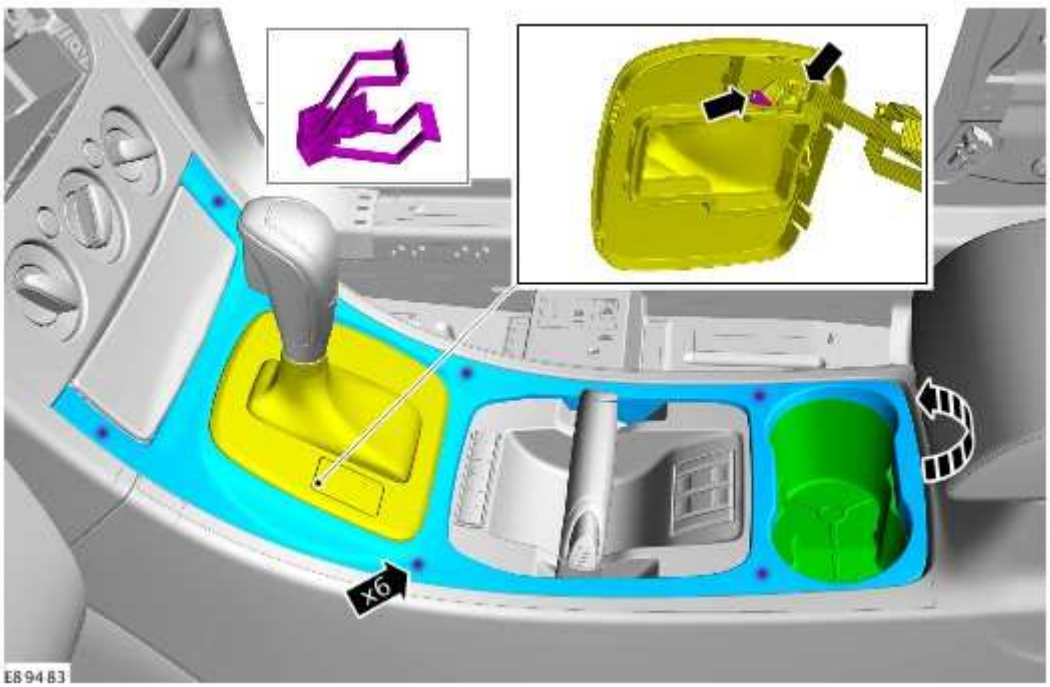
http://vnx.su

Removal and Installation

Removal

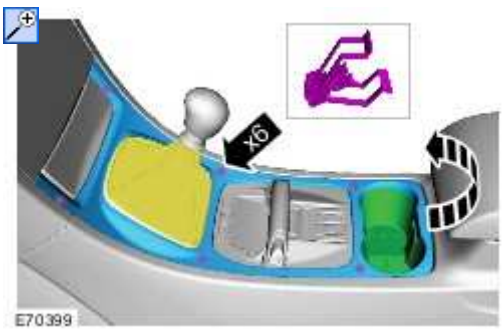
Vehicles with automatic transaxle

1.



Vehicles with manual transaxle

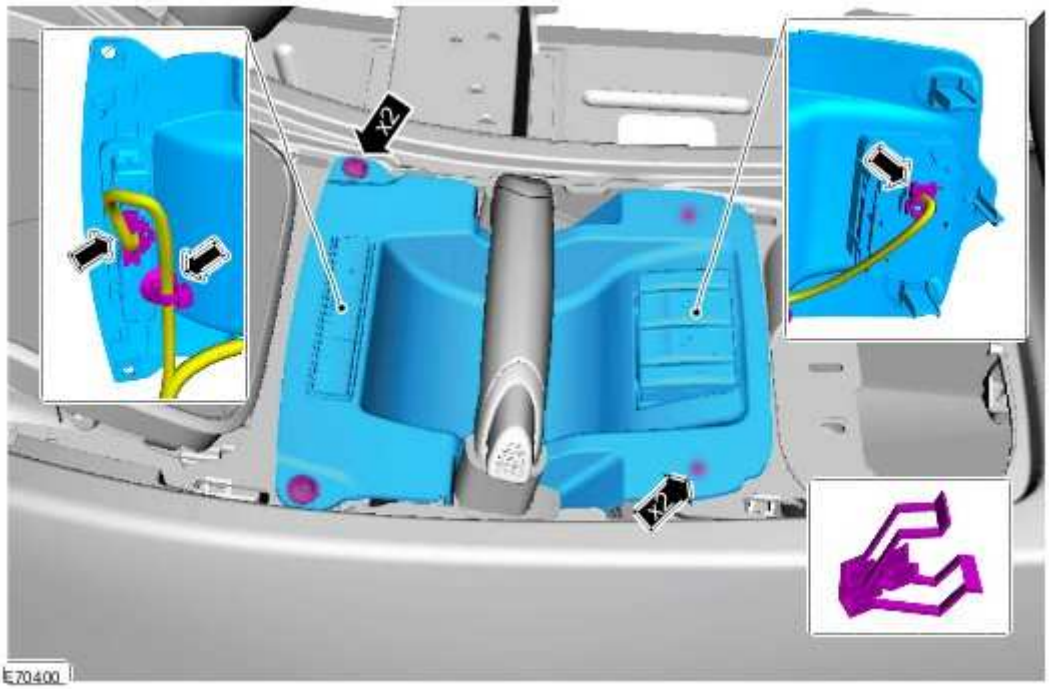
2.

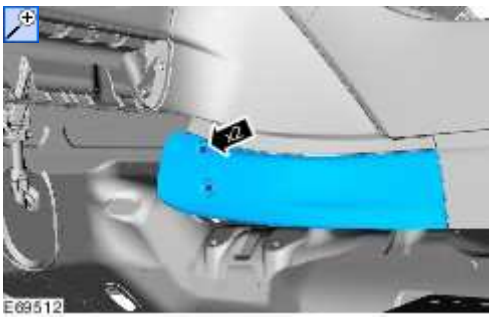


All vehicles

3.

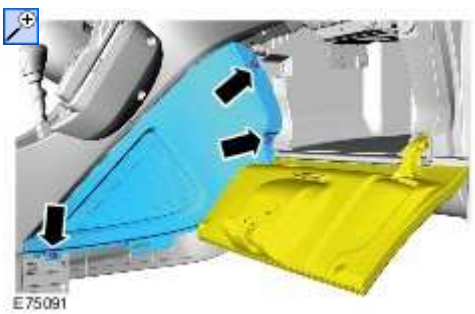
http://vnx.su





4. On both sides.

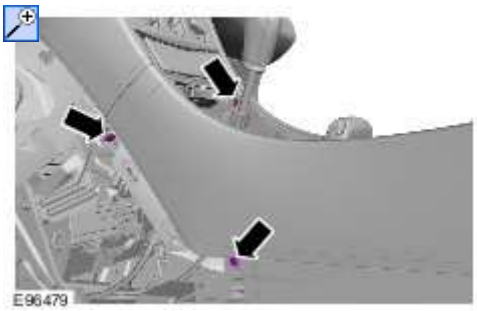
5.



6.

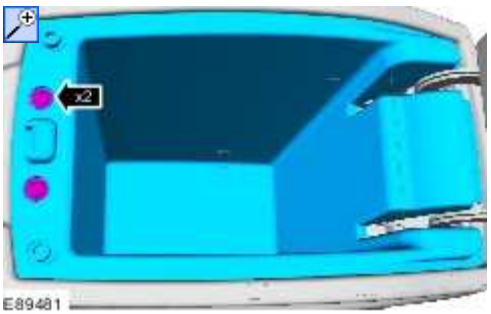
7. On both sides.

http://vnx.su


E96479

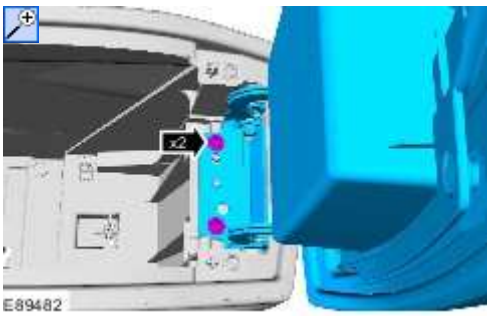
8.

E96480



E89481

9.



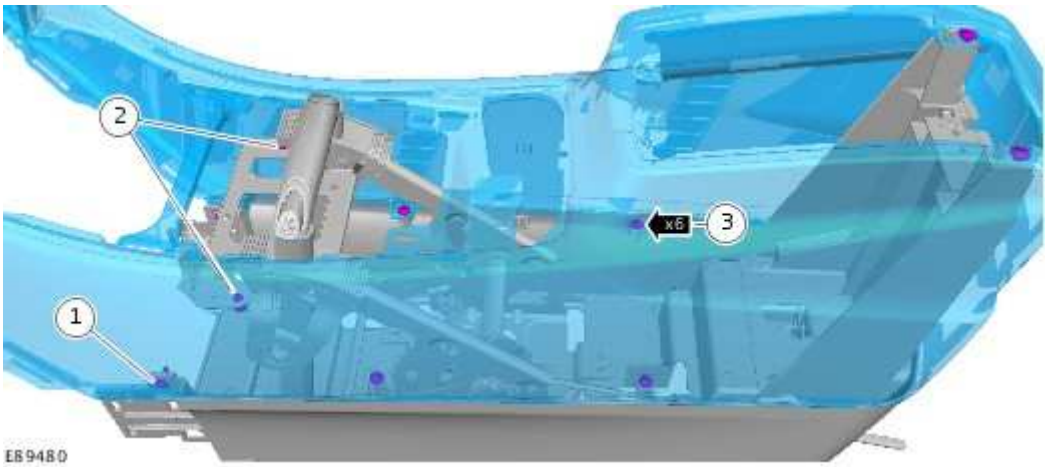
E89482

10.

11.

1. On both sides

http://vnx.su



Installation

1. To install, reverse the removal procedure.

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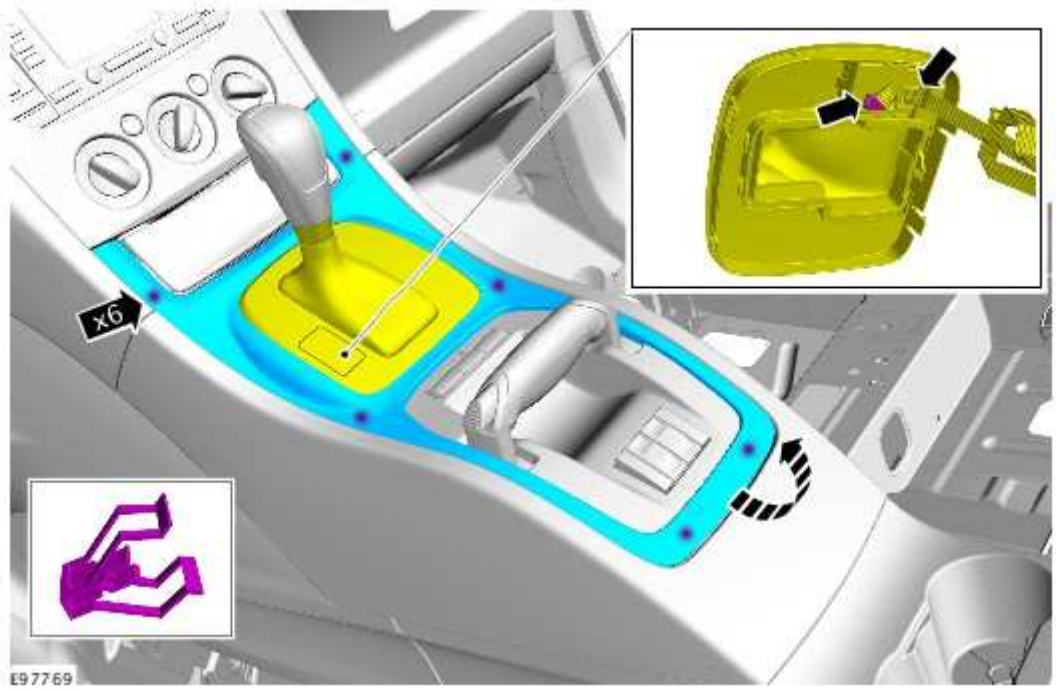
Print

Removal and Installation

Removal

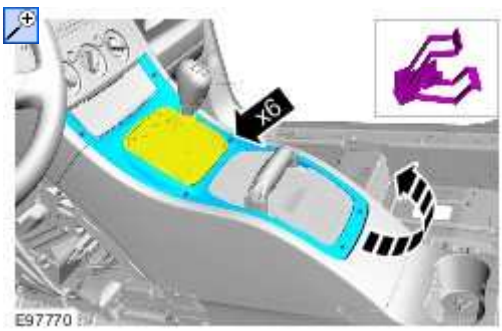
Vehicles with automatic transaxle

1.



Vehicles with manual transaxle

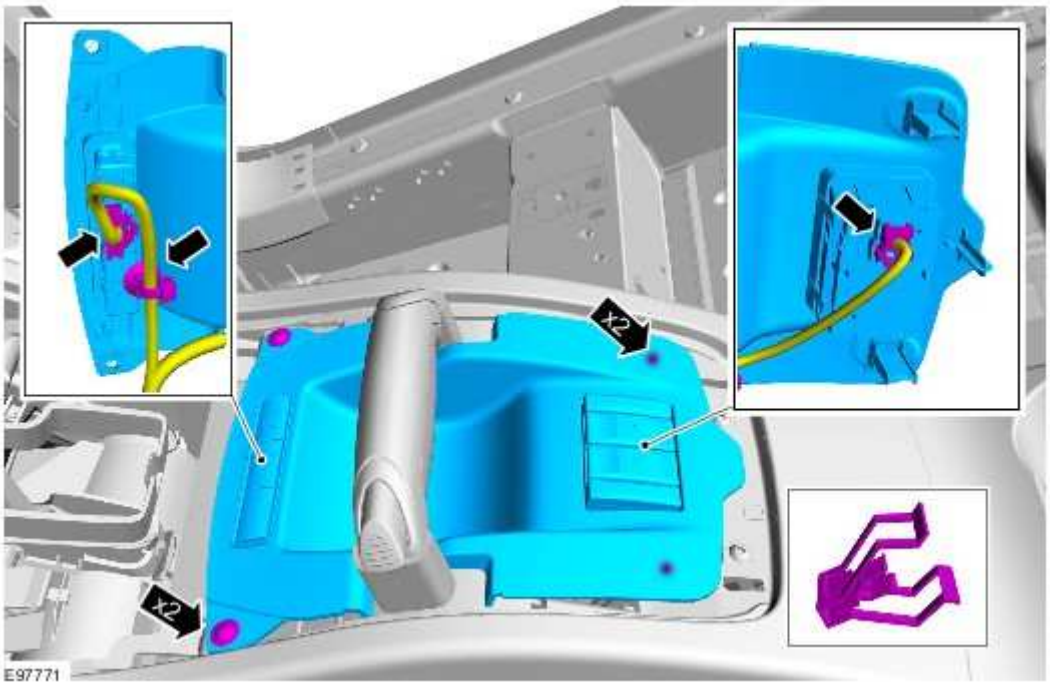
2.

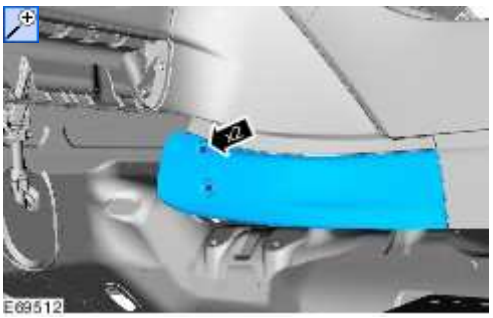


All vehicles

3.

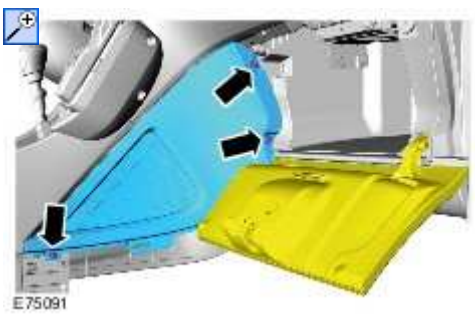
http://vnx.su





4. On both sides.

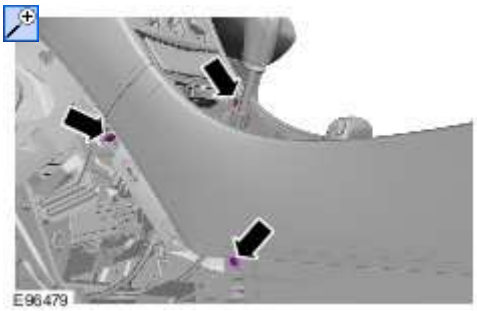
5.



6.

7. On both sides.

http://vnx.su



8.

Installation

1. To install, reverse the removal procedure.

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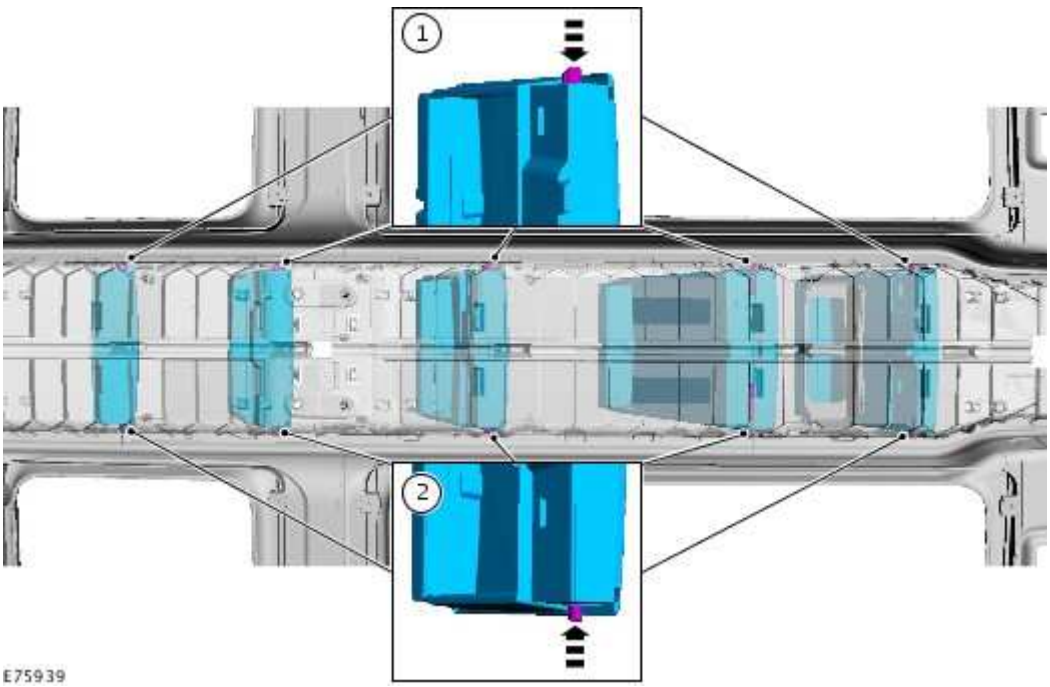
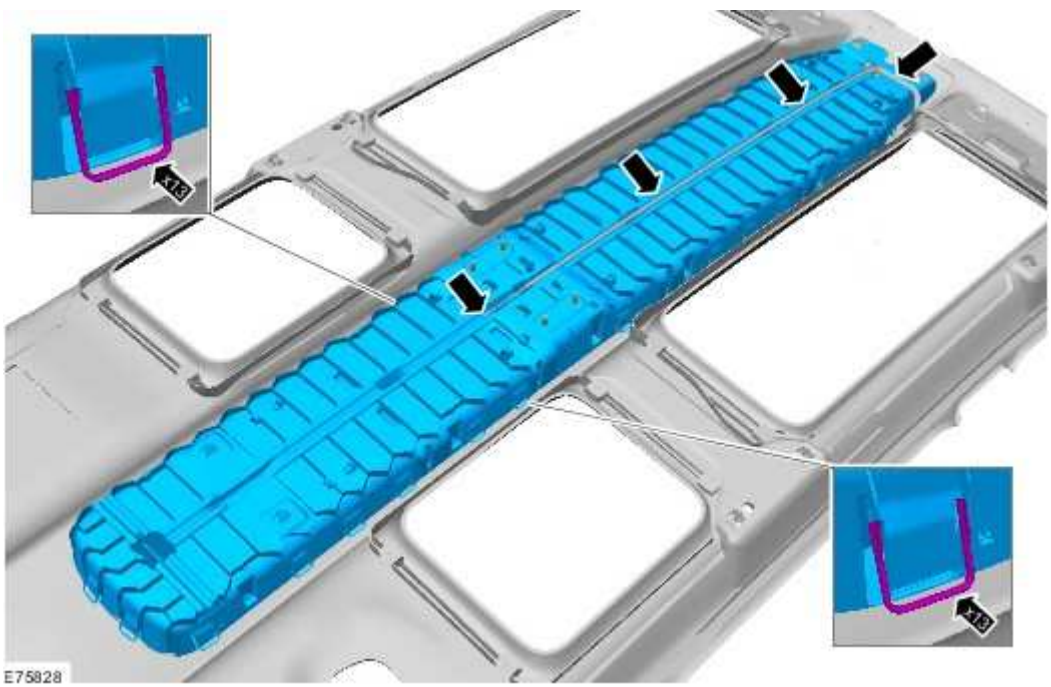
Print

Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Glass Roof Panel Blind - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. 

3. 

Installation

1. To install, reverse the removal procedure.

http://vnx.su

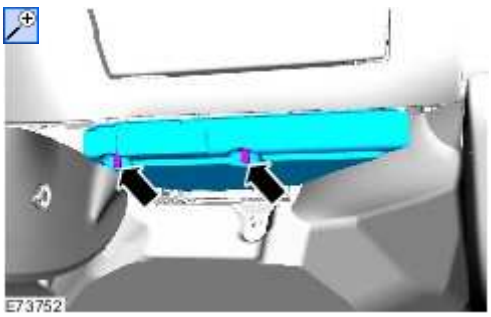
Removal and Installation

Removal

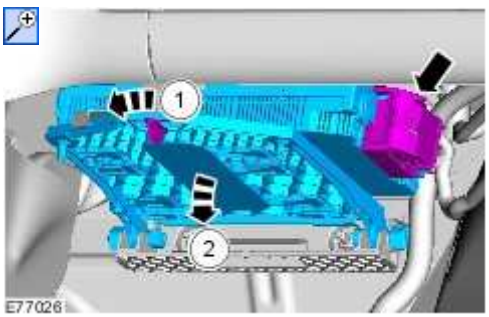
NOTE: Removal steps in this procedure may contain installation details.

1. Remove the left and right-hand front door.

   Refer to: Door (501-03 Body Closures, Removal and Installation).



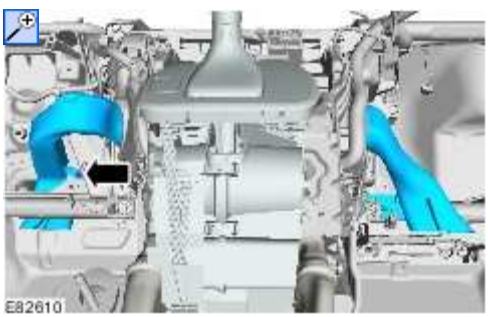
2.



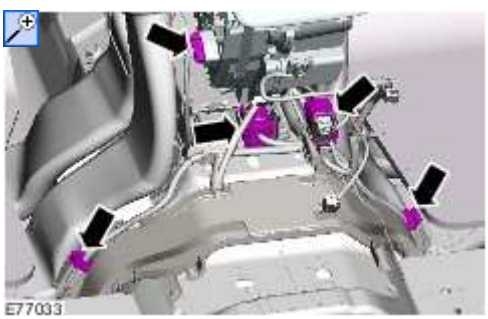
3.

4. Remove the instrument panel.

   Refer to: Instrument Panel - Vehicles Built From: 05/2007 (501-12 Instrument Panel and Console, Removal and Installation).



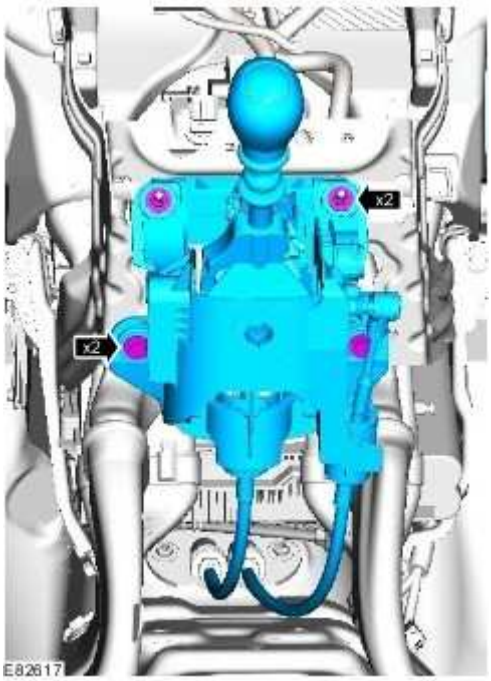
5.



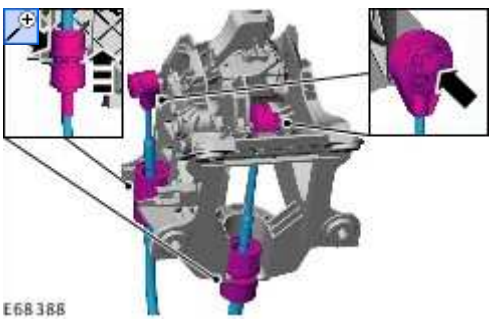
6.

http://vnx.su

Vehicles with manual transmission

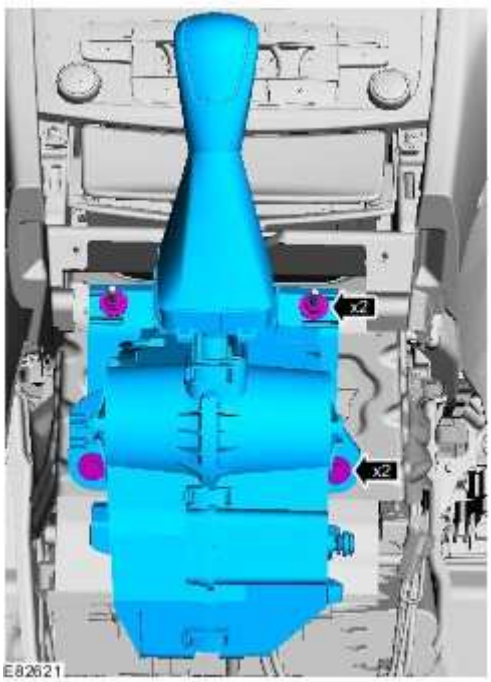


7. *Torque:* 9 Nm



8.

Vehicles with automatic transmission



9. *Torque:* 9 Nm

10.

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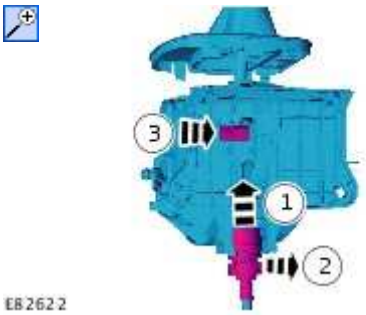
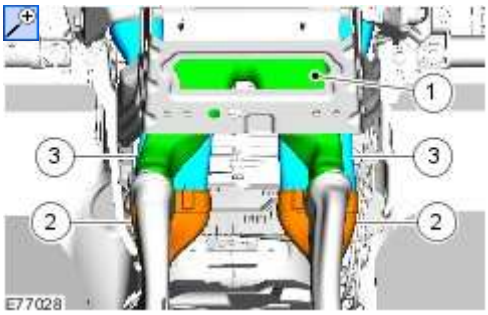


All vehicles



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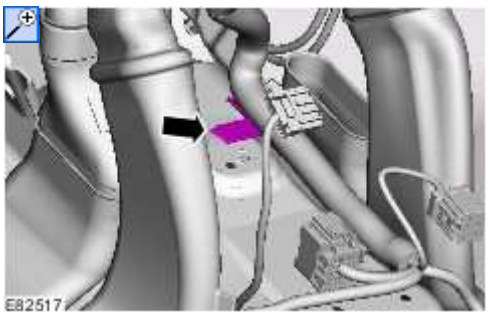

12.

13.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

14.

1. *Torque:* 9 Nm
2. *Torque:* 25 Nm

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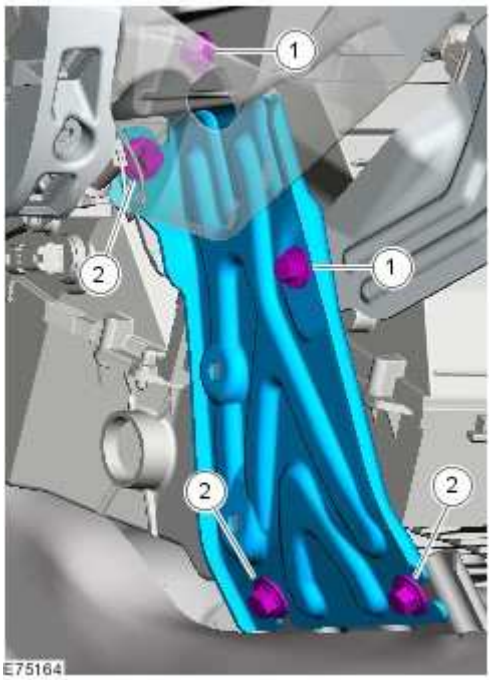
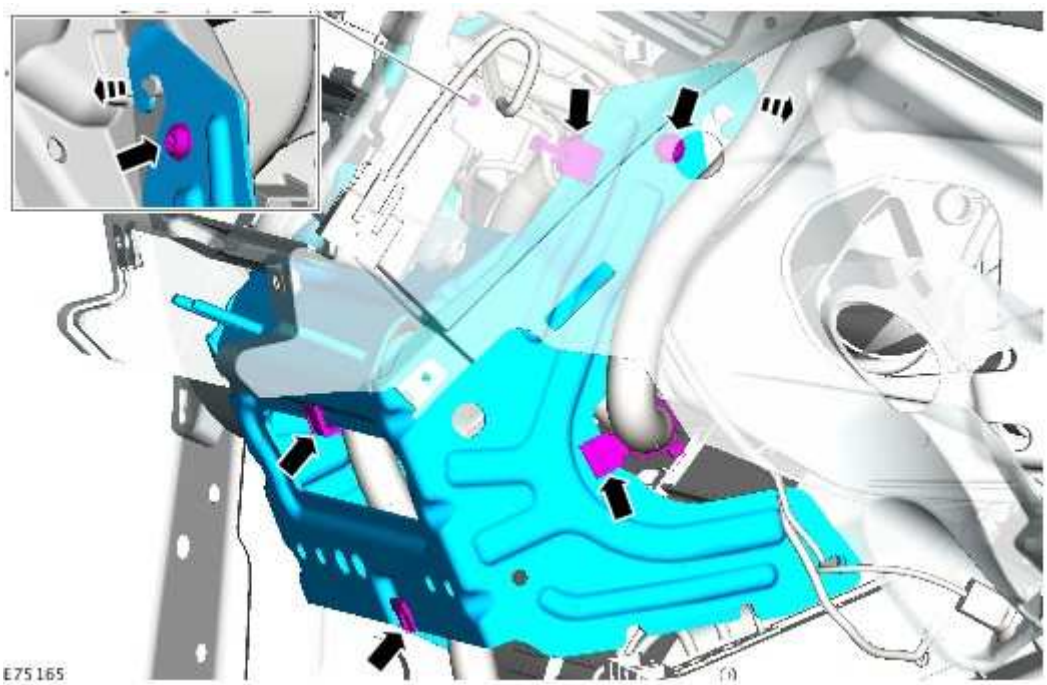


15. *Torque:* 9



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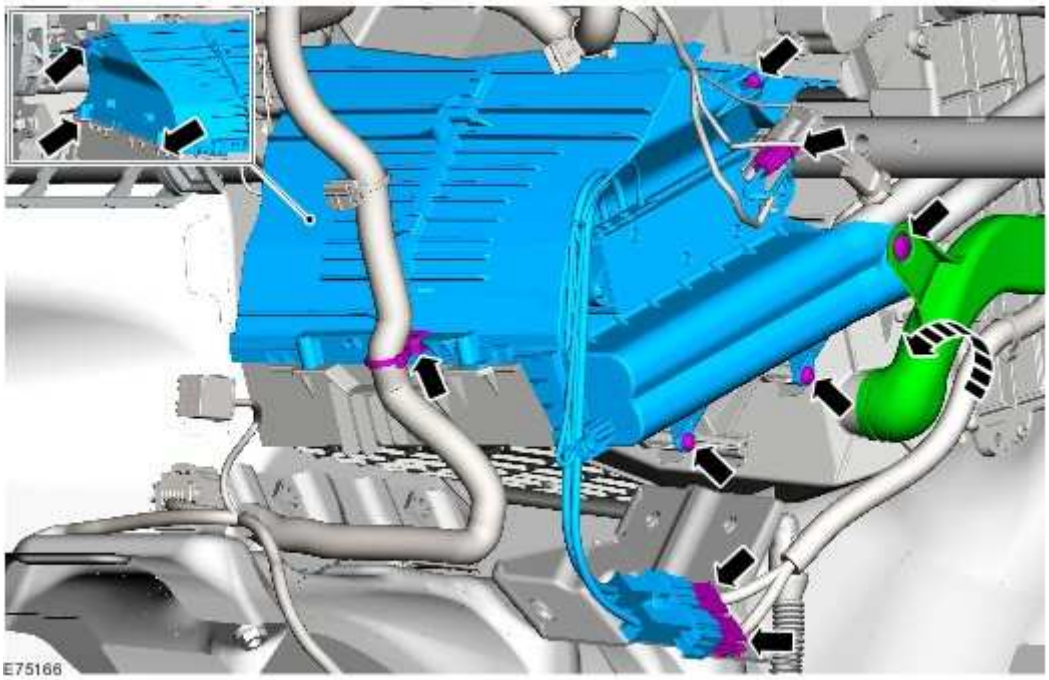
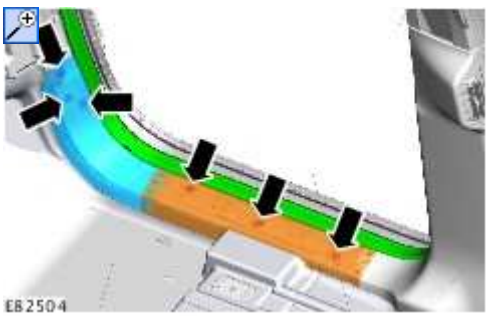
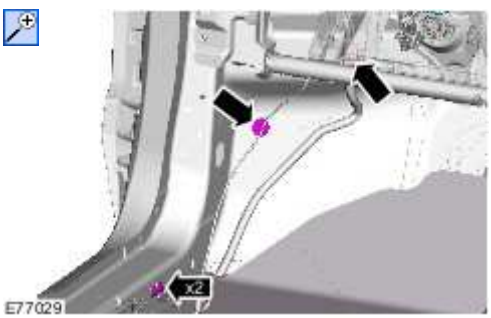


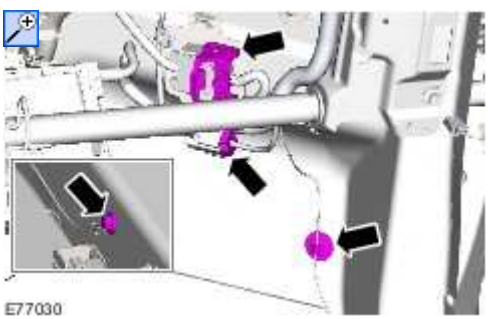


17.

- On both sides.



18. *Torque:* 10 Nm



19. *Torque:* 10 Nm

20.

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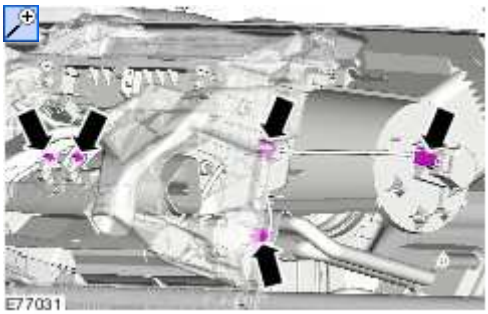

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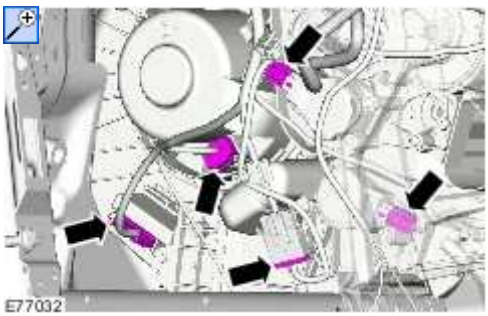

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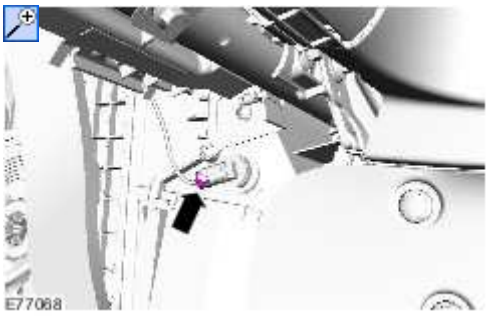

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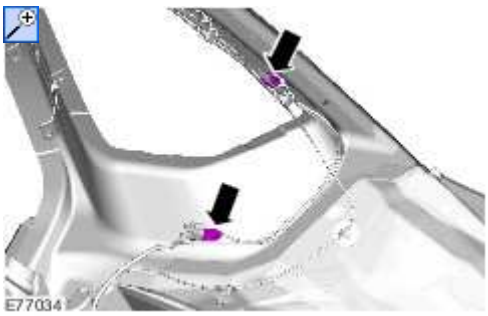

24.

1. *Torq*
   9 Nr
2. *Torq*
   25 N
3. *Torq*
   80 N
4. *Torq*
   25 N

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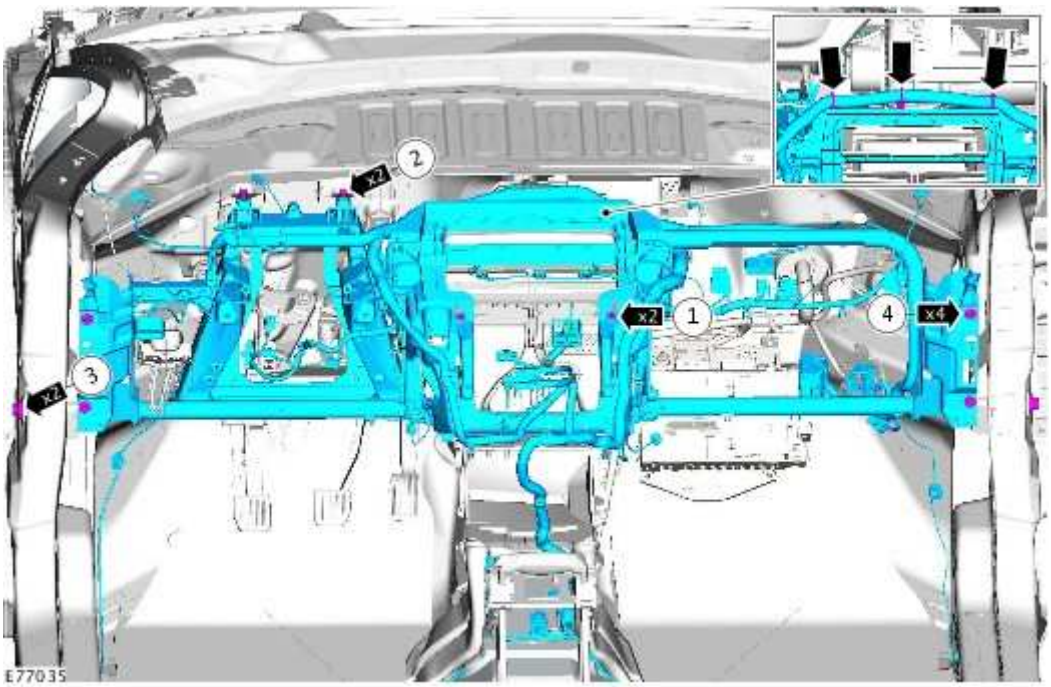
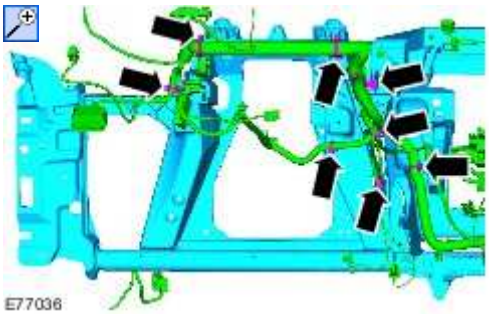
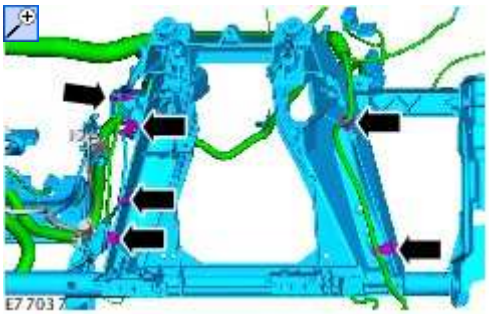
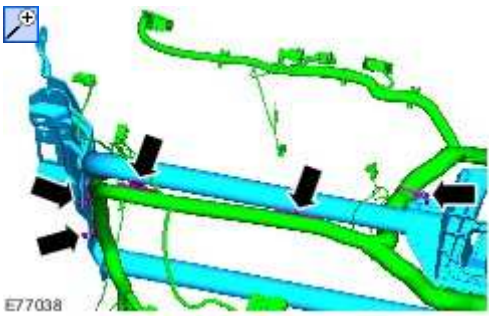




25. NOTE: This step is only required when installing a new component.



26. NOTE: This step is only required when installing a new component.



27. NOTE: This step is only required when installing a new component.

Installation

1. To install, reverse the removal procedure.

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Description and Operation

Vehicles with Central Locking

The locking system is available with a central locking function and a double locking function.

The systems consists of hard wired door latches, wired to the individual door control units (if equipped). The door latches are linked through the mid speed controller area network (CAN) bus to the central junction box (CJB).

On Vehicles with rear manual windows, there are no rear door control units intergrated into the rear door latches. The rear door latches are directly wired and controlled by the CJB.

The key position signal is sent from the driver door lock cylinder to the CJB. The CJB operates the lock or unlock relays, reversing the polarity of the door latch central locking motors.

Liftgate latch release operation is controlled directly by the CJB.

The fuel filler door lock is wired in parallel with the driver door latch central locking motor.

Vehicles with Remote Keyless Entry (RKE) System

General

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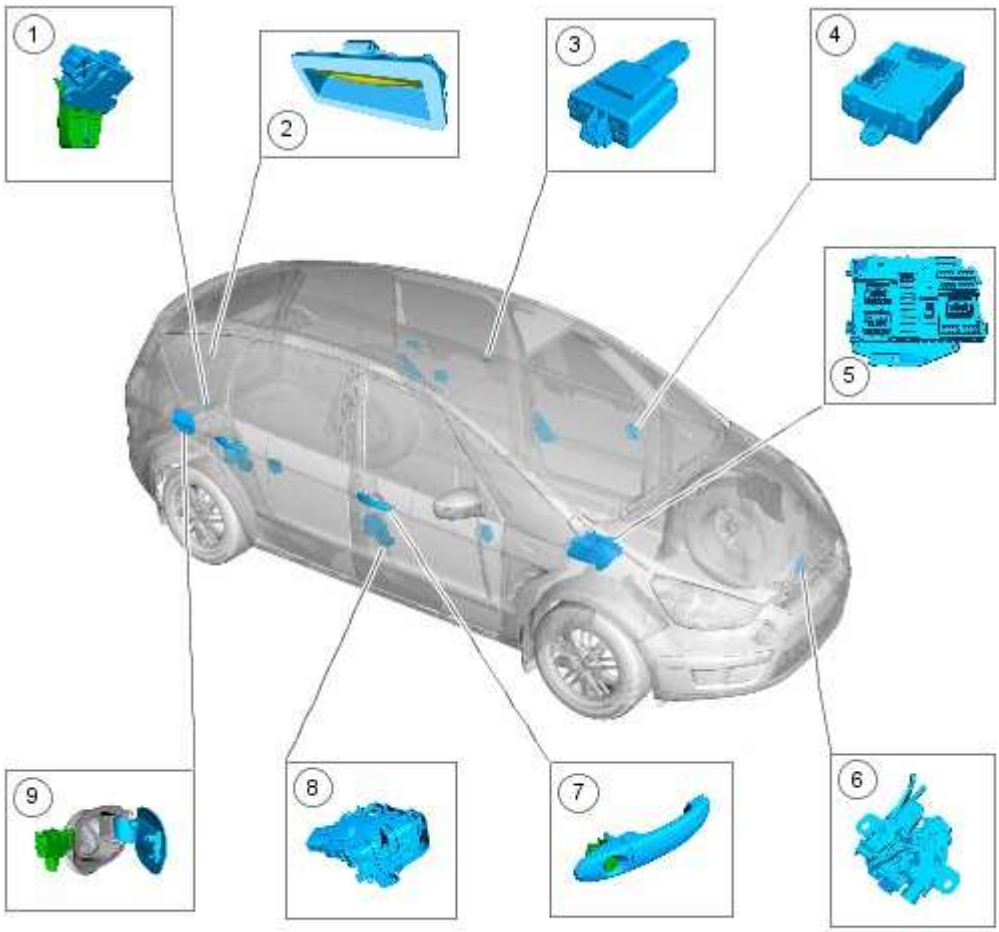

E70198

Item	Part Number	Description
1	-	Liftgate latch
2	-	Liftgate release switch
3	-	Radio frequency (RF) receiver
4	-	Remote keyless entry (RKE) module
5	-	Central junction box (CJB)
6	-	Hood latch
7	-	Exterior door handle
8	-	Door latch
9	-	Fuel filler door lock

RKE systems use mechanical/electrical door latches individually controlled by the corresponding RKE module.

RKE modules send and receive commands between each other and the CJB using the central area network (CAN) bus.

When a key is turned in the door lock cylinder, a lock or unlock signal is sent to the associated RKE module. The RKE module sends a signal to the CJB. The CJB issues a signal to the remaining RKE modules, which in turn command the latches to operate.

RKE is achieved by the transmission of a coded RF signal from a transmitter contained in the vehicle key. The signal is received by the RF receiver located above the headliner in the

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vicinity of the overhead console. The received signal is passed onto the CJB where it is decoded. If the coded signal is valid, the CJB will issue a command on the CAN bus circuit to operate the door latches or liftgate release.

The signals received by the CJB from the RF antenna or the RKE modules is also used to arm and disarm the vehicle security systems, illuminate the interior lights and operate the global closing functions.

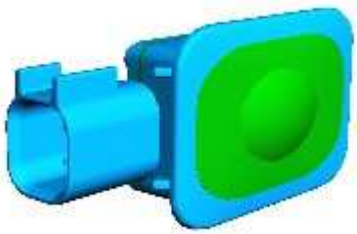
Liftgate Latch

E70211

The liftgate latch is a mechanical latch with a electric motor to drive the latch release. The liftgate latch has no remote mechanical release facility.

When the liftgate is closed, the latch is automatically locked.

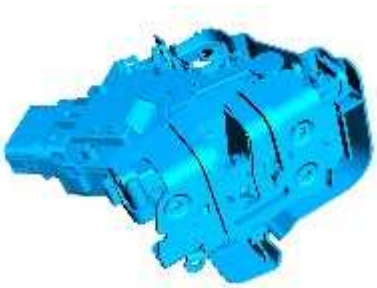
Liftgate Switch



E70212

The liftgate lock switch is located in the licence plate illumination panel. The command to open the liftgate latch is sent by the CJB when the liftgate switch is operated. The input command to the CJB can also be issued by the RF receiver.

Door latch



E70206

Door latches have mechanical latch release with electric motor operated locking and double locking function.

When the door latch is locked, the exterior door handle is disengaged from the door latch.

Incorporated within the door latch is a door ajar switch. The door ajar switch monitors the latch position and supplies information to the RKE module. This information is sent to the CJB for use in warning systems, locking functions and alarm system.

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General Procedures

1. A maximum of eight keyless entry remote transmitters can be programmed to the central junction box (CJB). Programming must be carried out at the same time for all the remote transmitters.
2. To enter programming mode, first make sure that the vehicle battery is fully charged and that the anti-theft system is not armed or triggered.
3. Make sure that the turn signal lamp switch is in the OFF position.
4. Fasten the safety belts and close all doors to make sure that conflicting chimes do not sound during programming.
5. The ignition switch must be turned from position 0 to position II exactly four times during remote transmitter programming. Failure to follow this instruction may result in incorrect remote transmitter programming.
6. Turn the ignition switch to position I.
7. Press and hold one of the buttons on the remote transmitter.
8. After each successful programming, another 10 second learning mode is automatically entered, up to a maximum of seven times.
9. To program additional remote transmitters, repeat step 9.
10. The system will leave the learning mode after the ignition switch is turned to either position II or III, or if no new remote transmitter is programmed during the 10 seconds, or if eight remote transmitters have been programmed.
11. After successful programming, only the new programmed remote transmitters will be accepted.
12. Test all the programmed remote transmitters, by activating and deactivating the locking/unlocking functions.

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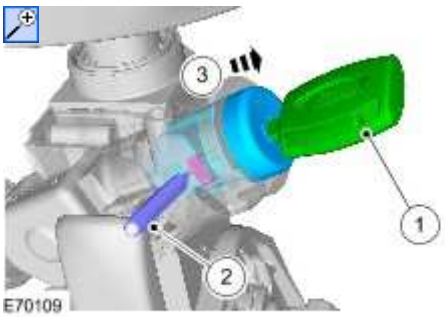
Removal and Installation

Removal



1. Remove the passive anti-theft system (PATS) transceiver.

   Refer to: Passive Anti-Theft System (PATS) Transceiver (419-01B Anti-Theft - Passive, Removal and Installation).

2.
   1. Turn the ignition key to position I.
   2. Using a suitable punch, release the locking tang.

Installation

1. CAUTION: Make sure that the ignition switch and the ignition lock cylinder are aligned before installation.
   To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Flat-bladed screwdriver

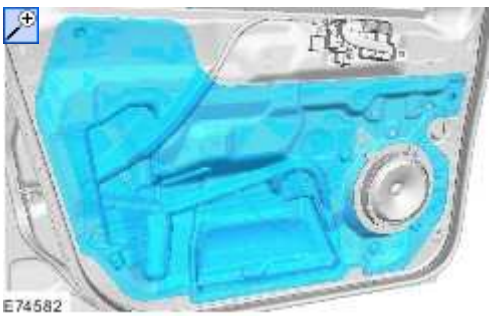
Removal

NOTE: Removal steps in this procedure may contain installation details.

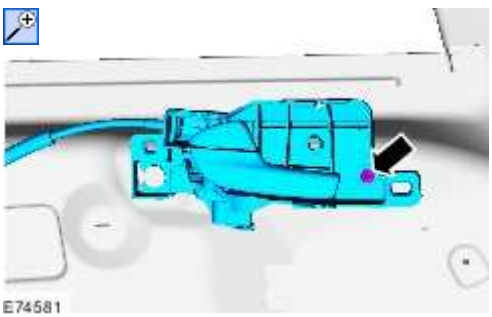
1. Remove the exterior front door handle.

   Refer to: Exterior Front Door Handle (501-14 Handle Locks, Latches and Entry Systems, Removal and Installation).
2. Remove the front door trim panel.

   Refer to: Front Door Trim Panel (501-05 Interior Trir Ornamentation, Removal and Installation).



3. NOTE: Touching the adhesive surface will impair rebonding.
   Torque: 2 Nm



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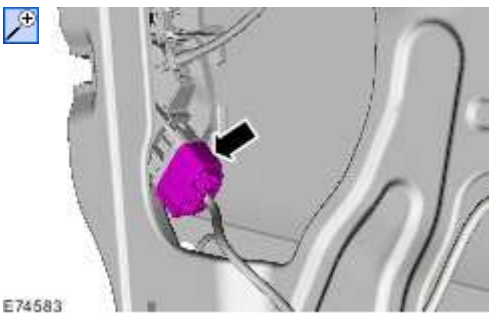

5.

6. *Torque:* 8 Nm

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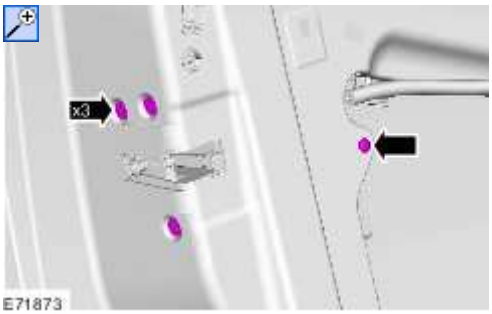

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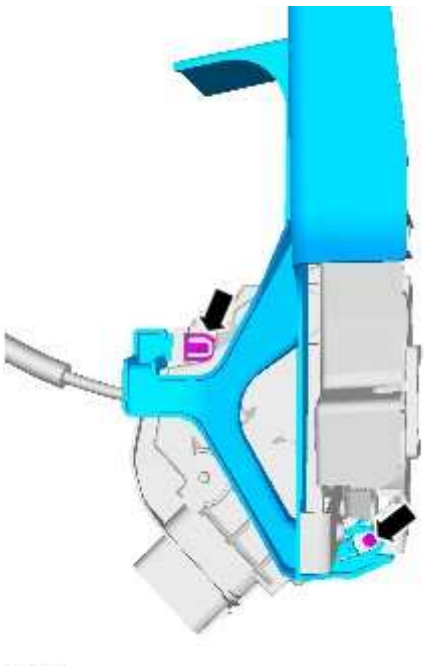

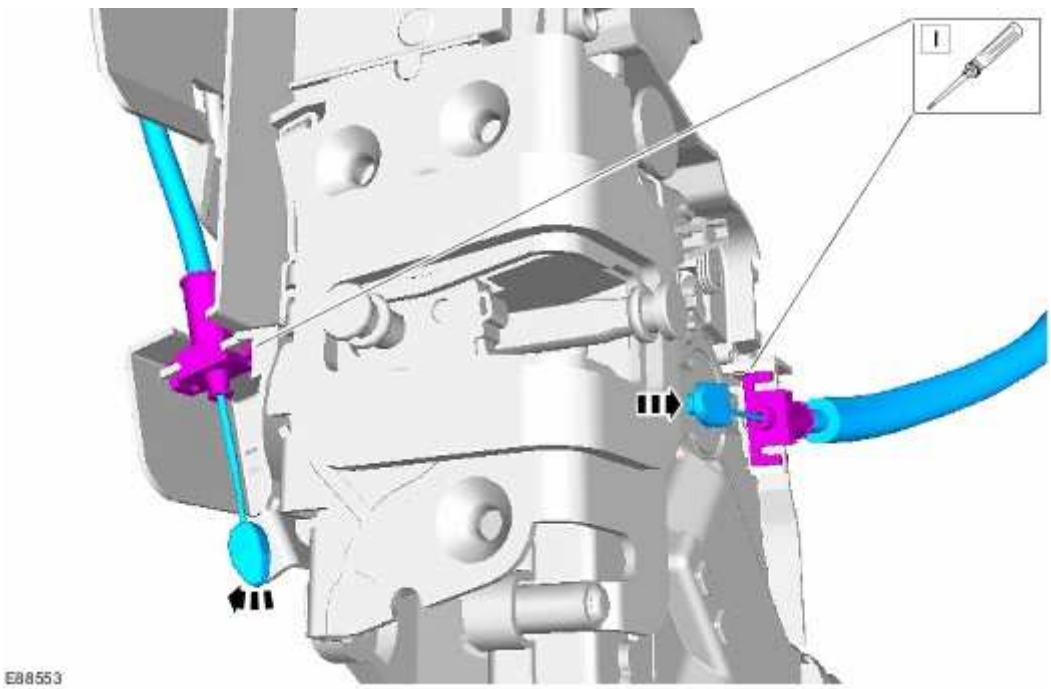

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Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the exterior rear door handle.

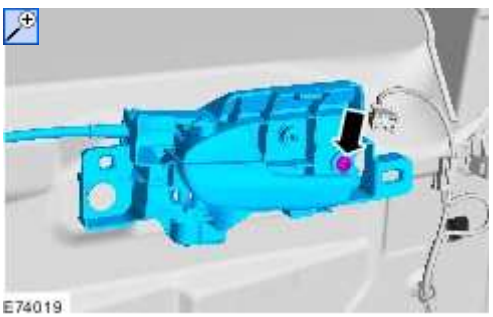
   Refer to: Exterior Rear Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

2. Remove the rear door trim panel.

   Refer to: Rear Door Trim Panel (501-05 Interior Trim, Ornamentation, Removal and Installation).

E72599

3. NOTE: Touching the adhesive surface will impair rebonding.


E74019

4.

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5.

6. *Torque:* 8 Nm

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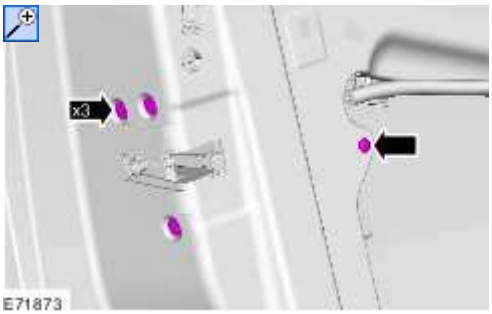

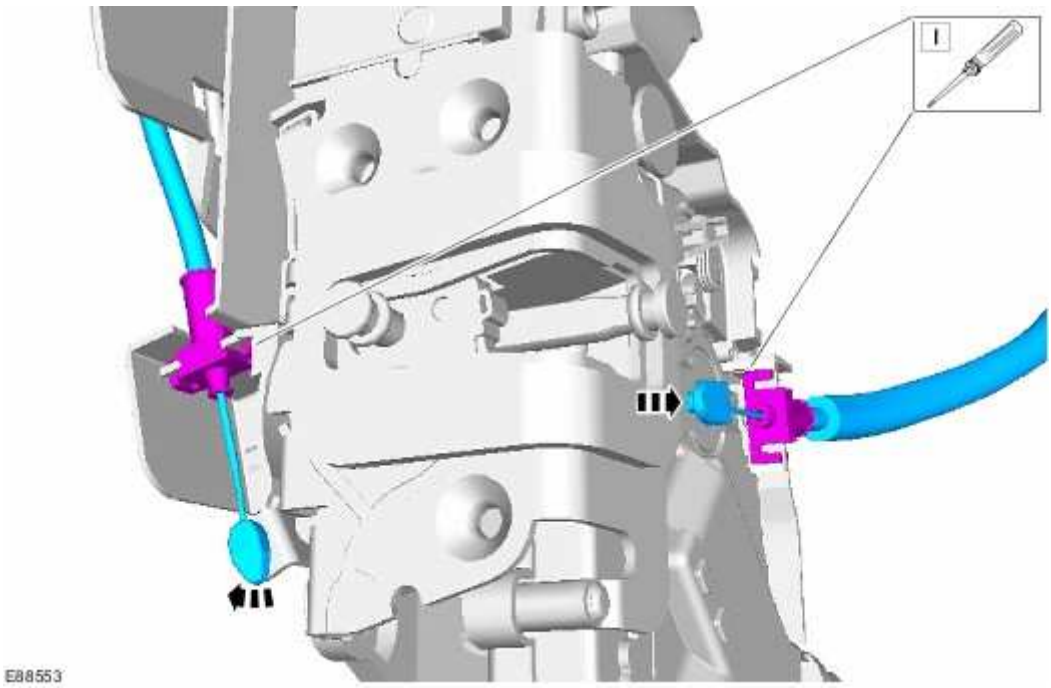

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Installation

1. To install, reverse the removal procedure.

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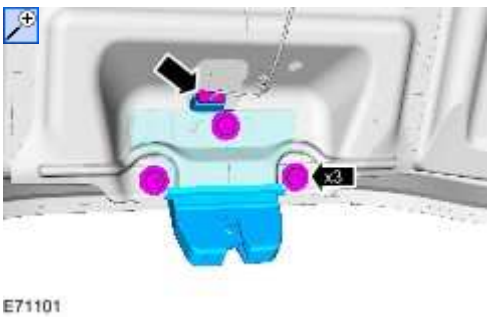
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the liftgate trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



E71101

2. *Torque:* 20 Nm

Installation

1. To install, reverse the removal procedure.

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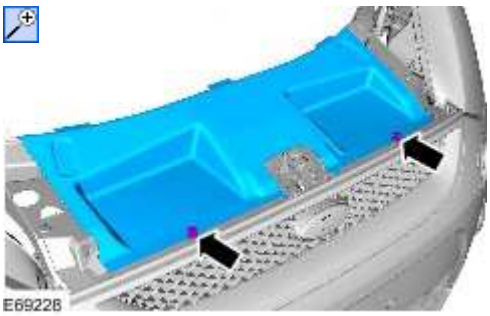
Removal and Installation

Removal

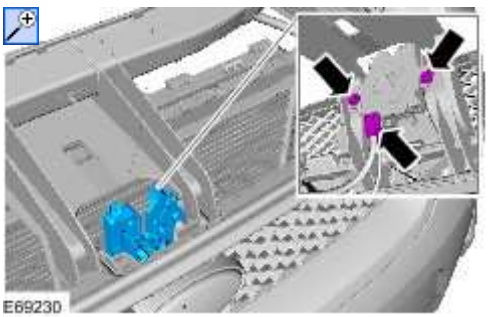
NOTE: Removal steps in this procedure may contain installation details.

All vehicles



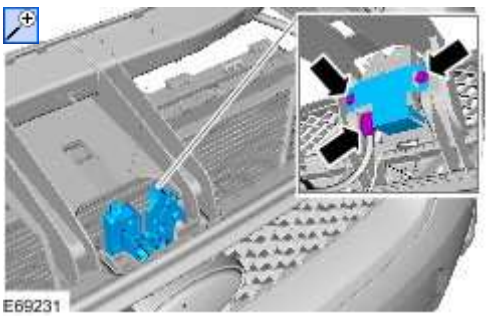
1.

Left-hand drive vehicles



2. *Torque:* 9 Nm

Right-hand drive vehicles



3. *Torque:* 9 Nm

All vehicles

4.

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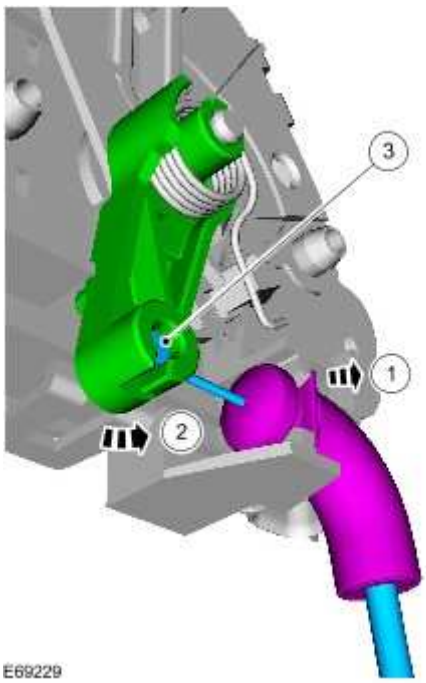

Installation

1. CAUTION: Make sure that the clearance on either side of the hood is equal and no strain is placed on the hood latch.
   To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Draw cord

Removal

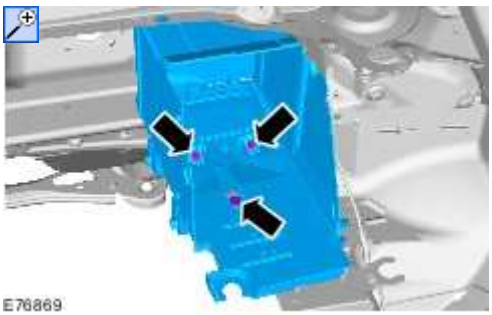
NOTE: Removal steps in this procedure may contain installation details.

All vehicles

1. Remove the hood latch.

   Refer to: Hood Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
2. Remove the battery.

   Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

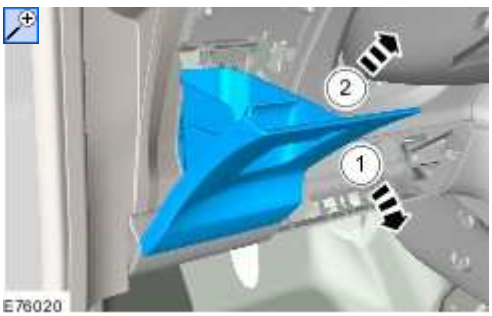


3.

Left-hand drive vehicles

4. Remove the driver lower air bag module.

   Refer to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).



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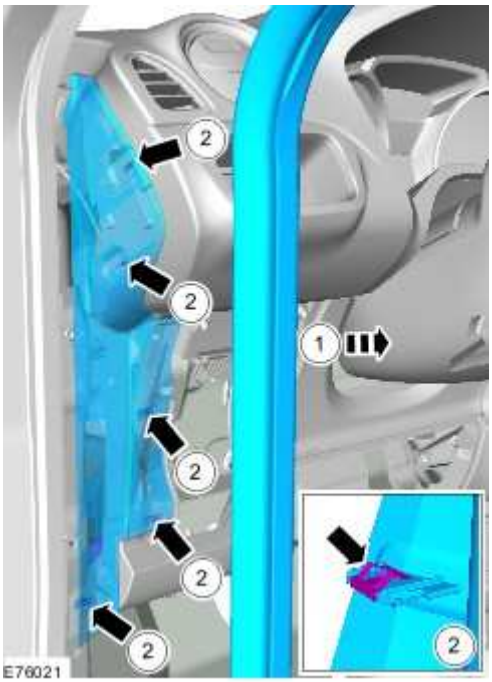

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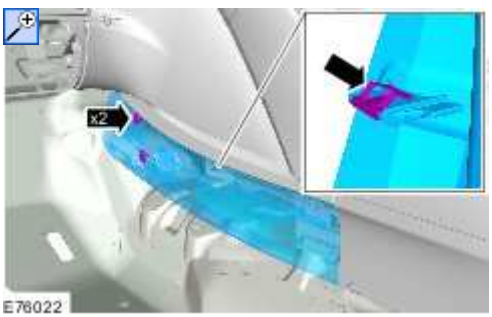

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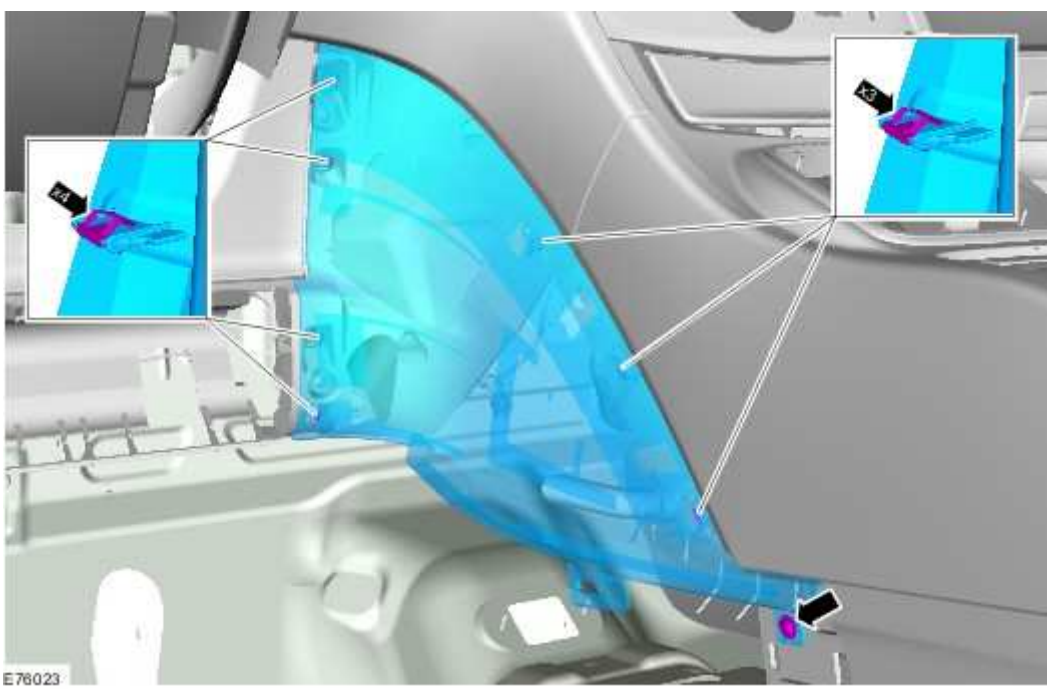

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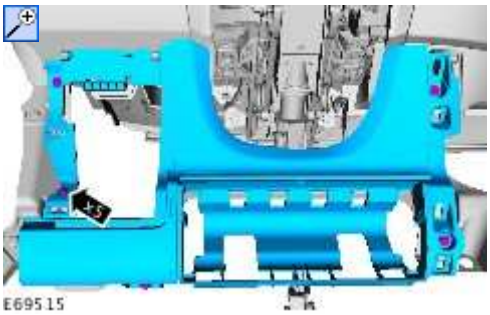
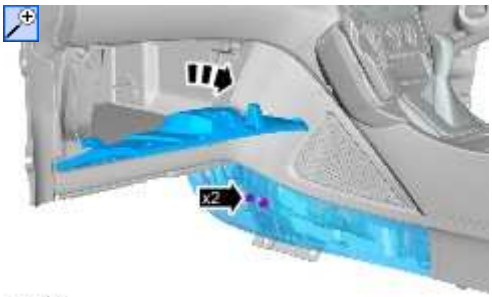


Right-hand drive vehicles

10.



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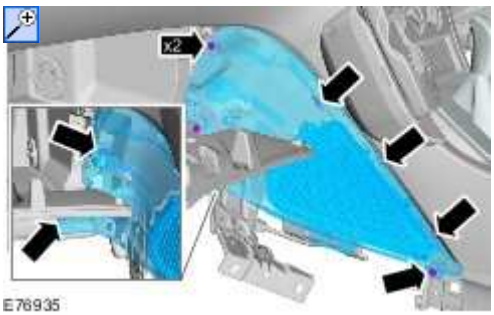

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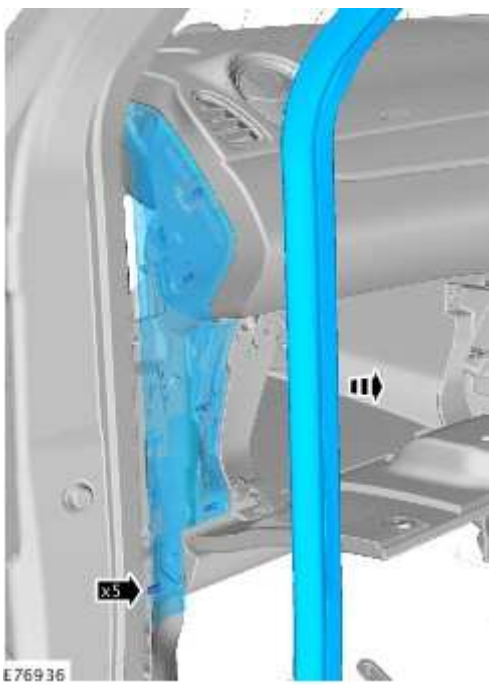

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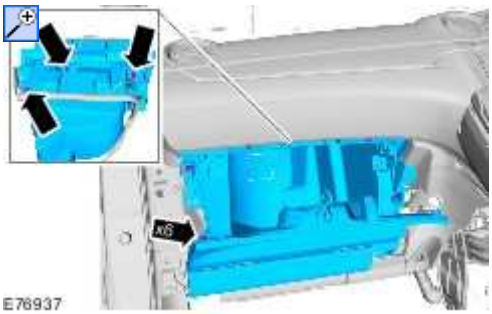

All vehicles

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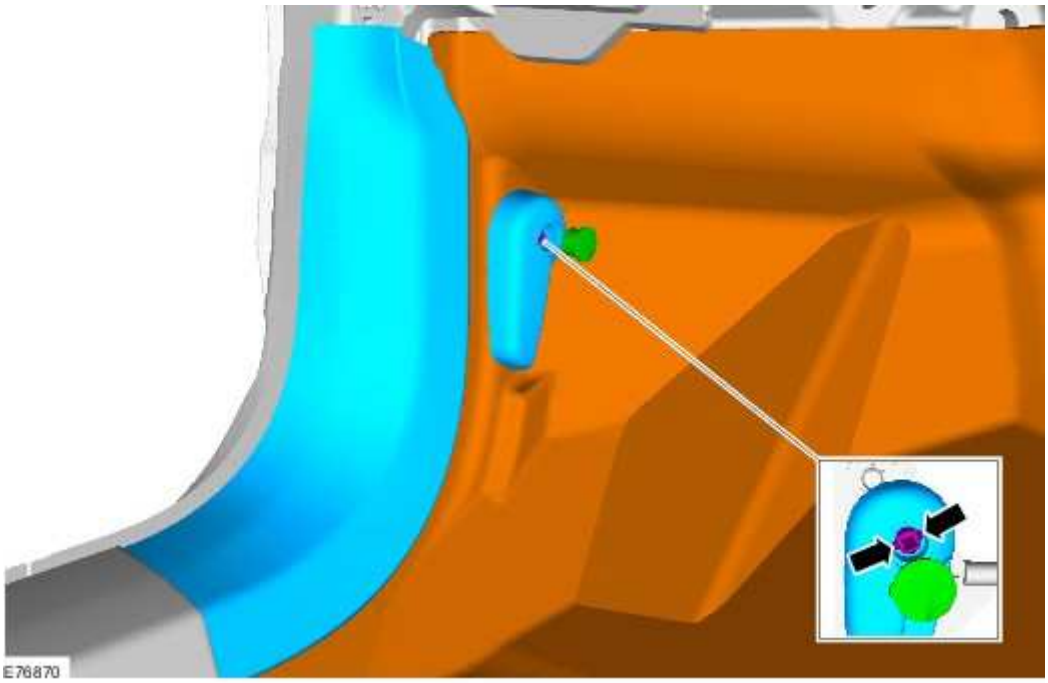

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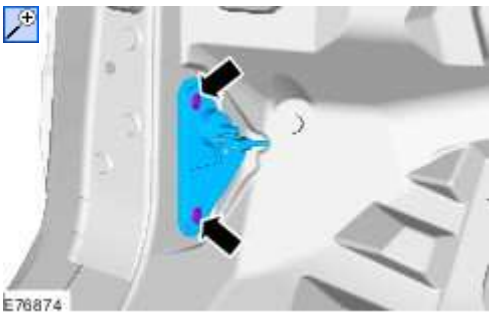

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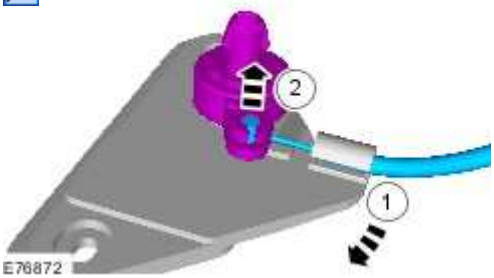

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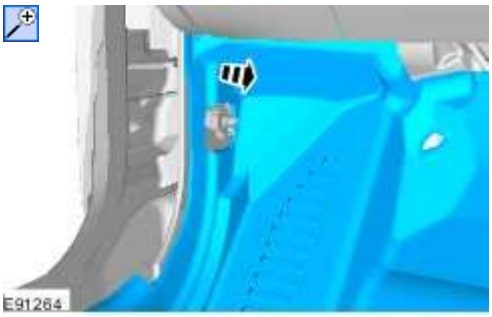

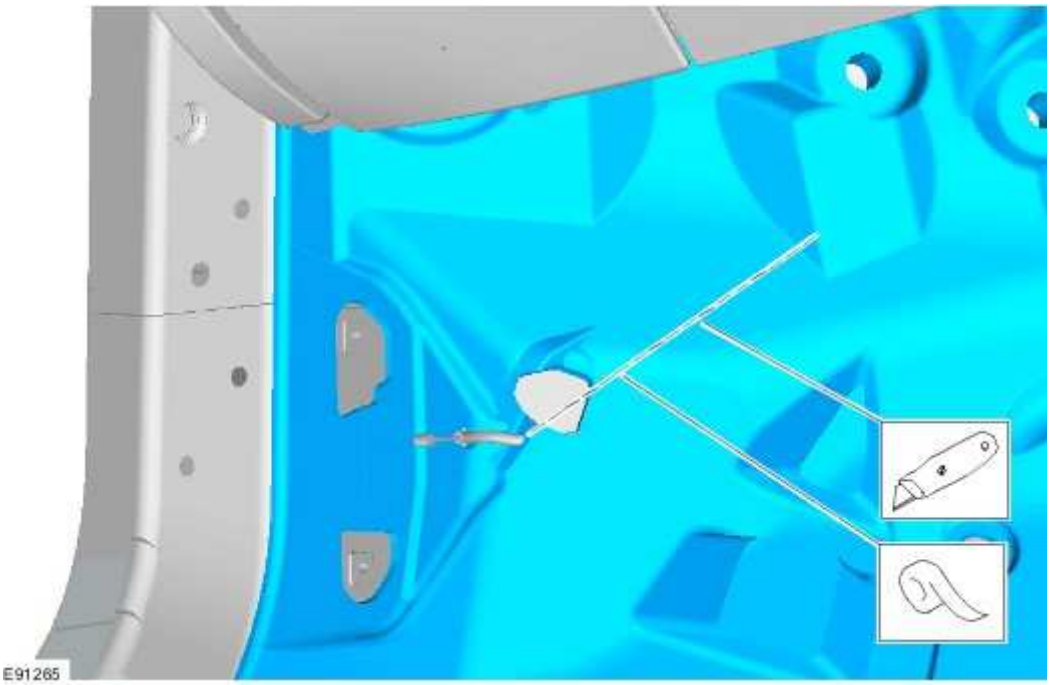

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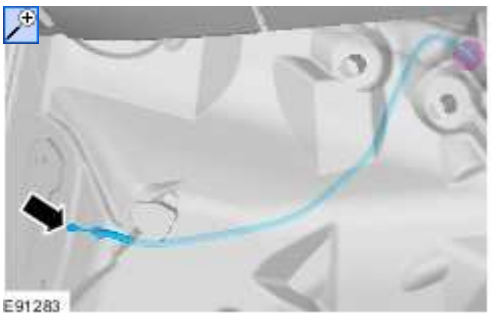

19. NOTE: This step requires the aid of another technician.
Attach a suitable draw cord to the hood latch cable.

General Equipment: Draw cord

20.

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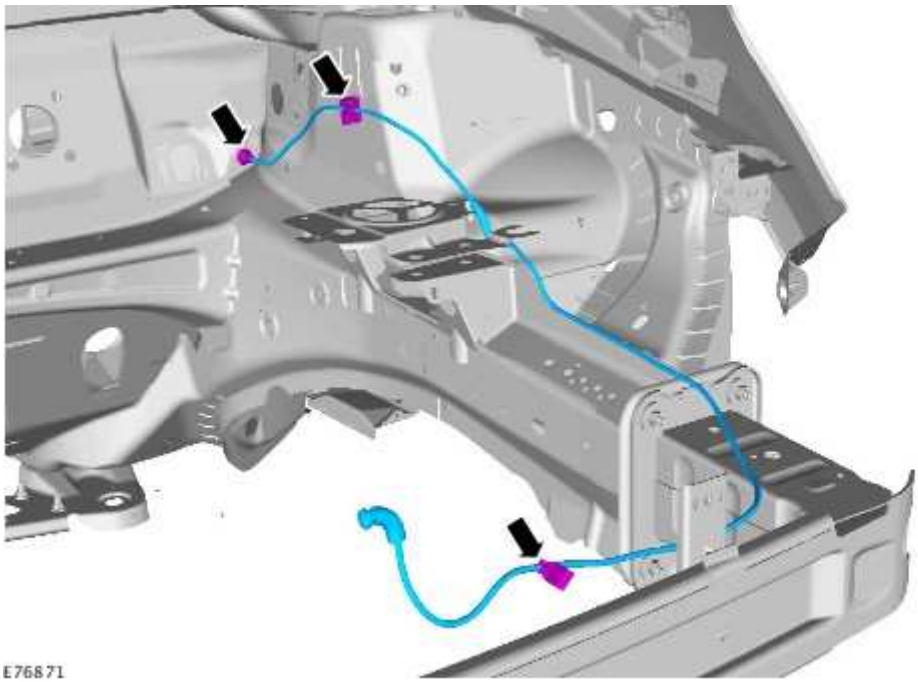

Installation

1. To install, reverse the removal procedure.

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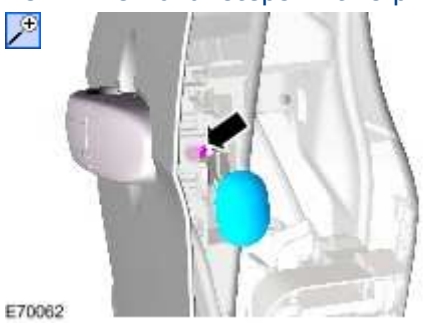
Print

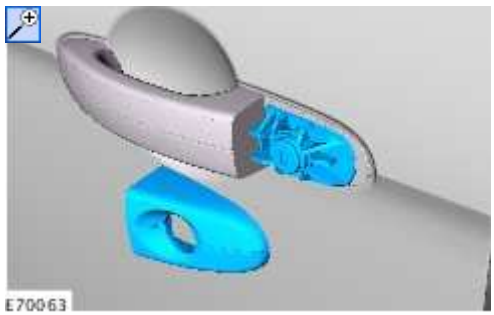
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 2 Nm



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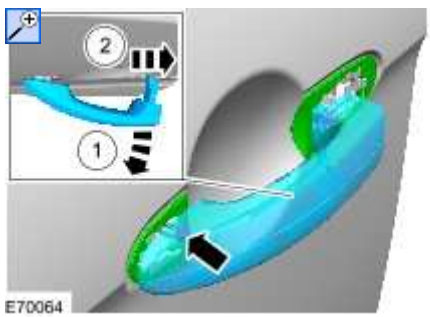

3.

Installation

1. To install, reverse the removal procedure.

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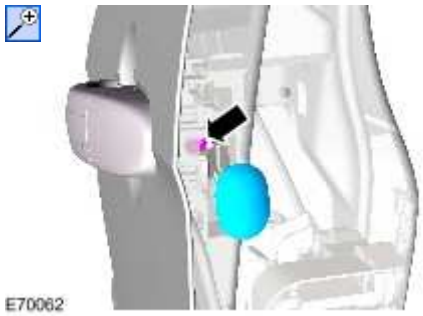
Print

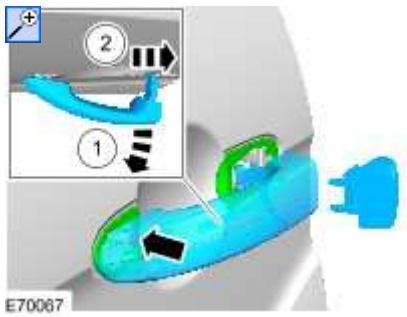
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 2 Nm



2.

Installation

1. To install, reverse the removal procedure.

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Prir

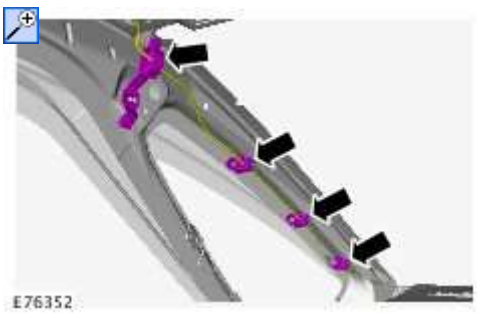
Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



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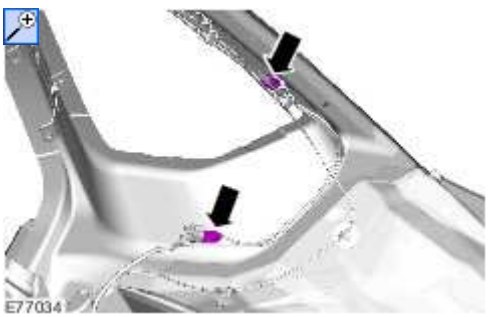

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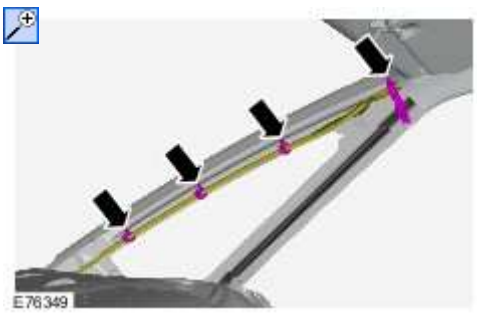

4.

5. Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
6. Refer to: C-Pillar Trim Panel - VIN Plate Body Style Code: M (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. *Torque:* 35 Nm

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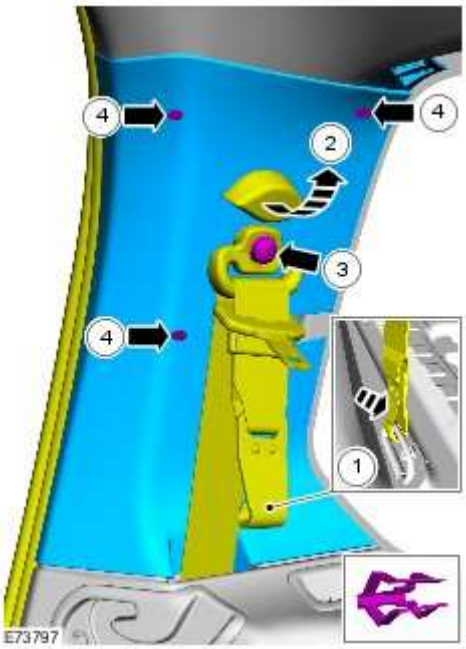

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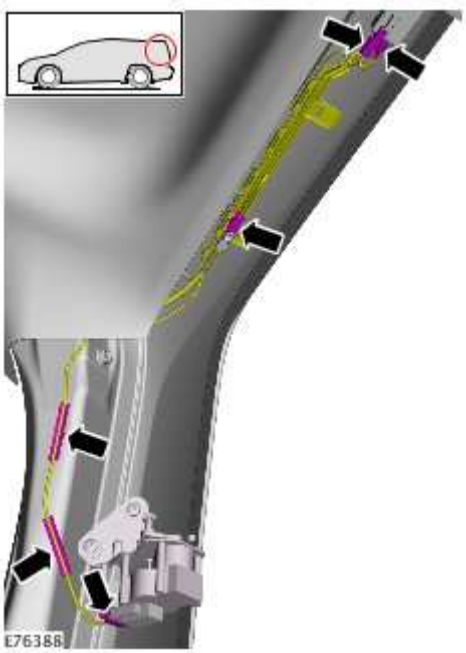
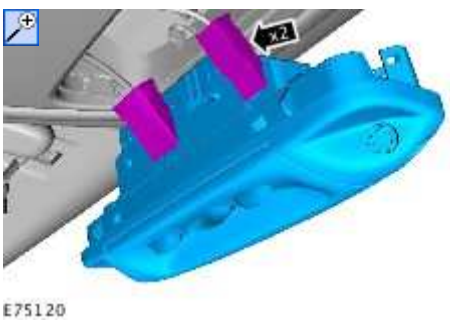


9.

http://vnx.su

10. *General Equipment:* Flat-bladed screwdriver



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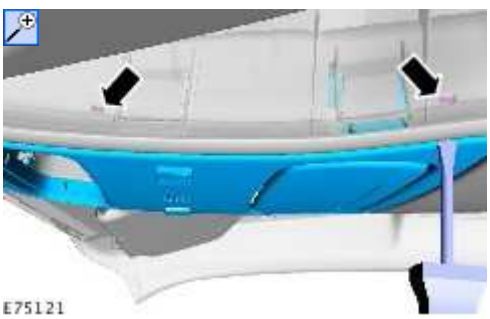
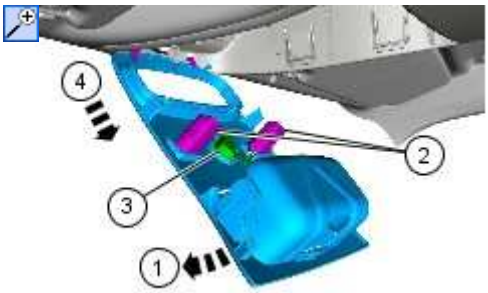


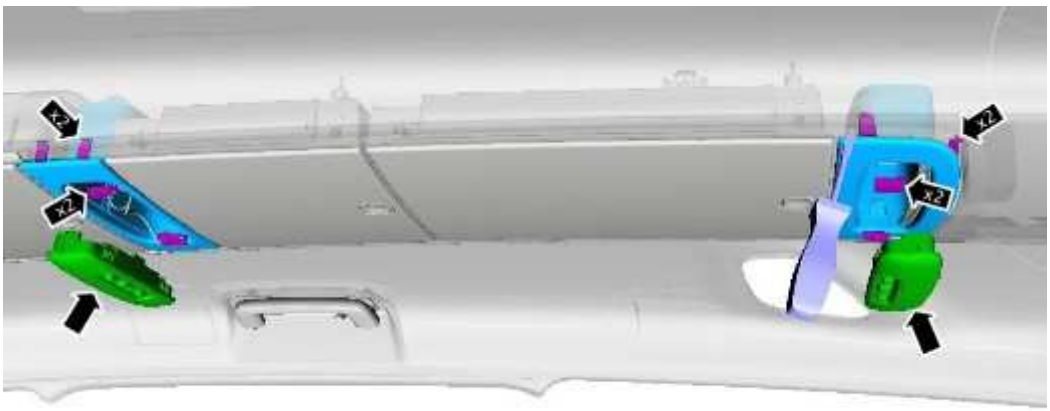
12. *General Equipment:* Flat-bladed screwdriver

13.

http://vnx.su

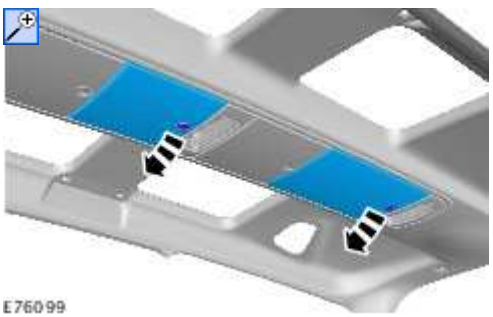


E75122



E75123

14. *General Equipment* Flat-blade screwdrive



E76099

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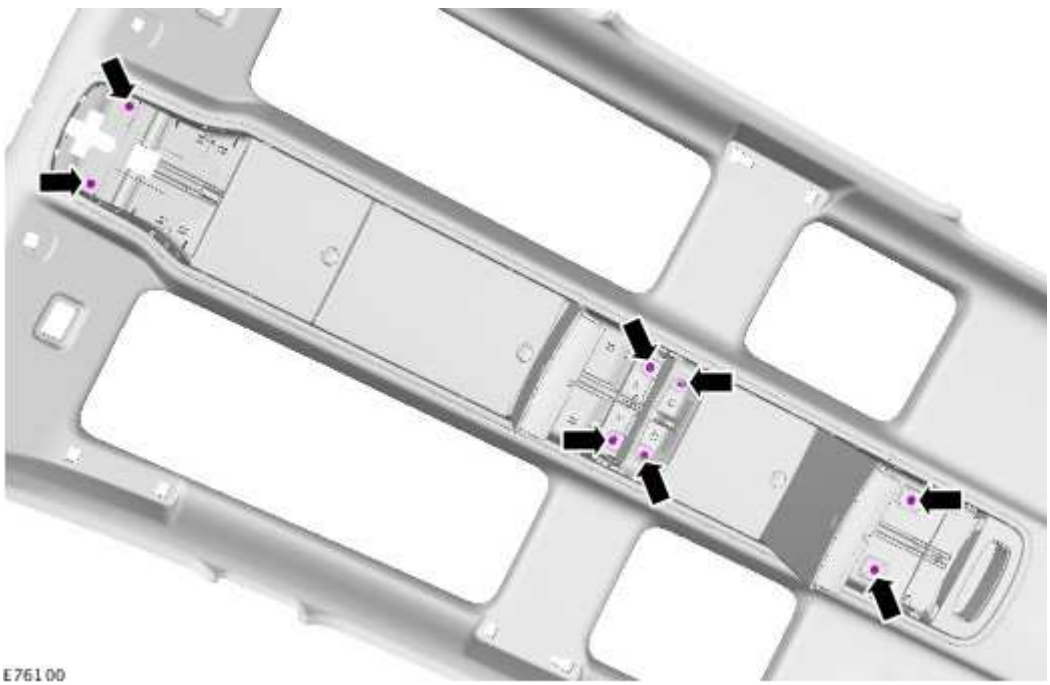

E76100

16.

17. If equipped.

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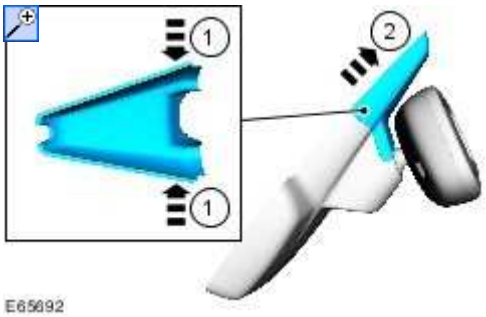
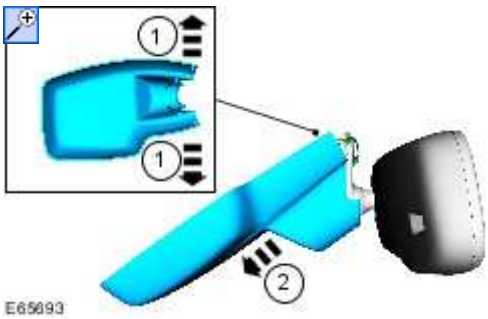
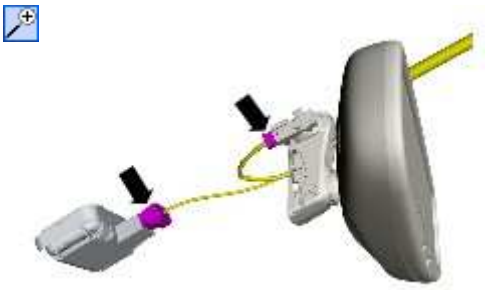


E65892

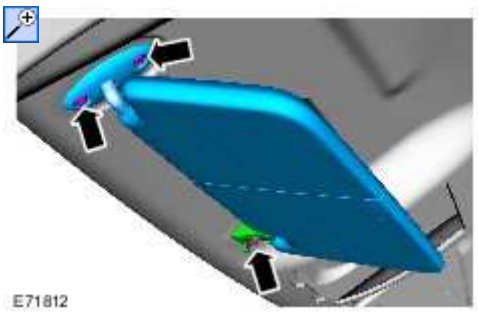


E65893

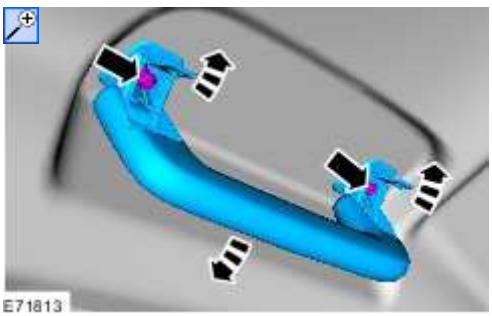
18. If equipped.


E74631

19. If equipped.


E71812

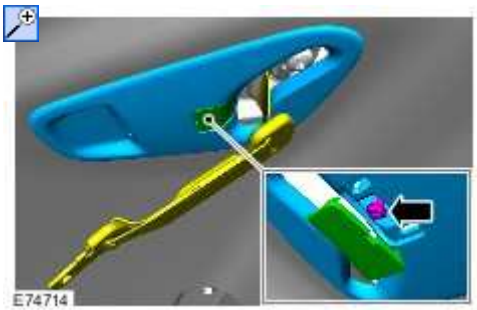
20. On both sides.

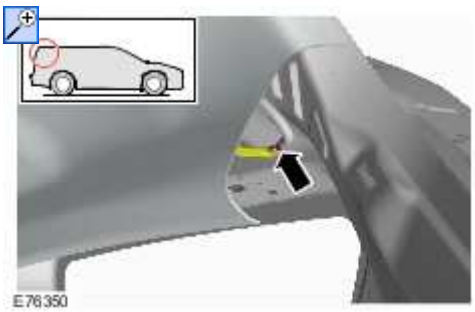

E71813

21. On both sides.

22.

http://vnx.su





23.

24. Recline the front seats backrests.
25. Recline the rear seats backrests.
26. Support the headliner.

27.

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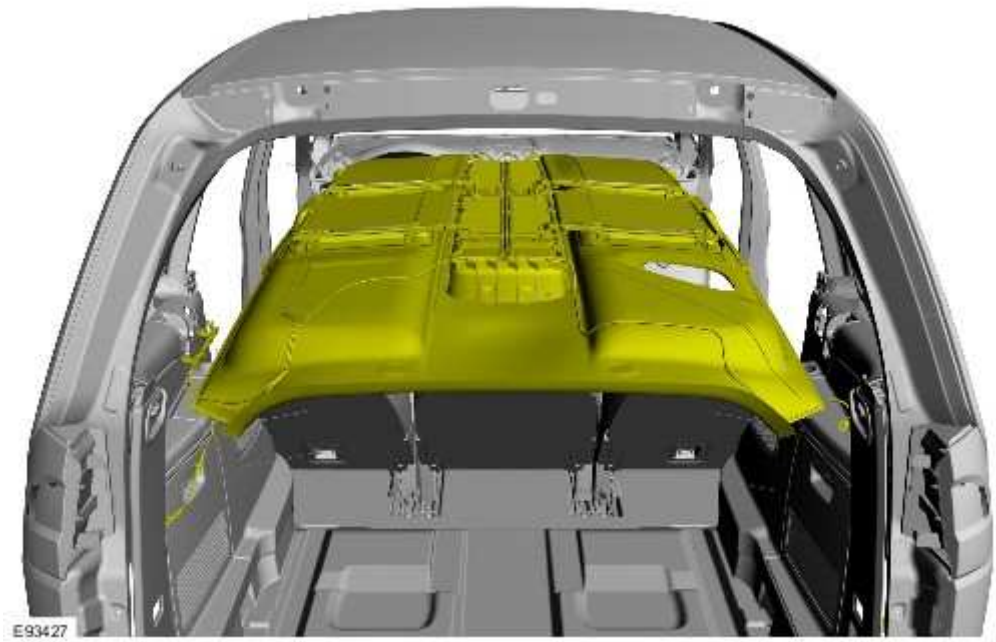

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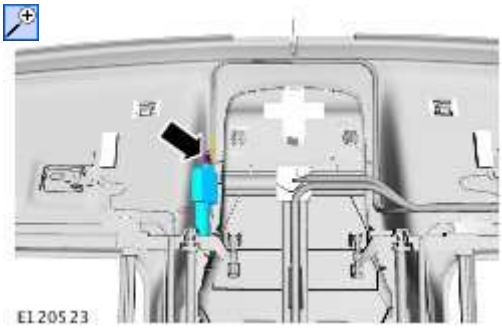

Installation

1. To install, reverse the removal procedure.

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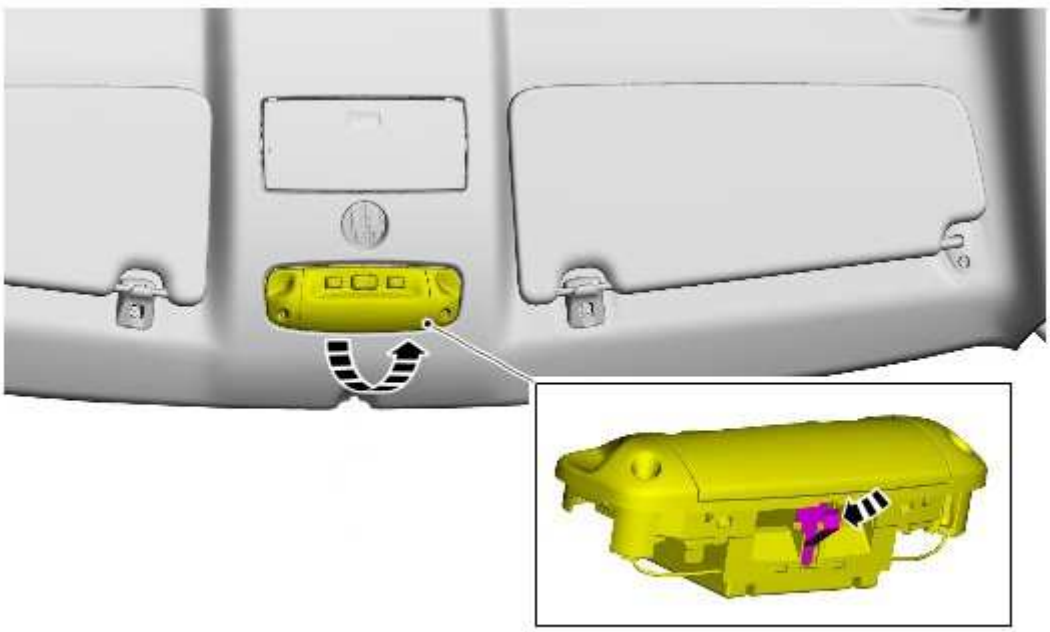
P

Removal and Installation

General Equipment

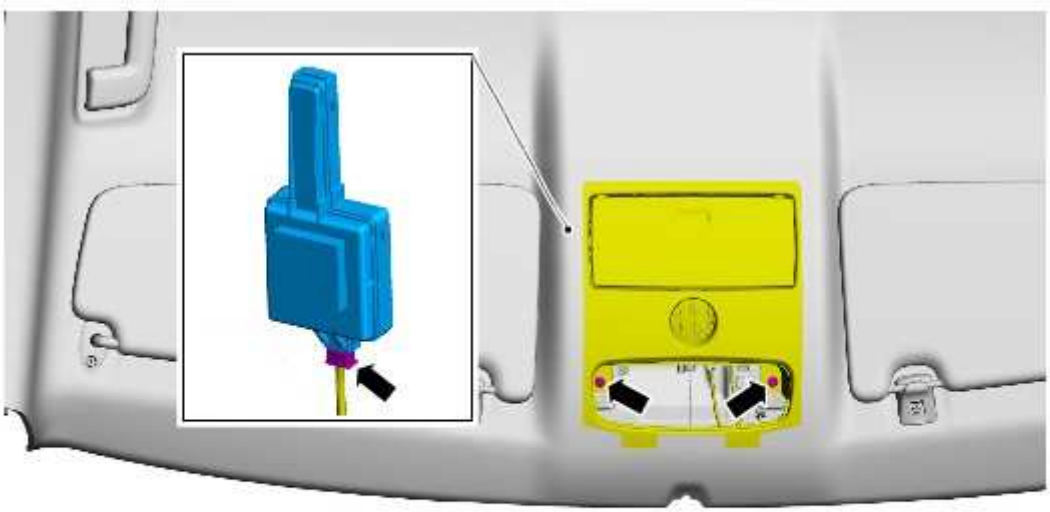
Flat-bladed screwdriver

Removal



E120329

1. *General Equipme* Flat-blad screwdri



E120330

2.

Installation

1. To install, reverse the removal procedure.

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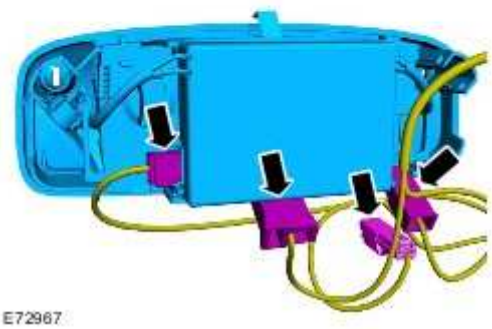
Removal and Installation

General Equipment

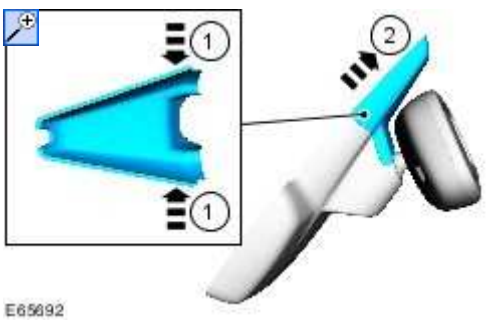
Flat-bladed screwdriver

Removal



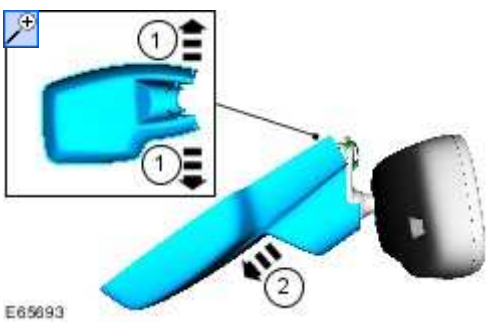
E72967

1. Refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. *General Equipment:* Flat-bladed screwdriver



E65692

3. If equipped.



E65693

4. If equipped.
5. If equipped.

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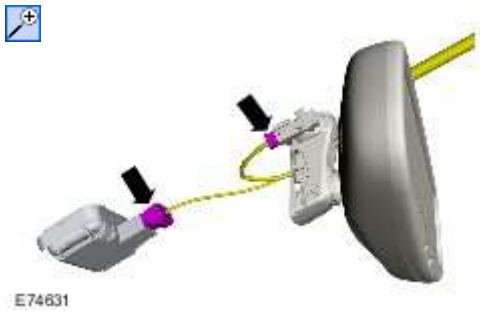
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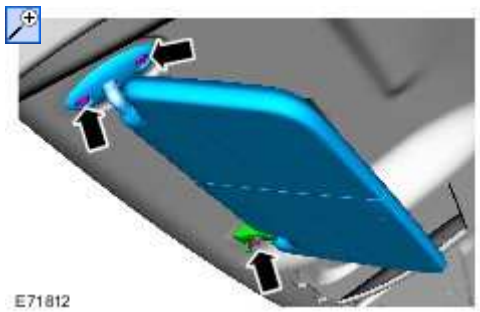
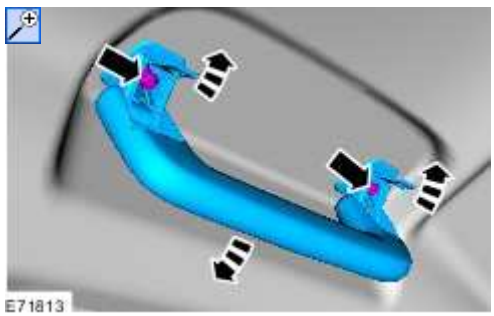
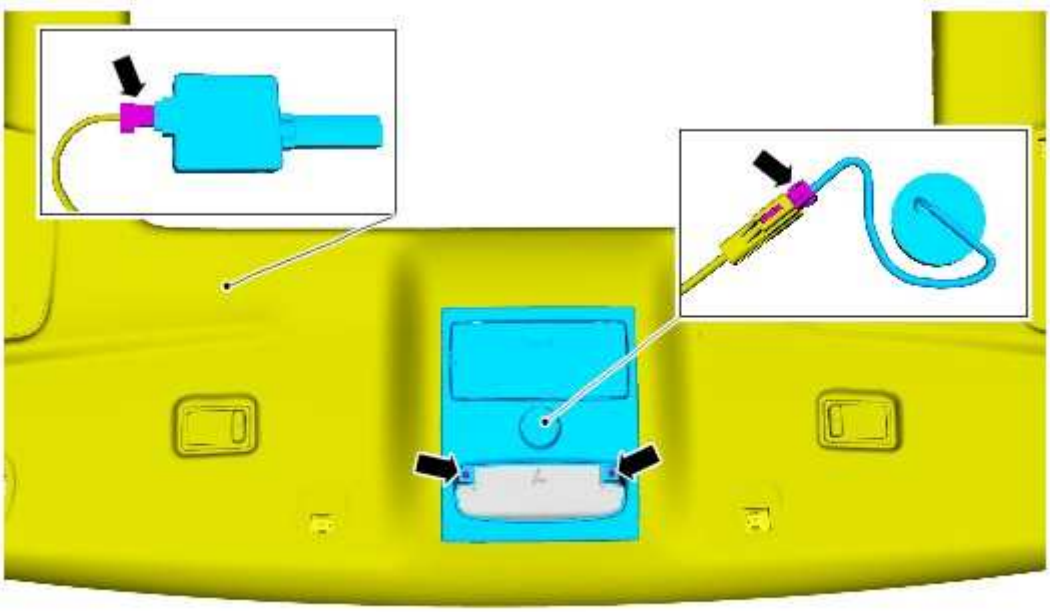

E71812

6. On both sides.


E71813

7. On both sides.


E120651

8. Support the headline

Installation

1. To install, reverse the removal procedure.

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Disassembly and Assembly

General Equipment

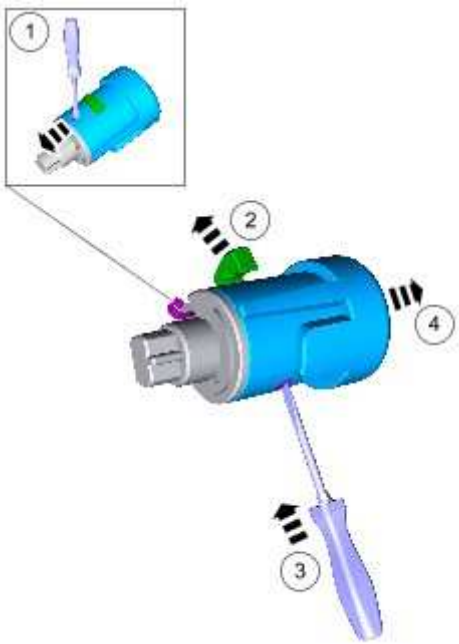
Flat-bladed screwdriver

Disassembly

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the ignition lock cylinder.

   Refer to: Ignition Lock Cylinder (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).



E70122

2.
   1. Ignition lock cylinder locking button leaf spring.

      General Equipment: Flat-bladed screwdriver
   3. Release the ignition lock cylinder clip.

      General Equipment: Flat-bladed screwdriver

E70123

3. *General Equipment:* Flat-bladed screwdriver

E70124

4.
   - Make sure to read the key code from the key entry to the end of the lock barrel in sequence.
   - Make a note of the position and orientation of the ignition lock cylinder barrel tumblers.
   - One group of tumblers is signed with a one digit number (1 to 5), the other group of tumblers is signed with a two digit number (11 to 15).

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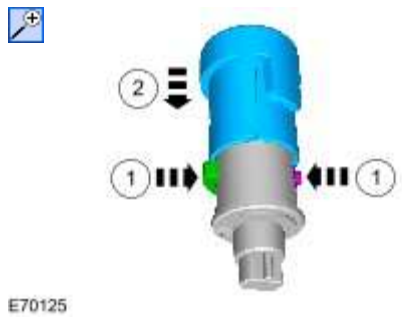
Assembly



5.

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Print

Disassembly and Assembly

General Equipment

Flat-bladed screwdriver

Disassembly

NOTE: Removal steps in this procedure may contain installation details.

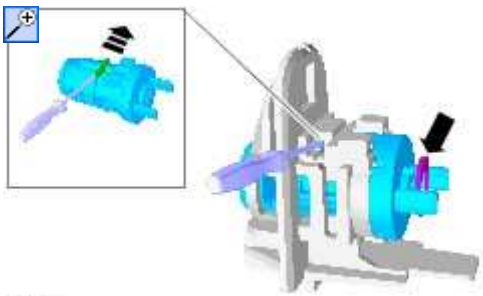
1. Remove the exterior front door handle.

   Refer to: Exterior Front Door Handle (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

2.

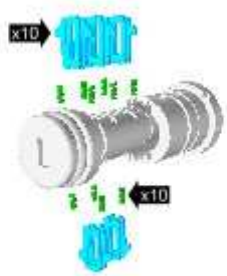
E73618

3. *General Equipment:* Flat-bladed screwdriver



E73619

4. NOTE: Note the position of each component before removal.
   - Make sure to read the key code from the key entry to the end of the lock barrel in sequence.



E73620

Assembly

5. To install, reverse the removal procedure.

E73618

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Wiper Blade and Pivot Arm Adjustment

	Degrees
Angle between the left-hand wiper arm and the windshield	4 ±2
Angle between the right-hand wiper arm and the windshield	-4 ±2
Angle between the rear wiper arm and the rear window	4 ±2

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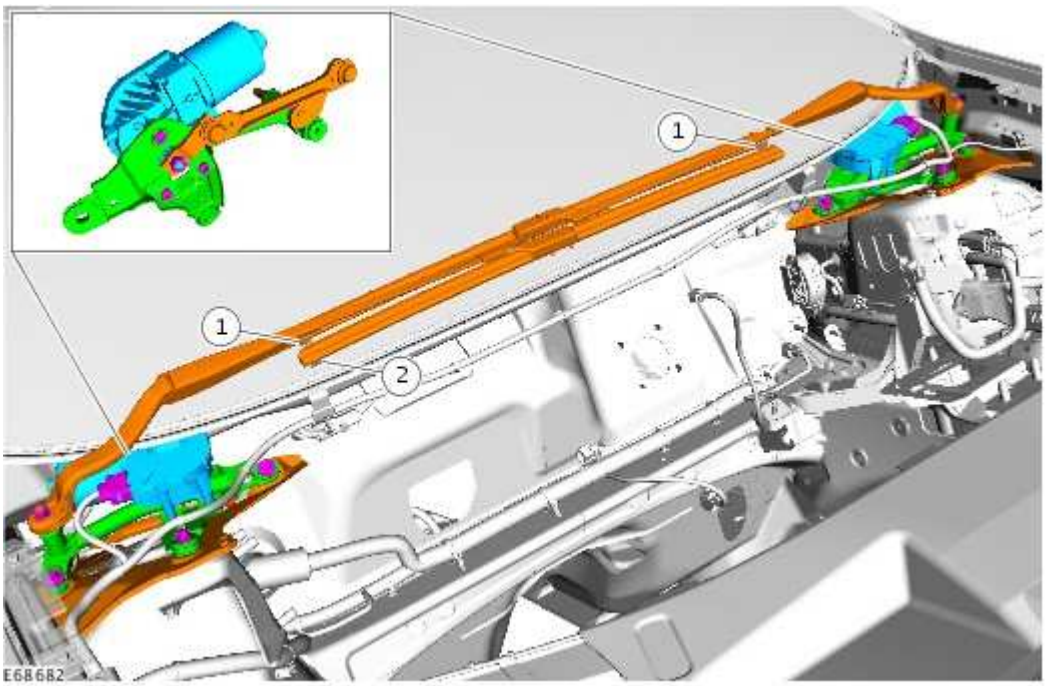
Description and Operation

Windshield/rear window wiper system

Windshield wiper system



Item	Part Number	Description
1	-	Markings, upper wiper arm
2	-	Marking, lower wiper arm

The drive for the windshield wipers is provided via two separate wiper drives with integrated electronics. Here, the left-hand unit (master) performs the control function via the right-hand unit (slave), whereby there is no difference between LHD vehicles and RHD vehicles. The left-hand wiper drive is connected via the control module subnetwork (LIN) bus with the generic electronic module (GEM) and therefore has one more electrical connection than the right-hand one. The GEM in turn provides the control functions for the left-hand wiper drive. The motors are each connected via a designated linkage to one of the wiper arms. They form a unit with the linkage which can only be replaced as a complete unit, as otherwise the park position of the wiper uinits cannot be correctly matched.

When replacing a wiper unit, make sure that only replacement parts are installed which have the same part number end digit as the wiper unit fitted to the vehicle. If no replacement part with the same end digit is available then both units should be replaced together.

When installing the wiper drives, note that they perform an automatic adjustment when they are switched on for the first time. It is important that the wiper arms are not mounted until after this automatic adjustment has been performed.

The wiper system can be set to a service position in order to install the wiper blades. The wipers are moved to this position by pressing the single wipe function within 3 seconds of switching the ignition off (pull the wiper lever down to do this). Then the wipers run to their upper reversing point, allowing the wiper blades to be replaced. Markings are provided on the windshield to help position the wiper arms during installation.

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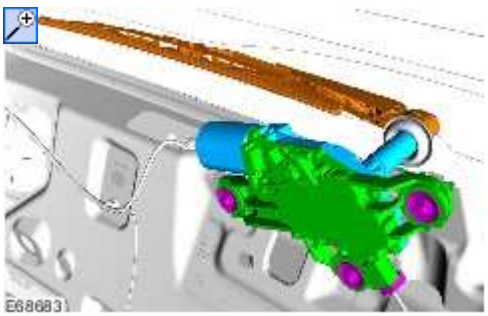
The wiper blade lengths are different on vehicles with a rain sensor compared to a vehicle without a rain sensor.

- left hand side: always 750 mm
- right hand side: 700 mm without rain sensor
- right hand side: 650 mm with rain sensor

On vehicles built up to 07/2006, the wiper system returns from the service position back to the park position after the ignition is switched on.

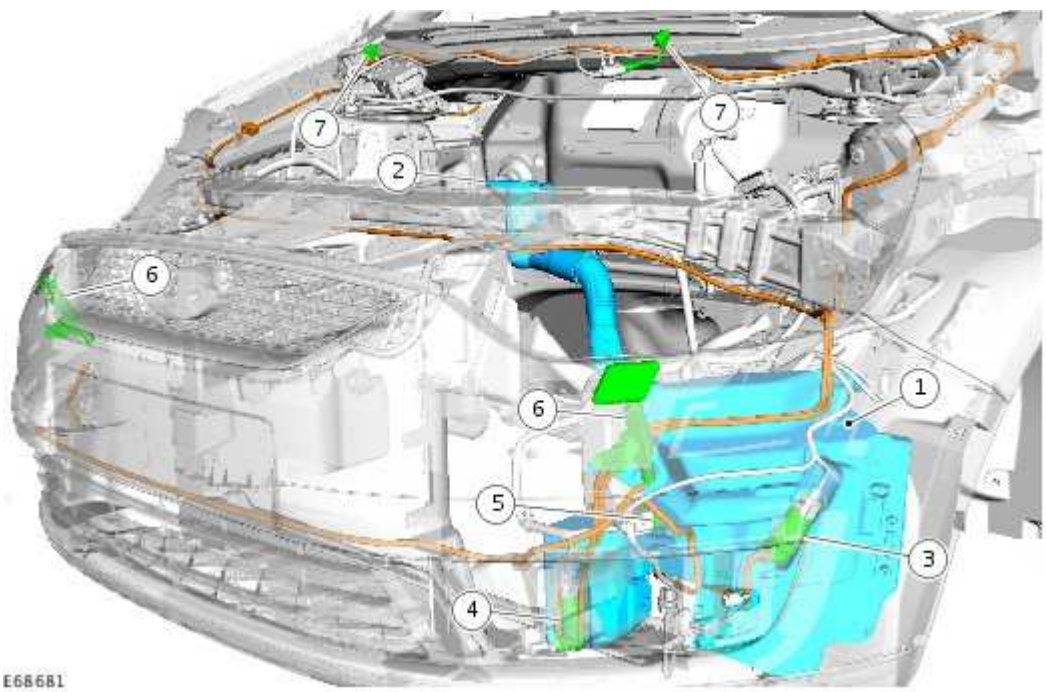
On vehicles built from 07/2006, in order to protect the wiper blades the wiper system does not automatically return to the park position after the ignition is switched on. The wiper system does not return to the park position until the wiper lever is moved to an arbitrary position.

Rear window wiper system



Washer

Overview



Item	Part Number	Description
1	-	Washer reservoir
2	-	Filler neck
3	-	Headlamp washer pump
4	-	Window washer pump
5	-	Wash water level sensor
	-	

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6		Headlamp washer nozzles
	7 -	Window washer nozzles

Windshield wash/wipe system

The windshield wash/wipe system will only operate if the ignition switch is in the position "I" or "II".

Four wipe functions are available: "Single Wipe", "Speed 1", "Speed 2" and "Intermittent Wipe" or "Automatic Wipe" (depending on the specification of the vehicle)".

In "Speed 1" or "Speed 2" mode, the wipers are operating continuously at either normal speed or fast speed.

When the intermittent wipe mode is switched on the windshield wipers operate at normal speed with the following wiper delays:

- Wiper delay 1: 1 second
- Wiper delay 2: 3.5 seconds
- Wiper delay 3: 6 seconds
- Wiper delay 4: 9.5 seconds
- Wiper delay 5: 15.5 seconds
- Wiper delay 6: 22 seconds

NOTE: In the event of a failure, the default time for the wiper delay is 3.5 seconds.
When the windshield washer switch is operated washer fluid is sprayed onto the windshield. After a short delay designed to protect the wiper blades the wipers perform 2 or 3 wipes at low speed.

If when the windshield washer switch is activated the windshield wipers are switched off, a single wipe is performed 4 seconds after the wipers have returned to the home position after performing the 2 or 3 wipes.

If the wipers are set to intermittent wipe and the window washer switch is actuated, the wipes are only performed if no further wipe request has been selected via a shorter delay time within the 4-second delay time.

The post wipe function on the windshield ensures that any water remaining on the windshield after washing is wiped away. It is only required if the wipers are switched off or they are set to intermittent mode.

Rear window wash/wipe system

The rear window wash/wipe system will only operate if the ignition switch is in the position "II".

If the windshield wiper switch is in the "Off", "intermittent mode" or "automatic windshield wiper" (no wiping or low speed) position, then the wipe interval of the rear window wiper is 10 seconds.

If the switch for the rear window washer is pressed, then washer fluid is sprayed onto the rear window, and the wiper operates continuously at low speed. When the switch is released the rear window wiper performs another 2-3 wipes.

If reverse gear is engaged and the windshield wiper switch is in the normal, high speed or automatic windshield wiper (wiping at high speed) position, the rear window wiper will operate continuously until the gearshift lever is moved back to the neutral position.

Headlamp washer system

The headlamp washer system will start to operate when the windshield washer function is activated if, at the same time, the light switch is set to "dipped beam" or the headlamps have been switched on by the "automatic headlamps" function. The electrical control functions are performed by the headlamp washer relay, which is actuated by the GEM.

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In order to prevent excessive water consumption, the headlamp washer system is only activated every fourth time the windshield wash/wipe switch is operated, provided the time elapsed since the first operation of the washer system does not exceed 10 minutes. If the windshield wash/wipe switch is activated again after 10 minutes the the headlamp washer system is activated and the time encoder is restarted.

If the wash water level warning lamp on the instrument cluster comes on because the wash water level in the washer reservoir is too low then the headlamp washer pump is no longer activated until the washer reservoir is topped up.

Rain sensor

CAUTIONS:

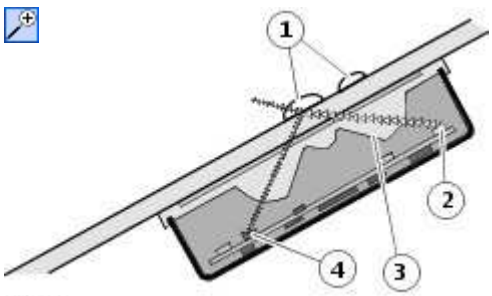
The automatic windshield wipers must be switched off before the vehicle is driven into a car wash.

If the windshield is iced up, the wipers may only be activated by the rain sensor after the windshield has been completely defrosted.
NOTE: The rain sensor is an optical measuring instrument. Contamination such as oil, grease or dust impair its correct operation. Before switching on the automatic windshield wipers, the windshield must be clean in the area of the rain sensor.
The rain sensor (1) is integrated together with the light sensor in a housing which is mounted behind the rear view mirror on the windshield.

E64533

The rain sensor comprises an opto-electronic measuring and evaluation circuit. The sensor can calculate the amount of precipitation falling on the windshield and request that the windshield wipers are switched on.

The wipers are then set to the required wipe speed by the GEM on the basis of the information supplied by the rain sensor.



E40970

Item	Part Number	Description
1	-	Raindrop
2	-	LED
3	-	Lens
4	-	Photodiode

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The rain sensor consists of three components:

- an LED
- a photodiode
- a lens

The LED emits a light beam of known intensity. The emitted beam emerges through the lens and is then reflected by the windshield.

The reflected light beam enters back through the lens and then reaches the photodiode. The corresponding value taken without moisture on the windshield is used as the reference value for the automatic calibration process.

Subsequent deviations from this value cause the windshield wipers to be switched on.

If rain lands on the windshield then the light reflected by the windshield has a lower intensity. This loss of intensity is registered by the photodiode and, proportionally to the loss of intensity, the module switches on the windshield wipers with the required wipe speed (in intermittent or continuous mode).

On vehicles built up to 07/2006 the wipers are only activated after switching on the automatic wipe function (wiper lever to intermittent position) when the water has been detected on the windshield by the rain sensor.

On vehicles built from 07/2006 a single confirmation wipe is performed after the automatic wipe function has been switched on.

It is not necessary to calibrate the rain sensor, as this has already been done at the factory.

The sensitivity of the rain sensor can be changed by adjusting the control resistor for the intermittent mode of the windshield wipers.

- Adjusting ring position - wide symbol: High sensitivity
  - The wipers wipe even if only a small amount of water has been measured on the windshield.
- Adjusting ring position - narrow symbol: Low sensitivity
  - The wipers only wipe if a large amount of water has been measured on the windshield.

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Diagnosis and Testing

General Equipment

Ford approved diagnostic tool

Inspection and Testing

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical systems
• Wiper blade(s) • Wiper arm pivot shaft • Washer fluid reservoir • Hose(s) • Washer nozzles • Check the wiper blades for residue-free wiping in the vicinity of the rain sensor. • Check the adhesive pad between the rain sensor and the windshield for trapped air. • Clean wax residues from the windshield in the vicinity of the rain sensor. • Check the windshield for damage/cracks in the vicinity of the rain sensor. • Check that the rain sensor retaining frame is correctly attached to the windshield.	• Fuse(s) • Connector • Wiring harness(es) • Washer pump motor • Headlamp washer pump • Front/rear window wiper motor(s) • Wash/wipe switch • Central junction box (CJB) • Rear junction box (RJB) • Engine junction box (EJB)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. **4.** If the cause is not visually evident, refer to the Ford approved diagnostic tool.

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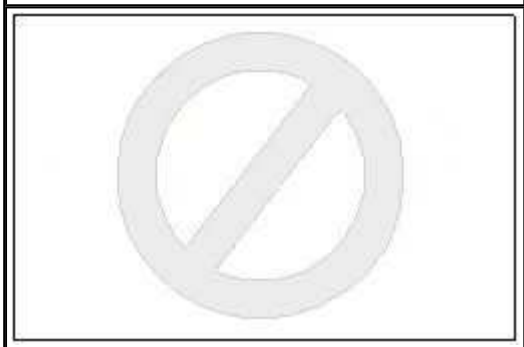
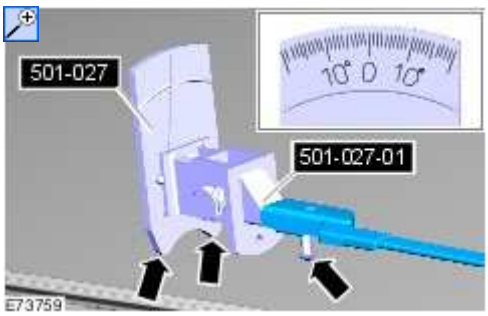
General Procedures

Special Tool(s)

	501-027 Aligner, Wiper Arm
	501-027-01 Adapter for 501-027

E77631

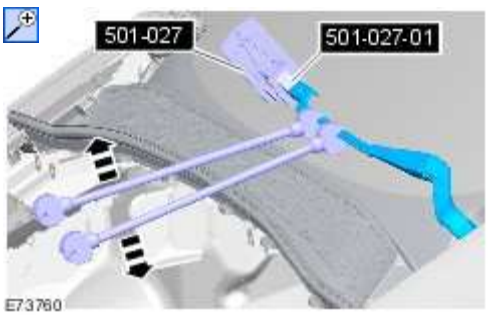
1. CAUTION: Make sure that the wiper motor is in the park position.



E73759

2. NOTE: Make sure that the 3 marked points of the special tool are in contact with the glass.
NOTE: The angle of the wiper on the scale must point from the zero center line to the center of the windshield/rear window. Ignore the sign (+/-) on the alignment tool.
Using the special tool, read off the angle between the wiper arm and the glass.

Special Tool(s): 501-027, 501-027-01



E73760

3. CAUTION: Make sure that the special tool is lifted off the glass during the adjustment.
Adjust the wiper arm.

Refer to: Specifications (501-16 Wipers and Washers, Specifications).

4.

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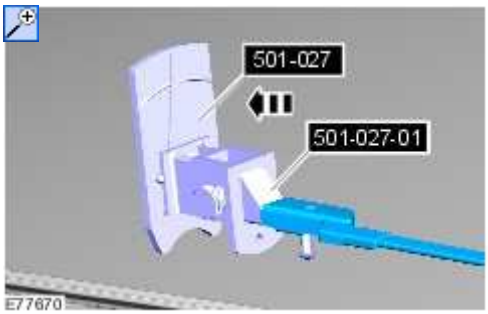

5.

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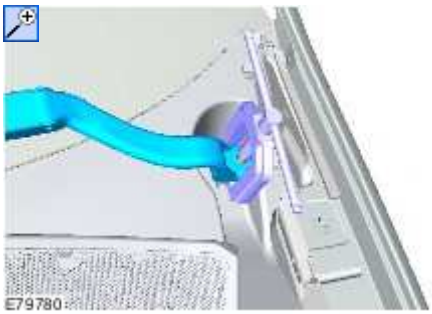
General Procedures

General Equipment

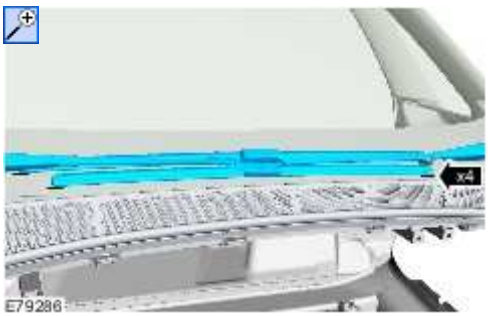
Two leg puller

CAUTION: The engine must be in the park position.

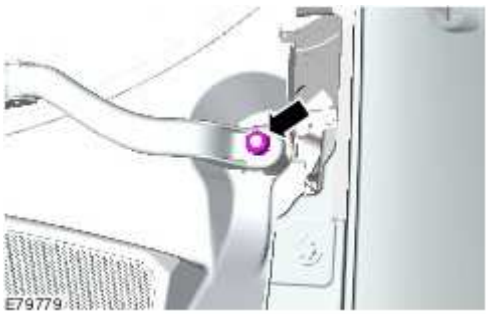
1.



2. *General Equipment:* Two leg puller



3.



4. *Torque:* 22 Nm

5. Check the angle of the wiper arms to the windscreen.

   Refer to: Wiper Blade Angle Adjustment (501-16 Wipers and Washers, General Procedures).

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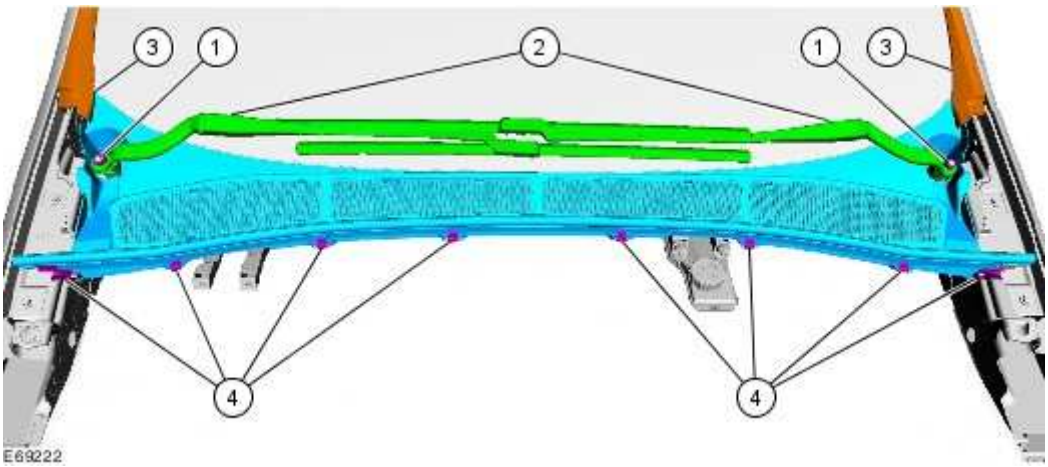
Removal and Installation

General Equipment

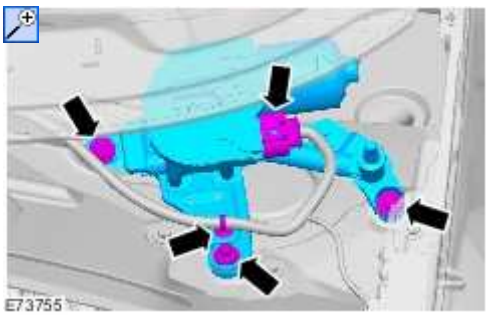
Two leg puller

Removal

NOTE: Removal steps in this procedure may contain installation details.



1. *General Equipment* Two leg puller *Torque:* 22 Nm



2. *Torque:* 8 Nm

Installation

1. CAUTIONS:

   The engine must be in the park position.

   The component must be aligned with the installation markings.

   To install, reverse the removal procedure.
2. Check the angle of the wiper arms to the windscreen.

   Refer to: Wiper Blade Angle Adjustment (501-16 Wipers and Washers, General Procedures).

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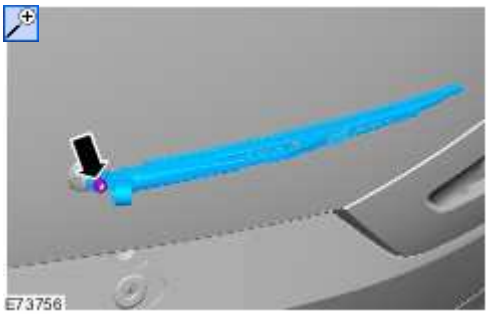
Removal and Installation

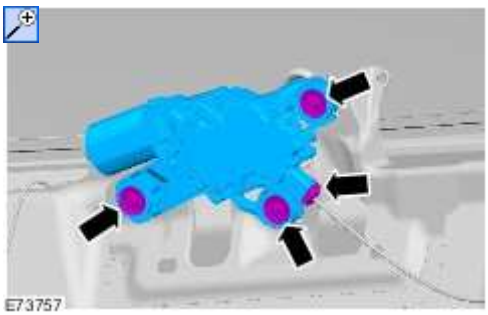
Removal

NOTE: Removal steps in this procedure may contain installation details.



1. *Torque:* 22 Nm
2. Remove the liftgate door trim panel.

   Refer to: Liftgate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. *Torque:* 8 Nm

Installation

1. CAUTION: The engine must be in the park position.
   Install the components in reverse order.
2. Check the angle between the rear wiper arm and the rear window

   Refer to: Wiper Blade Angle Adjustment (501-16 Wipers and Washers, General Procedures).

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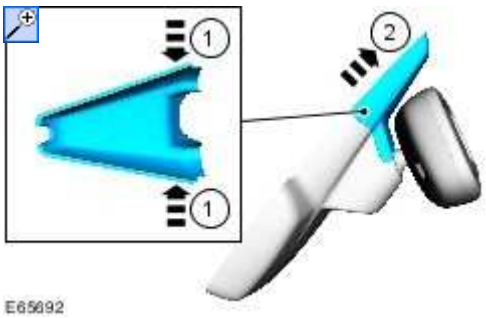
Removal and Installation

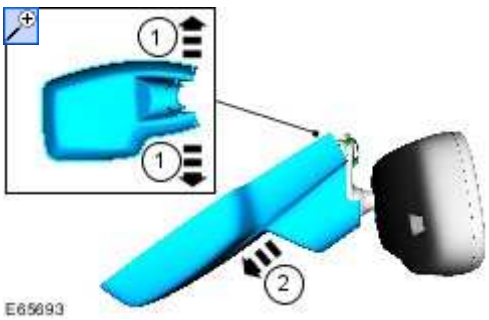
Removal

1.



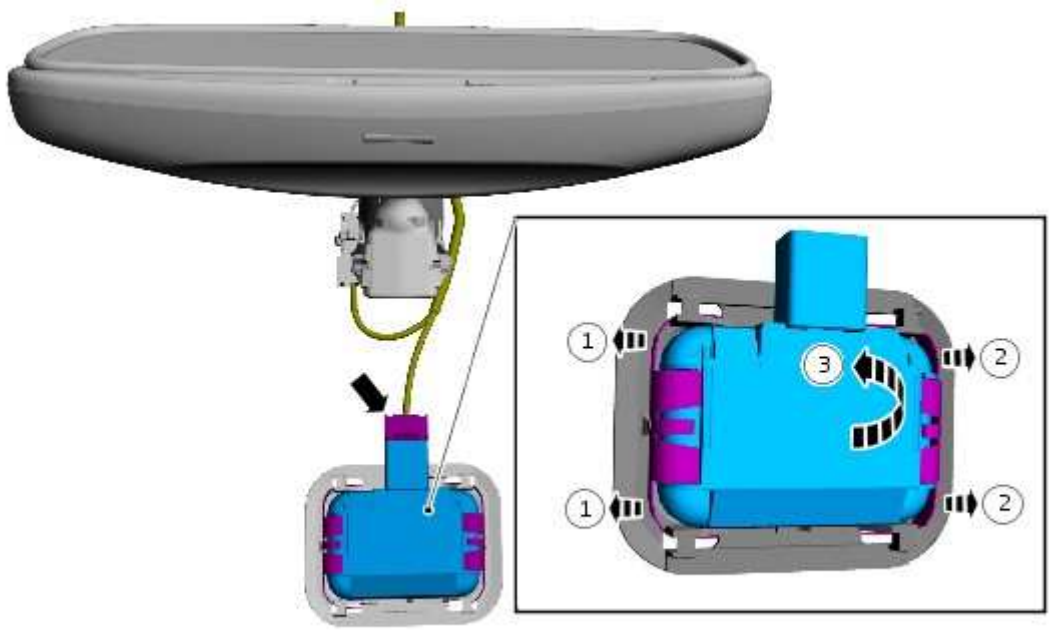
E65092

2.



E65093

3.



E117458

Installation

1. CAUTION: Make sure that the mating faces are clean and free of foreign material. Install the components in reverse order.

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Removal and Installation

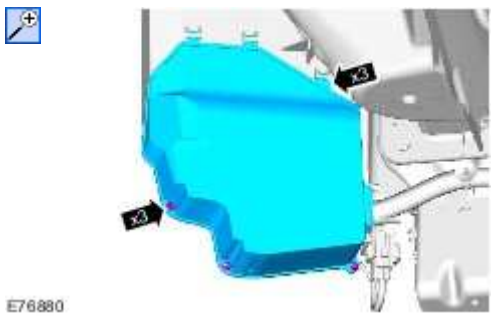
Removal

All vehicles

1. Refer to: Health and Safety Precautions (100-00 Ger Information, Description and Operation).
2. Detach the cover of the front bumper.

   Refer to: Front Bumper Cover - Vehicles With: Front Parking Aid (501-19 Bumpers, Removal and Installat

Vehicles with 1.8L or 2.0L engine



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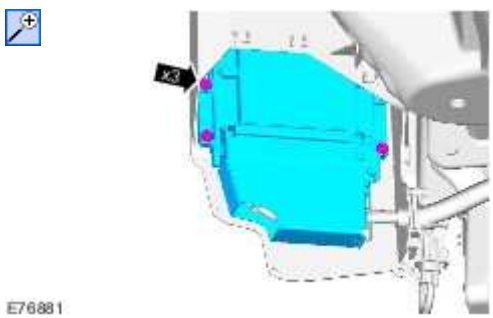

4.

All vehicles

5. CAUT All openin must be closed.

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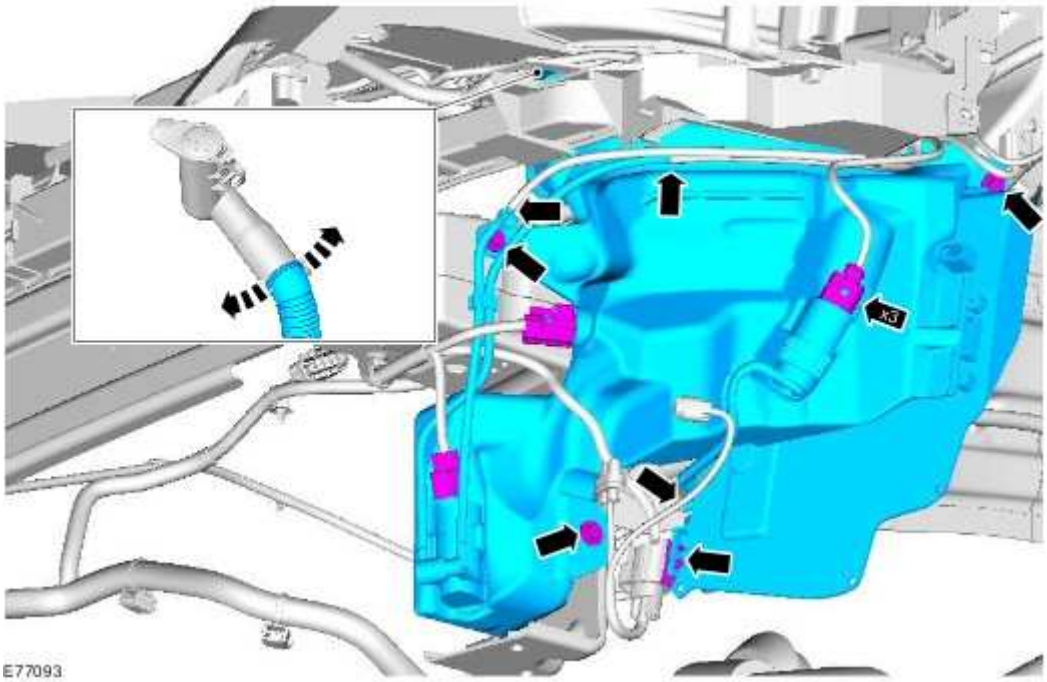

Installation

1. Install the components in reverse order.

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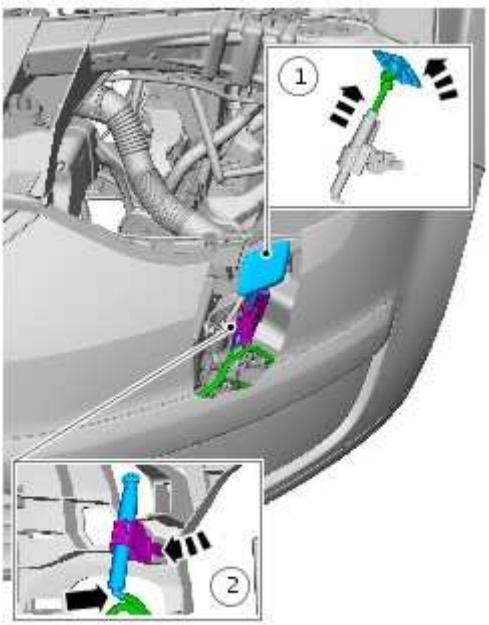
Removal and Installation

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Remove the headlamp assembly.

   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).



E77324

3. CAUTION: All openings must be closed.

Installation

1. Install the components in reverse order.

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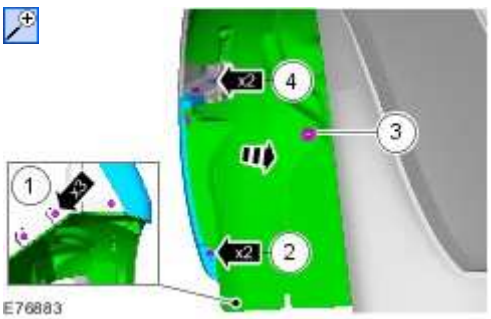
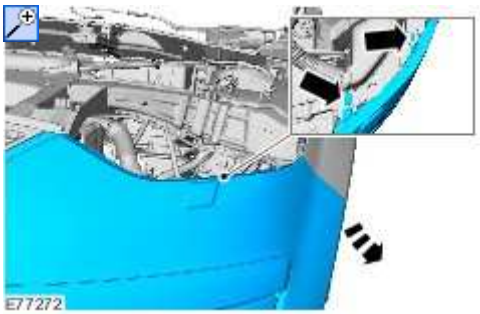
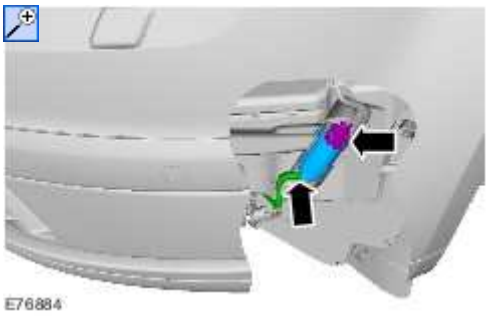
Removal and Installation

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. 

4. 

5. 

   CAUTION: All openings must be closed.

Installation

1. Install the components in reverse order.

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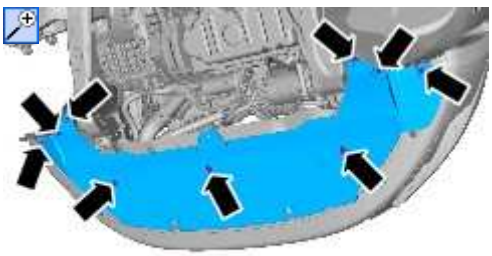
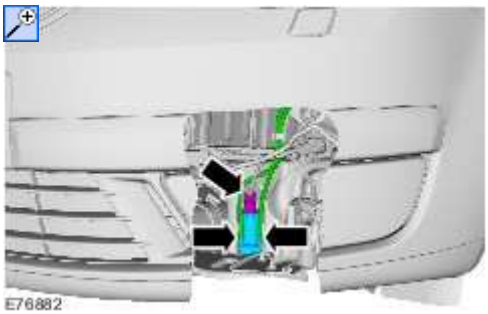
Removal and Installation

Removal

1. Refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).
2. Raise and support the vehicle.

   Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
3. 

E68962



E76882

4. CAUTION: All openings must be closed.
   NOTE: Make sure that the components are installed in their original positions.

Installation

1. Install the components in reverse order.

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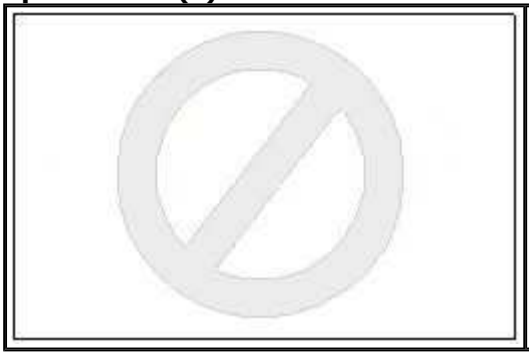
Removal and Installation

Special Tool(s)

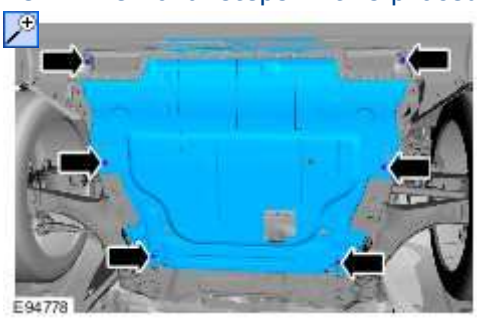
	501-130 Punching Tool, Parking Aid Sensor

General Equipment

15 mm drill bit
Flat file
Round-ended steel rule

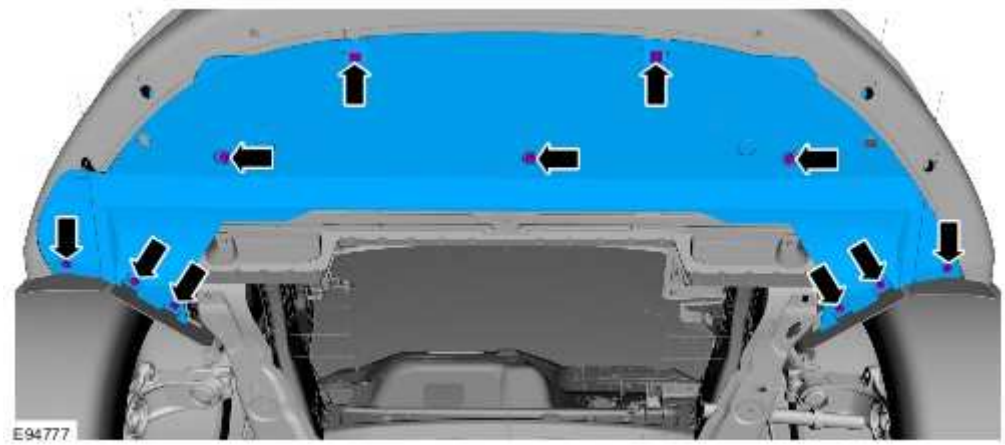
Removal

NOTE: Removal steps in this procedure may contain installation details.



1.

2.



3. On both sides.

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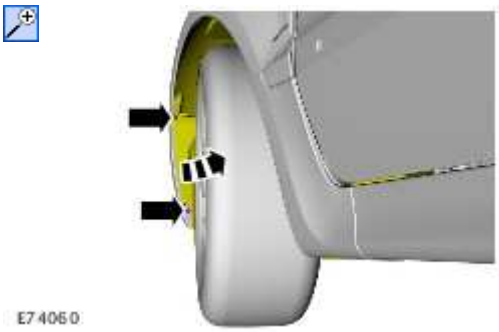
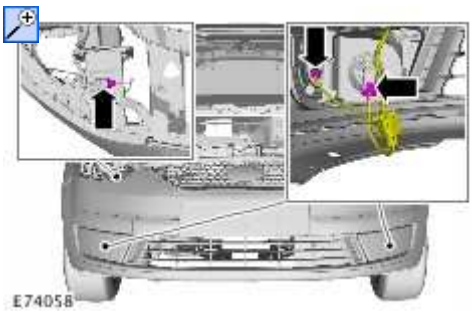


4. Remove the headlamps.

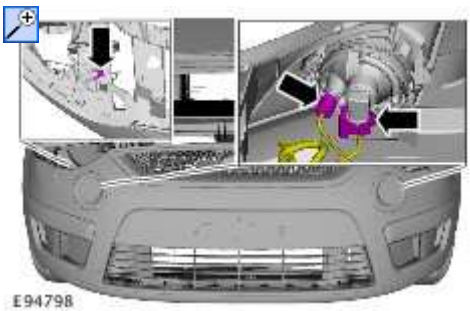
   Refer to: Headlamp Assembly (417-01 Exterior Light Removal and Installation).

Vehicles with VIN plate body code: M



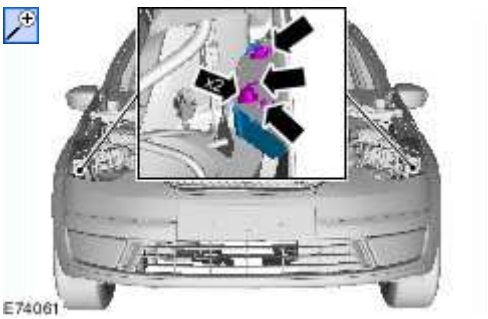
5.

Vehicles with VIN plate body code: S



6.

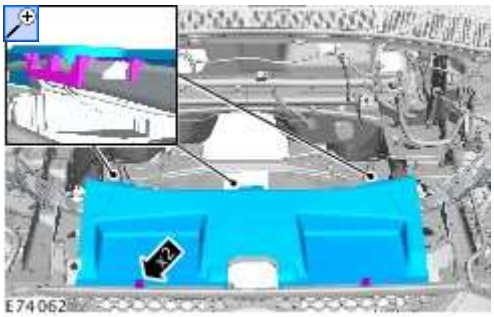
All vehicles



7. *Torque:* 10 Nm

8.

http://vnx.su



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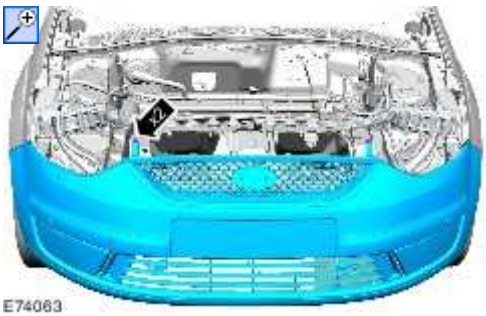

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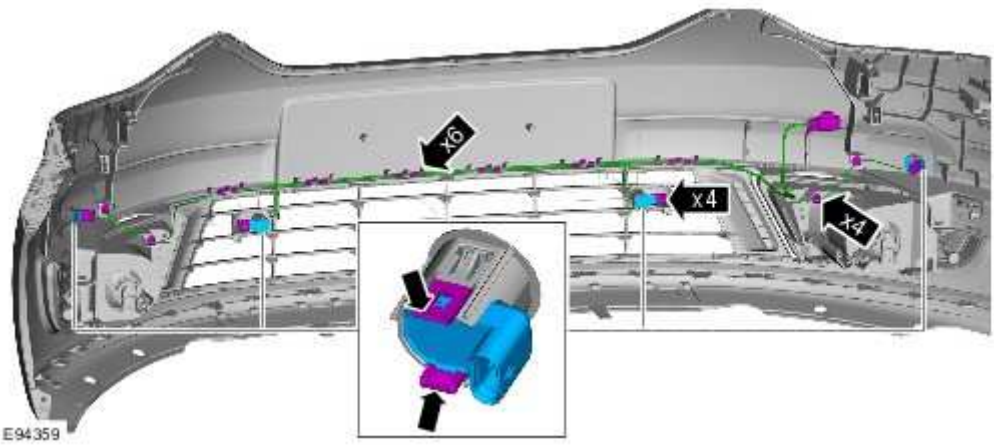

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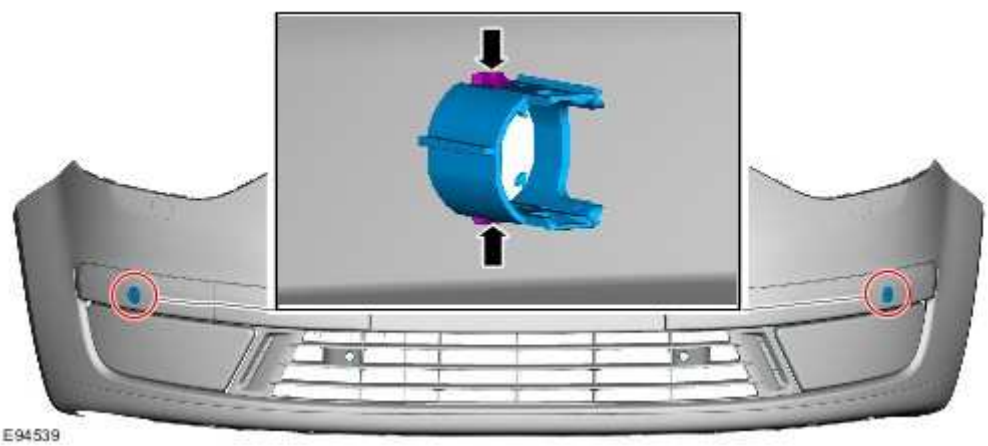

Vehicles with VIN plate body code: M

12. If equipped

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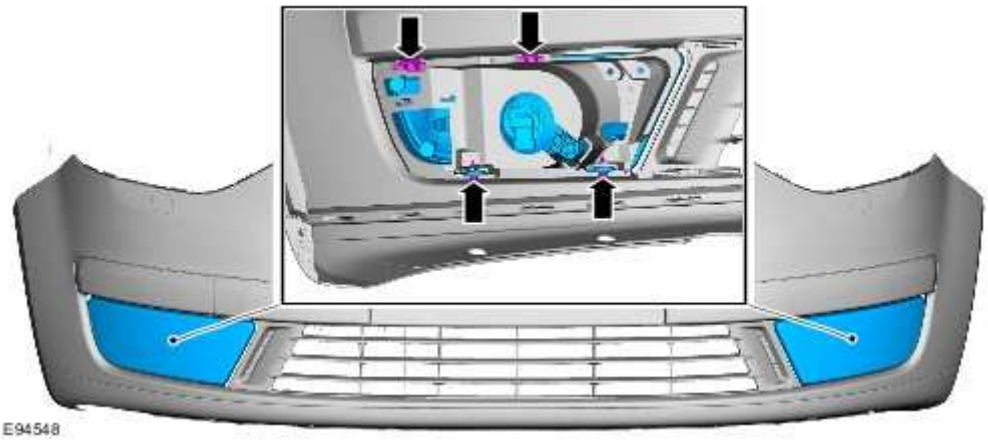
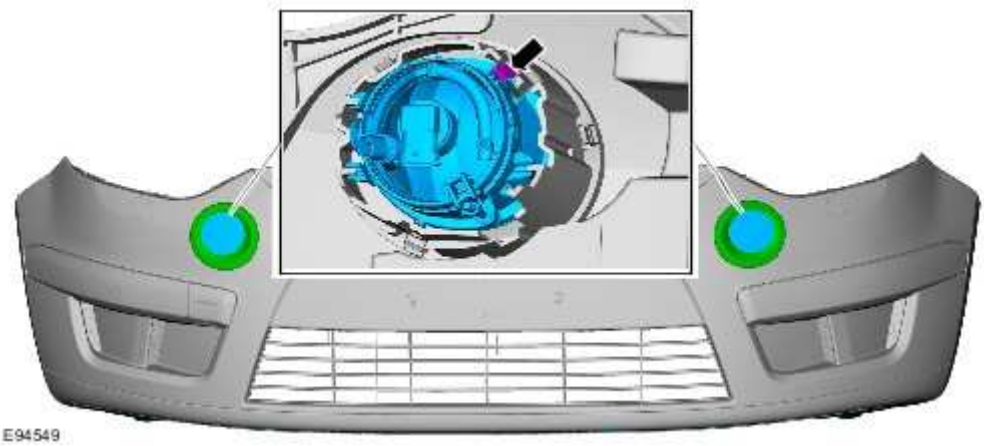

E94548

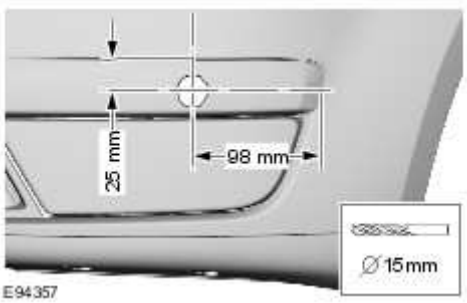
Vehicles with VIN plate body code: S

13. If equipped


E94549

Installation

Vehicles with VIN plate body code: M

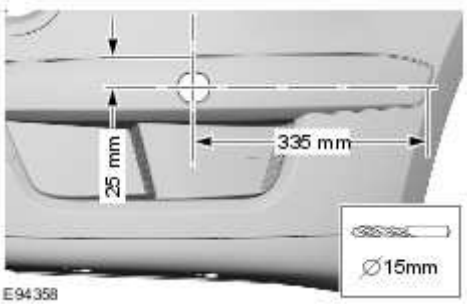


E94357

1. NOTE: Cutlines may already exist on the inner surface of a new bumper cover.
   On both sides.

   General Equipment: Round-ended steel rule
   General Equipment: 15 mm drill bit

Vehicles with VIN plate body code: S



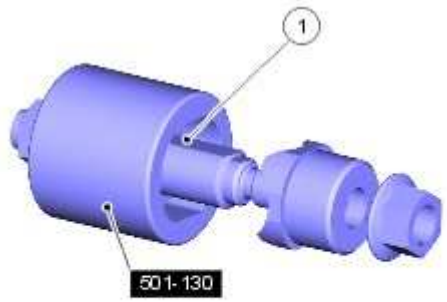
E94358

2. NOTE: Cutlines may already exist on the inner surface of a new bumper cover.
   On both sides.

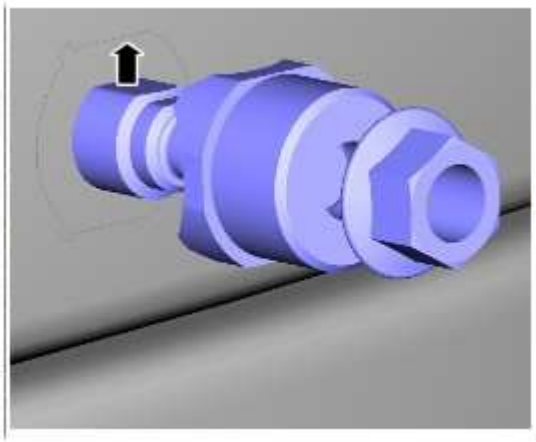
   General Equipment: Round-ended steel rule
   General Equipment: 15 mm drill bit

All vehicles

http://vnx.su



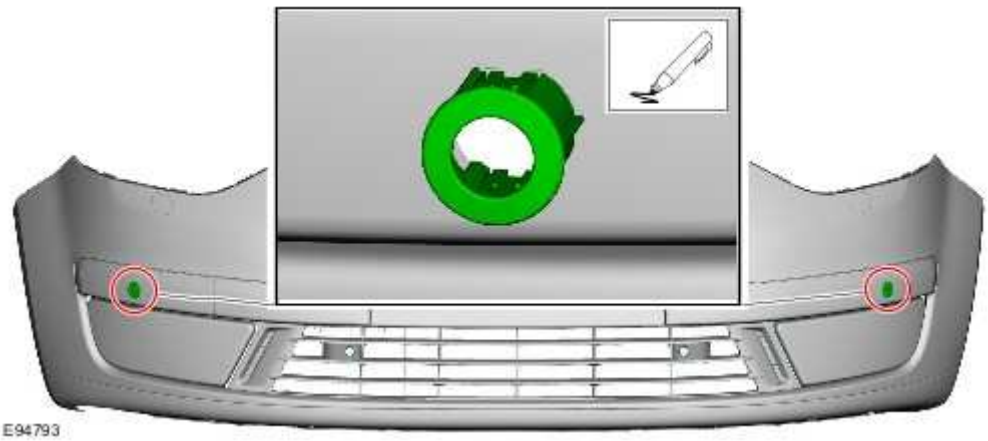
E94538



3.

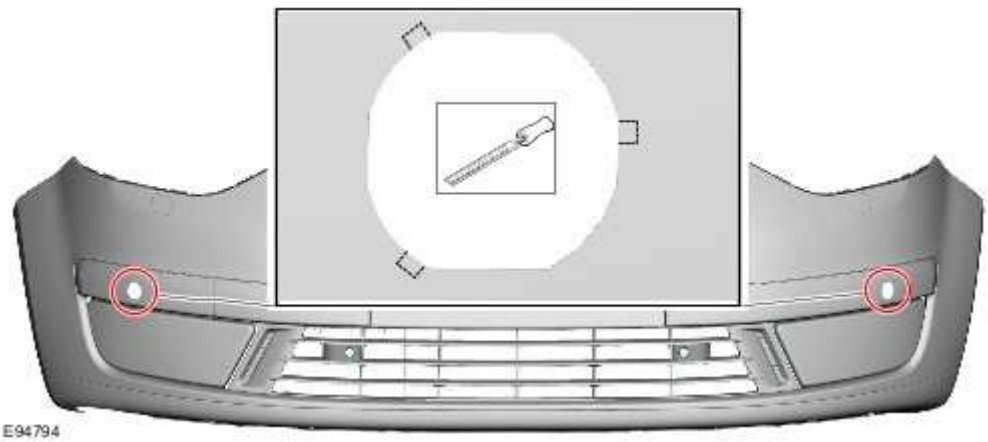
1. **Align t flatter side horizo upwar before punch each hole.**

   Specia Tool(s) 501-13



E94793

4. NOTE: Make sure that the correct parking aid sensor housing is used as a template to mark the position of th location grooves.



E94794

5. *General Equipment:* F file

6. To install, reverse the removal procedure.

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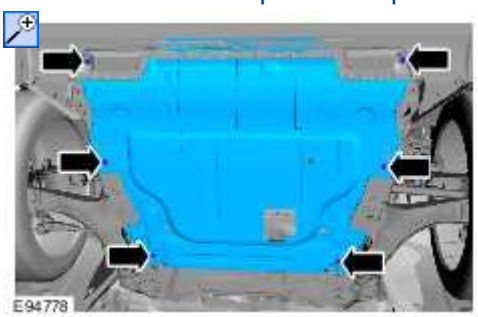
Print

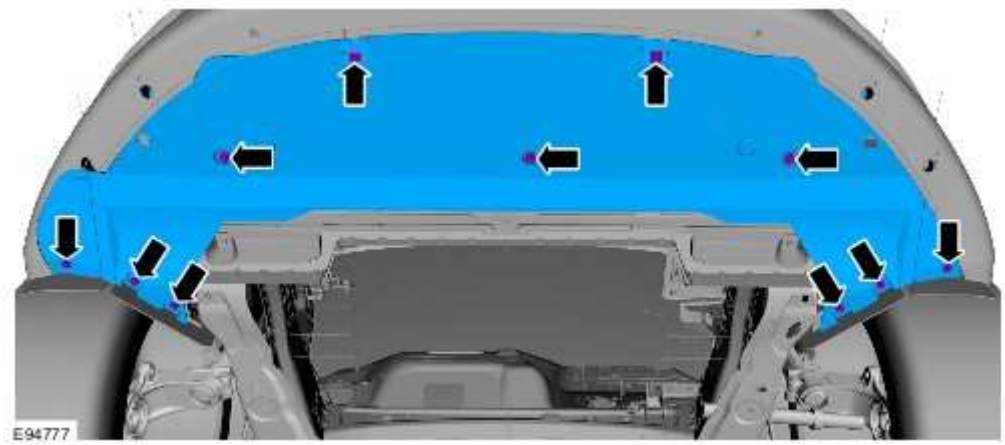
Removal and Installation

Removal

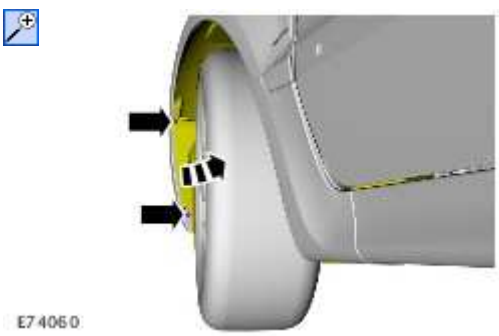
NOTE: Removal steps in this procedure may contain installation details.



1.



2.



3. On both sides.

4. Remove the headlamps.

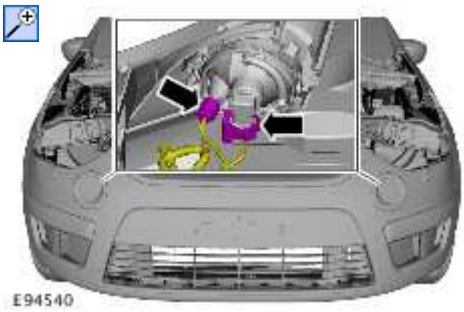
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

Vehicles with VIN plate body code: M

5. If equipped

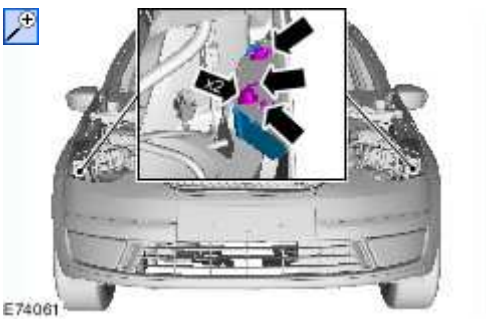
http://vnx.su

Vehicles with VIN plate body code: S

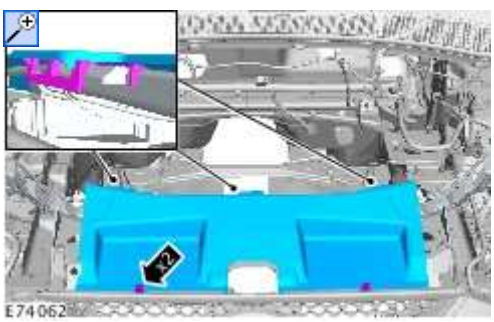


6. If equipped

All vehicles



7. *Torque:* 10 Nm



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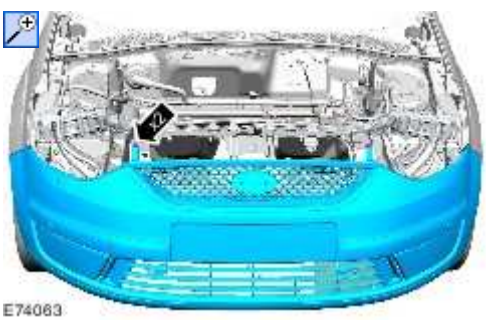

9.

Vehicles with VIN plate body code: M

10. If equipped

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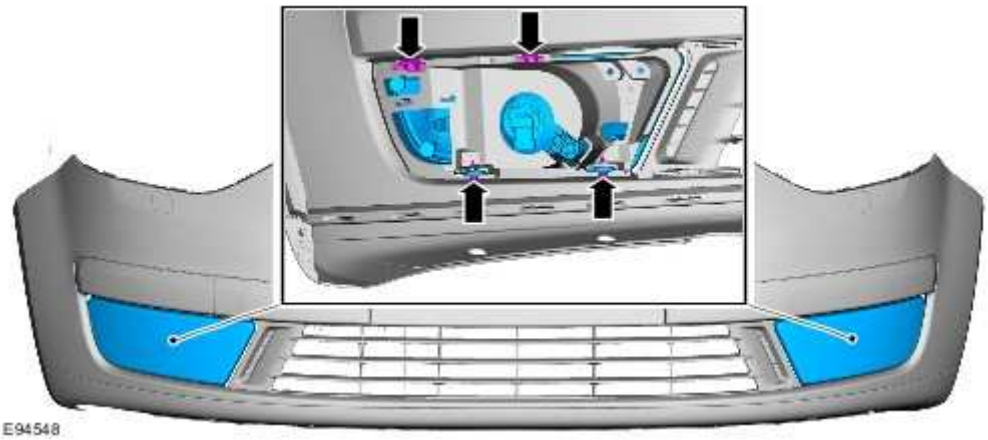
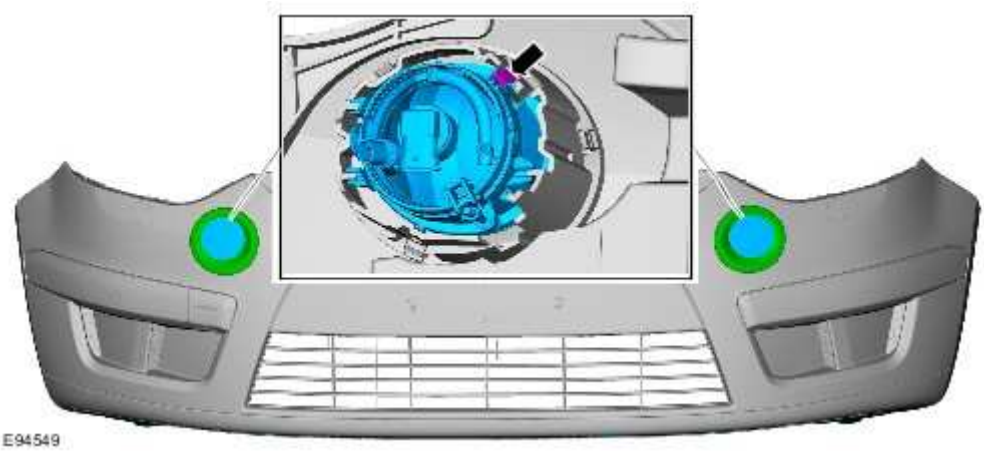

E94548

Vehicles with VIN plate body code: S

11. If equipped


E94549

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Special Tool(s)

	501-130 Punching Tool, Parking Aid Sensor

General Equipment

15 mm drill bit
Flat file
Hot glue gun
Knife
Round-ended steel rule

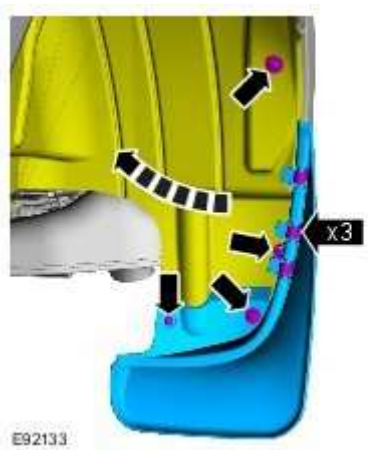
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the rear wheels.

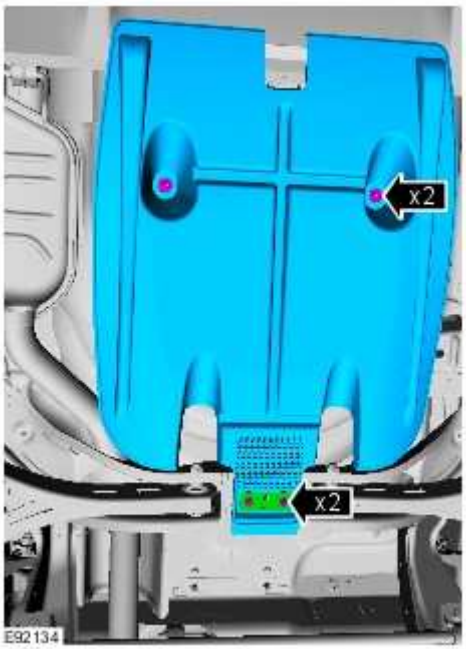
   Refer to: Wheel and Tire (204-04 Wheels and Tires, and Installation).

2. On both sides.

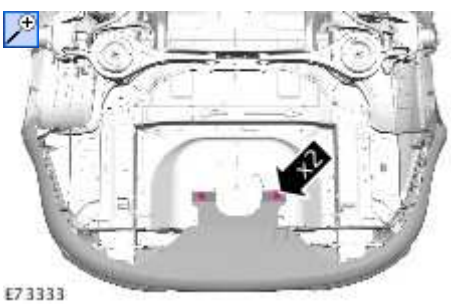


3.

http://vnx.su



4.



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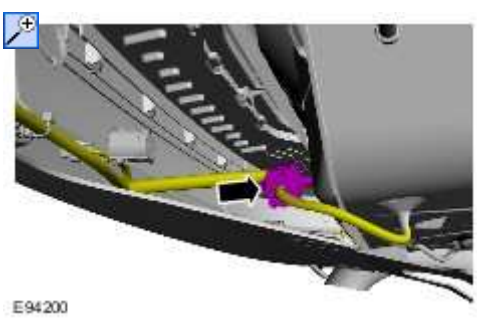
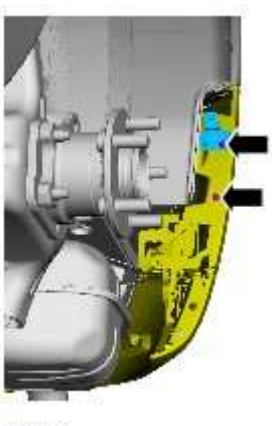


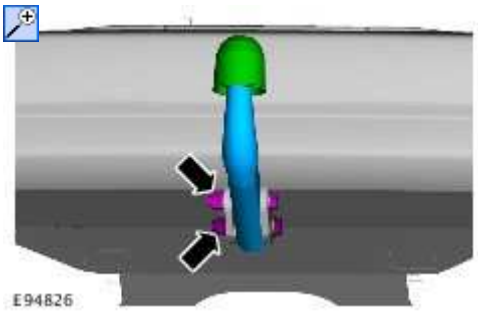
6. On both sides.



7. If equipped.

   Torque: 95 Nm

http://vnx.su



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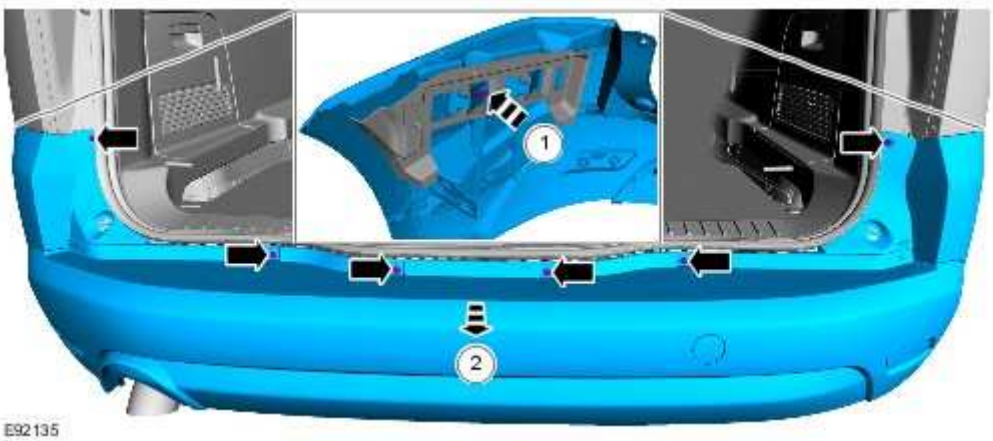

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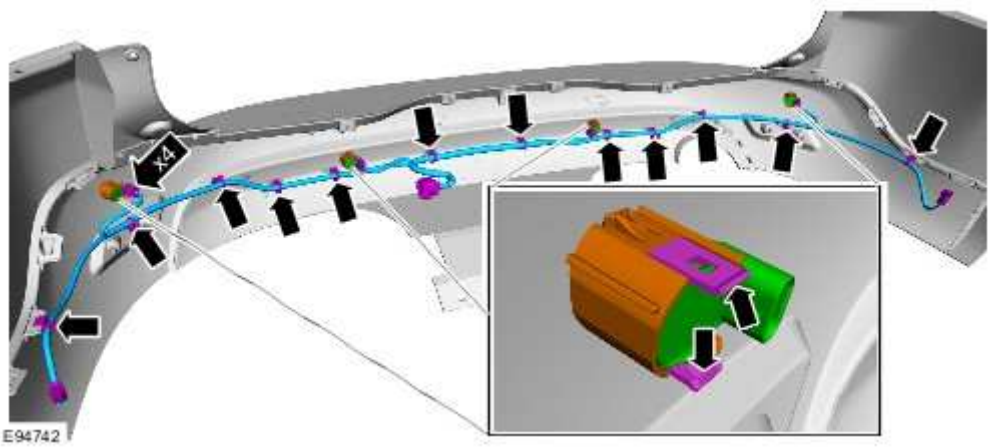
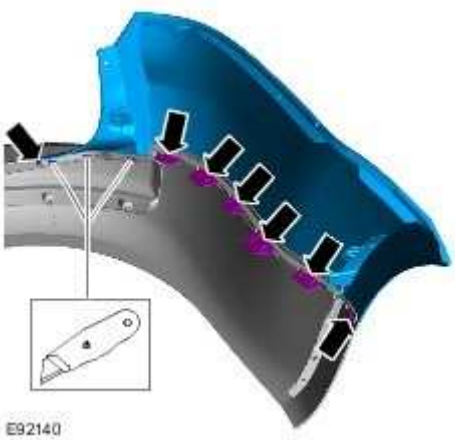


Vehicles with VIN plate body code: M

10. On both sides.

General Equipment: Knife



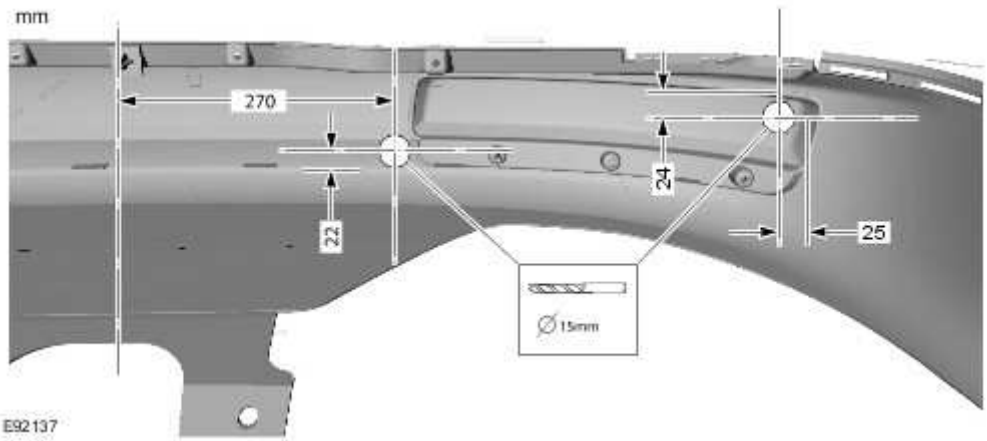
Vehicles with VIN plate body code: S

11. On both sides.

http://vnx.su

Installation

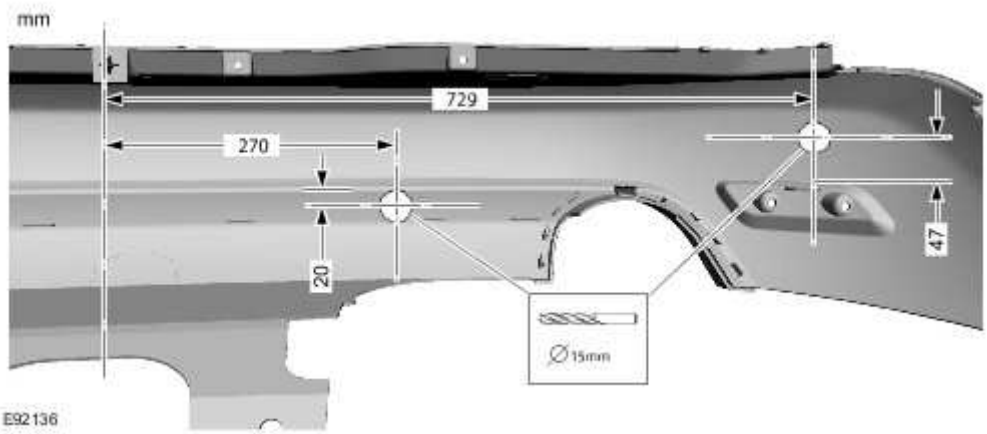
Vehicles with VIN plate body code: M



1. NOTE: Cutlin
may already
on the inner
surface of a
bumper cove
On both sides

General Equi
Round-ended
rule
General Equi
15 mm drill b

Vehicles with VIN plate body code: S



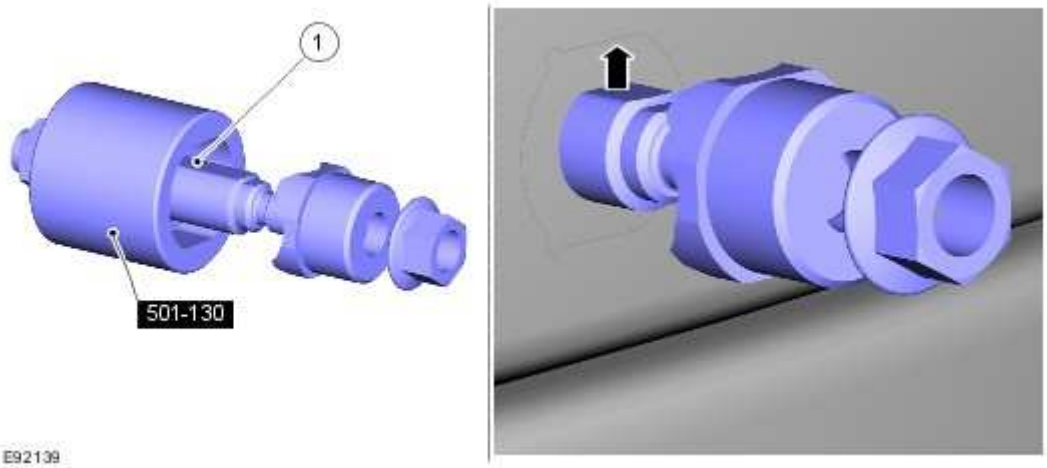
2. NOTE: Cutlin
may already
on the inner
surface of a
bumper cove
NOTE: Make
that the mea
tape has con
to the inner
surface of th
bumper cove
while measu
On both sides

General Equi
Round-ended
rule
General Equi
15 mm drill b

All vehicles

3.
1. **Al**
fla

http://vnx.su



E92139

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up
be
pu
ea
ho

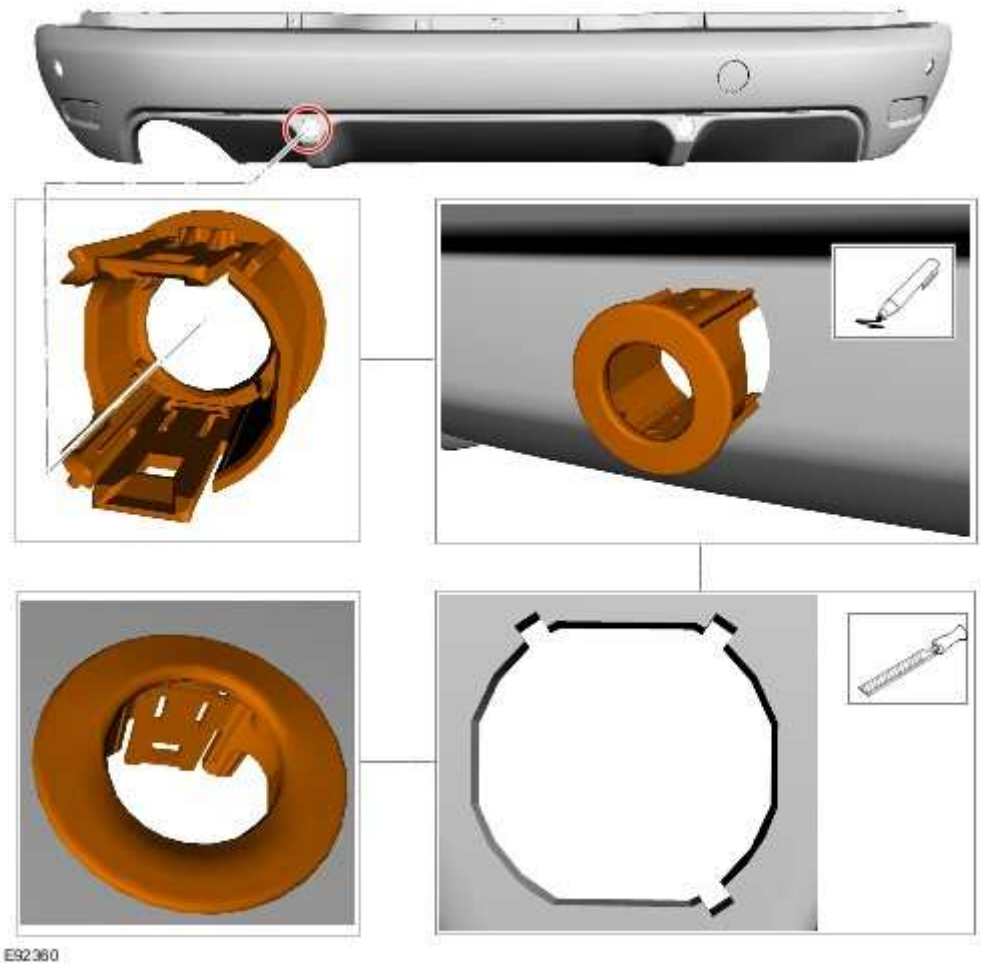
Sp
To
50

E92141

4. NOTE: Make
that the corr
parking aid s
housing is us
a template t
mark the pos
of the locatic
grooves.
General Equi
Flat file

5. NOTE: Make
that the corr
parking aid s
housing is us
a template t
mark the pos
of the locatic
grooves.
General Equi
Flat file

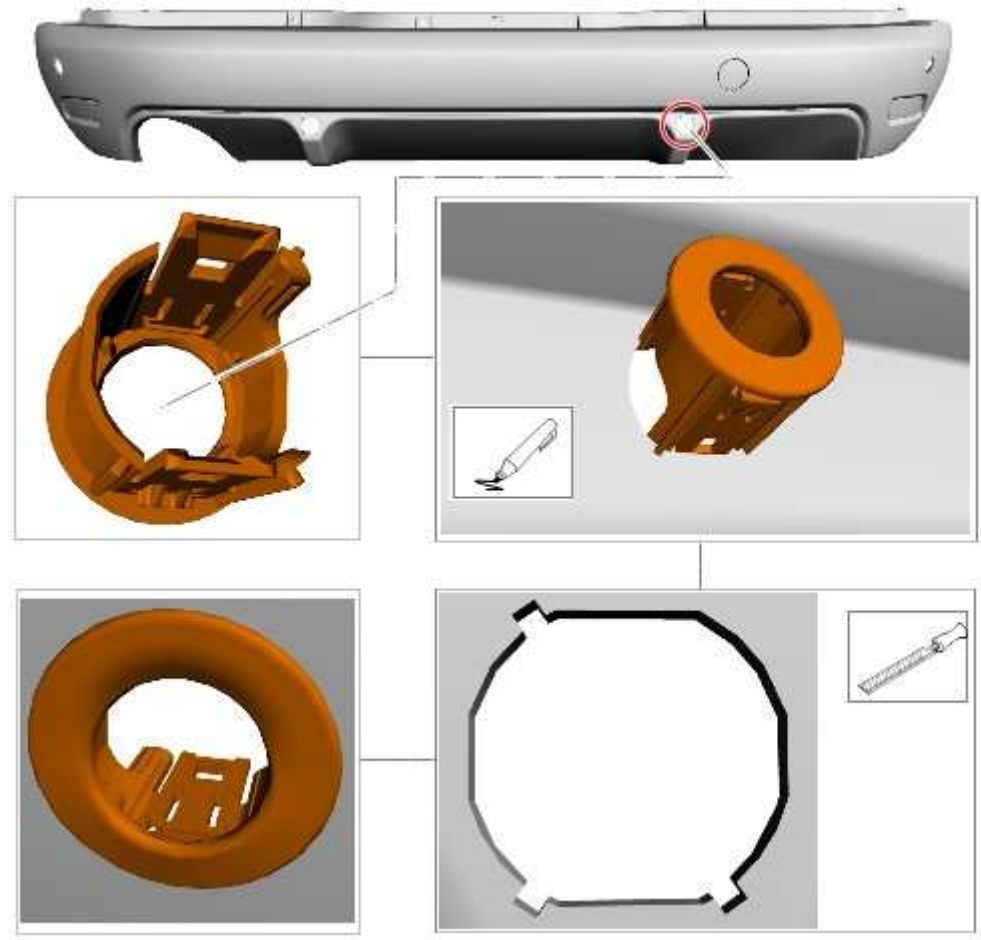
http://vnx.su



E92360

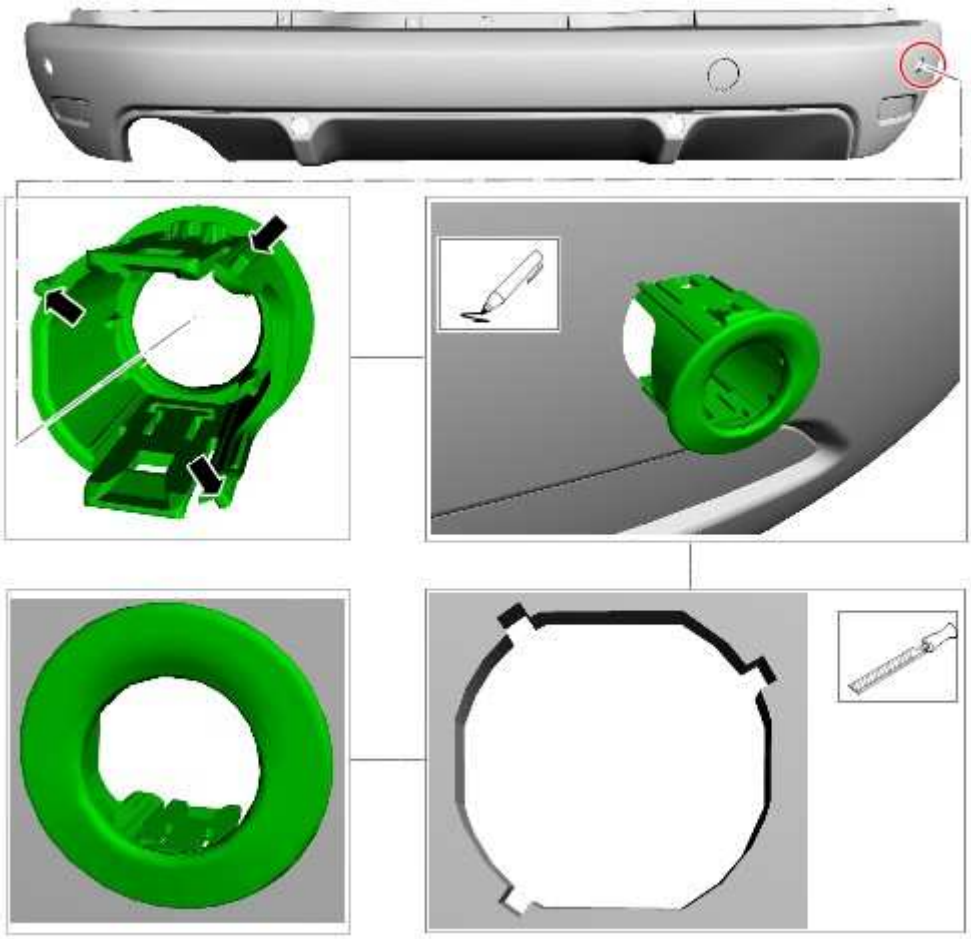
6. NOTE: Make
that the corr
parking aid s
housing is us
a template t
mark the pos
of the locatic
grooves.
General Equi
Flat file

http://vnx.su



7. NOTE: Make
that the corr
parking aid s
housing is us
a template t
mark the pos
of the locatic
grooves.
General Equi
Flat file

http://vnx.su

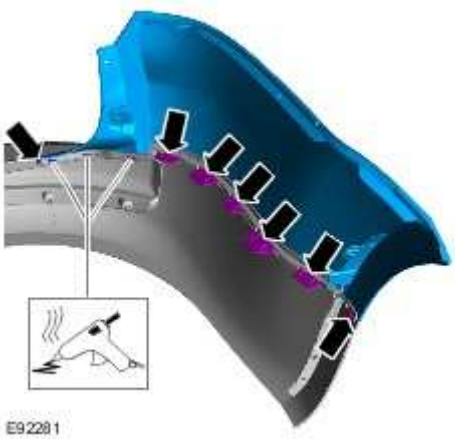


E94164

Vehicles with VIN plate body code: M

8. On both sides.

General Equipment: Hot glue gun



E92281

Vehicles with VIN plate body code: S

9. On both sides.

http://vnx.su

All vehicles

10. To install, reverse the removal procedure.

http://vnx.su

Print

Removal and Installation

General Equipment

Hot glue gun
Knife

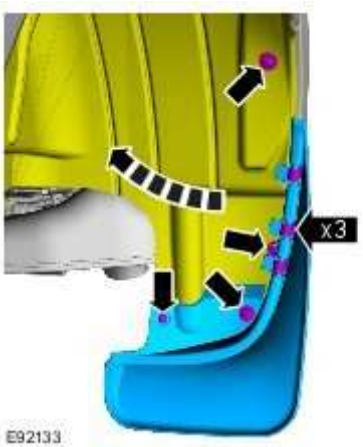
Removal

NOTE: Removal steps in this procedure may contain installation details.

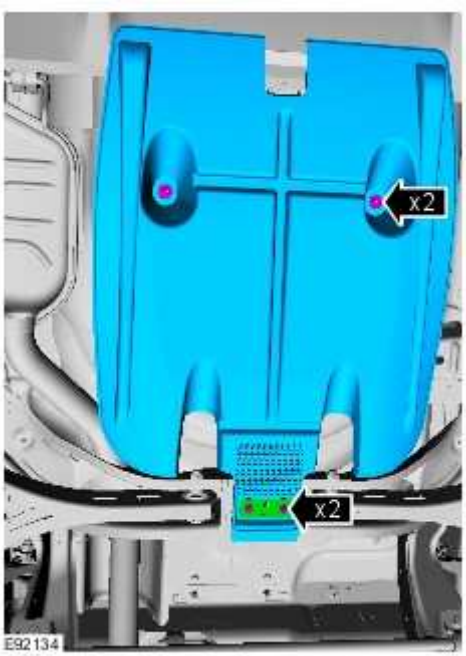
1. Remove the rear wheels.

   Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

2. On both sides.

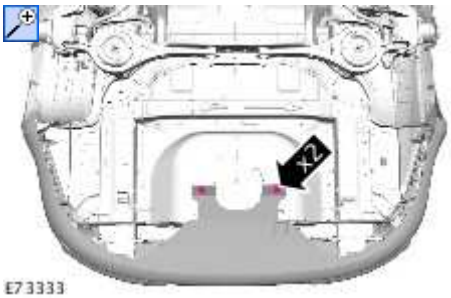


3.



4.

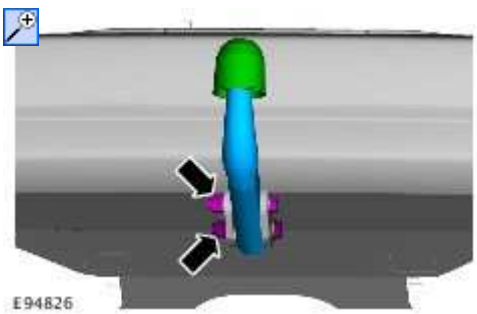
http://vnx.su



E73333

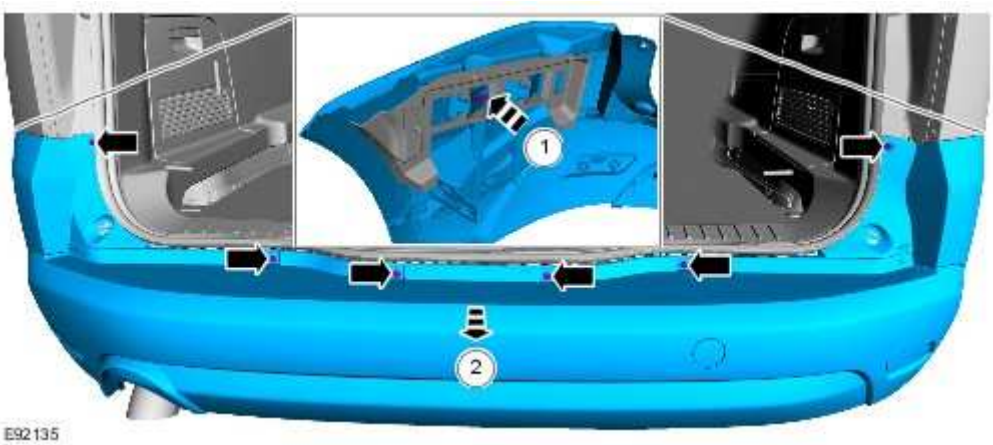
E92148

5. On both sides.


E94826

6. If equipped.

Torque: 95 Nm



E92135

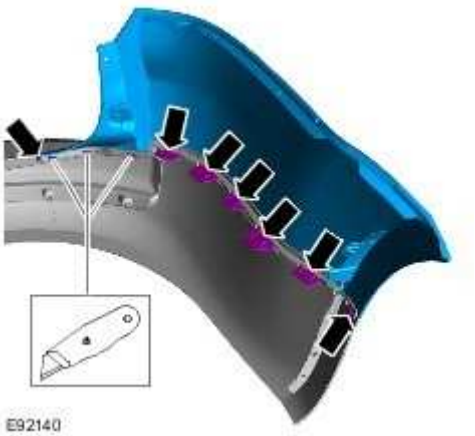
7.

Vehicles with VIN plate body code: M

8. On both sides.

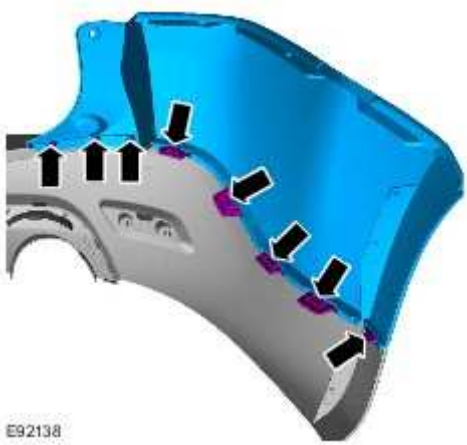
General Equipment: Knife

http://vnx.su



Vehicles with VIN plate body code: S

9. On both sides.

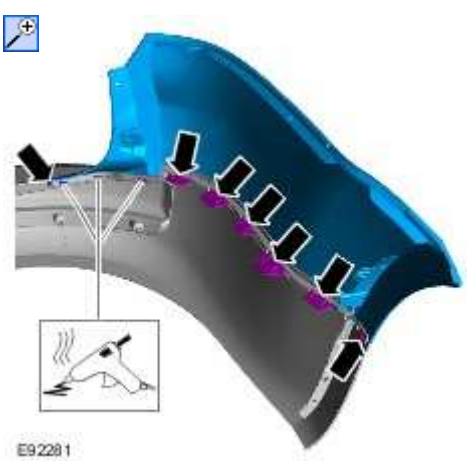


Installation

Vehicles with VIN plate body code: M

1. On both sides.

   General Equipment: Hot glue gun



Vehicles with VIN plate body code: S

2. On both sides.

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All vehicles

3. To install, reverse the removal procedure.

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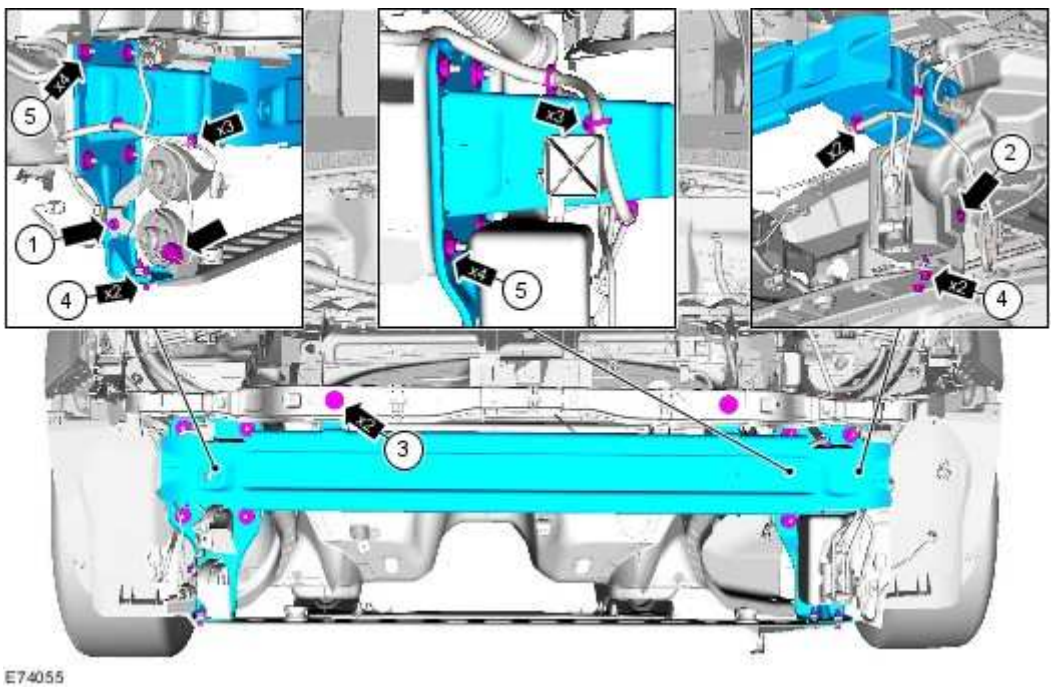
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the front bumper cover.

   Refer to: Front Bumper Cover - Vehicles With: Front Parking Aid (501-19 Bumpers, Removal and Installation).



E74055

2.
   1. *Torc* 24 N
   2. *Torc* 10 N
   3. *Torc* 22 N
   4. *Torc* 24 N
   5. *Torc* 30 N

Installation

1. To install, reverse the removal procedure.

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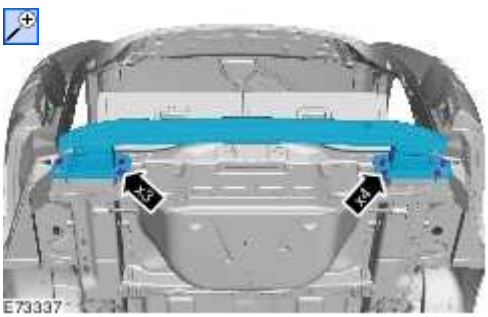
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Remove the rear bumper cover.

   Refer to: Rear Bumper Cover - Vehicles With: Rear Parking Aid (501-19 Bumpers, Removal and Installation).



2. *Torque:* 30 Nm

Installation

1. To install, reverse the removal procedure.

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Torque Specifications

Description	Nm	lb-ft	lb-in
Front seat safety belt buckle retaining nut	38	28	-

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Description and Operation

System overview

Safety belts and anchorages subjected to strain as a result of an accident should be checked by a trained technician and replaced in case of damage. Safety belts subjected to an accident with pretensioner or airbag deployment must be replaced and the anchorages checked by a trained technician. New safety belt components should also be installed where safety belts, not in use during a collision, are inspected and found to be damaged or operate incorrectly. Failure to follow these instructions may result in personal injury.

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All vehicles equipped with a passenger air bag have a WARNING sticker attached to the instrument panel PROHIBITING the use of rear facing child seats in the front seating positions. Failure to follow this instruction may result in personal injury.

Do not attempt to repair or lubricate the retractor/buckle mechanisms or modify the belts.

The safety belt system utilizes three-point lap and diagonal safety belts in all seat positions.

The front safety belt retractors incorporate a load limiting device, which allows progressive payout of additional safety belt webbing when the force exerted exceeds a predetermined limit.

The front safety belt upper anchors are connected to safety belt shoulder height adjusters mounted in the B-pillar.

Beltminder

The front seat safety belt buckles each incorporate a switch for the beltminder feature. The beltminder feature provides an audible and a visual warning when the driver and/or passenger have not fastened their safety belt(s) and the vehicle is moving. The presence of a passenger is detected by a sensor in the passenger seat.

The beltminder function uses the following input signals.

- Driver safety belt buckle switch
- Front passenger safety belt buckle switch
- Passenger detection sensor in the front passenger seat
- Vehicle speed

The beltminder warning is triggered when the vehicle speed is at 10 km/h (6 mph), or greater, and the driver and/or passenger safety belt(s) are not fastened. The warning will continue for 5 minutes or until the safety belt(s) are fastened, whichever is the first.

The safety belt minder feature can be disabled.
For additional information, refer to: Safety Belt Minder Deactivating/Activating (413-09, General Procedures).

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The safety belt retractor pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible that during a minor collision, which exceeds the deployment threshold, only the safety belt pretensioners will deploy. The belt pretensioner is not deployed in any side, rear or minor frontal collisions.

The 2nd row centre seat belt retractor is fitted in the roof. When the safety belt is used, the smaller safety belt buckle tongue is engaged into the belt buckle to the right of the centre seat. Then the larger safety belt buckle tongue is engaged into the belt buckle to the left of the centre seat. If the 2nd row safety belt is not in frequent use, the belt can be retracted and stowed in the roof.

Rear seat safety belt retractors and buckles are of the conventional type.

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Diagnosis and Testing

Principles of Operation

Safety belts and anchorages subjected to strain as a result of an accident should be checked by a trained technician and replaced in case of damage. Safety belts subjected to an accident with pretensioner or airbag deployment must be replaced and the anchorages checked by a trained technician. New safety belt components should also be installed where safety belts, not in use during a collision, are inspected and found to be damaged or operate incorrectly. Failure to follow these instructions may result in personal injury.

The front safety belt retractors are equipped with safety belt pretensioners, which are controlled as part of the supplemental restraint system (SRS).
REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Diagnosis and Testing).

The safety belt retractor, mounted within the base of the B-pillar, incorporates a torsion bar load limiting device. The device consists of a retractor reel which is mounted onto a spindle (torsion bar) which, once the sensor has locked the retractor reel and predetermined load is applied, twists and pays out additional webbing into the system. The deceleration force required to initiate this sequence is approximately the same as that required to initiate the safety belt pretensioner deployment. The torsion bar load limiting device will only react if the safety belt is in use at the time of impact.

Rear seat safety belt retractors do not use this type of retractor, they are equipped with a conventional retractor.

Emergency Locking Retractor (ELR)

The retractors in all seat positions feature ELR. The ELR is part of the safety belt system that in normal operation allows free movement of the belted occupant. In an emergency the ELR will lock, preventing webbing payout and hence forward movement of the occupant. Locking may be achieved by one of two mechanisms:

Vehicle Motion Sensor (VMS)

VMS is operated by sudden deceleration of the vehicle or excessive tilt. Once operated the VMS causes a locking pawl to be engaged, thus locking the retractor, preventing webbing payout. When the vehicle is stationary, the VMS stabilizes, causing the pawl to disengage and unlock the retractor, allowing webbing payout.

Webbing Motion Sensor (WMS)

The WMS is operated by rapid acceleration of the webbing. Once operated, it causes a locking pawl to be engaged thus locking the retractor. Webbing payout is prevented in the same manner as VMS.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical
• Safety belt retractor and pretensioner • Safety belt upper anchor and webbing • Safety belt buckle

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3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom	Possible Sources	Action
Normal mode - occupant restraint system inoperative	* Safety belt retractor.	* CARRY OUT the Safety Belt Component Test in this section.

Component Test

Poor Retraction

If a safety belt does not retract correctly, check that the anchor covers and trim bezels are correctly installed and not rubbing against the safety belt webbing. Where necessary, check that the safety belt webbing is not rubbing at one end of the retractor cover slot and, if so, correct by loosening the retaining bolt, aligning the retractor to centralize the safety belt webbing and retighten the bolt.

The safety belts are "dual sensitive" which means that they have:

- a vehicle motion sensor, which locks the safety belt webbing under braking, cornering, on steep hills and in adverse camber conditions.
- a webbing motion sensor, which locks when the safety belt webbing is quickly extracted.

Both systems should be fully operational and can be checked by the tests below:

Vehicle Motion Sensor Test

Either of the following two procedures may be used to check correct operation of the vehicle motion sensor. Both methods require two technicians but note that technicians of larger than normal build should not be asked to conduct these tests. This is to avoid the possibility of a fully unrolled safety belt webbing being mistaken for a correctly locked safety belt retractor.

Test Method 1 (braking)

It is important that during this test, the driver and passenger allow the safety belts to provide the restraint and do not attempt to anticipate the sudden deceleration. The steering wheel should not be used as a brace. However, both driver and passenger should prepare themselves for the possibility that the safety belt will not lock. The passenger should hold their hands in front of them, just clear of the instrument panel or front seat backrest, depending on which safety belt is being tested. Failure to follow these instructions may result in personal injury.

- Select for this test a quiet or private stretch of road. Make sure that the road is clear and that full visibility is maintained at all times.
- Both driver and passenger should adopt a normal, comfortable seating position. Both occupants should wear the safety belts and the safety belt webbing must be correctly adjusted, with no slack.
- Proceed at a speed of 10 km/h (6 mph). Do not exceed 10 km/h (6 mph) for this test.
- Apply the foot brake sharply to stop the vehicle. If the vehicle motion sensitive lock mechanism is operating correctly, the safety belt webbing will lock and restrain the wearer.
- Conduct the test twice in each front and rear passenger seat position.
- Any safety belt retractor which does not restrain the wearer during this test must not be reused. A new safety belt must be installed.

Test Method 2 (turning circle)

This method requires a flat open area of private road, sufficient for the vehicle to be driven

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in a continuous circle on full steering lock.

- The driver should wear the safety belt provided and the belt webbing must be correctly adjusted, with no slack.
- The passenger should occupy a rear seat with the safety belt correctly adjusted, with no slack.
- Start the engine and, with the steering on full right-hand lock, drive the vehicle in a continuous circle at 16 km/h (10 mph). Do not exceed 16 km/h (10 mph) for this test.
- When the speed is stable, the passenger should attempt to slowly extract the safety belt webbing from each safety belt retractor in turn. If the vehicle motion sensitive lock mechanism is operating correctly, it will not be possible to extract the webbing.
- Any safety belt retractor from which it is possible to extract the webbing during this test must not be used. A new safety belt must be installed.

Static Test

With the vehicle stationary and on level ground take firm hold of the safety belt webbing (on the tongue side of the upper safety belt anchor) and pull out quickly. The retractor should lock within 0.25 meter (10 inches), preventing further webbing payout. Any safety belt retractor from which it is possible to extract further webbing must not be used. A new safety belt must be installed.

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Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

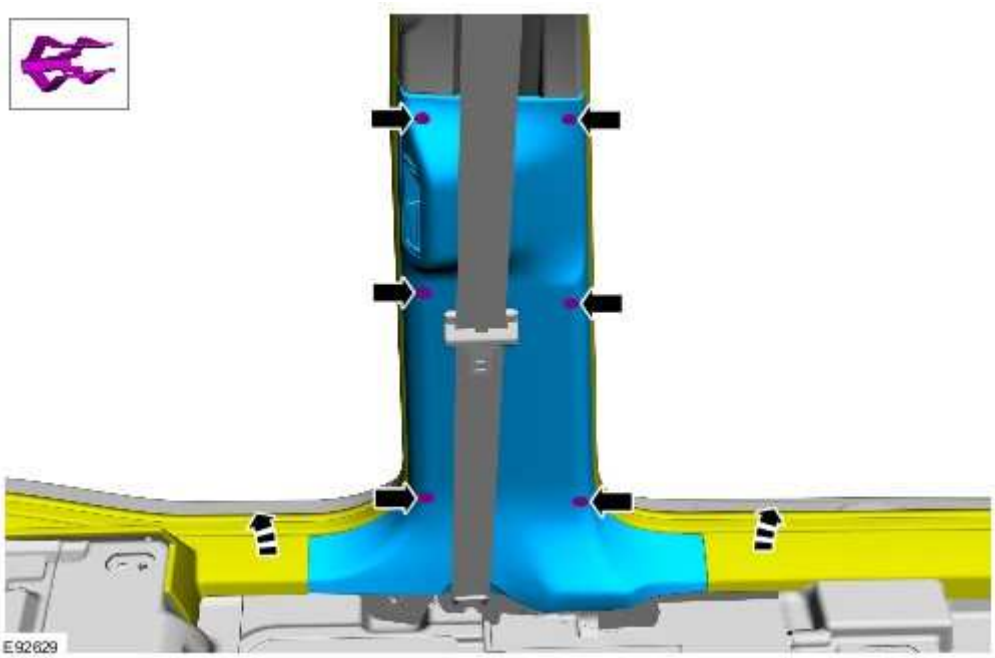
Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Refer to: Front Seat (501-10 Seating, Removal and Installation).
3. 

4. *Torque:* 35 Nm

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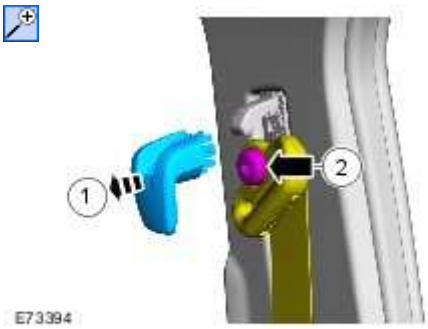

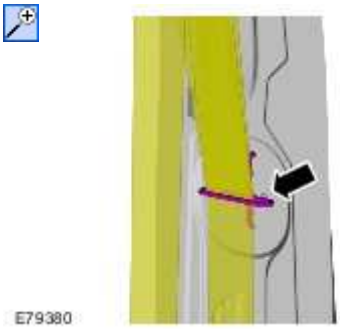

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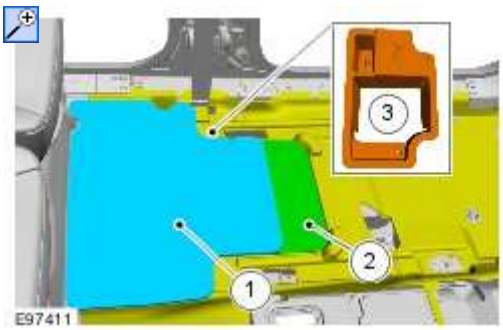

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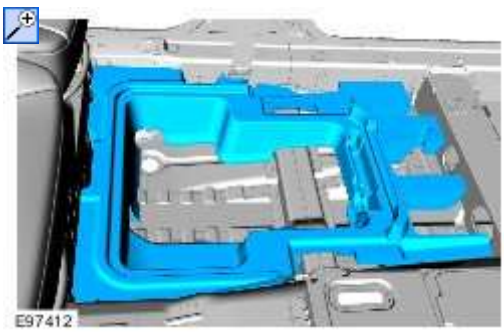

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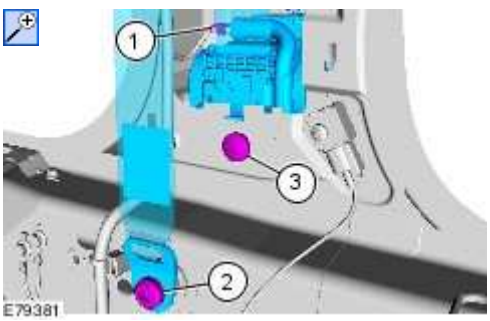

8. NOTE: Note the position of the component before removal.
   NOTE: Make sure that this component is installed to the noted removal position.
   2. *Torque:* 35 Nm
   3. *Torque:* 35 Nm

Installation

1. To install, reverse the removal procedure.

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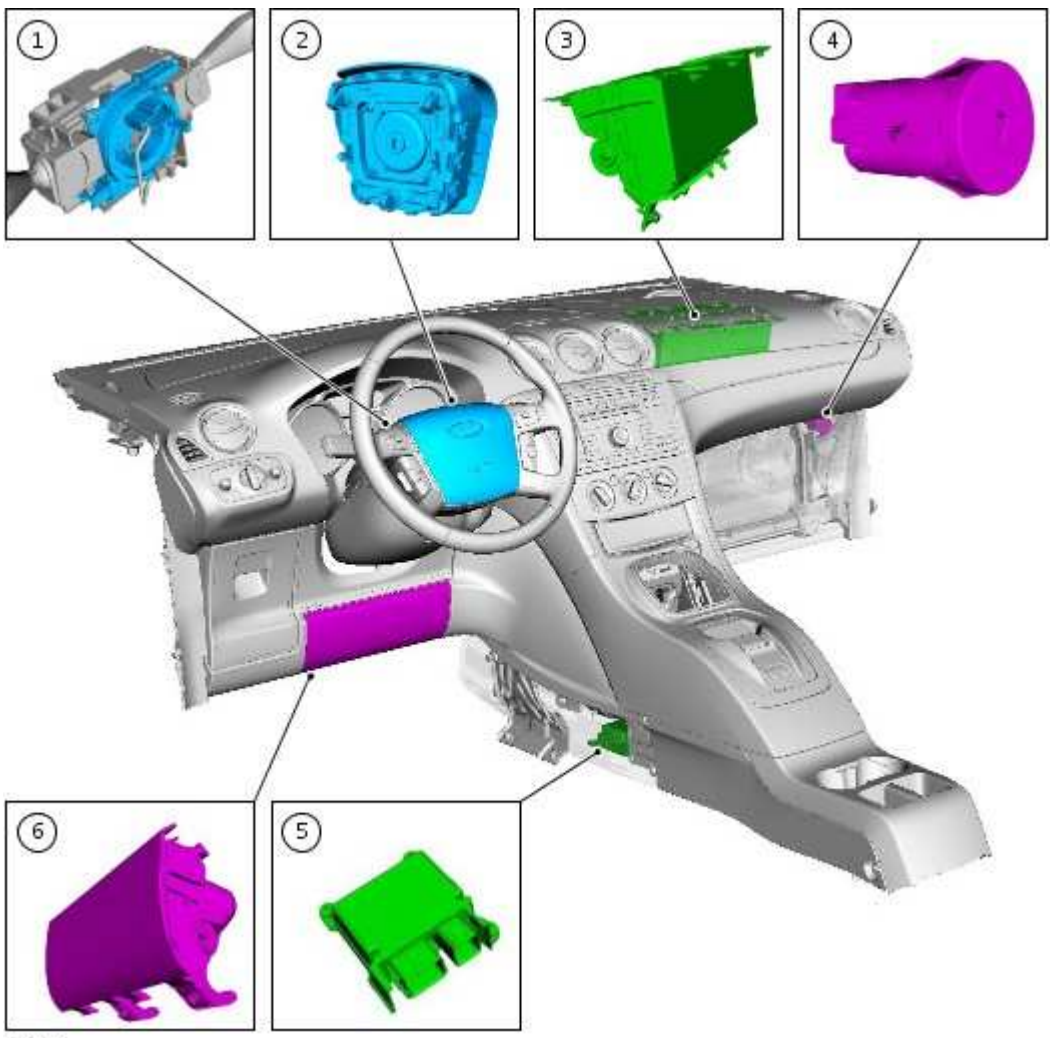
Description and Operation

System overview



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Item	Part Number	Description
1	-	Clockspring
2	-	Driver air bag module
3	-	Passenger air bag module
4	-	Passenger air bag deactivation (PAD) switch
5	-	Restraints control module (RCM)
6	-	Driver lower air bag module

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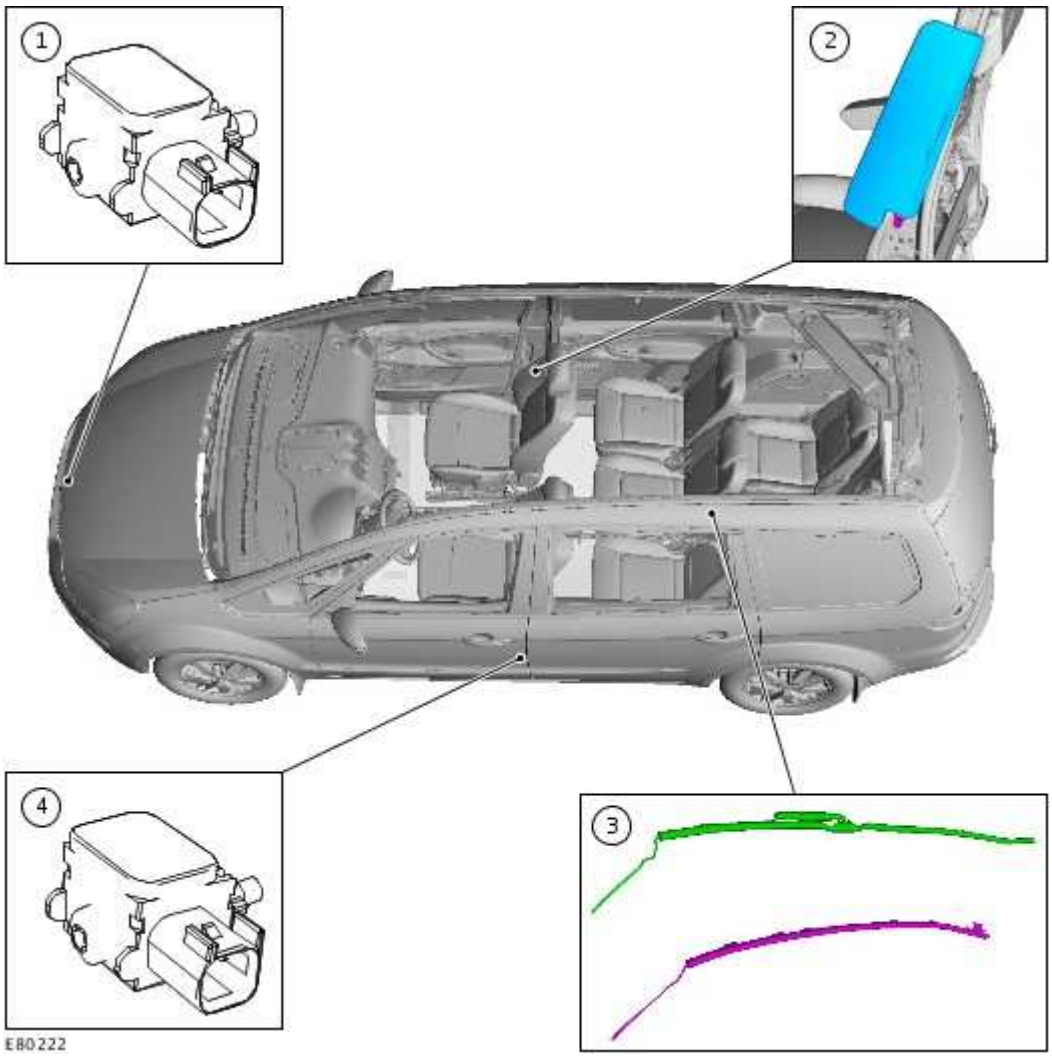

Item	Part Number	Description
1	-	Crash sensor
2	-	Side air bag module
3	-	Side air curtain module
4	-	Side impact sensor

System Structure

The following components form part of the supplemental restraint system (SRS):

- RCM
- Single-stage driver and passenger air bag modules
- Driver lower air bag module
- Side air bag modules
- Side air curtain modules
- Crash sensor
- Side impact sensors
- Clockspring
- Front safety belt retractors and pretensioners
- Rear safety belt retractors
- Air bag warning indicator
- Passenger air bag deactivation (PAD) switch (optional)

RCM

The RCM is located under the floor console, near to the gearshift lever. Installation direction

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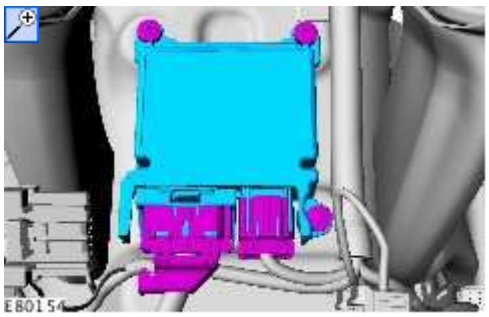
on the module are to make sure it is aligned correctly.



Electronic sensors are incorporated into the RCM; these measure the vehicle acceleration/deceleration in the event of a collision. The calculated value is evaluated by the RCM to determine the severity of the impact.

The RCM compares the values it receives from the crash sensor, side impact sensors and the internal electronic sensors. If the deceleration, due to a frontal or side impact, exceeds the stored value the RCM will trigger the air bag modules and the safety belt pretensioners as required.

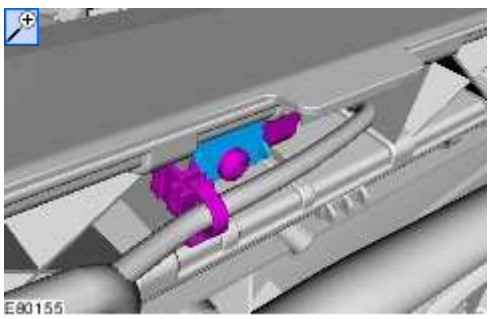
If the vehicle battery is destroyed in the collision, a voltage hold circuit in the RCM will still enable the air bag modules to be triggered up to 150 ms after the start of the impact.

If a system fault is detected by the RCM, the air bag warning lamp is illuminated. The fault can be located by carrying out a diagnostics check using the Worldwide Diagnostic System (WDS).

The RCM can be used again after a collision, provided the RCM is not physically damaged and it passes a self-test.

Crash Sensor

The crash sensor is installed at the front of the vehicle, behind the radiator grille. Data from the crash sensor is evaluated by the RCM to assess the severity of a frontal impact. The crash sensor transmits digitally encoded acceleration information to the RCM.



Power is supplied to the crash sensor by the RCM. If a crash sensor fails, the RCM stores a Diagnostic Trouble Code (DTC).

Continued use of the crash sensor is permissible provided it has not been physically damaged and it passes a self-test.

The external shape of the crash sensor prevents it from being installed incorrectly.

Side Impact Sensors

The side impact sensors are located at the bottom of the B-pillars and transmit digitally encoded acceleration information to the RCM.

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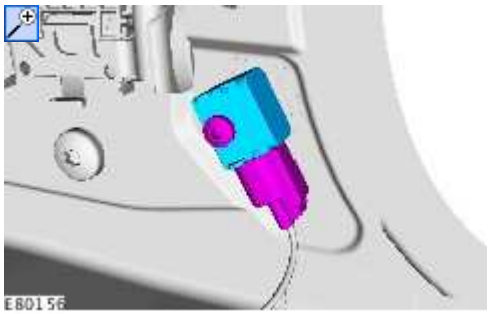

Continued use of the side impact sensor is permissible provided it has not been physically damaged and it passes a self-test.

Driver Air Bag Module, Driver Lower Air Bag Module and Passenger Air Bag Module

The driver, driver lower and passenger air bag modules are all single-stage air bags.

New Driver Air Bag Module design introduced for vehicles build 13.07.2009 onwards. New Air Bags require a revised removal instruction. See Removal And Installation procedure for details.

Clockspring

The clockspring is designed to carry signals between the RCM and the driver air bag module. The clockspring is installed on the steering column, and consists of fixed and moving parts connected by a coiled Mylar tape with internal conducting tracks. The Mylar tape is able to 'wind up' and 'unwind' as the steering wheel is rotated, maintaining electrical contact at all times between the RCM and the driver air bag module.

Vehicles with stability assist have a steering wheel rotation sensor as an integral part of the clockspring.

Passenger Air Bag Deactivation

A passenger air bag deactivation (PAD) switch can be fitted by the dealer as an optional extra; the PAD switch is installed in the glove box. The driver can operate the PAD switch with a key to deactivate the passenger air bag module.

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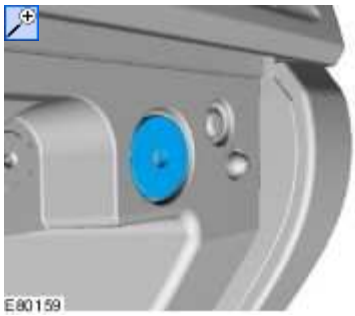
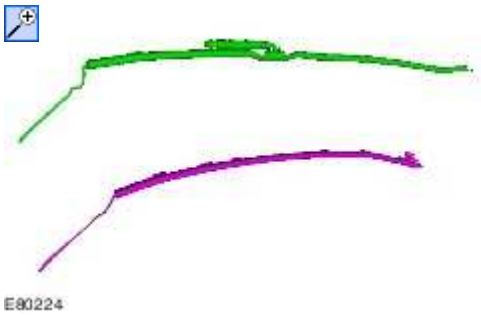


When the ignition is switched on, a warning lamp in the instrument panel indicates to the driver and passenger that the passenger air bag module has been deactivated.

After installing a PAD switch kit, the RCM must be re-configured using WDS.

Side Air Curtains

The side air curtain modules are located in the roof rail between the A-pillar and D-pillar. They are attached to the upper part of the side panel and are hidden behind the vehicle trim panels.



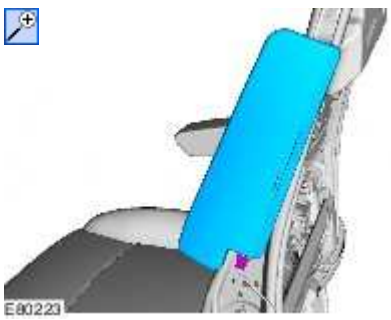
The electrical connector for the 5-door is located between the C-pillar and D-pillar. The electrical connector for the Wagon is located above the B-pillar.

In the event of a side impact the relevant side air curtain is deployed and forms a protective cushion between the corresponding side window and the head of the person(s) sat on the front and rear seat.

The side air curtains are deployed simultaneously with the side air bags.

Side Air Bag

The side air bags are incorporated in the front seat backrests; a sewn-on label on the respective backrest indicates the vehicle is equipped with side air bag modules.



When a side air bag is deployed, the seam of the seat cover tears open enabling the side air bag to inflate unhindered from the front seat backrest.

Safety Belt Retractor and Pretensioners

The pyrotechnic pretensioners for the driver and front passenger safety belts are incorporated into the safety belt retractors.

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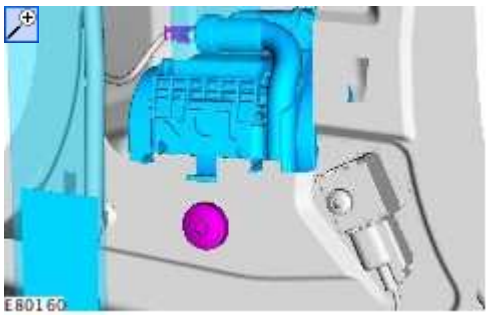

In the event of a collision, the safety belt pretensioners can be deployed in one of two ways:

- On their own.
- Simultaneously with the front air bag module(s).

The driver and front passenger safety belt buckles have a switch for the safety belt monitoring facility, which is required by law in some markets.

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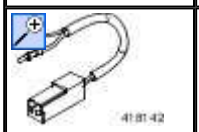
Diagnosis and Testing

Refer to Wiring Diagrams Section 501-20B, for schematic and connector information.

Special Tool(s)

	Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt 418-S055
	Test and Deployment Lead; Driver, Driver Lower and Passenger Air Bags and Side Air Curtain Module 418–525
	Test and Deployment Lead, Side Air Bag Module 418–555
	Simulator, Driver, Driver Lower and Passenger Air Bags and Side Air Curtain Module 501-073A
	Simulator, Occupant Restraint Systems 501–077
	Simulator, Passenger Safety Belt Retractor and Pretensioner 418-138

General Equipment

The Ford approved diagnostic tool

Diagnosing Customer Concerns Without Hard DTCs

WARNING: To avoid accidental deployment, the restraints control module (RCM) backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Following the pinpoint tests when a diagnostic trouble code (DTC) is not present, or the air bag warning lamp is not permanently illuminated, will result in needless replacement of air bag system components and repeat repairs.

Speak with the customer to determine if a particular set of conditions must be met in order for a fault to occur. If an illuminated air bag warning lamp is reported by the customer but is not present when the vehicle comes in for repair, pinpoint test diagnostics cannot be used.

Diagnosing Customer Concerns with Hard DTCs

WARNING: Do not use substitute air bag simulators when working on the SRS. Use only the appropriate tool. Failure to follow these instructions may result in personal injury.

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Most air bag system diagnostic procedures require the use of system deactivation and system reactivation procedures. These procedures require the air bag module(s) and safety belt retractor pretensioners to be disconnected from the SRS, thereby removing the risk of air bag deployment while diagnostics are carried out.

Air bag simulators are required to carry out diagnosis and testing of the air bag system. The simulator contains a resistor, used to simulate an air bag module connection to the system. It is not acceptable to short-circuit the air bag module connections with a 0 ohm jumper wire. If a 0 ohm jumper wire is used to short-circuit the air bag module connections, an illuminated air bag warning lamp will be displayed and a DTC logged by the restraints control module (RCM).

Deactivation

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

1. **1.** Disconnect the battery ground cable.
   REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. **2.** Wait at least one minute for the backup power supply in the RCM to deplete its stored energy.

WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.

3. **3.** Remove the driver air bag module from the vehicle.
   REFER to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation).

4. **4.** Connect the driver air bag simulator to the sub-harness in place of the driver air bag module at the top of the steering column.

5. **5.** Disconnect the passenger air bag module electrical connector.
   REFER to: Passenger Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

6. **6.** Connect the passenger air bag simulator to the wiring harness in place of the passenger air bag module.

7. **7.** Remove the driver lower air bag module from the vehicle.
   REFER to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

8. **8.** Connect the driver lower air bag simulator to the wiring harness in place of the driver lower air bag module.

9. **9.** Disconnect the side air curtain module electrical connector on both sides.
   REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation).

10. **10.** Connect the side air curtain simulators to the wiring harnesses in place of the

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side air curtain modules.

11. **11.** Disconnect the driver side underseat occupant restraint systems electrical connector.

12. **12.** Connect the occupant restraint systems simulator to the driver side underseat occupant restraint systems electrical connector in place of the side air bag module.

13. **13.** Disconnect the passenger side underseat occupant restraint systems electrical connector.

14. **14.** Connect the occupant restraint systems simulator to the passenger side underseat occupant restraint systems electrical connector in place of the side air bag module.

15. **15.** Detach the B-pillar trim panel to gain access to the driver safety belt retractor pretensioner electrical connector.
    REFER to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

16. **16.** Disconnect the driver safety belt retractor pretensioner electrical connector.

17. **17.** Connect the driver safety belt retractor pretensioner simulator to the wiring harness in place of the driver safety belt retractor pretensioner.

18. **18.** Detach the B-pillar trim panel to gain access to the passenger safety belt retractor pretensioner electrical connector.
    REFER to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

19. **19.** Disconnect the passenger safety belt retractor pretensioner electrical connector.

20. **20.** Connect the passenger safety belt retractor pretensioner simulator to the wiring harness in place of the passenger safety belt retractor pretensioner.

21. **21.** Connect the battery ground cable.
    REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

Reactivation

WARNING: The air bag simulators must be removed and the air bag modules reconnected when reactivated to avoid non-deployment in a collision. Failure to follow this instruction may result in personal injury.

1. **1.** Disconnect the battery ground cable.
   REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. **2.** Wait at least one minute for the backup power supply in the RCM to deplete its stored energy.

3. **3.** Remove the driver air bag simulator from the sub-harness at the top of the steering column.

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4. **4.** Connect and install the driver air bag module.
   REFER to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation).

5. **5.** Remove the passenger air bag simulator from the passenger air bag module harness.

6. **6.** Connect and install the passenger air bag module.
   REFER to: Passenger Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

7. **7.** Remove the driver lower air bag simulator from the driver lower air bag wiring harness.

8. **8.** Connect and install the driver lower air bag module.
   REFER to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation).

9. **9.** Remove the side air curtain simulators from the side air curtain module wiring harnesses.

10. **10.** Connect and install the side air curtain modules.
    REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation).

11. **11.** Remove the driver side underseat occupant restraint systems simulator.

12. **12.** Connect the driver side underseat occupant restraint systems electrical connector.

13. **13.** Remove the passenger side underseat occupant restraint systems simulator.

14. **14.** Connect the passenger side underseat occupant restraint systems electrical connector.

15. **15.** Remove the driver safety belt retractor pretensioner simulator from the driver safety belt retractor pretensioner wiring harness.

16. **16.** Connect the driver safety belt retractor pretensioner electrical connector.

17. **17.** Attach the B-pillar trim panel.
    REFER to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

18. **18.** Remove the passenger safety belt retractor pretensioner simulator from the passenger safety belt retractor pretensioner wiring harness.

19. **19.** Connect the passenger safety belt retractor pretensioner electrical connector.

20. **20.** Attach the B-pillar trim panel.
    REFER to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

21. **21.** Connect the battery ground cable.
    REFER to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

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22. **22.** Prove out the system.

Glossary

Air Bag Simulator

Air bag simulators are used to simulate air bag module connections to the system.

Deactivate the System

Deactivate the system means to carry out the deactivation procedure. REFER to Deactivation in this section.

Prove Out the System

The air bag warning indicator will illuminate for three seconds. If there is a fault condition, the air bag warning indicator will stay illuminated or illuminate after a five second delay.

Reactivate the System

Reactivate the system means to carry out the reactivation procedure. REFER to Reactivation in this section.

Principles of Operation

SRS Operation

The vehicle is equipped with a DC fired sensing system.

In the event of a severe frontal or three-quarter frontal impact, in excess of a predetermined limit, the driver and passenger front air bags and safety belt buckle pretensioners will deploy.

In the event of a severe full side impact, in excess of a predetermined limit, either the driver or passenger side air bag, side air curtain (if equipped) and both safety belt buckle pretensioners will deploy.

Air bag deployment will only occur, in the event of a severe collision, when the ignition key is in the RUN position. The passenger air bag deactivation (PAD) switch (if equipped) will deactivate the passenger air bag and passenger side air bag in the event of a severe frontal or side impact; it will not deactivate the passenger side air curtain.

RCM

The RCM retains full control of the whole system, providing continual system checks and full diagnostic capabilities. The non-volatile memory stores the DTCs, which can then be downloaded through the data link connector (DLC) to the Ford approved diagnostic tool.

In the event of a failure in the vehicle supply during an accident, the RCM provides a backup power supply, sufficient to deploy the air bag(s) for a minimum of 150 ms. The backup power supply is discharged by the RCM within 60 seconds of the battery ground cable being disconnected.

The RCM contains electronic acceleration sensors which measure longitudinal acceleration and lateral acceleration. Longitudinal and lateral signals, proportional to the amount of acceleration measured, are fed to a safing micro-controller. The crash sensor and the side impact sensors also feed signals, proportional to the amount of acceleration, to a micro-controller. When both micro-controllers sense an impact in excess of a predetermined limit the RCM initiates the circuit to deploy the air bag(s). The safing micro-controller enables the front air bags and the safety belt buckle pretensioners in the event of a front impact. The safing micro-controller also prevents unintentional deployment of the front air bags and safety belt buckle pretensioners in the event of a fault in the electronic acceleration sensor (s).

Crash Sensor

The crash sensor contains an acceleration sensor, filter, amplifier and an application specific

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integrated circuit for signal transmitting and is mounted on the radiator grille opening panel reinforcement. The crash sensor sends a signal at a level determined by the crash severity to the RCM. The RCM will evaluate the signal against stored data and deploy the frontal air bags and safety belt buckle pretensioners if required. Both the crash sensor and the internal RCM longitudinal acceleration sensor must exceed a preset limit to initiate the air bag.

Side Impact Sensor

The side impact sensors are mounted at the base of the B-pillar on either side of the vehicle, to facilitate remote lateral impact sensing. Each side impact sensor contains an acceleration sensor, filter, amplifier and an application specific integrated circuit for signal transmitting. In the event of an impact, in excess of a predetermined limit, the side impact sensor sends a signal at a level determined by the crash severity to the RCM. The RCM will evaluate the signal against stored data, to deploy the side air bag on the side the deployment request was initiated. Both the side impact sensor and the internal RCM lateral acceleration sensor must exceed a preset limit to initiate the air bag. The RCM retains control of the side air bags and side air curtains.

Air Bag Warning Indicator

The air bag warning indicator is incorporated into the instrument cluster, together with the automatic detach detect circuit. The air bag warning indicator illuminates for three seconds at key ON. If the system self-tests OK the air bag warning indicator extinguishes, if there is a fault condition, the air bag warning indicator will stay illuminated or illuminate after a five second delay.

The system is designed to illuminate the air bag warning indicator continuously if the RCM circuit is broken, either by loss of power, ground supply, module disconnect or CAN BUS failure. The RCM retaining bolts are the ground circuit.

Diagnostic evaluation of the SRS can be made through the DLC and the Ford approved diagnostic tool to establish the nature of the concern. Once the DTC is known the appropriate course of action can be selected from the Symptom Chart.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Electrical connector(s) • Circuit(s) • Wiring harness • Air bag module(s)

3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. **4.** If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

NOTE: It is only allowed to repair circuits between connectors. If damage has occurred within a connector a connector replacement kit, if available, must be installed. If a connector replacement kit is not available a new wiring harness must be installed.

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Connectors must not be disassembled.

Symptom	Possible Sources	Action
No communication with the module	* DLC. * RCM. * Circuit(s).	* GO to Pinpoint Test A.
DTC B0001 11: Driver air bag circuit short to ground	* Driver air bag module. * Clockspring. * Circuit(s).	* GO to Pinpoint Test B.
DTC B0001 12: Driver air bag short to battery	* Clockspring. * Circuit(s).	* GO to Pinpoint Test C.
DTC B0001 13: Driver air bag open circuit or high resistance	* Driver air bag module. * Clockspring. * Circuit(s).	* GO to Pinpoint Test D.
DTC B0001 19: Driver air bag cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test E.
DTC B0001 1A: Driver air bag circuit low resistance	* Driver air bag module. * Clockspring. * Circuit(s).	* GO to Pinpoint Test F.
DTC B0001 55: Driver air bag configuration failure	* Driver air bag module. * RCM.	* Configure the driver air bag module. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0004 11: Driver lower air bag circuit short to ground	* Driver lower air bag module. * Clockspring. * Circuit(s).	* GO to Pinpoint Test G.
DTC B0004 12: Driver lower air bag short to battery	* Circuit(s).	* GO to Pinpoint Test H.
DTC B0004 13: Driver lower air bag open circuit or high resistance	* Driver lower air bag module. * Circuit(s).	* GO to Pinpoint Test I.
DTC B0004 19: Driver lower air bag cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test J.
DTC B0004 1A: Driver lower air bag circuit low resistance	* Driver lower air bag module. * Circuit(s).	* GO to Pinpoint Test K.
DTC B0004 55: Driver lower air bag module configuration failure	* Driver lower air bag module. * RCM.	* Configure the driver lower air bag module. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0010 11: Passenger air bag circuit short to ground	* Passenger air bag module. * Circuit(s).	* GO to Pinpoint Test L.
DTC B0010 12: Passenger air bag short to battery	* Circuit(s).	* GO to Pinpoint Test M.
DTC B0010 13: Passenger air bag open circuit or high resistance	* Passenger air bag module. * Circuit(s).	* GO to Pinpoint Test N.
DTC B0010 19: Passenger air bag cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test.

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		* GO to Pinpoint Test O.
DTC B0010 1A: Passenger air bag circuit low resistance	* Passenger air bag module. * Circuit(s).	* GO to Pinpoint Test P.
DTC B0010 55: Passenger air bag configuration failure	* Passenger air bag module. * RCM.	* Configure the passenger air bag module. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0050 12: Driver safety belt buckle switch short to battery	* Driver safety belt buckle switch * Circuit(s).	* GO to Pinpoint Test Q.
DTC B0050 19: Driver safety belt buckle switch cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test R.
DTC B0050 1E: Driver safety belt buckle switch resistance out of range	* Driver safety belt buckle switch	* GO to Pinpoint Test S.
DTC B0050 55: Driver safety belt buckle switch configuration failure	* Driver safety belt buckle switch. * RCM.	* Configure the driver safety belt buckle switch. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0052 12: Passenger safety belt buckle switch short to battery	* Passenger safety belt buckle switch * Circuit(s).	* GO to Pinpoint Test T.
DTC B0052 19: Passenger safety belt buckle switch cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test U.
DTC B0052 1E: Passenger safety belt buckle switch resistance out of range	* Passenger safety belt buckle switch	* GO to Pinpoint Test V.
DTC B0052 55: Passenger safety belt buckle switch configuration failure	* Passenger safety belt buckle switch. * RCM.	* Configure the passenger safety belt buckle switch. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0070 11: Driver safety belt pretensioner short to ground	* Driver safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test W.
DTC B0070 12: Driver safety belt pretensioner short to battery	* Driver safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test X.
DTC B0070 13: Driver safety belt pretensioner open circuit	* Driver safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test Y.
DTC B0070 19: Driver safety belt pretensioner cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test Z.
DTC B0070 1A: Driver safety belt pretensioner low resistance	* Driver safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test AA.
DTC B0070 55: Driver safety belt pretensioner configuration failure	* Driver safety belt pretensioner. * RCM.	* Configure the driver safety belt pretensioner. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0072 11: Passenger safety belt pretensioner short	* Passenger safety belt pretensioner.	* GO to Pinpoint Test AB.

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to ground	* Circuit(s).	
DTC B0072 12: Passenger safety belt pretensioner short to battery	* Passenger safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test AC.
DTC B0072 13: Passenger safety belt pretensioner open circuit	* Passenger safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test AD.
DTC B0072 19: Passenger safety belt pretensioner cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AE.
DTC B0072 1A: Passenger safety belt pretensioner low resistance	* Passenger safety belt pretensioner. * Circuit(s).	* GO to Pinpoint Test AF.
DTC B0072 55: Passenger safety belt pretensioner configuration failure	* Passenger safety belt pretensioner. * RCM.	* Configure the passenger safety belt pretensioner. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0094 11: Front crash sensor circuit short to ground	* Circuit(s).	* GO to Pinpoint Test AG.
DTC B0094 12: Front crash sensor circuit short to battery	* Circuit(s).	* GO to Pinpoint Test AH.
DTC B0094 19: Front crash sensor cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AI.
DTC B0094 55: Front crash sensor configuration failure	* Crash sensor. * RCM.	* Configure the crash sensor. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B0094 87: Front crash sensor communications fault	* Crash sensor. * RCM. * Circuit(s).	* GO to Pinpoint Test AJ.
DTC B0094 92: Front crash sensor to restraints control module (RCM) mismatch	* Incorrect new crash sensor installed.	* INSTALL the correct crash sensor. REFER to: Crash Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC B0094 96: Front crash sensor internal fault	* Crash sensor.	* INSTALL a new crash sensor. REFER to: Crash Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC B00D2 01: RCM warning indicator lamp circuit failure	* Instrument cluster. * CAN bus.	* Check the instrument cluster. REFER to: Instrument Cluster (413-01 Instrument Cluster, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC B00D5 12: PAD indicator short to battery	* PAD indicator. * Circuit(s).	* GO to Pinpoint Test AK.
DTC B00D5 14: PAD indicator short to ground or disconnected	* PAD indicator. * Circuit(s).	* GO to Pinpoint Test AL.
DTC B00D5 55: PAD indicator configuration failure	* RCM. * PAD indicator.	* Configure the PAD indicator. REFER to the Ford approved diagnostic tool.

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		REPEAT the self-test, CLEAR the DTCs.
DTC B00DF 01: PAD switch	* PAD switch. * Circuit(s).	* GO to Pinpoint Test AM.
DTC B10FD 11: Driver side impact sensor short to ground	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AN.
DTC B10FD 12: Driver side impact sensor short to battery	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AO.
DTC B10FD 19: Driver side impact sensor cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AP.
DTC B10FD 55: Driver side impact sensor configuration failure	* RCM. * Driver side impact sensor.	* Configure the Driver side impact sensor. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B10FD 87: Driver side impact sensor communications fault	* Driver side impact sensor. * RCM. * Circuit(s).	* GO to Pinpoint Test AQ.
DTC B10FD 92: Driver side impact sensor to restraints control module (RCM) mismatch	* Incorrect new driver side impact sensor installed.	* INSTALL the correct driver side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC B10FD 96: Driver side impact sensor internal fault	* Side impact sensor.	* INSTALL a new side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC B10FE 11: Passenger side impact sensor short to ground	* Circuit(s).	* GO to Pinpoint Test AR.
DTC B10FE 12: Passenger side impact sensor short to battery	* Circuit(s).	* GO to Pinpoint Test AS.
DTC B10FE 19: Passenger side impact sensor cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AT.
DTC B10FE 55: Passenger side impact sensor configuration failure	* RCM. * Passenger side impact sensor.	* Configure the passenger side impact sensor. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B10FE 87: Passenger side impact sensor communications fault	* Passenger side impact sensor. * RCM. * Circuit(s).	* GO to Pinpoint Test AU.
DTC B10FE 92: Passenger side impact sensor to restraints control module (RCM) mismatch	* Incorrect new passenger side impact sensor installed.	* INSTALL the correct passenger side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).

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		REPEAT the self-test, CLEAR the DTCs.
DTC B10FE 96: Passenger side impact sensor internal fault	* Side impact sensor.	* INSTALL a new side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC B1126 11: Driver side air bag circuit short to ground	* Driver side air bag module. * Circuit(s).	* GO to Pinpoint Test AV.
DTC B1126 12: Driver side air bag circuit short to battery	* Driver side air bag module. * Circuit(s).	* GO to Pinpoint Test AW.
DTC B1126 13: Driver side air bag circuit open circuit or high resistance	* Driver side air bag module. * Circuit(s).	* GO to Pinpoint Test AX.
DTC B1126 19: Driver side air bag cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test AY.
DTC B1126 1A: Driver side air bag circuit low resistance	* Driver side air bag module. * Circuit(s).	* GO to Pinpoint Test AZ.
DTC B1126 55: Driver side air bag configuration failure	* RCM. * Driver side air bag.	* Configure the driver side air bag. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B1127 11: Passenger side air bag circuit short to ground	* Passenger side air bag module. * Circuit(s).	* GO to Pinpoint Test BA.
DTC B1127 12: Passenger side air bag circuit short to battery	* Passenger side air bag module. * Circuit(s).	* GO to Pinpoint Test BB.
DTC B1127 13: Passenger side air bag circuit open circuit or high resistance	* Passenger side air bag module. * Circuit(s).	* GO to Pinpoint Test BC.
DTC B1127 19: Passenger side air bag cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test BD.
DTC B1127 1A: Passenger side air bag circuit low resistance	* Passenger side air bag module. * Circuit(s).	* GO to Pinpoint Test BE.
DTC B1127 55: Passenger side air bag configuration failure	* RCM. * Passenger side air bag.	* Configure the passenger side air bag. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B1128 11: Driver side air curtain circuit short to ground	* Driver side air curtain module. * Circuit(s).	* GO to Pinpoint Test BF.
DTC B1128 12: Driver side air curtain circuit short to battery	* Circuit(s).	* GO to Pinpoint Test BG.
DTC B1128 13: Driver side air curtain circuit open circuit or high resistance	* Driver side air curtain module. * Circuit(s).	* GO to Pinpoint Test BH.
DTC B1128 19: Driver side air curtain cross link to another	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC

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firing circuit		before carrying out the pinpoint test. * GO to Pinpoint Test BI.
DTC B1128 1A: Driver side air curtain circuit low resistance	* Driver side air curtain module. * Circuit(s).	* GO to Pinpoint Test BJ.
DTC B1128 55: Driver side air curtain configuration failure	* RCM. * Driver side air curtain.	* Configure the driver side air curtain. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B1129 11: Passenger side air curtain circuit short to ground	* Passenger side air curtain module. * Circuit(s).	* GO to Pinpoint Test BK.
DTC B1129 12: Passenger side air curtain circuit short to battery	* Circuit(s).	* GO to Pinpoint Test BL.
DTC B1129 13: Passenger side air curtain circuit open circuit or high resistance	* Passenger side air curtain module. * Circuit(s).	* GO to Pinpoint Test BM.
DTC B1129 19: Passenger side air curtain cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test BN.
DTC B1129 1A: Passenger side air curtain circuit low resistance	* Passenger side air curtain module. * Circuit(s).	* GO to Pinpoint Test BO.
DTC B1129 55: Passenger side air curtain configuration failure	* RCM. * Passenger side air curtain.	* Configure the passenger side air curtain. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC B1A55 12: Event notification signal circuit short to ground or open circuit	* Circuit.	* GO to Pinpoint Test BP.
DTC B1A55 14: Event notification signal circuit short to battery	* Circuit.	* GO to Pinpoint Test BQ.
DTC B1B69 16: Battery voltage low	* Battery. * Charging system. * Circuit.	* GO to Pinpoint Test BR.
DTC B1B69 17: Battery voltage high	* Charging system.	* Check the charging system. REFER to: Charging System (414-00 Charging System - General Information, Diagnosis and Testing). REPEAT the self-test, CLEAR the DTCs.
DTC B1D74 12: PAD switch short to battery	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BS.
DTC B1D74 13: PAD switch open circuit or high resistance	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BT.
DTC B1D74 19: PAD switch circuit cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test BU.
DTC B1D74 1A: PAD switch short circuit	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BV.
DTC B1D74 1E: PAD switch resistance out of range	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BW.
DTC B1D74 55: PAD switch configuration failure	* RCM. * PAD switch.	* Configure the PAD switch. REFER to the Ford approved diagnostic tool.

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		REPEAT the self-test, CLEAR the DTCs.
DTC B1D75 12: PAD switch short to battery	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BX.
DTC B1D75 13: PAD switch open circuit or high resistance	* PAD switch. * Circuit(s).	* GO to Pinpoint Test BY.
DTC B1D75 19: PAD switch circuit cross link to another firing circuit	* Circuit(s).	NOTE: Check for a matching 'cross link to another firing circuit' DTC before carrying out the pinpoint test. * GO to Pinpoint Test BZ.
DTC B1D75 1A: PAD switch short circuit	* PAD switch. * Circuit(s).	* GO to Pinpoint Test CA.
DTC B1D75 1E: PAD switch resistance out of range	* PAD switch. * Circuit(s).	* GO to Pinpoint Test CB.
DTC B1D75 55: PAD switch configuration failure	* RCM. * PAD switch.	* Configure the PAD switch. REFER to the Ford approved diagnostic tool. REPEAT the self-test, CLEAR the DTCs.
DTC U0010 88 Control module communications bus off	* Circuit(s).	* GO to Pinpoint Test CC.
DTC U0140 00: Lost communication with Generic electronic module (GEM).	* CAN bus.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
DTC U0155 00: Lost communication with instrument cluster	* CAN bus.	* REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
DTC U1A37 00: Crash status telegram	* RCM crash data.	* Clear the data memory using the Ford diagnostic equipment. REPEAT the self test, CLEAR the DTCs.
DTC U2100 00: Restraints control module (RCM) configuration failure	* New RCM incorrectly configured.	* CHECK model option content. CONFIGURE the RCM. For additional information, REFER to the Ford approved diagnostic tool.
DTC U2101 00: Restraints control module (RCM) configuration incompatible	* New RCM incorrectly configured.	* CHECK model option content. CONFIGURE the RCM. For additional information, REFER to the Ford approved diagnostic tool.
DTC U3000 00: Restraints control module (RCM) is defective	* RCM.	* INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.
DTC U3000 13: Air bag diagnostic monitor ground circuit open	* RCM.	* GO to Pinpoint Test CD.

Pinpoint Tests

PINPOINT TEST A : NO COMMUNICATION WITH THE MODULE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE FORD APPROVED DIAGNOSTIC TOOL IS COMMUNICATING THROUGH THE DATA LINK CONNECTOR (DLC)	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the	

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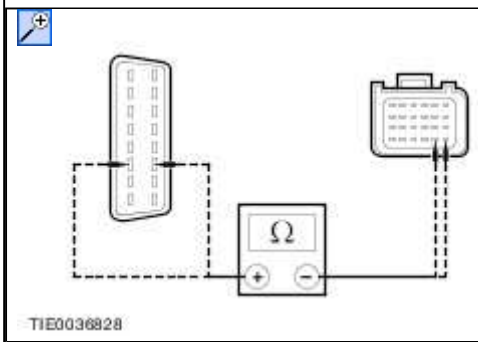
SRS sensors. Failure to follow these instructions may result in personal injury.

	1 Select an alternative system to check the DLC.
	Is the Ford approved diagnostic tool able to communicate with the selected system? **Yes** GO to A2. **No** CHECK the DLC. For additional information, REFER to the Wiring Diagrams.
A2: CHECK THE AIR BAG WARNING INDICATOR	
	1 Ignition switch in position II.
	2 The air bag warning indicator should illuminate when the ignition is in the ON position for three seconds then go out. If a fault is present, the air bag warning indicator will illuminate after five seconds.
	Does the air bag warning indicator illuminate after five seconds? **Yes** INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to A3.
A3: CHECK THE DLC CIRCUIT	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0.
	2 Deactivate the SRS.
	3 Disconnect RCM C2R114-A.
	4 Measure the resistance between the: • DLC C3DB04 pin 3, circuit VDB06X (GY/OG) and the RCM C2R114-A pin 19, circuit VDB06AB (GY/OG), harness side. • DLC C3DB04 pin 11, circuit VDB07D (VT/OG) and the RCM C2R114-A pin 20, circuit VDB07H (VT/OG), harness side.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit VDB06AB (GY/OG), or circuit VDB06X (GY/OG), or circuit VDB07D (VT/OG), or circuit VDB07H (VT/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST B : DTC B0001 11: DRIVER AIR BAG CIRCUIT SHORT TO GROUND

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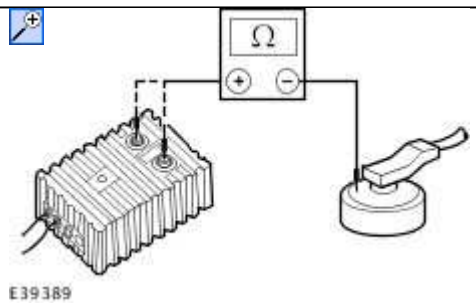
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK THE DRIVER AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to B2. **No** GO to B3.
B2: CHECK THE DRIVER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance between each of the terminals and the driver air bag module casing.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver air bag module. REFER to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
B3: CHECK THE CLOCKSPRING FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Clockspring C2R115-A.
	4 Measure the resistance between the: • RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and ground. • RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and ground.

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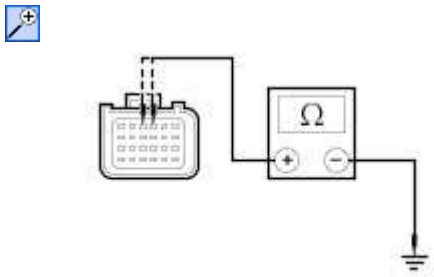


Are the resistances greater than 10,000 ohms?

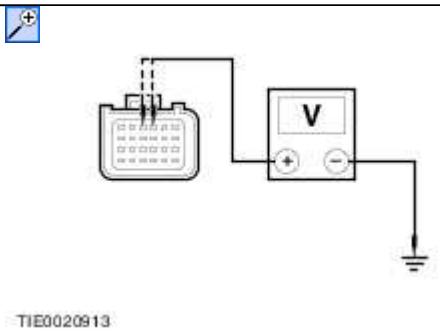
Yes

INSTALL a new clockspring.
REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).
REPEAT the self-test, CLEAR the DTCs.
REACTIVATE the system.

No

REPAIR circuit CR101A (VT/BN) and circuit RR101A (YE/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST C : DTC B0001 12: DRIVER AIR BAG SHORT TO BATTERY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK THE DRIVER AIR BAG WIRING HARNESS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Driver Air Bag Module Simulator.
	3 Disconnect RCM C2R114-A.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and ground. • RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and ground.
	Is any voltage present? **Yes** GO to C2. **No** CONNECT the driver air bag module simulator and RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
C2: CHECK THE CLOCKSPRING FOR A SHORT TO BATTERY	
	1 Ignition switch in position 0.
	2 Disconnect Clockspring C2R115-A.
	3 Ignition switch in position II.

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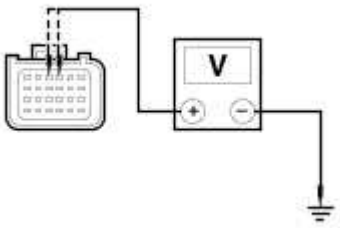

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4 Measure the voltage between the:

- RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and ground.
- RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and ground.

Is any voltage present?

Yes

REPAIR circuit CR101A (VT/BN) or circuit RR101A (YE/GN) and circuit CBP02A (GN).
REPEAT the self-test, CLEAR the DTCs.
REACTIVATE the system.

No

INSTALL a new clockspring.
REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation).
REPEAT the self-test, CLEAR the DTCs.
REACTIVATE the system.

PINPOINT TEST D : DTC B0001 13: DRIVER AIR BAG OPEN CIRCUIT OR HIGH RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

D1: CHECK THE DRIVER AIR BAG CIRCUIT RESISTANCE

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1 Deactivate the SRS.

2 Ignition switch in position II.

3 Carry out the self-test with the simulators installed.

Does the system prove out correctly?

Yes

GO to D2.

No

GO to D3.

D2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE

WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.

1 Connect the test and deployment lead to the driver air bag module.

2 Select DMM specific on the Ford approved diagnostic tool.

3 Connect the test and deployment lead to the Ford approved diagnostic tool.

4 Measure the resistance of the driver air bag module squib.

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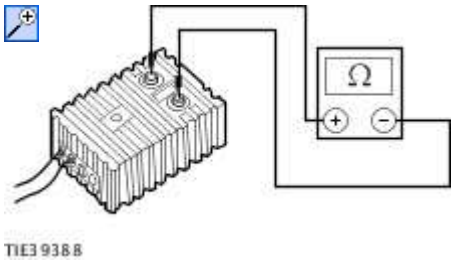


Is the resistance between 2 and 3 ohms?

Yes

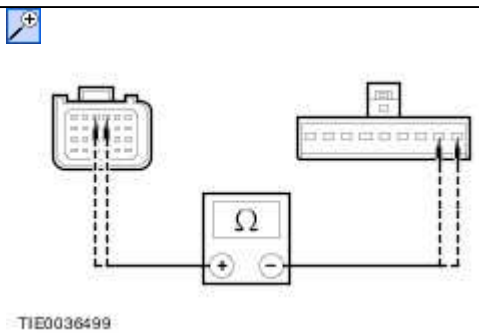
REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

INSTALL a new driver air bag module. REFER to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

D3: CHECK THE CLOCKSPRING FOR OPEN CIRCUIT OR HIGH RESISTANCE

1. Ignition switch in position 0.
2. Disconnect RCM C2R114-A.
3. Disconnect Clockspring C2R115-A.



4. Measure the resistance between the:
   - RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and the clockspring C2R115-A pin 1, circuit CR101A (VT/BN), harness side.
   - RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and the clockspring C2R115-A pin 2, circuit RR101A (YE/GN), harness side.

Are the resistances less than 5 ohms?

Yes

INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPAIR circuit CR101A (VT/BN) or circuit RR101A (YE/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST E : DTC B0001 19: DRIVER AIR BAG CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

E1: CHECK THE DRIVER AIR BAG CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1. Deactivate the SRS.
2. Disconnect RCM C2R114-A.

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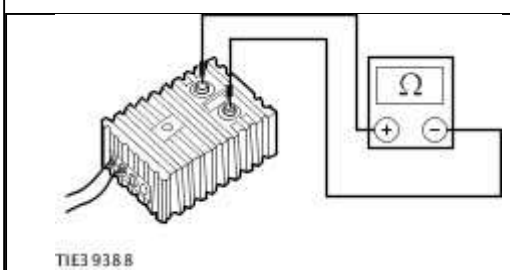
	3 Disconnect Driver Air Bag Module Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and the inoperative air bag module circuits. • RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST F : DTC B0001 1A: DRIVER AIR BAG CIRCUIT LOW RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE DRIVER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to F2. **No** GO to F3.
F2: CHECK THE DRIVER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the driver air bag module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

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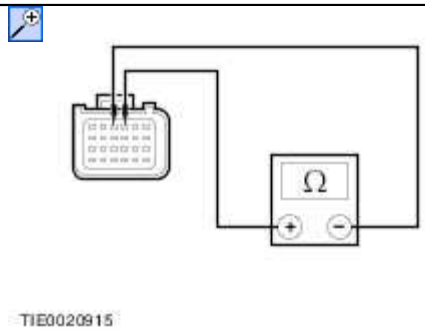
	No INSTALL a new driver air bag module. REFER to: Driver Air Bag Module - Vehicles Built Up To: 13-07-2009 (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
F3: CHECK THE CLOCKSPRING FOR LOW RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Clockspring C2R115-A.
	4 Measure the resistance between the RCM C2R114-A pin 3, circuit CR101A (VT/BN) and the RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new clockspring. REFER to: Clockspring (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR101A (VT/BN) and circuit RR101A (YE/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST G : DTC B0004 11: DRIVER LOWER AIR BAG CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: CHECK THE DRIVER LOWER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to G2. **No** GO to G3.
G2: CHECK THE DRIVER LOWER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the

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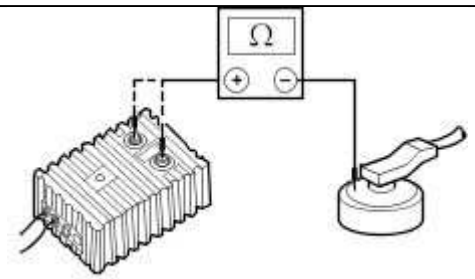
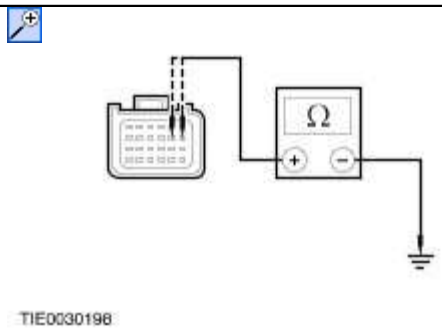
	driver lower air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance between each of the terminals and the driver lower air bag module casing.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver lower air bag module. REFER to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
G3: CHECK THE DRIVER LOWER AIR BAG MODULE WIRING HARNESS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Driver Lower Air Bag Module Simulator.
	4 Measure the resistance between the: • RCM C2R114-A pin 7, circuit RR139A (YE), harness side and ground. • RCM C2R114-A pin 8, circuit CR139A (VT/WH), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR139A (YE) or circuit CR139A (VT/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST H : DTC B0004 12: DRIVER LOWER AIR BAG SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: CHECK THE DRIVER LOWER AIR BAG WIRING HARNESS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be	

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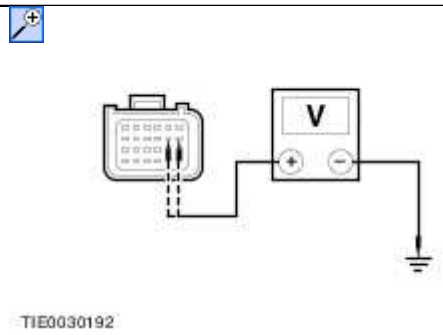
depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Disconnect Driver Lower Air Bag Module Simulator.
	3 Disconnect RCM C2R114-A.
	4 Ignition switch in position II.
 TIE0030192	5 Measure the voltage between the: • RCM C2R114-A pin 7, circuit RR139A (YE), harness side and ground. • RCM C2R114-A pin 8, circuit CR139A (VT/WH), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR139A (VT/WH) or circuit RR139A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** CONNECT the driver lower air bag module simulator and RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST I : DTC B0004 13: DRIVER LOWER AIR BAG OPEN CIRCUIT OR HIGH RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: CHECK THE DRIVER LOWER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to I2. **No** GO to I3.
I2: CHECK THE DRIVER LOWER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver lower air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.

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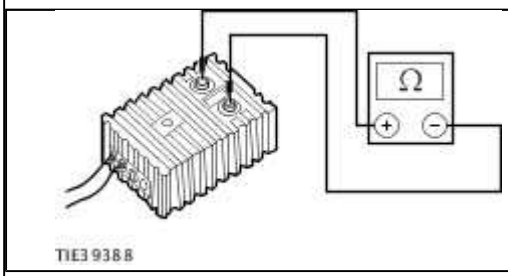
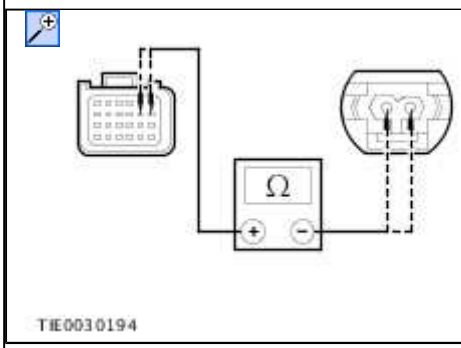
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the driver lower air bag module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver lower air bag module. REFER to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
I3: CHECK THE DRIVER LOWER AIR BAG CIRCUIT FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Driver Lower Air Bag Module Simulator.
	4 Measure the resistance between the: • RCM C2R114-A pin 7, circuit RR139A (YE), harness side and the driver lower air bag module C2R139 pin 2, circuit RR139A (YE), harness side. • RCM C2R114-A pin 8, circuit CR139A (VT/WH), harness side and the driver lower air bag module C2R139 pin 1, circuit CR139A (VT/WH), harness side.
	Are the resistances less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR139A (YE) or circuit CR139A (VT/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST J : DTC B0004 19: DRIVER LOWER AIR BAG CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: CHECK THE DRIVER AIR BAG CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.

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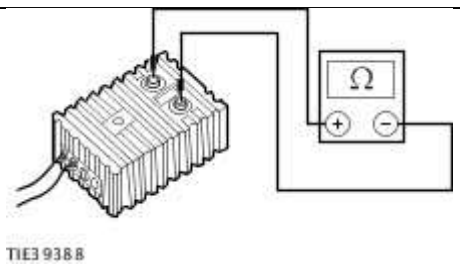
	2 Disconnect RCM C2R114-A.
	3 Disconnect Driver Air Bag Module Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C2R114-A pin 3, circuit CR101A (VT/BN), harness side and the inoperative air bag module circuits. • RCM C2R114-A pin 4, circuit RR101A (YE/GN), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST K : DTC B0004 1A: DRIVER LOWER AIR BAG CIRCUIT LOW RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
K1: CHECK THE DRIVER LOWER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to K2. **No** GO to K3.
K2: CHECK THE DRIVER LOWER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver lower air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the driver lower air bag module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs.

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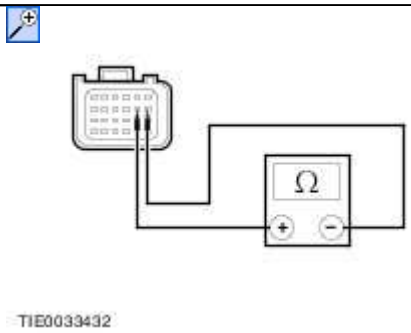
	REACTIVATE the system. **No** INSTALL a new driver lower air bag module. REFER to: Driver Lower Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
K3: CHECK THE DRIVER LOWER AIR BAG CIRCUIT FOR LOW RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Driver Lower Air Bag Module Simulator.
	4 Measure the resistance between the RCM C2R114-A pin 7, circuit RR139A (YE), harness side and the RCM C2R114-A pin 8, circuit CR139A (VT/WH), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR139A (YE) and circuit CR139A (VT/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST L : DTC B0010 11: PASSENGER AIR BAG CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE PASSENGER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to L2. **No** GO to L3.
L2: CHECK THE PASSENGER AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the passenger air bag module.

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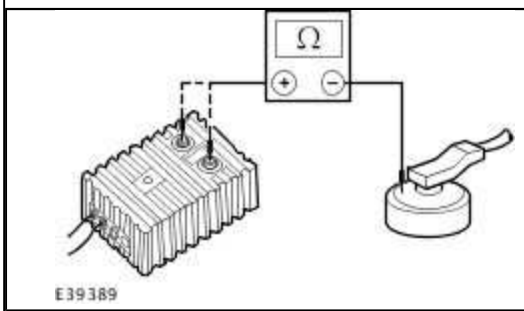
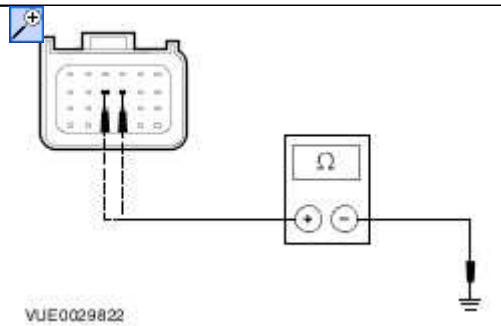
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance between each of the terminals and the passenger air bag module casing.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger air bag module. REFER to: Passenger Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
L3: CHECK THE PASSENGER AIR BAG WIRING HARNESS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Passenger Air Bag Module Simulator.
	4 Measure the resistance between the: • RCM C2R114-A pin 9, circuit CR103A (GY/BU), harness side and ground. • RCM C2R114-A pin 10, circuit RR103A (VT/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR103A (GY/BU) or circuit RR103A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST M : DTC B0010 12: PASSENGER AIR BAG SHORT TO BATTERY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: CHECK THE PASSENGER AIR BAG CIRCUIT FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	

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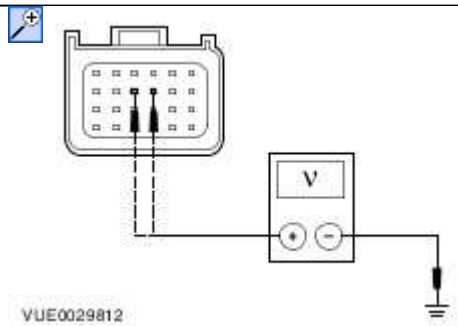
NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Disconnect Passenger Air Bag Module Simulator.
	3 Disconnect RCM C2R114-A.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C2R114-A pin 9, circuit CR103A (GY/BU), harness side and ground. • RCM C2R114-A pin 10, circuit RR103A (VT/GN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR103A (GY/BU) or circuit RR103A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** CONNECT the passenger air bag module simulator and the RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST N : DTC B0010 13: PASSENGER AIR BAG OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
N1: CHECK THE PASSENGER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to N2. **No** GO to N3.
N2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the passenger air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the passenger air bag module squib.

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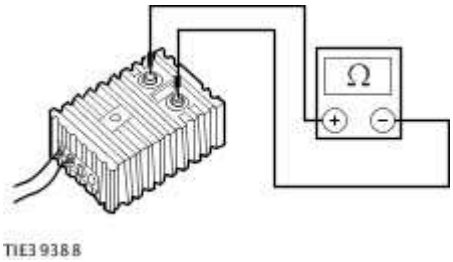


Is the resistance between 2 and 3 ohms?

Yes

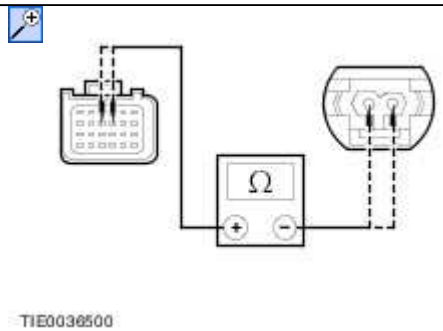
REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

INSTALL a new passenger air bag module. REFER to: Passenger Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

N3: CHECK THE PASSENGER AIR BAG WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE

1. Ignition switch in position 0.
2. Disconnect RCM C2R114-A.
3. Disconnect Passenger Air Bag Module Simulator.



4. Measure the resistance between the:
   - RCM C2R114-A pin 9, circuit CR103A (GY/BU), harness side and the passenger air bag module C2R103 pin 1, circuit CR103A (GY/BU), harness side.
   - RCM C2R114-A pin 10, circuit RR103A (VT/GN), harness side and the passenger air bag module C2R103 pin 2, circuit RR103A (VT/GN), harness side.

Are the resistances less than 5 ohms?

Yes

REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPAIR circuit CR103A (GY/BU) or circuit RR103A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST O : DTC B0010 19: PASSENGER AIR BAG CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

O1: CHECK THE PASSENGER AIR BAG CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1. Deactivate the SRS.
2. Disconnect RCM C2R114-A.
3. Disconnect Passenger Air Bag Module Simulator.
4. Disconnect Inoperative Air Bag Module Simulator.

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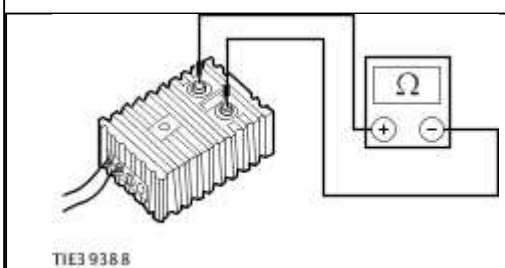
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C2R114-A pin 9, circuit CR103A (GY/BU), harness side and the inoperative air bag module circuits. • RCM C2R114-A pin 10, circuit RR103A (VT/GN), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST P : DTC B0010 1A: PASSENGER AIR BAG CIRCUIT LOW RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
P1: CHECK THE PASSENGER AIR BAG CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to P2. **No** GO to P3.
P2: CHECK THE PASSENGER AIR BAG MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the passenger air bag module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the passenger air bag module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger air bag module.

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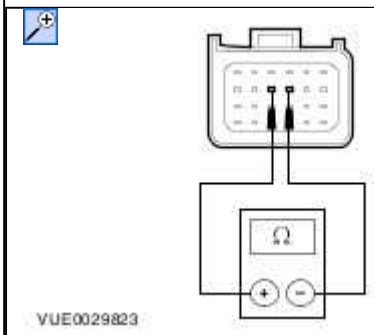
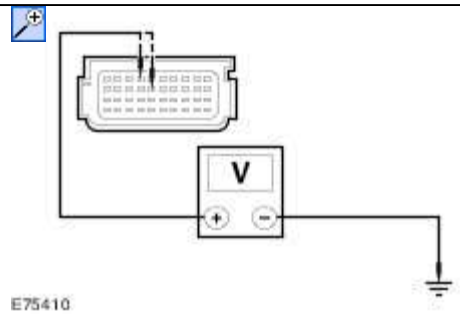
	REFER to: Passenger Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
P3: CHECK THE PASSENGER AIR BAG CIRCUIT FOR LOW RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Air Bag Module Simulator.
	3 Disconnect RCM C2R114-A.
	4 Measure the resistance between the RCM C2R114-A pin 9, circuit CR103A (GY/BU), harness side and the RCM C2R114-A pin 10, circuit RR103A (VT/GN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR103A (GY/BU) and circuit RR103A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST Q : DTC B0050 12: DRIVER SAFETY BELT BUCKLE SWITCH SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH WIRING HARNESS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Driver Underseat Air Bag Simulator.
	3 Disconnect RCM C3R114.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • The RCM C3R114 pin 25, circuit CR201A (BU/OG), harness side and ground. • The RCM C3R114 pin 34, circuit RR155E (GY), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR201A (BU/OG) or circuit RR155E (GY). REPEAT the self-test, CLEAR the

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	DTCs. REACTIVATE the system. **No** CONNECT the driver underseat air bag simulator and RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST R : DTC B0050 19: DRIVER SAFETY BELT BUCKLE SWITCH CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Underseat Occupant Restraint Systems Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 25, circuit CR201A (BU/OG), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 34, circuit RR155C (GY), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST S : DTC B0050 1E: DRIVER SAFETY BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
S1: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** INSTALL a new driver safety belt buckle. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to S2.
S2: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT CONTINUITY	

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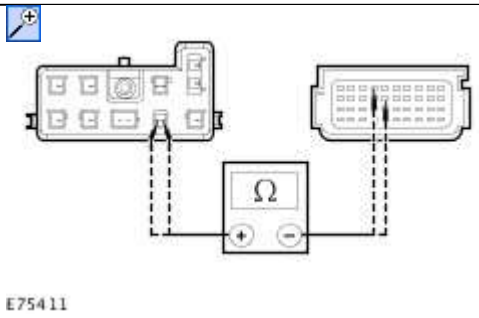
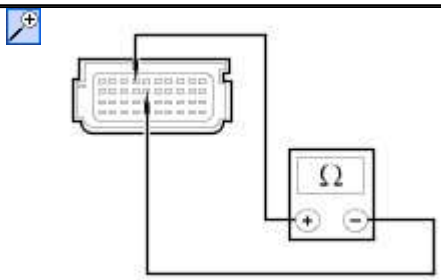
	1 Ignition switch in position 0. 2 Disconnect Driver Underseat Air Bag Simulator.
	3 Measure the resistance between: • The driver safety belt buckle switch C33-L pin 13, circuit RR155E (GY), harness side and the RCM C3R114 pin 34, circuit RR155E (GY), harness side. • The driver safety belt buckle switch C33-L pin 14, circuit CR201A (BU/OG), harness side and the RCM C3R114 pin 25, circuit CR201A (BU/OG), harness side.
	Are the resistances less than 5 ohms? **Yes** GO to S3. **No** REPAIR circuit CR201A (BU/OG) or circuit RR155E (GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
S3: CHECK THE DRIVER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR LOW RESISTANCE	
	1 Measure the resistance between the RCM C3R114 pin 25, circuit CR201A (BU/OG), harness side and the RCM C3R114 pin 34, circuit RR155C (GY), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR201A (BU/OG) or circuit RR155C (GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST T : DTC B0052 12: PASSENGER SAFETY BELT BUCKLE SWITCH SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH WIRING HARNESS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Disconnect Passenger Underseat Air Bag Simulator. 3 Disconnect RCM C3R114. 4 Ignition switch in position II.
	5 Measure the voltage between the:

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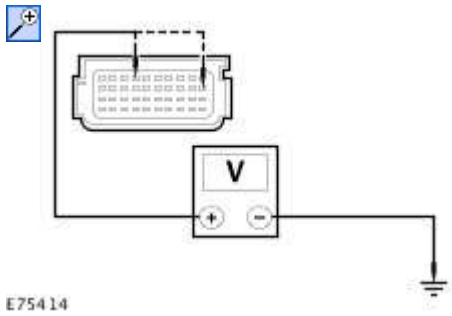

- The RCM C3R114 pin 30, circuit CR203A (GY/VT), harness side and ground.
- The RCM C3R114 pin 34, circuit RR155D (GY), harness side and ground.

Is any voltage present?

Yes

REPAIR circuit CR203A (GY/VT) or circuit RR155D (GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

CONNECT the passenger underseat air bag simulator and RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST U : DTC B0052 19: PASSENGER SAFETY BELT BUCKLE SWITCH CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

U1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1	Deactivate the SRS.
2	Disconnect RCM C3R114.
3	Disconnect Passenger Underseat Occupant Restraint Systems Simulator.
4	Disconnect Inoperative Air Bag Module Simulator.

NOTE: Refer to the Wiring Diagrams for pin detail.

5 Measure the resistance between the:

- RCM C3R114 pin 30, circuit CR203A (GY/VT), harness side and the inoperative air bag module circuits.
- RCM C3R114 pin 34, circuit RR155C (GY), harness side and the inoperative air bag module circuits.

Are the resistances greater than 10,000 ohms?

Yes

REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST V : DTC B0052 1E: PASSENGER SAFETY BELT BUCKLE SWITCH RESISTANCE OUT OF RANGE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

V1: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the

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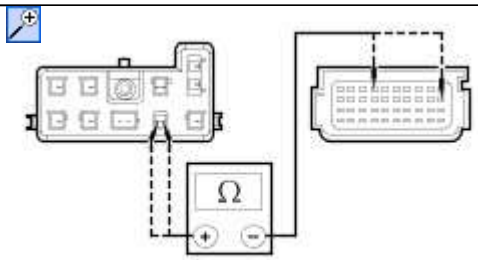
SRS sensors. Failure to follow these instructions may result in personal injury.

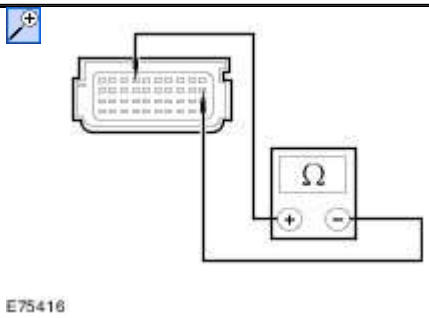
NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** INSTALL a new passenger safety belt buckle. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to V2.

V2: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT CONTINUITY

	1 Ignition switch in position 0.
	2 Disconnect Passenger Underseat Air Bag Simulator.
	3 Measure the resistance between: • The passenger safety belt buckle switch C33-M pin 13, circuit RR155D (GY), harness side and the RCM C3R114 pin 34, circuit RR155C (GY), harness side. • The passenger safety belt buckle switch C33-M pin 14, circuit CR203A (GY/VT), harness side and the RCM C3R114 pin 30, circuit CR203A (GY/VT), harness side.
	Are the resistances less than 5 ohms? **Yes** GO to V3. **No** REPAIR circuit CR203A (GY/VT) or circuit RR155D (GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

V3: CHECK THE PASSENGER SAFETY BELT BUCKLE SWITCH CIRCUIT FOR LOW RESISTANCE

	1 Measure the resistance between the RCM C3R114 pin 30, circuit CR203A (GY/VT), harness side and the RCM C3R114 pin 34, circuit RR155C (GY), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR203A (GY/VT) or circuit RR155C (GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST W : DTC B0070 11: DRIVER SAFETY BELT PRETENSIONER SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

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W1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

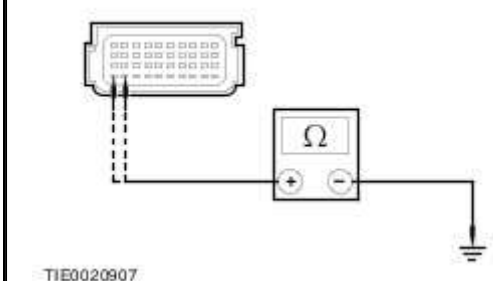
NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to W2. **No** GO to W3.

W2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Driver Safety Belt Pretensioner Simulator.
	3 Connect Driver Safety Belt Pretensioner Electrical Connector C5R120.
	4 Ignition switch in position II.
	5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

W3: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT FOR A SHORT TO GROUND

	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 1, circuit RR120A (BN/GN), harness side and ground. • RCM C3R114 pin 2, circuit CR120A (BU/OG), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No**

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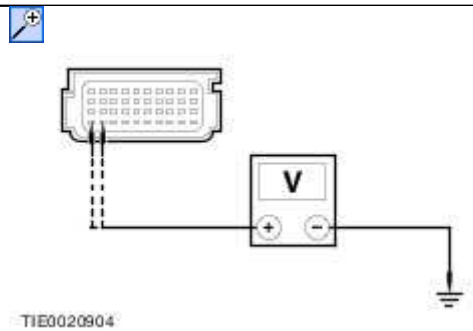
	REPAIR circuit RR120A (BN/GN) or circuit CR120A (BU/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST X : DTC B0070 12: DRIVER SAFETY BELT PRETENSIONER SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Disconnect RCM C3R114. 3 Disconnect Driver Safety Belt Pretensioner Simulator. 4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 1, circuit RR120A (BN/GN), harness side and ground. • RCM C3R114 pin 2, circuit CR120A (BU/OG), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR120A (BU/OG) or circuit RR120A (BN/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST Y : DTC B0070 13: DRIVER SAFETY BELT PRETENSIONER OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to Y2.

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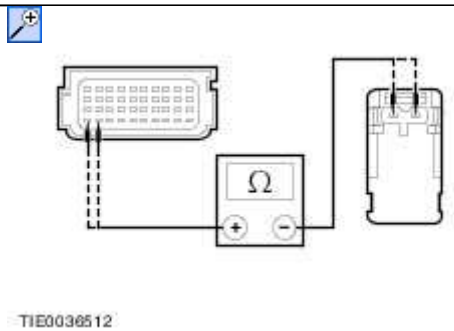
	No GO to Y3.
Y2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Driver Safety Belt Pretensioner Simulator.
	3 Connect Driver Safety Belt Pretensioner Electrical Connector C5R120.
	4 Ignition switch in position II.
	5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
Y3: CHECK THE DRIVER SAFETY BELT PRETENSIONER FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 1, circuit RR120A (BN/GN), harness side and the driver safety belt pretensioner C5R120 pin 1, circuit RR120A (BN/GN), harness side. • RCM C3R114 pin 2, circuit CR120A (BU/OG), harness side and the driver safety belt pretensioner C5R120 pin 2, circuit CR120A (BU/OG), harness side.
	Are the resistances less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR120A (BN/GN) or circuit CR120A (BU/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST Z : DTC B0070 19: DRIVER SAFETY BELT PRETENSIONER CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Z1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	

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	1 Deactivate the SRS. 2 Disconnect RCM C3R114. 3 Disconnect Driver Safety Belt Pretensioner Simulator. 4 Disconnect Inoperative Air Bag Module Simulator. NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 1, circuit RR120A (BN/GN), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 2, circuit CR120A (BU/OG), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AA : DTC B0070 1A: DRIVER SAFETY BELT PRETENSIONER LOW RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AA1: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AA2. **No** GO to AA3.
AA2: PROVE OUT THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Ignition switch in position 0. 2 Disconnect Driver Safety Belt Pretensioner Simulator. 3 Connect Driver Safety Belt Pretensioner Electrical Connector C5R120. 4 Ignition switch in position II. 5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

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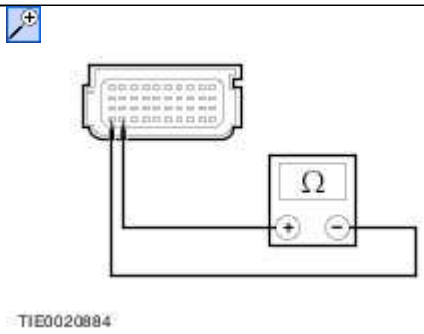
	REACTIVATE the system.

AA3: CHECK THE DRIVER SAFETY BELT PRETENSIONER CIRCUIT FOR LOW RESISTANCE

	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the RCM C3R114 pin 1, circuit RR120A (BN/GN), harness side and the RCM C3R114 pin 2, circuit CR120A (BU/OG), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR120A (BU/OG) or circuit RR120A (BN/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AB : DTC B0072 11: PASSENGER SAFETY BELT PRETENSIONER SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AB1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AB2. **No** GO to AB3.
AB2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Safety Belt Pretensioner Simulator.
	3 Connect Passenger Safety Belt Pretensioner Electrical Connector C6R122.
	4 Ignition switch in position II.
	5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs.

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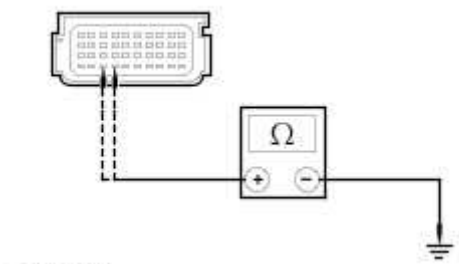
	REACTIVATE the system. **No** INSTALL a new passenger safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AB3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 3, circuit CR122A (WH/OG), harness side and ground. • RCM C3R114 pin 4, circuit RR122A (BN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR122A (WH/OG) or circuit RR122A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AC : DTC B0072 12: PASSENGER SAFETY BELT PRETENSIONER SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position 0.
	3 Disconnect RCM C3R114.
	4 Disconnect Passenger Safety Belt Pretensioner Simulator.
	5 Ignition switch in position II.
	6 Measure the voltage between the: • RCM C3R114 pin 3, circuit CR122A (WH/OG), harness side and ground. • RCM C3R114 pin 4, circuit RR122A (BN), harness side and ground.

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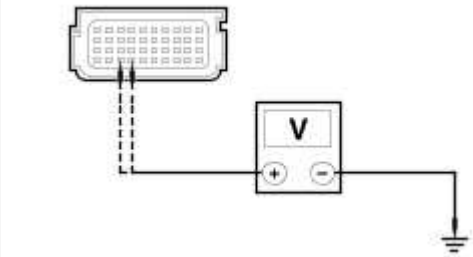

Does the system prove out correctly?

Yes

REPAIR circuit CR122A (WH/OG) or circuit RR122A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AD : DTC B0072 13: PASSENGER SAFETY BELT PRETENSIONER OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AD1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AD2. **No** GO to AD3.
AD2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT	
	1 Ignition switch in position 0.
	2 Disconnect Passenger Safety Belt Pretensioner Simulator.
	3 Connect Passenger Safety Belt Pretensioner Electrical Connector C6R122.
	4 Ignition switch in position II.
	5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

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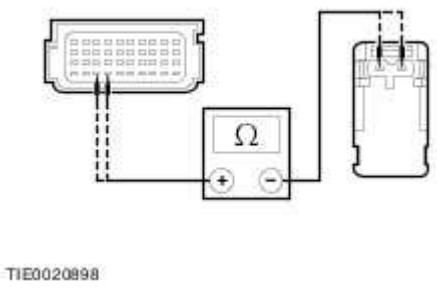
AD3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER FOR OPEN CIRCUIT OR HIGH RESISTANCE

	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 3, circuit CR122A (WH/OG), harness side and the passenger safety belt pretensioner C6R122 pin 1, circuit CR122A (WH/OG), harness side. • RCM C3R114 pin 4, circuit RR122A (BN), harness side and the passenger underseat occupant restraint systems electrical connector C6R122 pin 2, circuit RR122A (BN), harness side.
	Are the resistances less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit circuit CR122A (WH/OG) or circuit RR122A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AE : DTC B0072 19: PASSENGER SAFETY BELT PRETENSIONER CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

AE1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Safety Belt Pretensioner Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 3, circuit CR122A (WH/OG), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 4, circuit RR122A (BN), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AF : DTC B0072 1A: PASSENGER SAFETY BELT PRETENSIONER LOW RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

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AF1: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

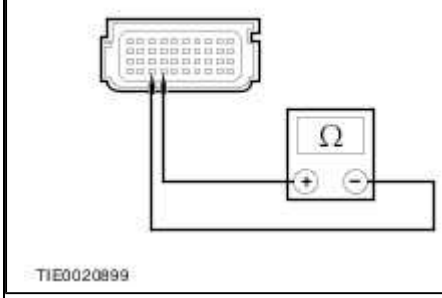
NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AF2. **No** GO to AF3.

AF2: PROVE OUT THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT

	1 Ignition switch in position 0.
	2 Disconnect Passenger Safety Belt Pretensioner Simulator.
	3 Connect Passenger Safety Belt Pretensioner Electrical Connector C6R122.
	4 Ignition switch in position II.
	5 Carry out the self-test.
	Does the system prove out correctly? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger safety belt retractor and pretensioner. REFER to: Front Safety Belt Retractor and Pretensioner (501-20A Safety Belt System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

AF3: CHECK THE PASSENGER SAFETY BELT PRETENSIONER CIRCUIT FOR LOW RESISTANCE

	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Safety Belt Pretensioner Simulator.
	4 Measure the resistance between the RCM C3R114 pin 3, circuit CR122A (WH/OG), harness side and the RCM C3R114 pin 4, circuit RR122A (BN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No**

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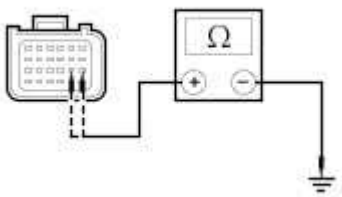
	REPAIR circuit CR122A (WH/OG) and circuit RR122A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AG : DTC B0094 11: FRONT CRASH SENSOR CIRCUIT SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AG1: CHECK THE CRASH SENSOR FOR A SHORT TO GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Crash Sensor C1R213.
	3 Disconnect RCM C2R114-A.
 TIE0020920	4 Measure the resistance between the: • RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and ground. • RCM C2R114-A pin 14, circuit VR213A (VT/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR129A (YE/GY) or circuit VR213A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AH : DTC B0094 12: FRONT CRASH SENSOR CIRCUIT SHORT TO BATTERY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AH1: CHECK THE CRASH SENSOR FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Crash Sensor C1R213.
	3 Disconnect RCM C2R114-A.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and ground. • RCM C2R114-A pin 14, circuit VR213A (VT/GN), harness side and ground.

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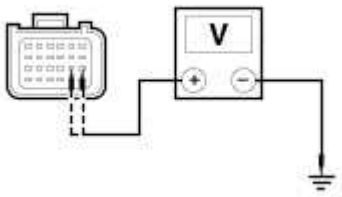

Is any voltage present?

Yes

REPAIR circuit RR129A (YE/GY) or circuit VR213A (VT/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AI : DTC B0094 19: CRASH SENSOR CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

AI1: CHECK THE CRASH SENSOR CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1	Deactivate the SRS.
2	Disconnect RCM C2R114-A.
3	Disconnect Crash Sensor C1R213.
4	Disconnect Inoperative Air Bag Module Simulator.

NOTE: Refer to the Wiring Diagrams for pin detail.

5 Measure the resistance between the:

- RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the inoperative sensor circuits.
- RCM C2R114-A pin 14, circuit VR213A (VT/GN), harness side and the inoperative sensor circuits.

Are the resistances greater than 10,000 ohms?

Yes

REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

No

REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AJ : DTC B0094 87: FRONT CRASH SENSOR COMMUNICATIONS FAULT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

AJ1: CHECK THE CRASH SENSOR CIRCUIT

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

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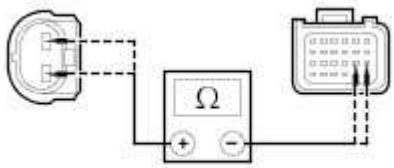
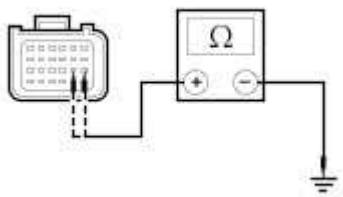
	1 Deactivate the SRS. 2 Disconnect Crash Sensor C1R213. 3 Disconnect RCM C2R114-A.
 TIE0036507	4 Measure the resistance between the: • RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the crash sensor C1R213 pin 2, circuit RR129A (YE/GY), harness side. • RCM C2R114-A pin 14, circuit VR213A (VT/GN), harness side and the crash sensor C1R213 pin 1, circuit VR213A (VT/GN), harness side.
	Are the resistances less than 5 ohms? **Yes** GO to AJ2. **No** REPAIR circuit VR213A (VT/GN) or circuit RR129A (YE/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AJ2: CHECK THE CRASH SENSOR FOR A SHORT CIRCUIT TO GROUND	
 TIE0020920	1 Measure the resistance between the: • RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and ground. • RCM C2R114-A pin 14, circuit VR213A (VT/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** INSTALL a new crash sensor. REFER to: Crash Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit VR213A (VT/GN) or circuit RR129A (YE/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AK : DTC B00D5 12: PAD INDICATOR SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AK1: CHECK THE PAD INDICATOR TO RCM CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Disconnect PAD Indicator C2R224-A. 3 Disconnect RCM C2R114-A. 4 Ignition switch in position II.

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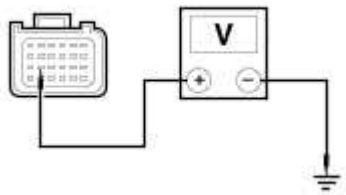
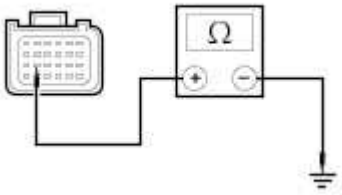
 TIE0036497	5 Measure the voltage between the RCM C2R114-A pin 17, circuit CR116A (GN/WH), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR116A (GN/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new PAD indicator. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AL : DTC B00D5 14: PAD INDICATOR SHORT TO GROUND OR OPEN CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AL1: CHECK FOR CONTINUITY BETWEEN THE RCM AND GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Disconnect PAD Indicator C2R224-A.
 TIE0038192	4 Measure the resistance between the RCM C2R114-A pin 17, circuit CR116A (GN/WH), harness side and ground.
	Is the resistance greater than 10,000 ohms? **Yes** GO to AL2. **No** REPAIR circuit CR116A (GN/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AL2: CHECK FOR CONTINUITY BETWEEN THE PAD INDICATOR AND THE RCM	
	1 Measure the resistance between the RCM C2R114-A pin 17, circuit CR116A (GN/WH), harness side and the PAD indicator C2R224-A pin 4, circuit CR116A (GN/WH), harness side.

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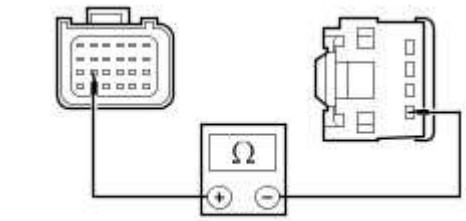
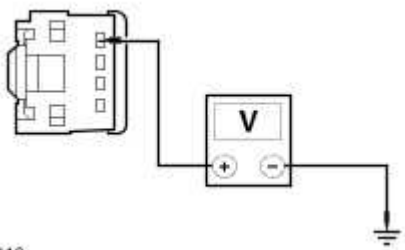
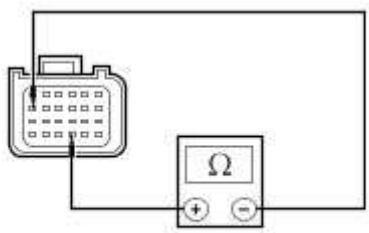
 E75418	
	Is the resistance less than 5 ohms? **Yes** GO to AL3. **No** REPAIR circuit CR116A (GN/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AL3: CHECK THE PAD INDICATOR SUPPLY CIRCUIT	
	1 Ignition switch in position II.
 E75419	2 Measure the voltage between the PAD indicator C2R224-A pin 1, circuit CBP04N (VT), harness side and ground.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new PAD indicator. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CBP04N (VT). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AM : DTC B00DF 01: PAD SWITCH	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AM1: CHECK THE PAD SWITCH CIRCUIT FOR LOW RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
 E75420	3 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the RCM C2R114-A pin 21, circuit CR225A (YE), harness side.

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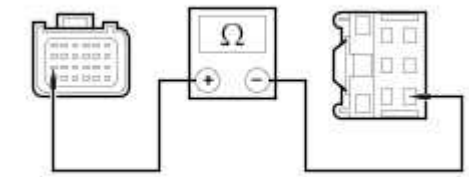
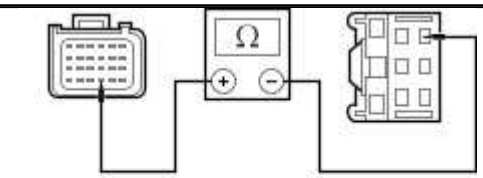
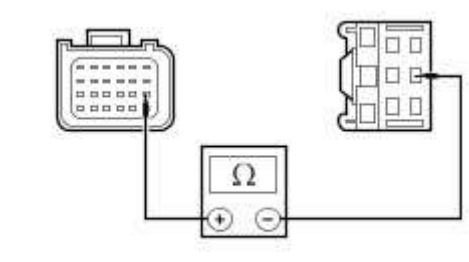
	Is the resistance greater than 10,000 ohms? **Yes** GO to AM2. **No** GO to AM5.
AM2: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH - ACTIVATION CIRCUIT	
	1 Disconnect PAD Switch C2R224-B.
 TIE0036491	2 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the PAD switch C2R224-B pin 6, circuit CR224A (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to AM3. **No** REPAIR circuit CR224A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AM3: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH - DEACTIVATION CIRCUIT	
 E0036492	1 Measure the resistance between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and the PAD switch C2R224-B pin 4, circuit CR225A (YE), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to AM4. **No** REPAIR circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AM4: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH - COMMON CIRCUIT	
 E75421	1 Measure the resistance between the RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the PAD switch C2R224-B pin 5, circuit RR129C (YE/GY), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new PAD switch. REFER to: Passenger Air Bag Deactivation (PAD) Switch (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs.

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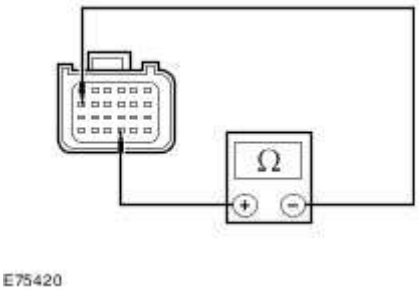
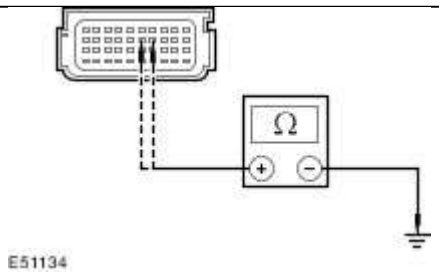
	REACTIVATE the system. **No** REPAIR circuit RR129C (YE/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AM5: CHECK THE PAD SWITCH CIRCUIT FOR LOW RESISTANCE	
	1 Disconnect PAD Switch C2R224-B.
	2 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the RCM C2R114-A pin 21, circuit CR225A (YE), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new PAD switch. REFER to: Passenger Air Bag Deactivation (PAD) Switch (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR224A (GN) and circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AN : DTC B10FD 11: DRIVER SIDE IMPACT SENSOR SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AN1: CHECK THE DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Measure the resistance between the: • RCM C3R114 pin 26, circuit VR217A (GY/YE), harness side and ground. • RCM C3R114 pin 27, circuit RR131A (VT/GY), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** GO to AN2. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AN2: PROVE OUT THE DRIVER SIDE IMPACT SENSOR	
	1 Disconnect Driver Side Impact Sensor C5R217.

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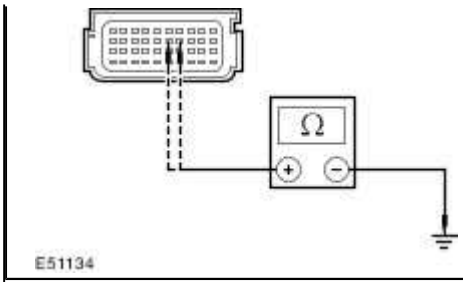
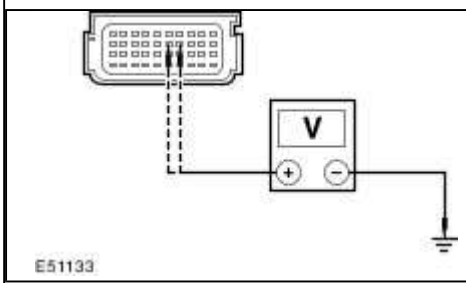
	2 Measure the resistance between the: • RCM C3R114 pin 26, circuit VR217A (GY/YE), harness side and ground. • RCM C3R114 pin 27, circuit RR131A (VT/GY), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** REPAIR circuit VR217A (GY/YE) or circuit RR131A (VT/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AO : DTC B10FD 12: DRIVER SIDE IMPACT SENSOR SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AO1: CHECK THE DRIVER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Impact Sensor C5R217.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 26, circuit VR217A (GY/YE), harness side and ground. • RCM C3R114 pin 27, circuit RR131A (VT/GY), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit VR217A (GY/YE) or circuit RR131A (VT/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AP : DTC B10FD 19: DRIVER SIDE IMPACT SENSOR CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AP1: CHECK THE DRIVER SIDE IMPACT SENSOR CIRCUITS	

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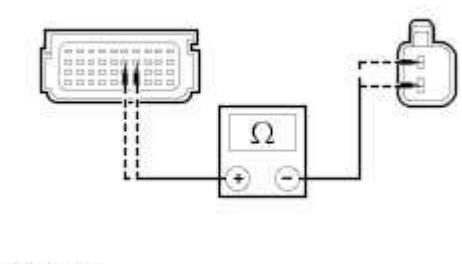
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Impact Sensor C5R217.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 26, circuit VR217A (GY/YE), harness side and the inoperative sensor circuits. • RCM C3R114 pin 27, circuit RR131A (VT/GY), harness side and the inoperative sensor circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AQ : DTC B10FD 87: DRIVER SIDE IMPACT SENSOR COMMUNICATIONS FAULT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AQ1: CHECK THE DRIVER SIDE IMPACT SENSOR CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Impact Sensor C5R217.
	4 Measure the resistance between the: • RCM C3R114 pin 26, circuit VR217A (GY/YE), harness side and the left-hand side impact sensor C5R217 pin 1, circuit VR217A (GY/YE), harness side. • RCM C3R114 pin 27, circuit RR131A (VT/GY), harness side and the left-hand side impact sensor C5R217 pin 2, circuit RR131A (VT/GY), harness side.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new driver side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No**

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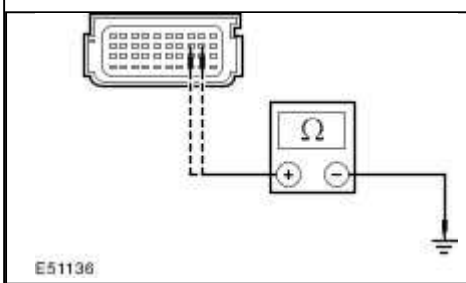
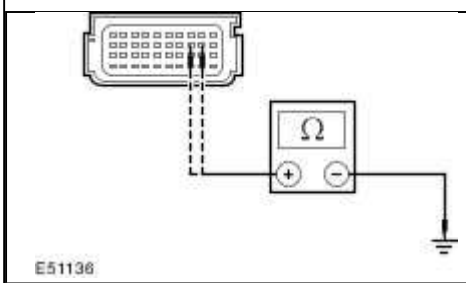
	REPAIR circuit RR131A (VT/GY) or circuit VR217A (GY/YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AR : DTC B10FE 11: PASSENGER SIDE IMPACT SENSOR SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AR1: CHECK THE PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR SHORT TO GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Measure the resistance between the: • RCM C3R114 pin 28, circuit RR132A (BU/WH), harness side and ground. • RCM C3R114 pin 29, circuit VR218A (YE/OG), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** GO to AR2. **No** REPAIR circuit RR132A (BU/WH) or circuit VR218A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AR2: PROVE OUT THE PASSENGER SIDE IMPACT SENSOR	
	1 Disconnect Passenger Side Impact Sensor C6R218.
	2 Measure the resistance between the: • RCM C3R114 pin 28, circuit RR132A (BU/WH), harness side and ground. • RCM C3R114 pin 29, circuit VR218A (YE/OG), harness side and ground.
	Are the resistances less than 5 ohms? **Yes** REPAIR circuit VR218A (YE/OG) or circuit RR132A (BU/WH). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AS : DTC B10FE 12: PASSENGER SIDE IMPACT SENSOR SHORT TO BATTERY

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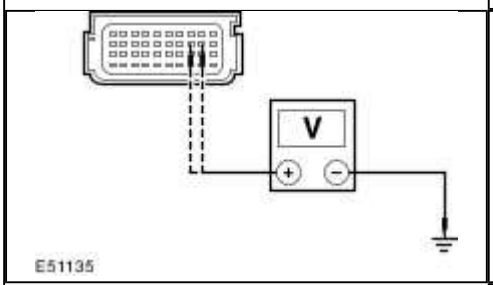
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AS1: CHECK THE PASSENGER SIDE IMPACT SENSOR CIRCUITS FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Impact Sensor C6R218.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 28, circuit RR132A (BU/WH), harness side and ground. • RCM C3R114 pin 29, circuit VR218A (YE/OG), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit RR132A (BU/WH) or circuit VR218A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AT : DTC B10FE 19: PASSENGER SIDE IMPACT SENSOR CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AT1: CHECK THE PASSENGER SIDE IMPACT SENSOR CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Impact Sensor C6R218.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 28, circuit RR132A (BU/WH), harness side and the inoperative sensor circuits. • RCM C3R114 pin 29, circuit VR218A (YE/OG), harness side and the inoperative sensor circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs.

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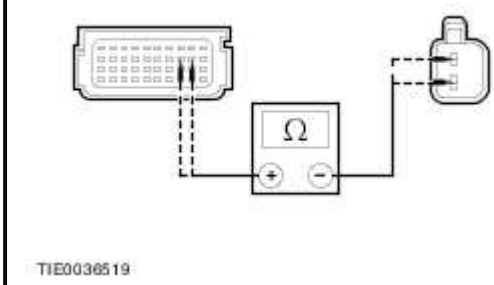
	REACTIVATE the system.

PINPOINT TEST AU : DTC B10FE 87: PASSENGER SIDE IMPACT SENSOR COMMUNICATIONS FAULT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AU1: CHECK THE PASSENGER SIDE IMPACT SENSOR CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Disconnect RCM C3R114. 3 Disconnect Passenger Side Impact Sensor C6R218.
	4 Measure the resistance between the: • RCM C3R114 pin 28, circuit RR132A (BU/WH), harness side and the passenger side impact sensor C6R218 pin 2, circuit RR132A (BU/WH), harness side. • RCM C3R114 pin 29, circuit VR218A (YE/OG), harness side and the passenger side impact sensor C6R218 pin 1, circuit VR218A (YE/OG), harness side.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new passenger side impact sensor. REFER to: Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR132A (BU/WH) or circuit VR218A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AV : DTC B1126 11: DRIVER SIDE AIR BAG CIRCUIT SHORT TO GROUND.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AV1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AV2. **No**

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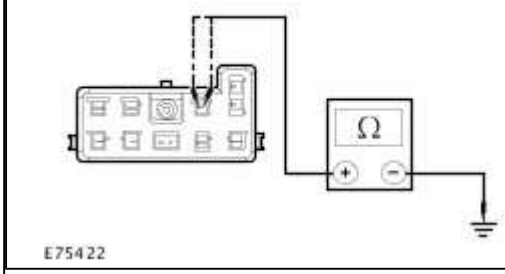
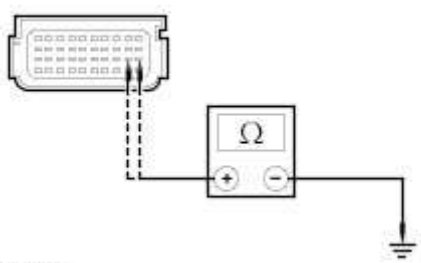
	GO to AV3.
AV2: CHECK THE DRIVER SIDE AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Ignition switch in position 0.
	2 Select DMM specific on the Ford approved diagnostic tool.
 E75422	3 Measure the resistance between the: • Driver side air bag module underseat connector C33-L pin 5, circuit CR105A (GN/BU), component side and ground. • Driver side air bag module underseat connector C33-L pin 6, circuit RR105A (GY/YE), component side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
AV3: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR A SHORT TO GROUND.	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Underseat Occupant Restraint Systems Simulator.
 TIE0022428	4 Measure the resistance between the: • RCM C3R114 pin 19, circuit RR105A (GY/YE), harness side and ground. • RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR105A (GN/BU) or circuit RR105A (GY/YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AW : DTC B1126 12: DRIVER SIDE AIR BAG CIRCUIT SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AW1: CHECK THE DRIVER AIR BAG CIRCUIT	

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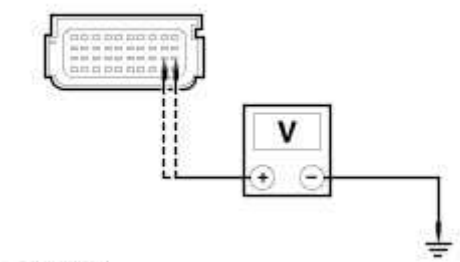
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** INSTALL a new driver side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to AW2.

AW2: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR A SHORT TO BATTERY

	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Underseat Occupant Restraint Systems Simulator.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 19, circuit RR105A (GY/YE), harness side and ground. • RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR105A (GN/BU) or circuit RR105A (GY/YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AX : DTC B1126 13: DRIVER SIDE AIR BAG CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

AX1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.

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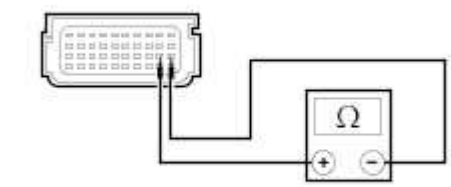
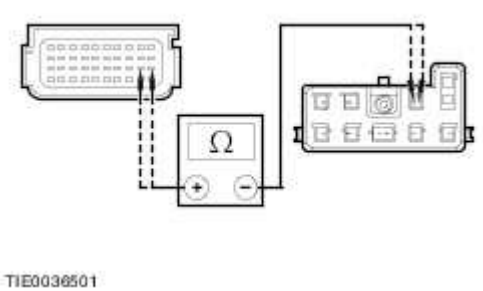
	2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed. Does the system prove out correctly? **Yes** GO to AX2. **No** GO to AX3.
AX2: CHECK THE DRIVER SIDE AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Ignition switch in position 0. 2 Select DMM specific on the Ford approved diagnostic tool. 3 Disconnect RCM C3R114.
 TIE0036502	4 Measure the resistance between the RCM C3R114 pin 19, circuit RR105A (GY/YE) and the RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to AX3.
AX3: CHECK THE DRIVER SIDE AIR BAG FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Ignition switch in position 0. 2 Disconnect RCM C3R114. 3 Disconnect Driver Side Underseat Occupant Restraint Systems Simulator.
 TIE0036501	4 Measure the resistance between the: • RCM C3R114 pin 19, circuit RR105A (GY/YE), harness side and the driver side underseat occupant restraint systems electrical connector C33-L pin 6, circuit RR105A (GY/YE), harness side. • RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side and the driver side underseat occupant restraint systems electrical connector C33-L pin 5, circuit CR105A (GN/BU), harness side.
	Are the resistances less than 5 ohms? **Yes** INSTALL a new driver side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

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	No REPAIR circuit CR105A (GN/BU) or circuit RR105A (GY/YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AY : DTC B1126 19: DRIVER SIDE AIR BAG CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AY1: CHECK THE DRIVER SIDE AIR BAG CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Underseat Occupant Restraint Systems Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 19, circuit RR105A (GY/YE), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST AZ : DTC B1126 1A: DRIVER SIDE AIR BAG CIRCUIT LOW RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AZ1: CHECK THE DRIVER SIDE AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to AZ2. **No** GO to AZ3.
AZ2: CHECK THE DRIVER SIDE AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic	

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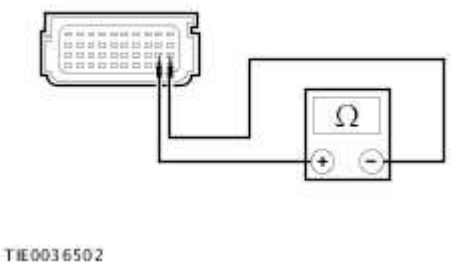
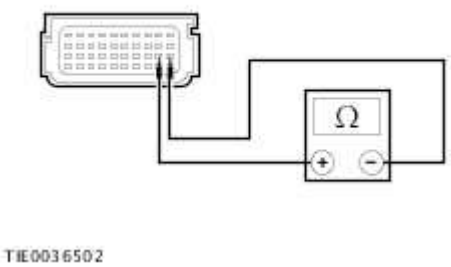
tool. Failure to follow this instruction may result in personal injury.

	1 Ignition switch in position 0. 2 Select DMM specific on the Ford approved diagnostic tool. 3 Disconnect RCM C3R114.
	4 Measure the resistance between the RCM C3R114 pin 19, circuit RR105A (GY/YE) and the RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to AZ3.
AZ3: CHECK THE DRIVER SIDE AIR BAG CIRCUIT FOR LOW RESISTANCE	
	1 Ignition switch in position 0. 2 Disconnect RCM C3R114. 3 Disconnect Driver Side Underseat Occupant Restraint Systems Simulator.
	4 Measure the resistance between the RCM C3R114 pin 19, circuit RR105A (GY/YE) and the RCM C3R114 pin 20, circuit CR105A (GN/BU), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new driver side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR105A (GN/BU) and circuit RR105A (GY/YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BA : DTC B1127 11: PASSENGER SIDE AIR BAG CIRCUIT SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BA1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the	

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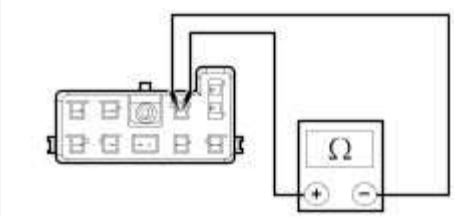
SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

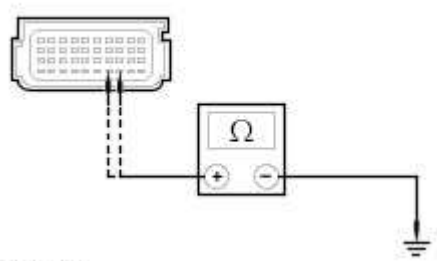
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with simulators installed. Does the system prove out correctly? **Yes** GO to BA2. **No** GO to BA3.

BA2: CHECK THE PASSENGER SIDE AIR BAG MODULE

WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.

	1 Ignition switch in position 0. 2 Select DMM specific on the Ford approved diagnostic tool.
 E75424	3 Measure the resistance between the passenger side air bag module underseat connector C33-M pin 5, circuit CR106A (VT/GY), component side and the passenger side air bag module underseat connector C33-M pin 6, circuit RR106A (YE/OG), component side.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

BA3: CHECK THE PASSENGER SIDE AIR BAG FOR A SHORT TO GROUND

	1 Ignition switch in position 0. 2 Disconnect RCM C3R114. 3 Passenger Side Underseat Occupant Restraint Systems Simulator
 TIE0036504	4 Measure the resistance between the: • RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and ground. • RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

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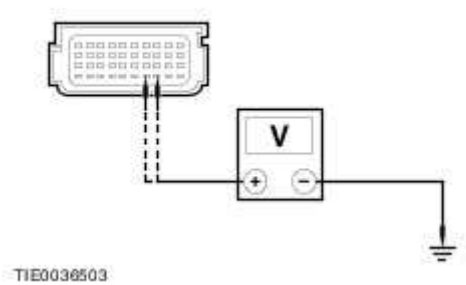
	No REPAIR circuit CR106A (VT/GY) or circuit RR106A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BB : DTC 1127 12: PASSENGER SIDE AIR BAG CIRCUIT SHORT TO BATTERY.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BB1: CHECK THE PASSENGER AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with simulators installed.
	Does the system prove out correctly? **Yes** INSTALL a new passenger side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to BB2.
BB2: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR A SHORT TO BATTERY	
	1 Ignition switch in position 0. 2 Disconnect RCM C3R114. 3 Disconnect Passenger Side Underseat Occupant Restraint Systems Simulator. 4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and ground. • RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR106A (VT/GY) or circuit RR106A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BC : DTC B1127 13: PASSENGER SIDE AIR BAG CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BC1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	

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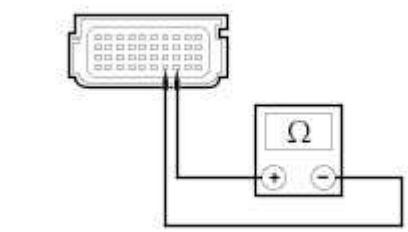
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

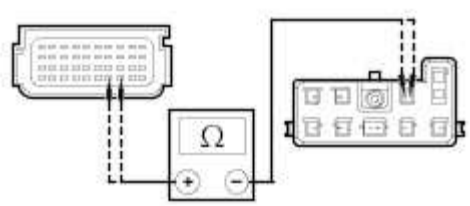
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BC2. **No** GO to BC3.

BC2: CHECK THE PASSENGER SIDE AIR BAG MODULE

WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury

	1 Ignition switch in position 0. 2 Select DMM specific on the Ford approved diagnostic tool. 3 Disconnect RCM C3R114.
 TIE0036506	4 Measure the resistance between the RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and the RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to BC3.

BC3: CHECK THE PASSENGER SIDE AIR BAG FOR OPEN CIRCUIT OR HIGH RESISTANCE

	1 Ignition switch in position 0. 2 Disconnect RCM C3R114. 3 Disconnect Passenger Side Underseat Occupant Restraint Systems Simulator.
 TIE0036505	4 Measure the resistance between the: • RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and the passenger side underseat occupant restraint systems electrical connector C6R122 pin 5, circuit CR106A (VT/GY), harness side. • RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side and the passenger side underseat occupant restraint systems electrical connector C6R122 pin 6, circuit RR106A (YE/OG), harness side.

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	Are the resistances less than 5 ohms? **Yes** INSTALL a new passenger side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR106A (VT/GY) or circuit RR106A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BD : DTC B1127 19: PASSENGER SIDE AIR BAG CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BD1: CHECK THE PASSENGER SIDE AIR BAG CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Underseat Occupant Restraint Systems Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 5 Measure the resistance between the: • RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BE : DTC B1127 1A: PASSENGER SIDE AIR BAG CIRCUIT LOW RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BE1: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly?

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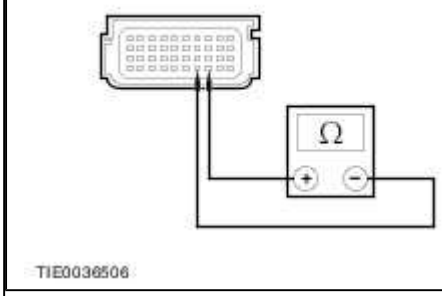
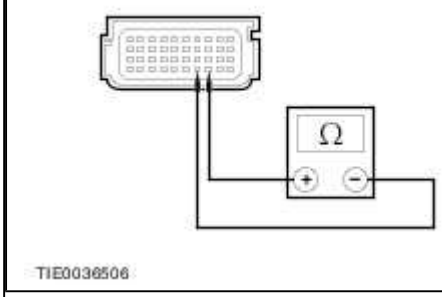
	Yes GO to BE2. **No** GO to BE3.
BE2: CHECK THE PASSENGER SIDE AIR BAG MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Ignition switch in position 0.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Disconnect RCM C3R114.
	4 Measure the resistance between the RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and the RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to BE3.
BE3: CHECK THE PASSENGER SIDE AIR BAG CIRCUIT FOR LOW RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Underseat Occupant Restraint Systems Simulator.
	4 Measure the resistance between the RCM C3R114 pin 7, circuit CR106A (VT/GY), harness side and the RCM C3R114 pin 8, circuit RR106A (YE/OG), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** INSTALL a new passenger side air bag module. REFER to: Side Air Bag Module (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR106A (VT/GY) and circuit RR106A (YE/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BF : DTC B1128 11: DRIVER SIDE AIR CURTAIN CIRCUIT

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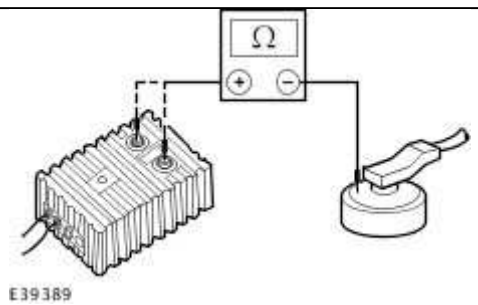
SHORT TO GROUND

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BF1: CHECK THE DRIVER SIDE AIR CURTAIN CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BF2. **No** GO to BF3.
BF2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver side air curtain module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance between each of the terminals and the driver side air curtain module casing.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BF3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Air Curtain Module Simulator.
	4 Measure the resistance between the:

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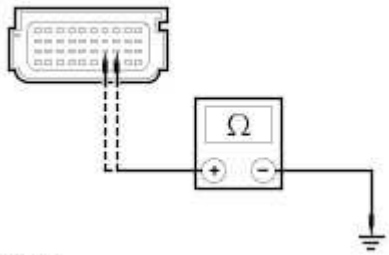
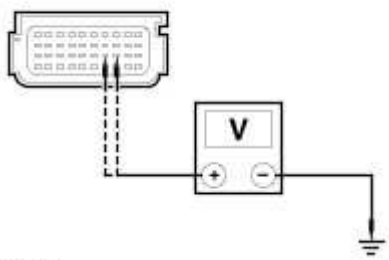
	• RCM C3R114 pin 17, circuit CR109A (BN/BU), harness side and ground. • RCM C3R114 pin 18, circuit RR109A (BU/GN), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit circuit CR109A (BN/BU) or circuit RR109A (BU/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BG : DTC B1128 12: DRIVER SIDE AIR CURTAIN CIRCUIT SHORT TO BATTERY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BG1: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Driver Side Air Curtain Module Simulator.
	3 Disconnect RCM C3R114.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 17, circuit CR109A (BN/BU), harness side and ground. • RCM C3R114 pin 18, circuit RR109A (BU/GN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit circuit CR109A (BN/BU) or circuit RR109A (BU/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** CONNECT the driver side air curtain module simulator and the RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BH : DTC B1128 13: DRIVER SIDE AIR CURTAIN CIRCUIT OPEN CIRCUIT

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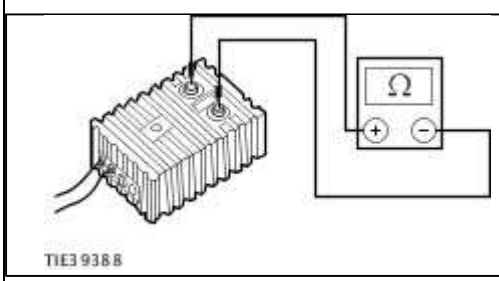
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BH1: CHECK THE DRIVER SIDE AIR CURTAIN CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BH2. **No** GO to BH3.
BH2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the driver side air curtain module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the driver side air curtain module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BH3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Air Curtain Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 17, circuit CR109A (BN/BU), harness side and the driver side air curtain module C5R109 pin 2, circuit CR109A (BN/BU), harness side.

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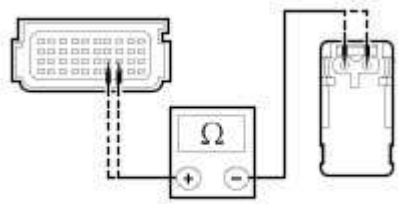	• RCM C3R114 pin 18, circuit RR109A (BU/GN), harness side and the driver side air curtain module C5R109 pin 1, circuit RR109A (BU/GN), harness side.
	Are the resistances less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR109A (BN/BU) or circuit RR109A (BU/GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BI : DTC B1128 19: DRIVER SIDE AIR CURTAIN CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BI1: CHECK THE DRIVER SIDE AIR CURTAIN CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C3R114.
	3 Disconnect Driver Side Air Curtain Module Simulator.
	4 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. **5** Measure the resistance between the: • RCM C3R114 pin 17, circuit CR109A (BN/BU), harness side and the inoperative air bag module circuits. • RCM C3R114 pin 18, circuit RR109A (BU/GN), harness side and the inoperative air bag module circuits.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BJ : DTC B1128 1A: DRIVER SIDE AIR CURTAIN CIRCUIT LOW RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BJ1: CHECK THE DRIVER SIDE AIR CURTAIN MODULE CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	

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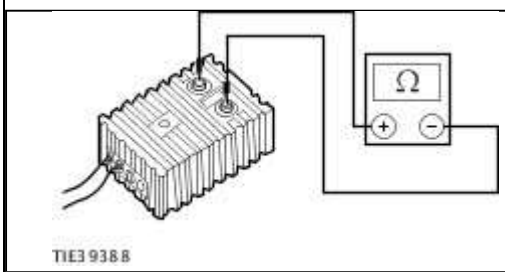
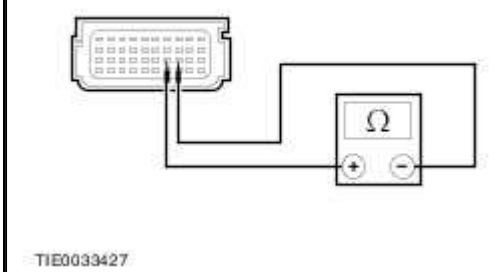
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed. Does the system prove out correctly? **Yes** GO to BJ2. **No** GO to BJ3.
BJ2: CHECK THE DRIVER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
	1 Connect the test and deployment lead to the driver side air curtain module. 2 Select DMM specific on the Ford approved diagnostic tool. 3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the driver side air curtain module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new driver side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BJ3: CHECK THE DRIVER SIDE AIR CURTAIN WIRING HARNESS FOR LOW RESISTANCE	
	1 Ignition switch in position 0. 2 Disconnect Driver Side Air Curtain Simulator. 3 Disconnect RCM C3R114.
	4 Measure the resistance between the RCM C3R114 pin 17, circuit CR109A (BN/BU), harness side and the RCM C3R114 pin 18, circuit RR109A (BU/GN), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit circuit CR109A (BN/BU) and circuit RR109A (BU/GN). REPEAT the self-test, CLEAR

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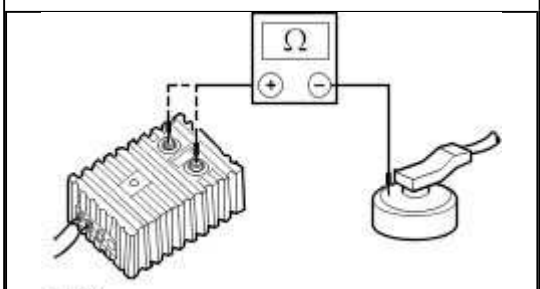
	the DTCs. REACTIVATE the system.

PINPOINT TEST BK : DTC B1129 11: PASSENGER SIDE AIR CURTAIN CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BK1: CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BK2. **No** GO to BK3.
BK2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE	
WARNING: Do not proceed with the test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the passenger side air curtain module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance between each of the terminals and the passenger side air curtain module casing.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BK3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO GROUND	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Air Curtain Module

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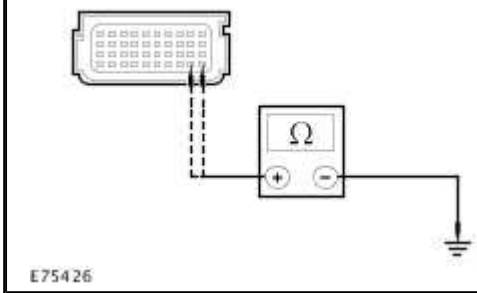
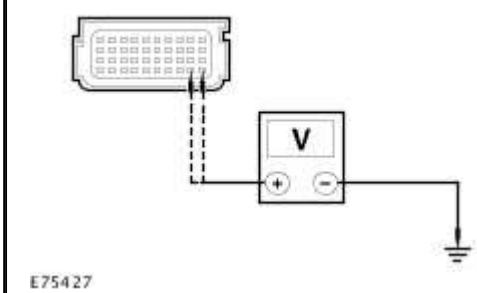
	Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 9, circuit RR111A (YE/VT), harness side and ground. • RCM C3R114 pin 10, circuit CR111A (BN/WH), harness side and ground.
	Are the resistances greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR111A (BN/WH) or circuit RR111A (YE/VT). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BL : DTC B1129 12: PASSENGER SIDE AIR CURTAIN CIRCUIT SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BL1: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR A SHORT TO BATTERY OR IGNITION	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect Passenger Side Air Curtain Module Simulator.
	3 Disconnect RCM C3R114.
	4 Ignition switch in position II.
	5 Measure the voltage between the: • RCM C3R114 pin 9, circuit RR111A (YE/VT), harness side and ground. • RCM C3R114 pin 10, circuit CR111A (BN/WH), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR111A (BN/WH) or circuit RR111A (YE/VT). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** CONNECT the passenger side air curtain module simulator and the RCM. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BM : DTC B1129 13: PASSENGER SIDE AIR CURTAIN CIRCUIT OPEN CIRCUIT	

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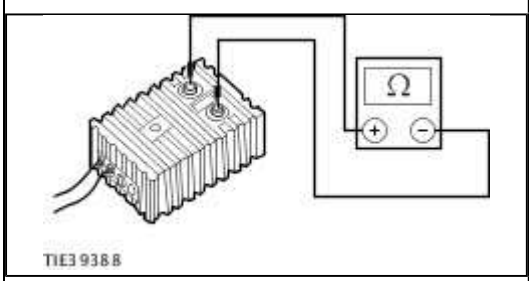
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BM1: CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUIT RESISTANCE	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Ignition switch in position II.
	3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BM2. **No** GO to BM3.
BM2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
WARNING: Do not proceed with this test unless using the Ford approved diagnostic tool. Failure to follow this instruction may result in personal injury.	
	1 Connect the test and deployment lead to the passenger side air curtain module.
	2 Select DMM specific on the Ford approved diagnostic tool.
	3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the passenger side air curtain module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BM3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR OPEN CIRCUIT OR HIGH RESISTANCE	
	1 Ignition switch in position 0.
	2 Disconnect RCM C3R114.
	3 Disconnect Passenger Side Air Curtain Module Simulator.
	4 Measure the resistance between the: • RCM C3R114 pin 9, circuit RR111A (YE/VT), harness side and the passenger side air curtain module C6R111 pin 2, circuit RR111A (YE/VT),

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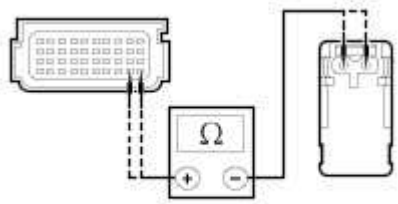

harness side.
- RCM C3R114 pin 10, circuit CR111A (BN/WH), harness side and the passenger side air curtain module C6R111 pin 1, circuit CR111A (BN/WH), harness side.

Are the resistances less than 5 ohms?
Yes
REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
No
REPAIR circuit CR111A (BN/WH) or circuit RR111A (YE/VT). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BN : DTC B1129 19: PASSENGER SIDE AIR CURTAIN CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

BN1: CHECK THE PASSENGER SIDE AIR CURTAIN CIRCUITS

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

1 Deactivate the SRS.

2 Disconnect RCM C3R114.

3 Disconnect Passenger Side Air Curtain Module Simulator.

4 Disconnect Inoperative Air Bag Module Simulator.

NOTE: Refer to the Wiring Diagrams for pin detail.

5 Measure the resistance between the:

- RCM C3R114 pin 11, circuit 91S-JA51 (BK/BU), harness side and the inoperative air bag module circuits.
- RCM C3R114 pin 12, circuit CR111A (BN/WH), harness side and the inoperative air bag module circuits.

Are the resistances greater than 10,000 ohms?
Yes
REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
No
REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BO : DTC B1129 1A: PASSENGER SIDE AIR CURTAIN CIRCUIT LOW RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

BO1: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE CIRCUIT RESISTANCE

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: Use a digital multimeter for all electrical measurements.

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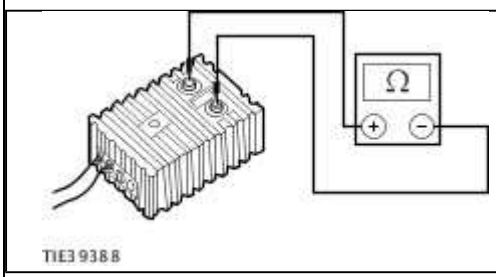
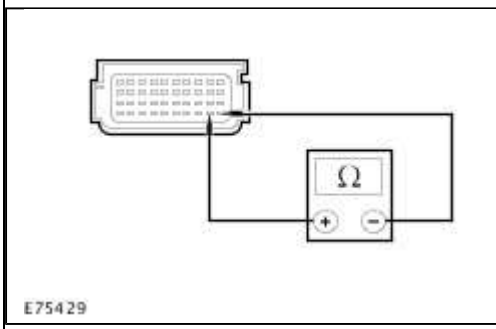
	1 Deactivate the SRS. 2 Ignition switch in position II. 3 Carry out the self-test with the simulators installed.
	Does the system prove out correctly? **Yes** GO to BO2. **No** GO to BO3.
BO2: CHECK THE PASSENGER SIDE AIR CURTAIN MODULE SQUIB RESISTANCE	
	1 Connect the test and deployment lead to the passenger side air curtain module. 2 Select DMM specific on the Ford approved diagnostic tool. 3 Connect the test and deployment lead to the Ford approved diagnostic tool.
	4 Measure the resistance of the passenger side air curtain module squib.
	Is the resistance between 2 and 3 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** INSTALL a new passenger side air curtain module. REFER to: Side Air Curtain Module - VIN Plate Body Style Code: S (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BO3: CHECK THE PASSENGER SIDE AIR CURTAIN WIRING HARNESS FOR LOW RESISTANCE	
	1 Ignition switch in position 0. 2 Disconnect Passenger Side Air Curtain Module Simulator. 3 Disconnect RCM C3R114.
	4 Measure the resistance between the RCM C3R114, pin 9, circuit RR111A (YE/VT), harness side and the RCM C3R114 pin 10 circuit CR111A (BN/WH), harness side.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR111A (BN/WH) and circuit RR111A (YE/VT). REPEAT the self-test, CLEAR the

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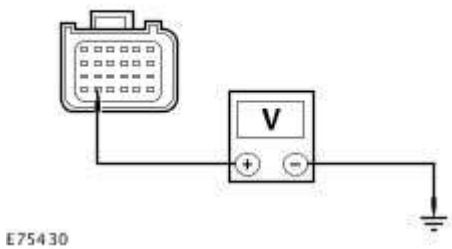
	DTCs. REACTIVATE the system.

PINPOINT TEST BP : DTC B1A55 12: EVENT NOTIFICATION SIGNAL CIRCUIT SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BP1: CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR A SHORT TO BATTERY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect CJB C1BP02-C.
	4 Ignition switch in position II.
	5 Measure the voltage between the RCM C2R114-A pin 23, circuit CR115A (BN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR115A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BQ : DTC B1A55 14: EVENT NOTIFICATION SIGNAL CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BQ1: CHECK THE EVENT NOTIFICATION SIGNAL CIRCUIT FOR A SHORT TO GROUND	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0.
	2 Disconnect RCM C2R114-A.
	3 Disconnect CJB C1BP02-C.
	4 Measure the resistance between the RCM C2R114-A pin 23, circuit CR115A (BN), harness side and ground.

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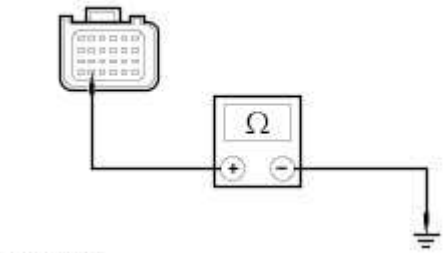
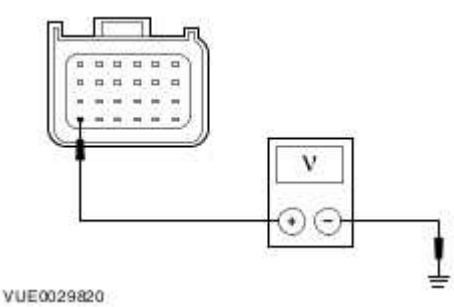


Is the resistance greater than 10,000 ohms?
Yes
REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
No
REPAIR circuit CR115A (BN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BR : DTC B1B69 16: BATTERY VOLTAGE LOW

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BR1: CHECK THE BATTERY VOLTAGE	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position II.
	2 Check the battery voltage with the ignition in the ON position.
	Is the battery voltage greater than 8 volts? **Yes** GO to BR2. **No** CHECK the battery and charging system. REPEAT the self-test, CLEAR the DTCs.
BR2: CHECK THE RCM SUPPLY CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
	1 Ignition switch in position 0.
	2 Deactivate the SRS.
	3 Disconnect RCM C2R114-A.
	4 Ignition switch in position II.
	5 Measure the voltage between the RCM C2R114-A pin 24, circuit CBP02A (GN), harness side.
	Is the voltage greater than 10 volts? **Yes** GO to BR3. **No** REPAIR circuit CBP02A (GN). REPEAT the self-

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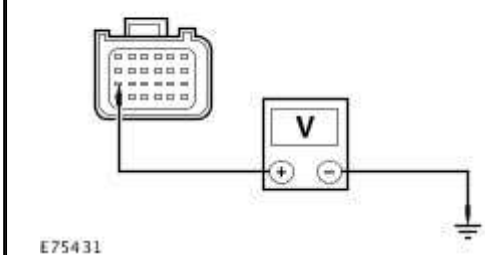
	test, CLEAR the DTCs. REACTIVATE the system.
BR3: CHECK THE RCM SUPPLY CIRCUIT	
	1 Disconnect Fuse 2.
	2 Measure the resistance between the RCM C2R114-A pin 24, circuit CBP02A (GN), harness side and fuse 2, harness side.
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CBP02A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BS : DTC B1D74 12: PAD SWITCH ENABLE CIRCUIT SHORT TO BATTERY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BS1: CHECK THE PAD SWITCH ENABLE CIRCUIT FOR A SHORT TO BATTERY OR IGNITION	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0.
	2 Deactivate the SRS.
	3 Disconnect RCM C2R114-A.
	4 Disconnect PAD Switch C2R224-B.
	5 Measure the voltage between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR224A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BT : DTC B1D74 13: PAD SWITCH ENABLE CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BT1: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: CHECK that the PAD switch is in the air bag live position before carrying out this	

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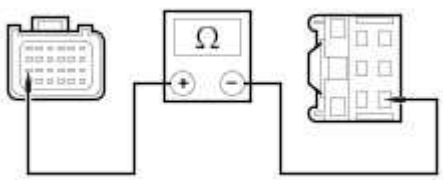
test.

	1 Ignition switch in position 0. 2 Deactivate the SRS. 3 Disconnect RCM C2R114-A. 4 Disconnect PAD Switch C2R224-B.
 TIE0036491	5 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the PAD switch C2R224-B pin 6, circuit CR224A (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR224A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BU : DTC B1D74 19: PAD SWITCH ENABLE CIRCUIT CROSS LINK TO ANOTHER FIRING CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BU1: CHECK THE PAD SWITCH CIRCUITS	
	WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.
	NOTE: Use a digital multimeter for all electrical measurements.
	1 Deactivate the SRS. 2 Disconnect RCM C2R114-A. 3 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 4 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the inoperative air bag module circuits.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BV : DTC B1D74 1A: PAD SWITCH ENABLE CIRCUIT SHORT CIRCUIT

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BV1: CHECK THE PAD SWITCH WIRING HARNESS FOR SHORT CIRCUIT	
	WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

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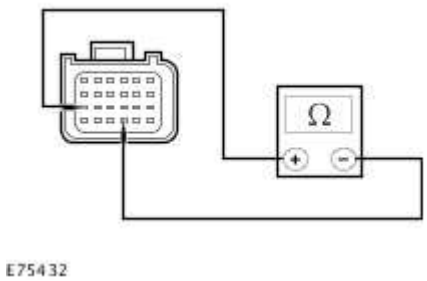
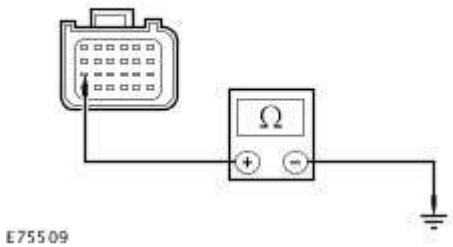
NOTE: Use a digital multimeter for all electrical measurements.

	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the RCM C2R114-A pin 21, circuit CR225A (YE), harness side.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit CR224A (GN) and circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to BV2.

BV2: CHECK THE PAD SWITCH WIRING HARNESS FOR A SHORT TO GROUND

	1 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR224A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BW : DTC B1D74 1E: PAD SWITCH ENABLE CIRCUIT RESISTANCE OUT OF RANGE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS

BW1: CHECK THE PAD SWITCH CIRCUIT FOR CONTINUITY

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

NOTE: CHECK that the PAD switch is in the air bag live position before carrying out this test.

	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Measure the resistance between the RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the RCM C2R114-A pin 18, circuit CR224A (GN), harness side.

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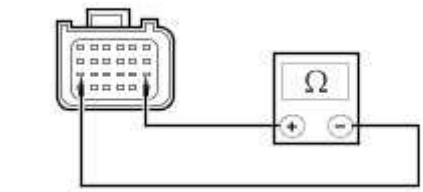
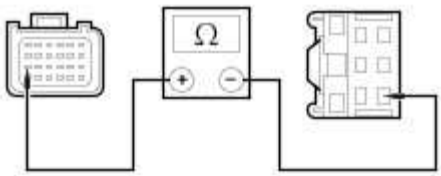
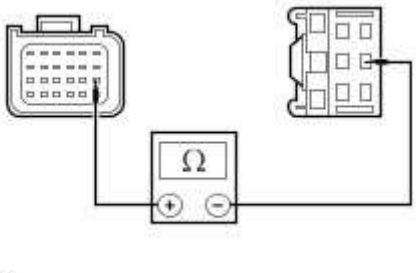
 E75433	
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to BW2.
BW2: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH	
	1 Disconnect PAD Switch C2R224-B.
 TIE0036491	2 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the PAD switch C2R224-B pin 6, circuit CR224A (GN), harness side.
	Is the resistance less than 5 ohms? **Yes** GO to BW3. **No** REPAIR circuit CR224A (GN). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
BW3: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH COMMON CIRCUIT	
 E75421	1 Measure the resistance between the RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the PAD switch C2R224-B pin 5, circuit RR129C (YE/GY), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new PAD switch. REFER to: Passenger Air Bag Deactivation (PAD) Switch (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR129C (YE/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BX : DTC B1D75 12: PAD SWITCH DISABLE CIRCUIT

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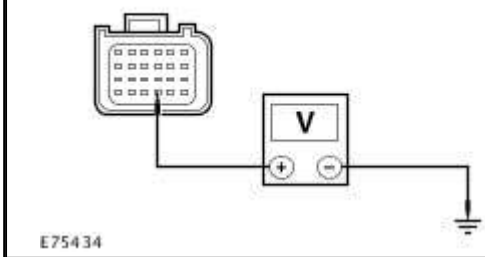
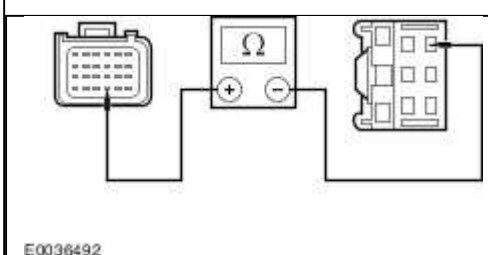
SHORT TO BATTERY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BX1: CHECK THE PAD SWITCH DISABLE CIRCUIT FOR A SHORT TO BATTERY OR IGNITION	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Ignition switch in position 0. 2 Deactivate the SRS. 3 Disconnect RCM C2R114-A. 4 Disconnect PAD Switch C2R224-B.
	5 Measure the voltage between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and ground.
	Is any voltage present? **Yes** REPAIR circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BY : DTC B1D75 13: PAD SWITCH DISABLE CIRCUIT OPEN CIRCUIT OR HIGH RESISTANCE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
BY1: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: CHECK that the PAD switch is in the air bag live position before carrying out this test.	
	1 Ignition switch in position 0. 2 Deactivate the SRS. 3 Disconnect RCM C2R114-A. 4 Disconnect PAD Switch C2R224-B.
	5 Measure the resistance between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and the PAD switch C2R224-B pin 4, circuit CR225A (YE), harness side.
	Is the resistance less than 5 ohms?

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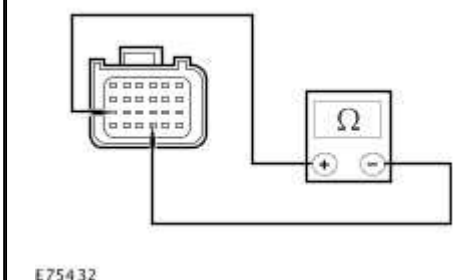
	Yes REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST BZ : DTC B1D75 19: PAD SWITCH DISABLE CIRCUIT CROSS LINK TO ANOTHER FIRING CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
BZ1: CHECK THE PAD SWITCH CIRCUITS	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Disconnect Inoperative Air Bag Module Simulator.
	NOTE: Refer to the Wiring Diagrams for pin detail. 4 Measure the resistance between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and the inoperative air bag module circuits.
	Is the resistance greater than 10,000 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR the circuits. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST CA : DTC B1D75 1A: PAD SWITCH DISABLE CIRCUIT SHORT CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
CA1: CHECK THE PAD SWITCH WIRING HARNESS FOR SHORT CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Measure the resistance between the RCM C2R114-A pin 18, circuit CR224A (GN), harness side and the RCM C2R114-A pin 21, circuit CR225A (YE), harness side.
	Is the resistance less than 5 ohms? **Yes** REPAIR circuit CR224A (GN) and circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs.

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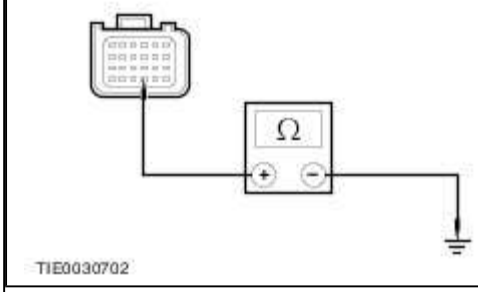
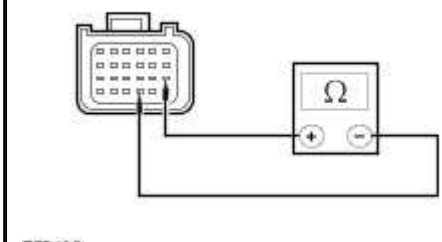
	REACTIVATE the system. **No** GO to CA2.
CA2: CHECK THE PAD SWITCH WIRING HARNESS FOR A SHORT TO GROUND	
 	1 Measure the resistance between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and ground.
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST CB : DTC B1D75 1E: PAD SWITCH DISABLE CIRCUIT RESISTANCE OUT OF RANGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
CB1: CHECK THE PAD SWITCH CIRCUIT FOR CONTINUITY	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: CHECK that the PAD switch is in the air bag live position before carrying out this test.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
 	3 Measure the resistance between the RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the RCM C2R114-A pin 21, circuit CR225A (YE), harness side.
	Is the resistance less than 5 ohms? **Yes** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** GO to CB2.
CB2: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH	
	1 Disconnect PAD Switch C2R224-B.
	2 Measure the resistance between the RCM C2R114-A pin 21, circuit CR225A (YE), harness side and the PAD switch C2R224-B pin 4, circuit CR225A (YE), harness side.

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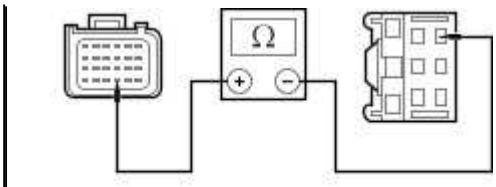
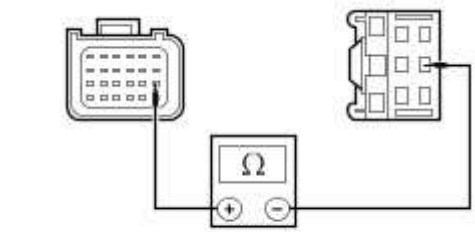
	
	Is the resistance less than 5 ohms? **Yes** GO to CB3. **No** REPAIR circuit CR225A (YE). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.
CB3: CHECK FOR CONTINUITY BETWEEN THE RCM AND THE PAD SWITCH COMMON CIRCUIT	
	1 Measure the resistance between the RCM C2R114-A pin 13, circuit RR129A (YE/GY), harness side and the PAD switch C2R224-B pin 5, circuit RR129C (YE/GY), harness side.
	Is the resistance less than 5 ohms? **Yes** INSTALL a new PAD switch. REFER to: Passenger Air Bag Deactivation (PAD) Switch (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPAIR circuit RR129C (YE/GY). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST CC : DTC U0010 88: CONTROL MODULE COMMUNICATION BUS OFF	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
CC1: CHECK THE RCM COMMUNICATION BUS CIRCUIT FOR A SHORT CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: Use a digital multimeter for all electrical measurements.	
	1 Deactivate the SRS.
	2 Disconnect RCM C2R114-A.
	3 Measure the resistance between the RCM C2R114-A pin 19, circuit VDB06AB (GY/OG), harness side and the RCM C2R114-A pin 20, circuit VDB07H (VT/OG), harness side.

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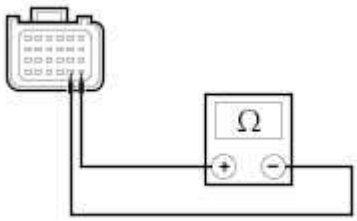
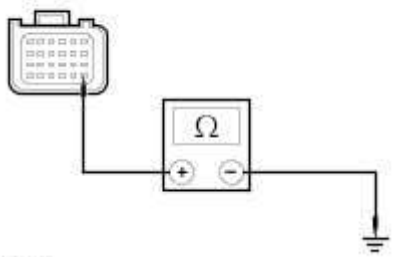


Is the resistance greater than 10,000 ohms?
Yes
GO to CC2.
No
REPAIR circuits VDB06AB (GY/OG) and VDB07H (VT/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

CC2: CHECK THE RCM COMMUNICATION BUS CIRCUIT FOR A SHORT CIRCUIT TO GROUND

WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.

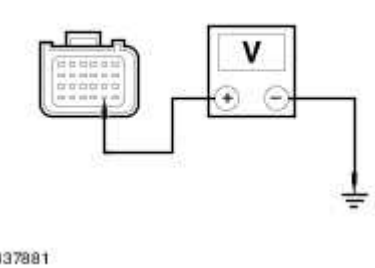


1 Measure the resistance between the RCM C2R114-A pin 19, circuit VDB06AB (GY/OG), harness side and ground.

Is the resistance greater than 10,000 ohms?
Yes
GO to CC3.
No
REPAIR circuit VDB06AB (GY/OG). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

CC3: CHECK THE RCM COMMUNICATION BUS CIRCUIT FOR A SHORT CIRCUIT TO BATTERY OR IGNITION

1 Ignition switch in position II.



2 Measure the voltage between the RCM C2R114-A pin 20, circuit VDB07H (VT/OG), harness side and ground.

Is any voltage present?
Yes
REPAIR circuit VDB07H (VT/OG). REPEAT the

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	self-test, CLEAR the DTCs. REACTIVATE the system. **No** REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

PINPOINT TEST CD : DTC U3000 13: AIR BAG DIAGNOSTIC MONITOR GROUND CIRCUIT OPEN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
CD1: CHECK THE RCM GROUND CIRCUIT	
WARNING: To avoid accidental deployment, the RCM backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the SRS, or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.	
NOTE: CHECK that the PAD switch is in the air bag live position before carrying out this test.	
	1 Deactivate the SRS.
	2 Check the RCM electrical connectors.
	Are the RCM electrical connectors fully engaged? **Yes** Check the RCM installation. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system. If the DTC remains, INSTALL a new RCM. REFER to: Restraints Control Module (RCM) (501-20B Supplemental Restraint System, Removal and Installation). **No** CONNECT the RCM electrical connectors. REPEAT the self-test, CLEAR the DTCs. REACTIVATE the system.

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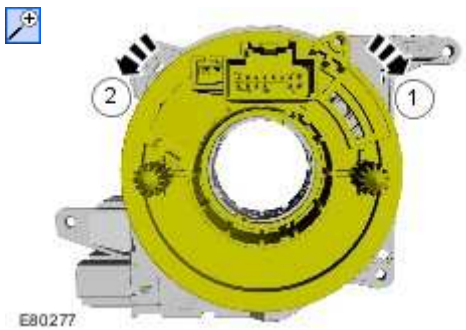
General Procedures

WARNINGS:

If there is a break between installing the clockspring and steering wheel rotation sensor assembly and installing the steering wheel, the centralizing of the clockspring must be repeated.

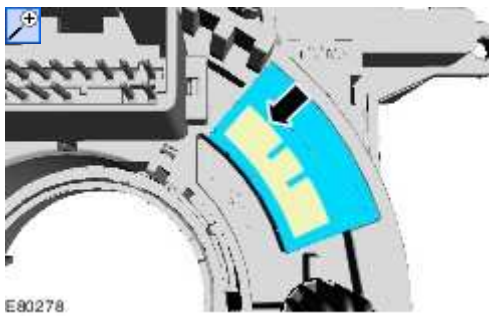
If the centralization of the clockspring is in doubt, the centralizing of the clockspring must be repeated.

CAUTION: The clockspring and steering wheel rotation sensor assembly must not be rotated in a couterclockwise direction more than the specified revolutions.
NOTE: Make sure that the road wheels are in the straight ahead position.



1.

1. Turn the clockspring rotor in a clockwise direction until a resistance is felt.
2. Turn the clockspring in a counterclockwise direction 2.5 revolutions.



2.

- Check to see if the yellow roller is visible in the clockspring window.
- Using a suitable piece of tape, secure the clockspring rotor to the clockspring body.

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General Procedures

WARNING: After deployment, the air bag module surface may contain deposits of sodium hydroxide, a product of the gas generate combustion, that is irritating to the skin. Use protective gloves when handling any deployed air bag module. Failure to follow this instruction may result in personal injury.

1. Remove the deployed air bag module(s). For additional information, refer to the relevant procedure in this section.
2. Seal the deployed air bag module(s) in the packaging from the new air bag module(s) or a suitable polythene bag, and then dispose of in accordance with local contaminated waste regulations.

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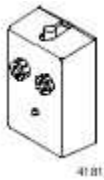
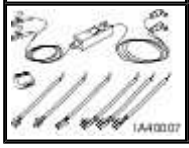
General Procedures

Special Tool(s)

	418-143 Adapter Box (AC)
	418-S055C Test and Deployment Lead, Air Bag/Pyrotechnic Safety Belt

Activation

WARNINGS:

To avoid accidental deployment, the restraints control module (RCM) backup power supply depleted. Wait at least one minute after disconnecting the battery ground cable(s) before com repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjace sensors. Failure to follow these instructions may result in personal injury.

To minimize the possibility of premature deployment, do not use radio key code savers wh on the SRS. Failure to follow this instruction may result in personal injury.

Before deploying the air bag module or safety belt pretensioner pyrotechnic make sure tha personnel in the vicinity are aware that a loud noise (bang) is about to occur. Do not let anybo closer than 6 meters. Failure to follow this instruction may result in personal injury.

The air bag module or the safety belt pretensioner should not be handled immediately foll deployment as the air bag module will be very hot. Failure to follow this instruction may result injury.

After deployment, the inflator(s) becomes inert, direct contact to the skin or eyes of any f pyrotechnic residues should be avoided. Failure to follow this instruction may result in persona

Always wear gloves and safety glasses when handling deployed air bag modules and safet pretensioners, Failure to follow this instruction may result in personal injury.

If the air bag module or safety belt pretensioner pyrotechnic residue should contact the ey eyes with clean water and seek medical assistance. Failure to follow this instruction may result injury.

If a large amount of air bag or safety belt pretensioner pyrotechnic residue is inhaled, see assistance. Failure to follow this instruction may result in personal injury.

1. Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).
2. Refer to: Floor Console - VIN Plate Body Style Code: Instrument Panel and Console, Removal and Installa Refer to: Floor Console - Vehicles With: Electronic Pa (EPB), VIN Plate Body Style Code: M (501-12 Instru Console, Removal and Installation).
3.

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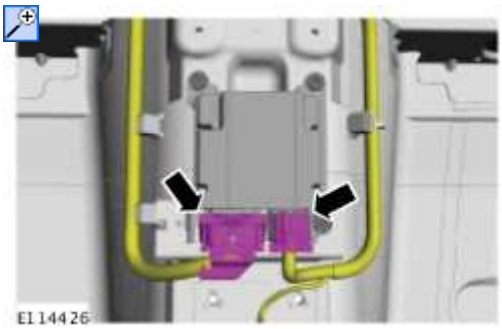

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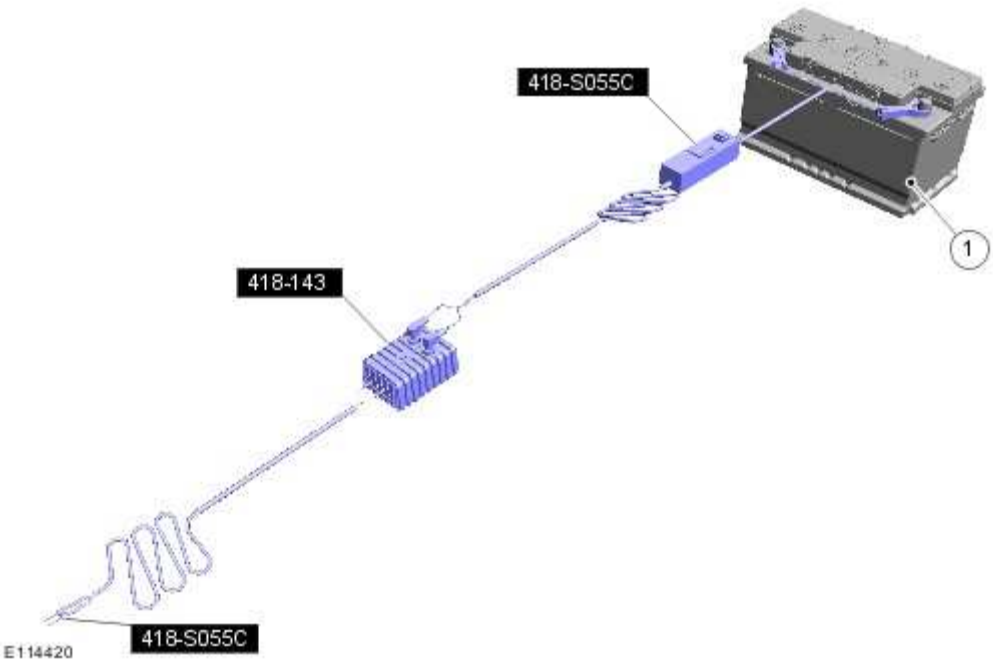

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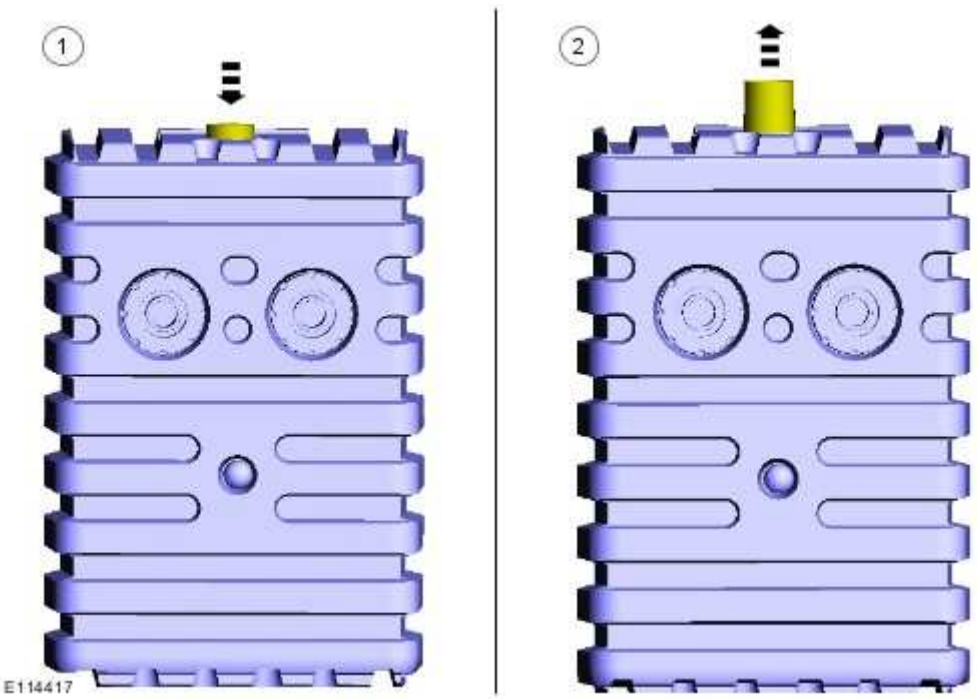

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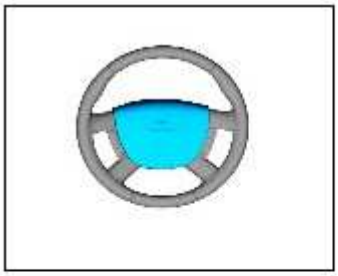

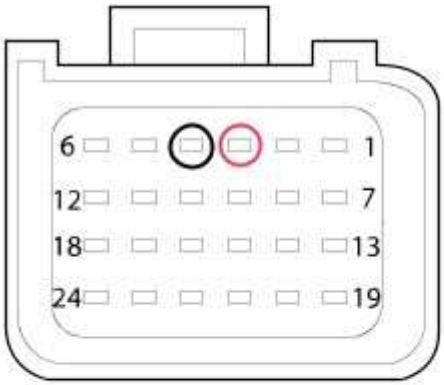

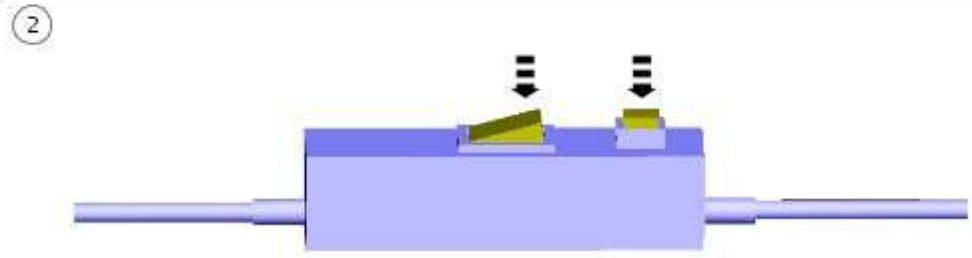

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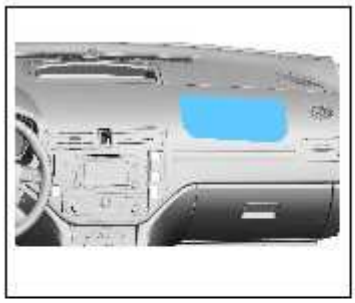

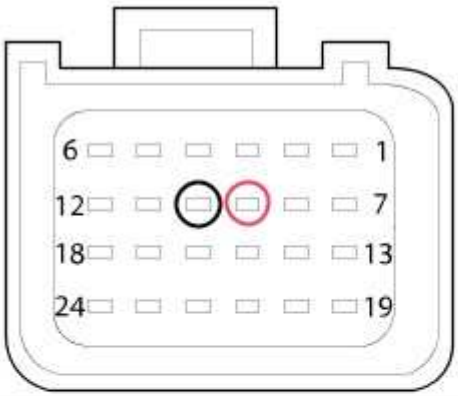

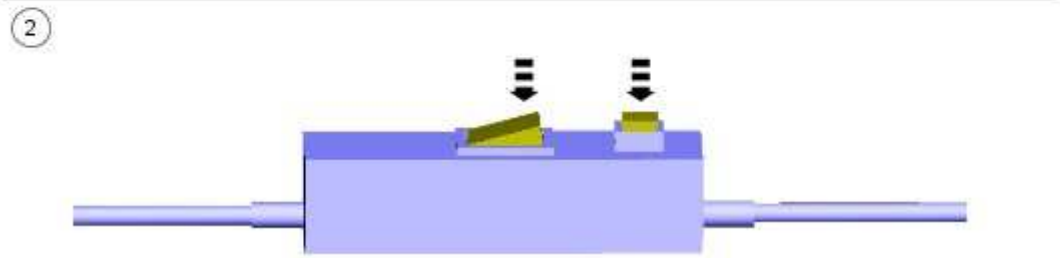

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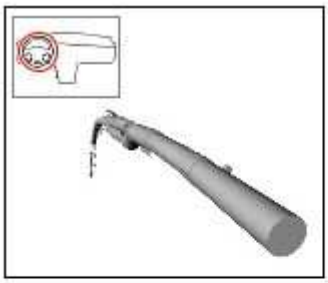

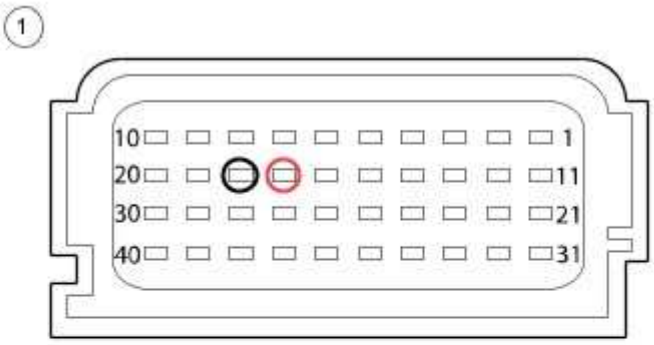

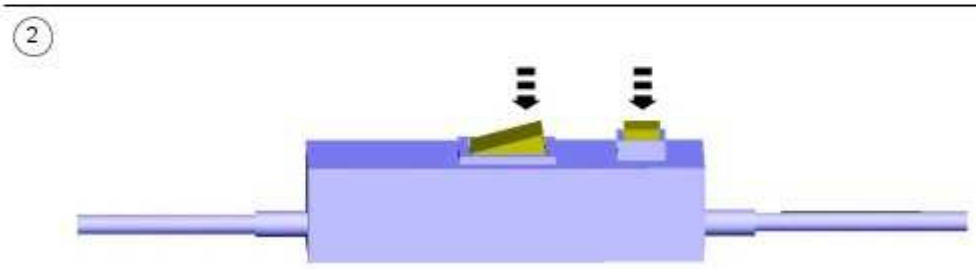

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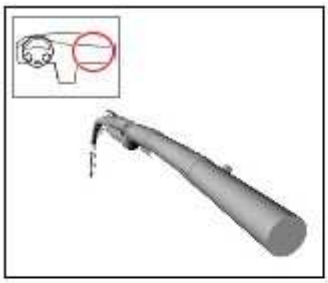

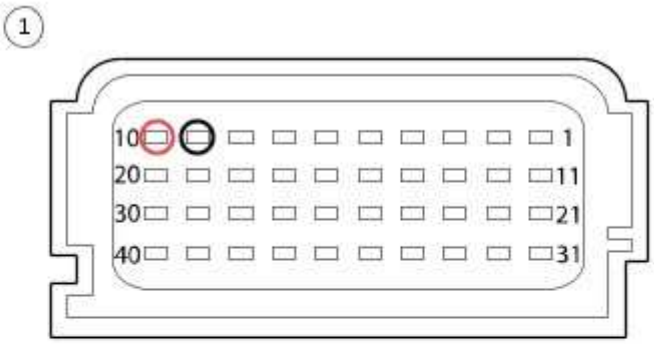

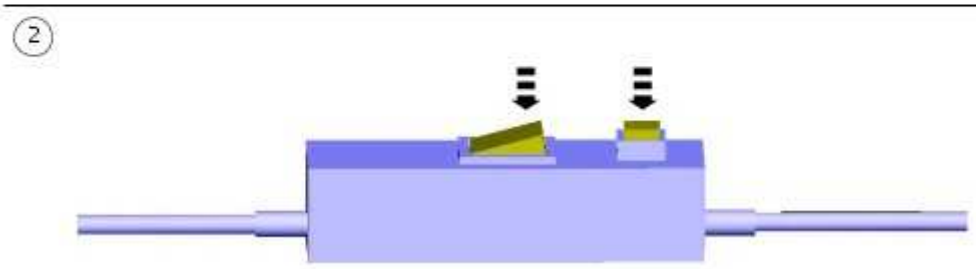

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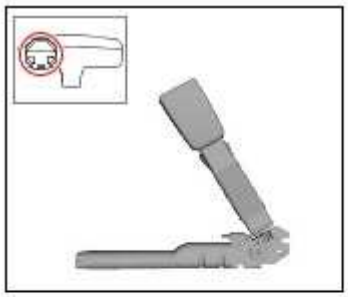

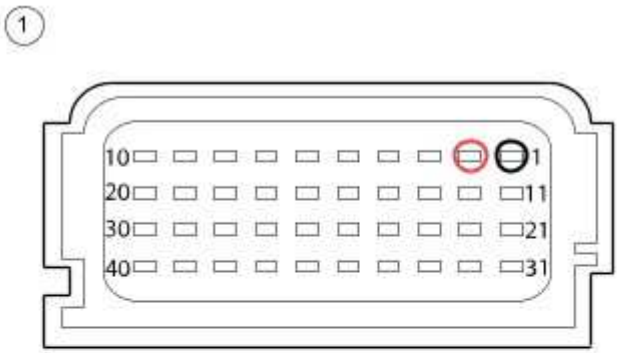

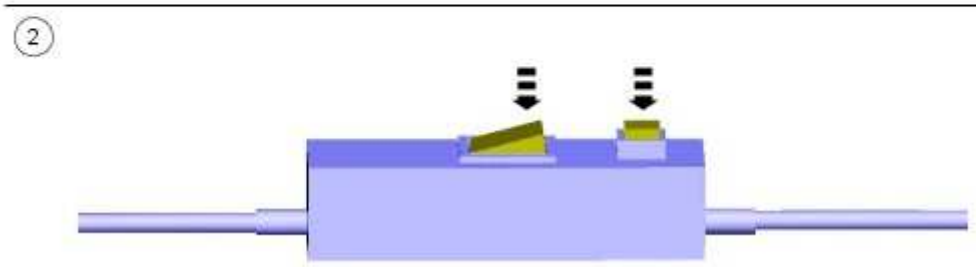

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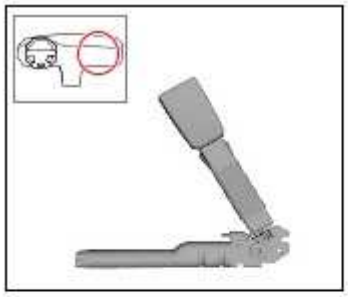

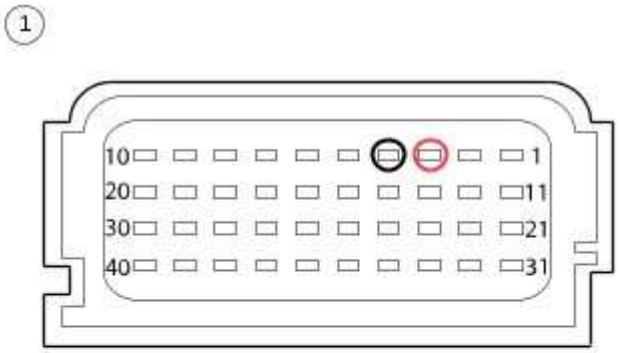

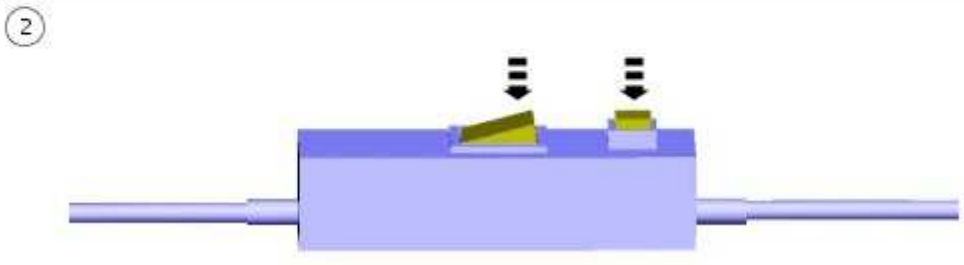

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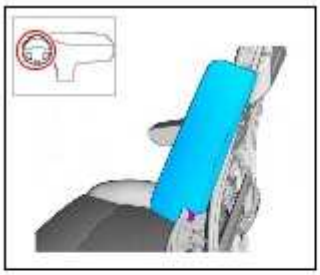

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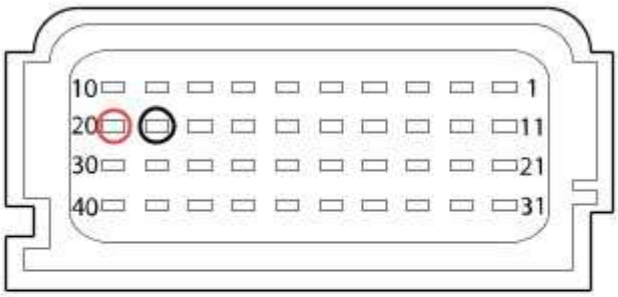

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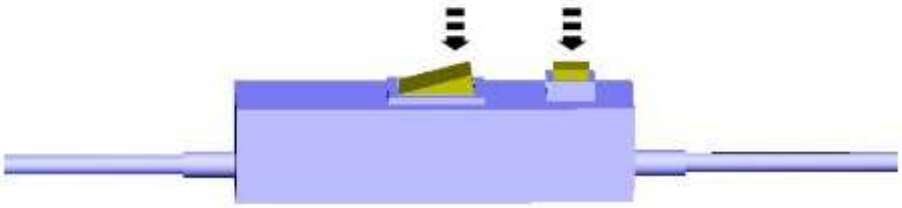

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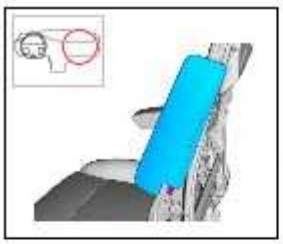

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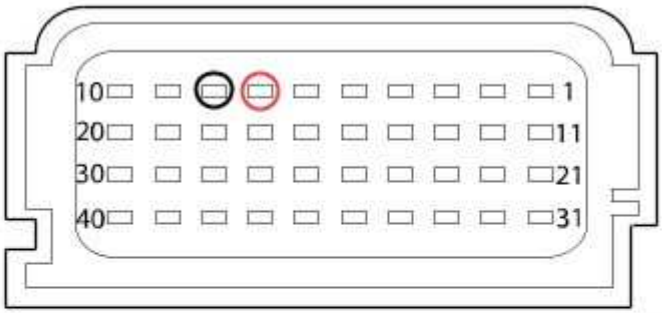

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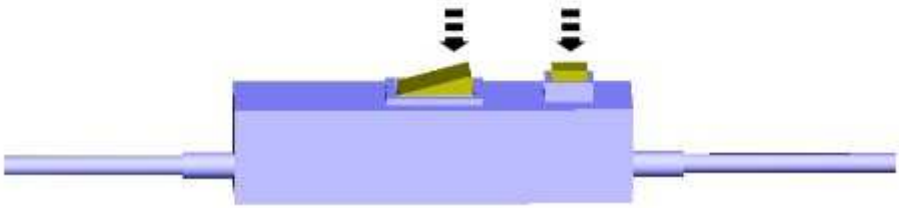

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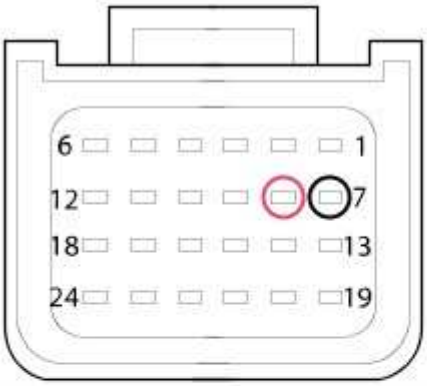

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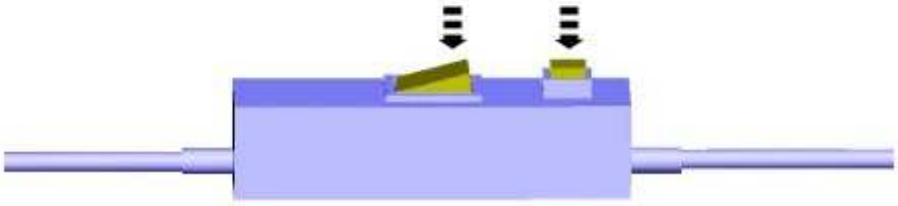

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15. Deployed air bag module(s) and safety belt pretensi
sealed in suitable bags and then disposed of in accor
local contaminated waste regulations.

16. NOTE: All unserviceable air bag modules have bee
the Mandatory Return List. All discolored or damag
modules should be treated the same as any unser
air bag module being returned.
Refer to: Front Safety Belt Retractor and Pretensione
Safety Belt System, Removal and Installation).
Refer to: Driver Air Bag Module - Vehicles Built Up T
(501-20B Supplemental Restraint System, Removal
Installation).
Refer to: Driver Lower Air Bag Module (501-20B Sup
Restraint System, Removal and Installation).
Refer to: Passenger Air Bag Module (501-20B Supple
Restraint System, Removal and Installation).
Refer to: Side Air Bag Module (501-20B Supplement
System, Removal and Installation).
Refer to: Side Air Curtain Module - VIN Plate Body S
(501-20B Supplemental Restraint System, Removal
Installation).
Refer to: Side Air Curtain Module - Vehicles With: GI
VIN Plate Body Style Code: M (501-20B Supplement
System, Removal and Installation).
Refer to: Front Side Air Curtain Module - Vehicles Wi
Panel, VIN Plate Body Style Code: M (501-20B Supp
Restraint System, Removal and Installation).

17. WARNING: Under no circumstances is an unse
bag module or safety belt pretensioner to be retur
the local mailing system. Failure to follow this inst
result in personal injury.
If an air bag module or safety belt pretensioner fails
the unserviceable air bag module or safety belt prete
suitable packaging and return to the Exchange Plan
appointed through the local National Sales Company

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General Procedures

1. WARNINGS:

   To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.

   To prevent premature deployment, live air bag modules must only be placed on work benches which have been ground bonded. Failure to follow this instruction may result in personal injury.

   NOTE: All unserviceable air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules should be treated the same as any unserviceable live air bag module being returned.

   Remove the unserviceable air bag module. For additional information, refer to the relevant procedure in this section.

2. WARNING: Under no circumstances is an unserviceable air bag module(s) to be returned through the local mailing system. Failure to follow this instruction may result in personal injury.

   Seal the unserviceable air bag module(s) in the packaging from the new air bag module(s) and address to the appropriate manufacturer. The package should then be forwarded to the Exchange Plan Center (as appointed through the national sales company) who will arrange forwarding to the manufacturer.

3. NOTE: Autoliv air bag modules and seat belt pretensioners.

   Autoliv Gmbh, Theodor Heuss Strasse 2, 85221, Dachau, Germany.

4. NOTE: TRW air bag modules.

   TRW Occupant Restraint Systems, FAO Rene Getto, Industriestr 20, 73551, Aldorf, Germany.

5. NOTE: TRW seat belt pretensioners.

   TRW Occupant Restraint Systems, FAO Helmut Goss, Industriestr 20, 73551, Aldorf, Germany.

6. NOTE: Takata Petri air bag modules.

   Takata Petri AG, Grossostheimer Strasse 223, D-63741 Aschaffenburg, (Supplier Code P790M) Germany.

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Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

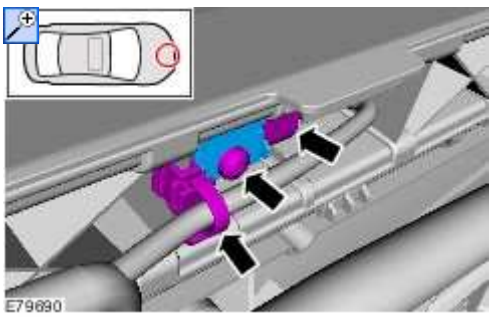
Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).



2. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

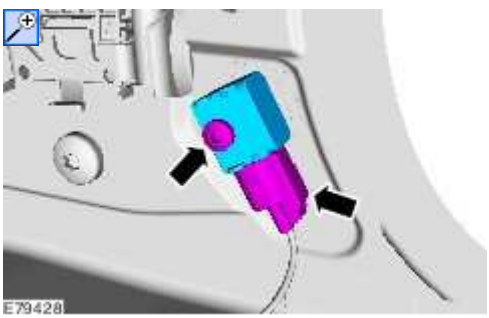
Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the B-pillar trim panel.

   Refer to: B-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting o removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

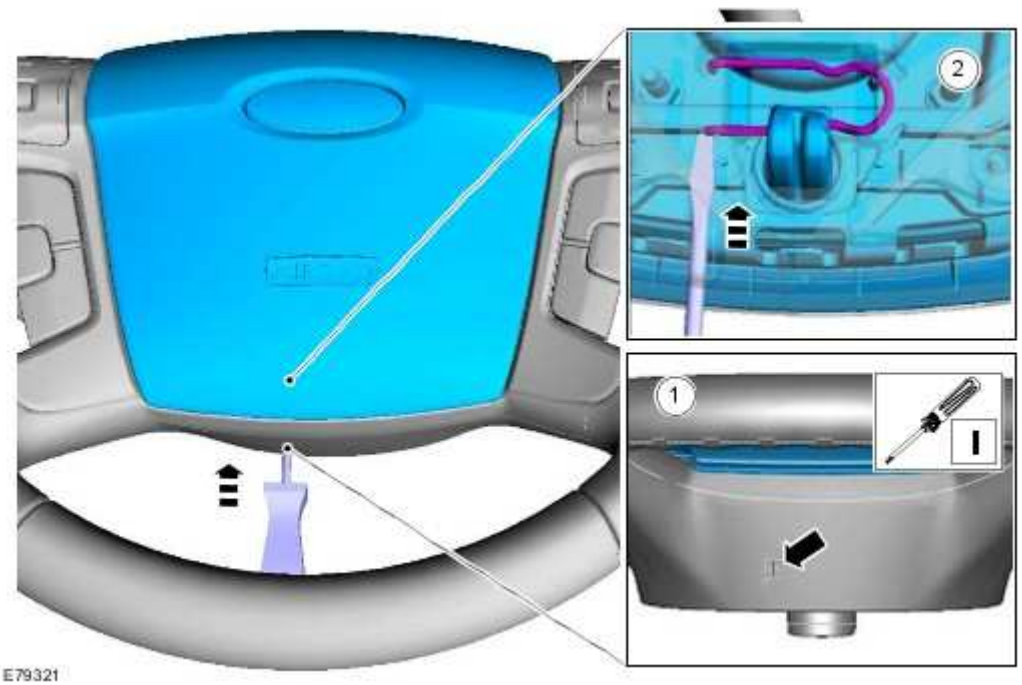
Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. *General Equipme* Flat-blad screwdri



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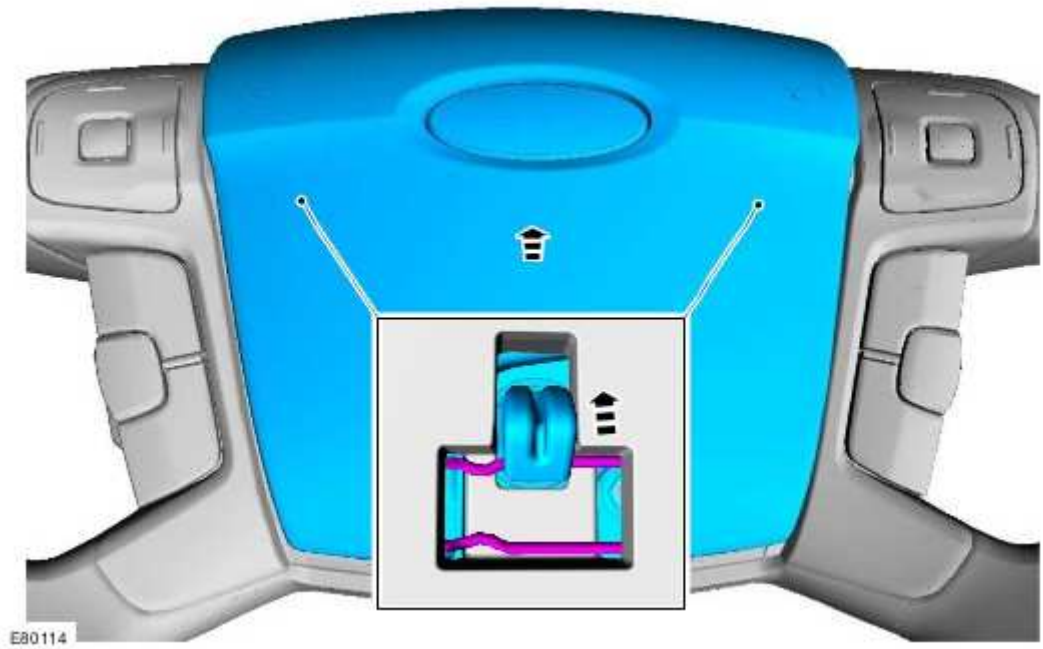

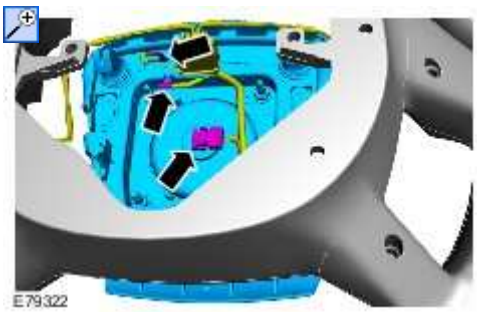

4.

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting o removing any SRS components.

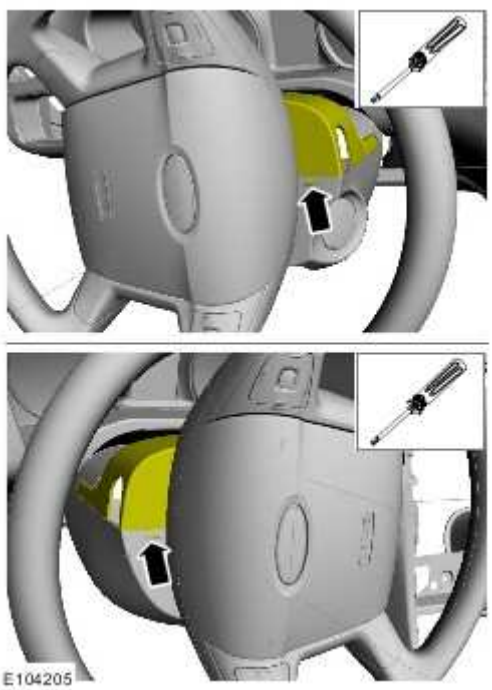
Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Supplemental Restraint System (SRS) Hea and Safety Precautions (100-00 General Information Description and Operation).

NOTE: Make sure that the steering column lock is not engaged.

2. Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
3. *General Equipment:* Flat-bladed screwdriver



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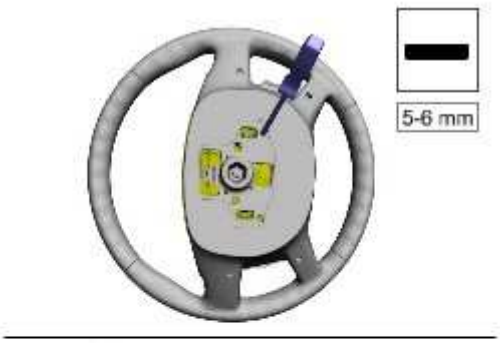

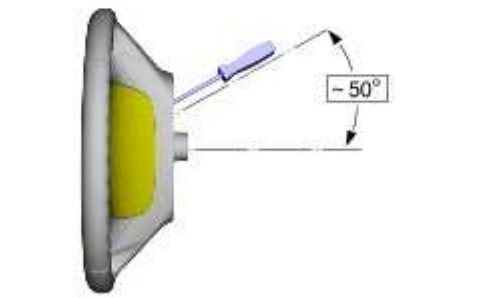

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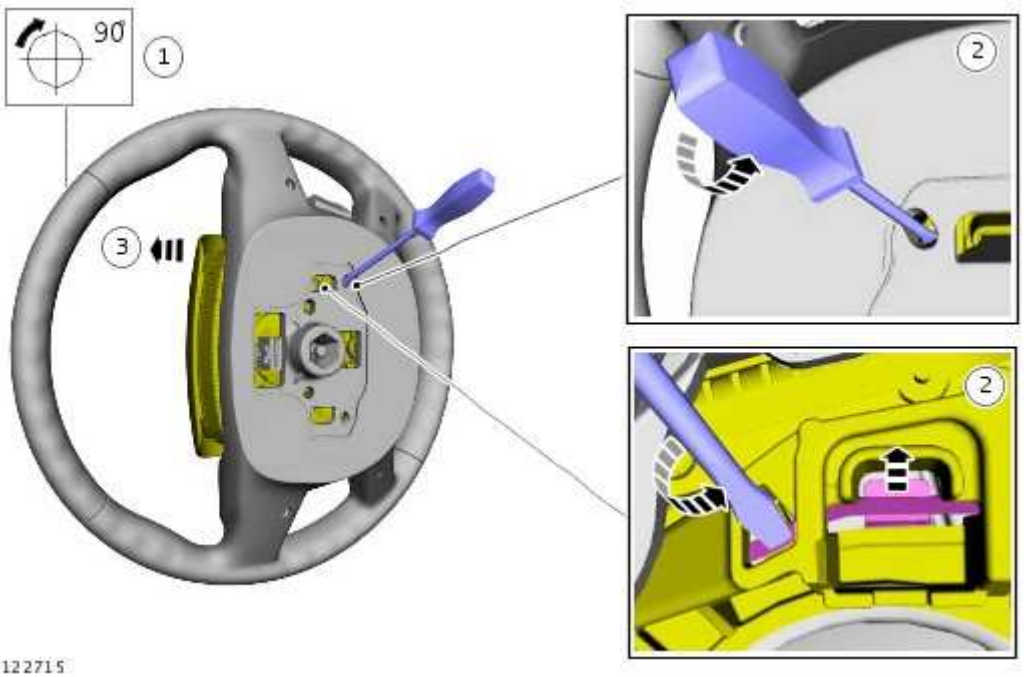
5.

General Equipment: Flat-bladed screwdriver



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6.

General Equipme
Flat-blad screwdri

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General Equipme
Flat-blad screwdri

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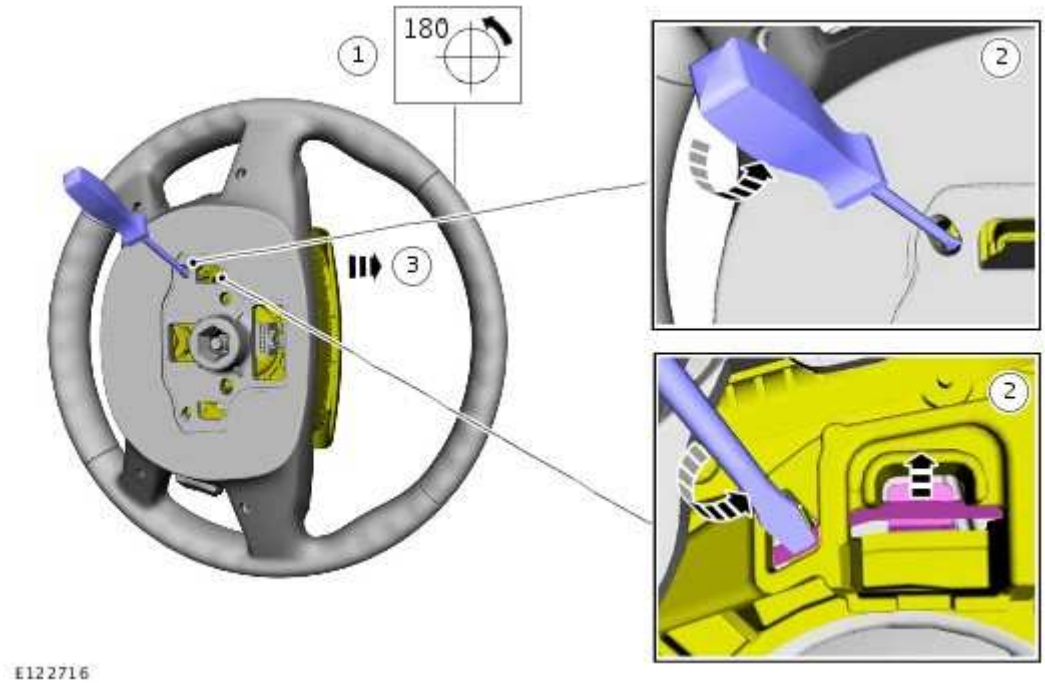

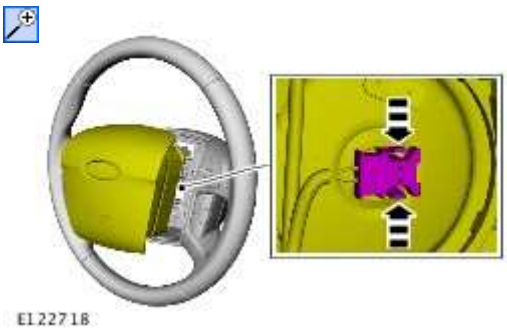

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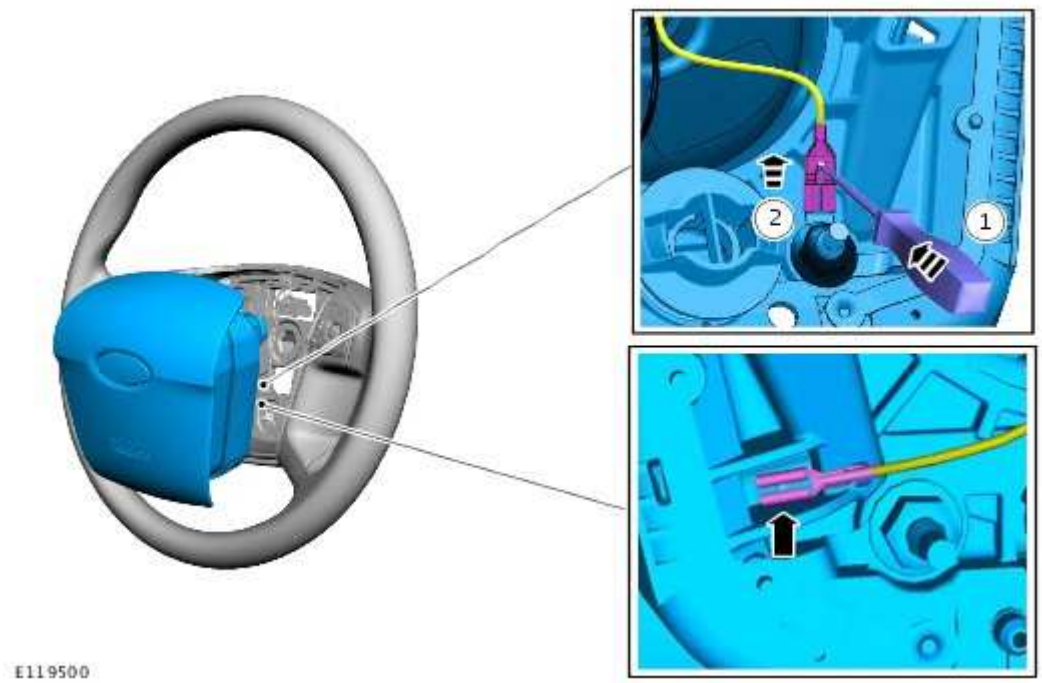

9.

General
Equipme
Flat-blad
screwdri

Installation

1. To install, reverse the removal procedure.

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Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

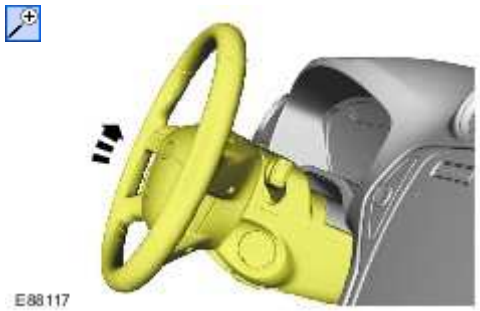
Wear safety goggles.

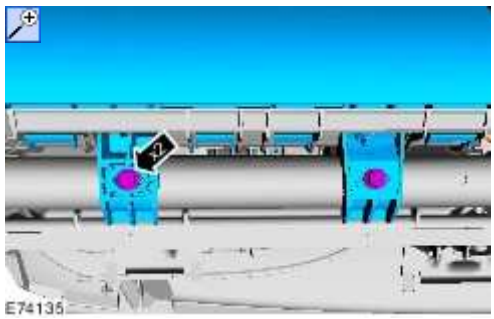
Do not probe supplemental restraint system (SRS) electrical connectors.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

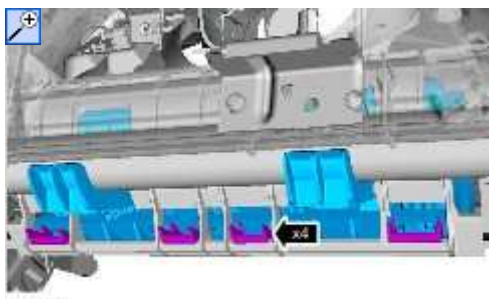
1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. 

3. 

4. CAUTION: The component must only be removed by pushing from behind.
   Release the clips and at the same time push on the back of the air bag module.



5. CAUTION: The component must only be removed by pushing from behind.
   Release the clips and at the same time push on

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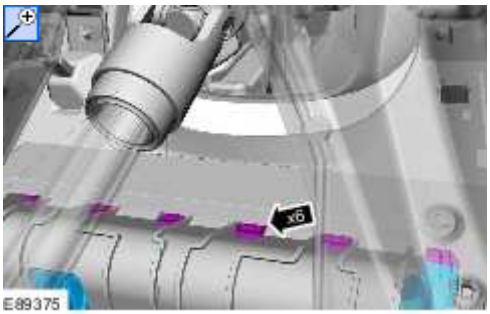
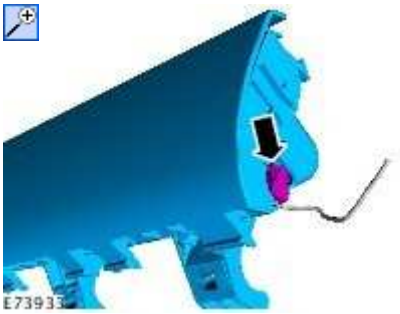
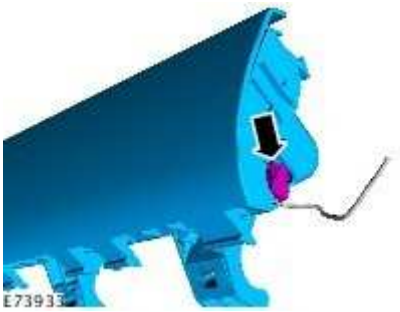


the back of the air bag module.

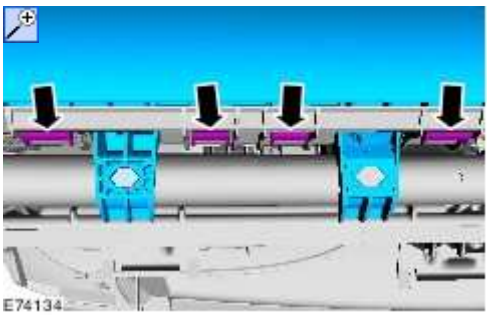


6.

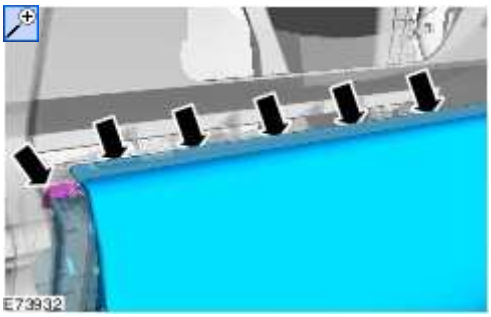
Installation



1.



2. CAUTION: Make sure that equal pressure is applied to the full length of the component.



3. CAUTION: Make sure that equal pressure is applied to the full length of the component.

4. *Torque:* 8 Nm

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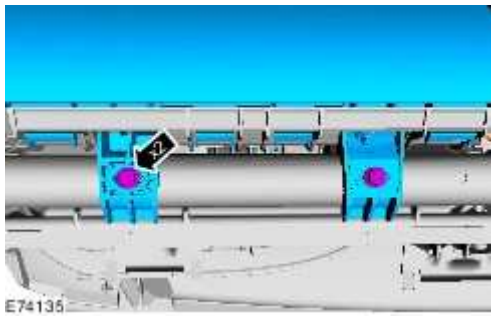

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Print

Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

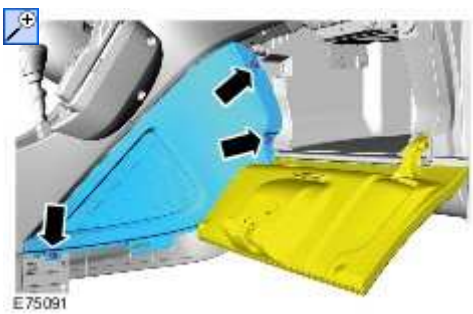
2. Remove the navigation system digital versatile disc (DVD) unit, if equipped.

   Refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).

3.

E79836

4.



E75091

Vehicles with air conditioning

5.

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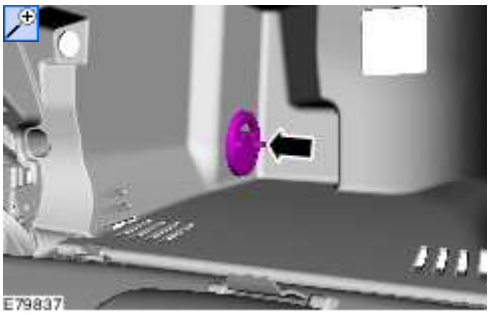
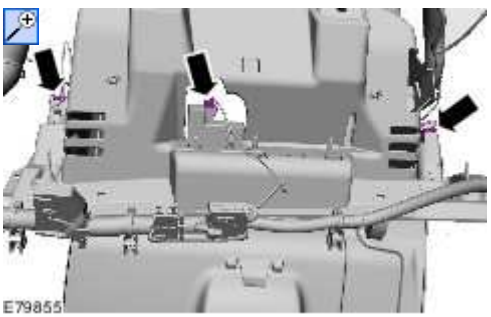


All vehicles

6.

7.



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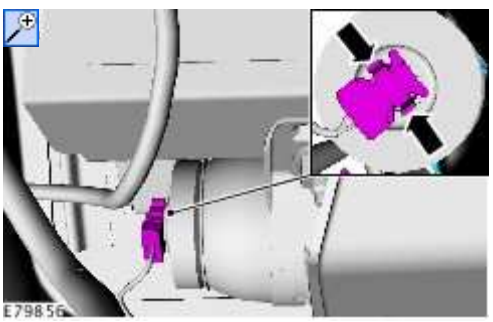

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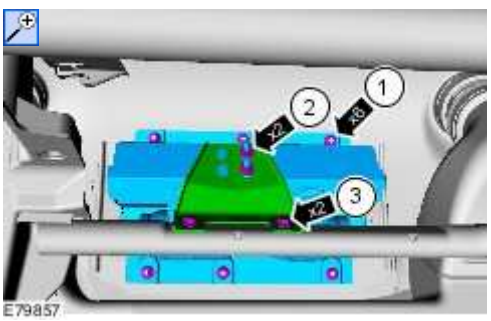

1. *Torque:* 8 Nm
2. *Torque:* 8 Nm
3. *Torque:* 10 Nm

Installation

1. To install, reverse the removal procedure.
2. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-

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11 Glass, Frames and Mechanisms, General Procedures).

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Print

Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

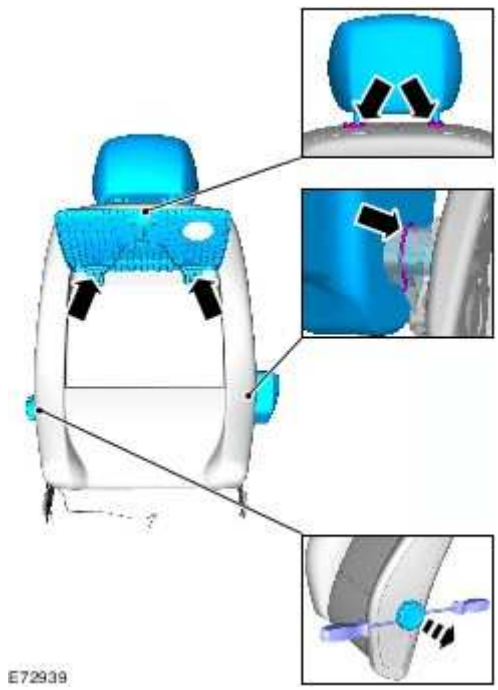
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the front seat backrest.

   Refer to: Front Seat Backrest (501-10 Seating, Removal and Installation).

3. 

4.

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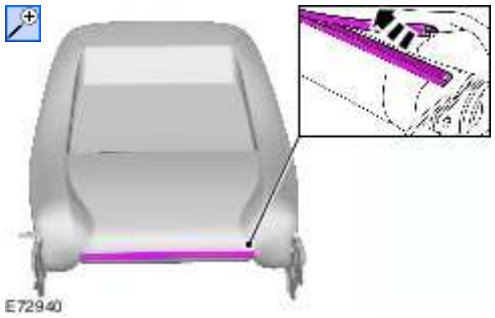

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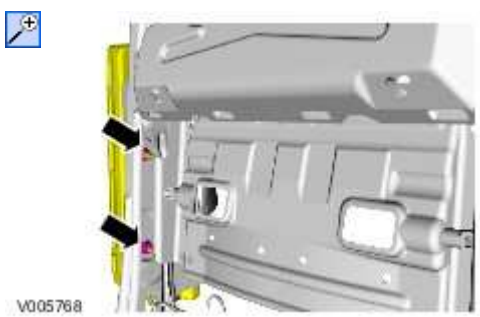

6. *Torque:* 5 Nm

7.

Installation

1. To install, reverse the removal procedure.
2. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General

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Procedures).

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

WARNINGS:

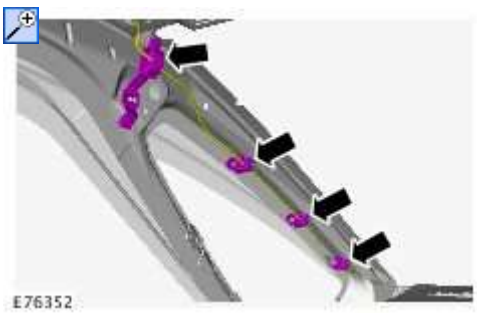
The supplemental restraint system (SRS) is active for a certain length of time after the po supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or remo any SRS components.

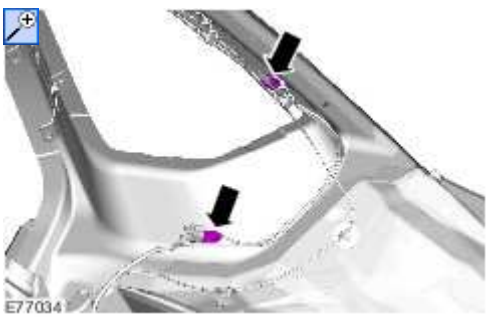
Make sure that the vehicle electrical system is fully depowered and no other power source connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).
2. Refer to: A-Pillar Trim Panel (501-05 Interior Trim a Ornamentation, Removal and Installation).
3. 

4. 

5.

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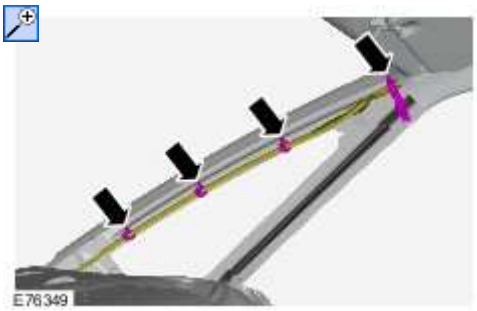
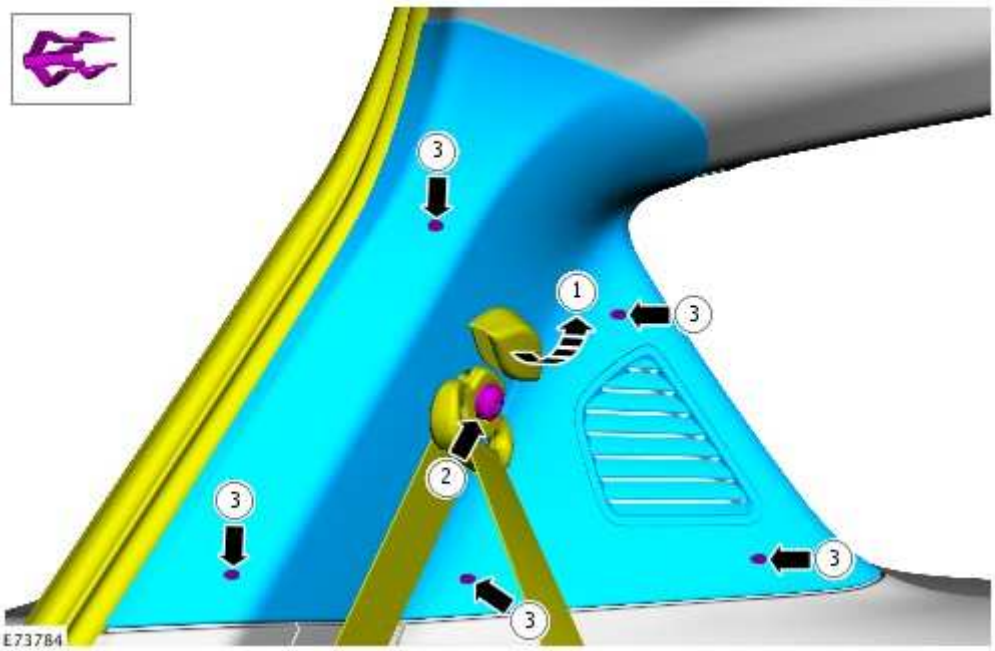
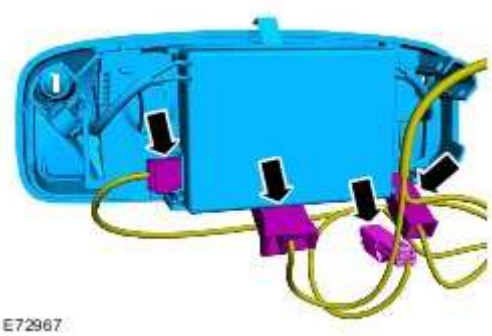


6. Refer to: B-Pillar Trim Panel (501-05 Interior Trim a
Ornamentation, Removal and Installation).
7. Refer to: C-Pillar Trim Panel - VIN Plate Body Style C
S (501-05 Interior Trim and Ornamentation, Remova
Installation).



8. *Torque:* 35 N

9. *General Equipment:* Flat-bladed screwdriver



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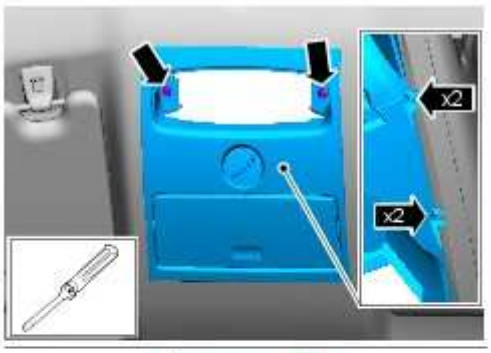
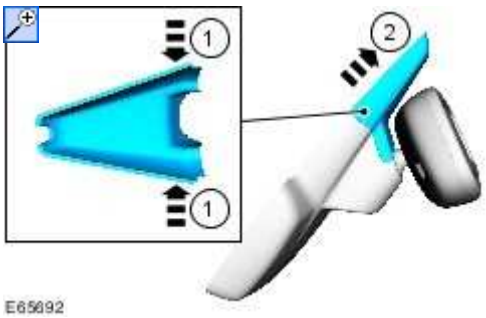
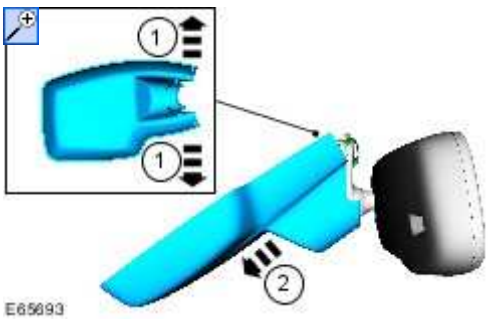
10.



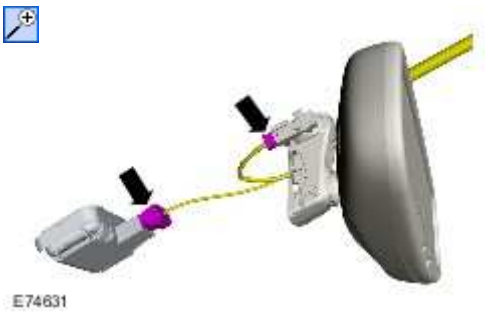
11. If equipped.



12. If equipped.



13. If equipped.



14. On both sides.

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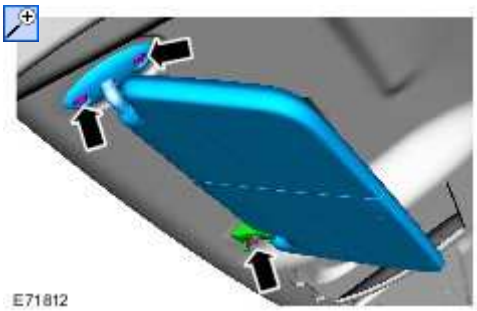
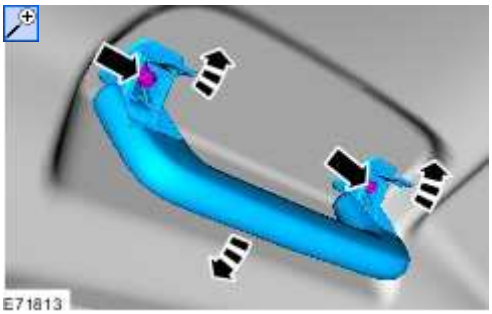
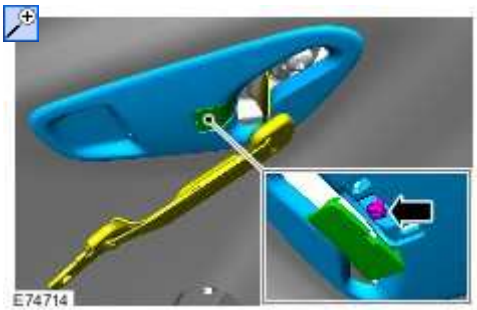
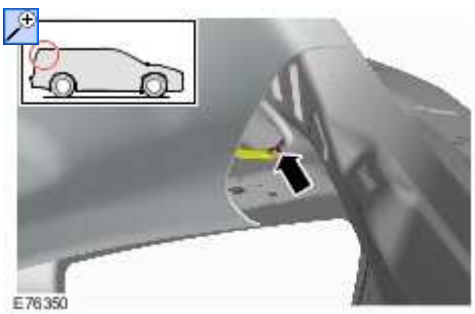




15. On both sides.



16.



17.

18.

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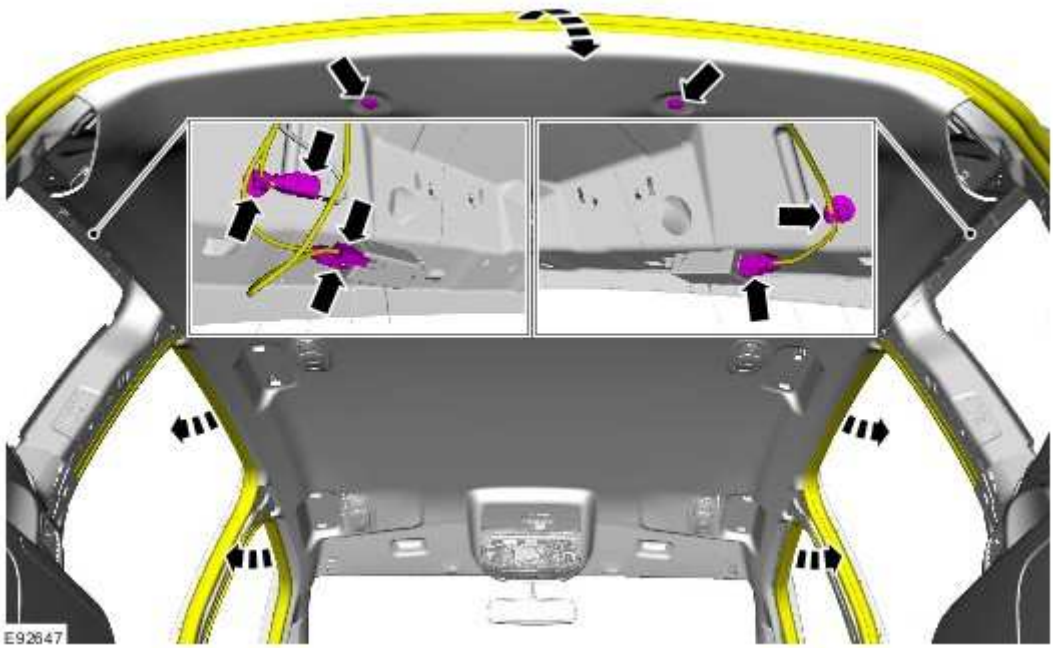
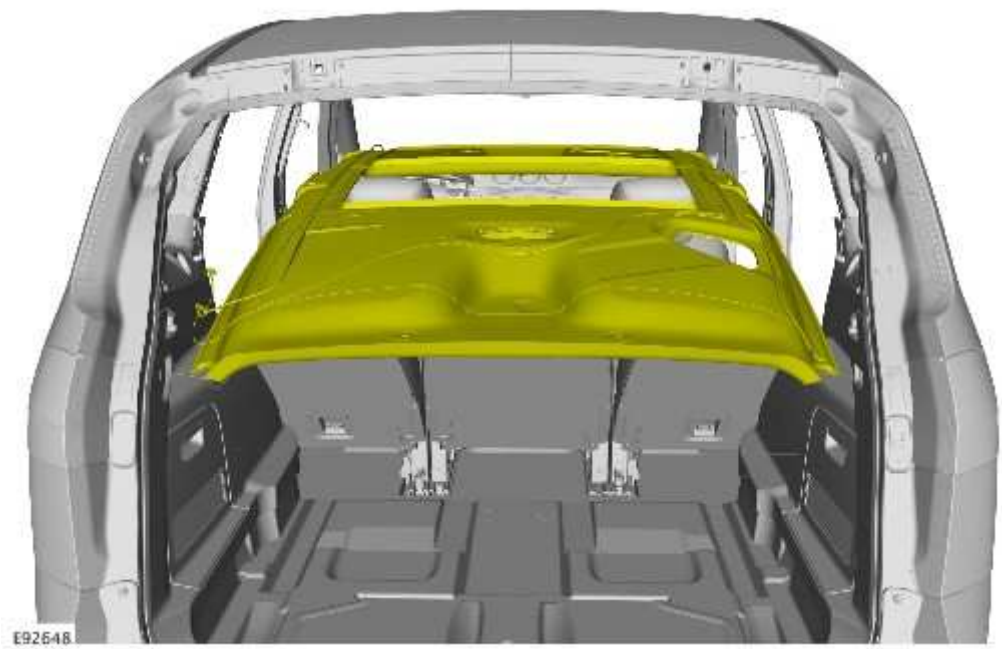
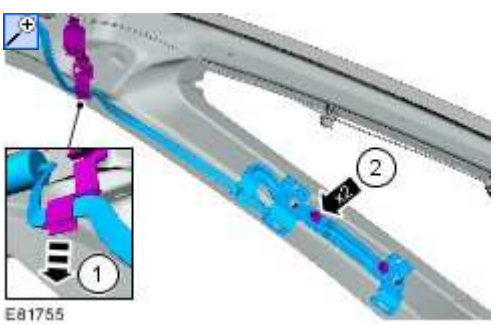


19. Recline the front seats backrests.
20. Recline the rear seats backrests.
21. Support the headliner.



22.



23. NOTE: Note the position of the component before removal.

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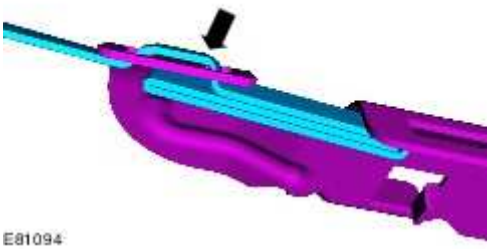
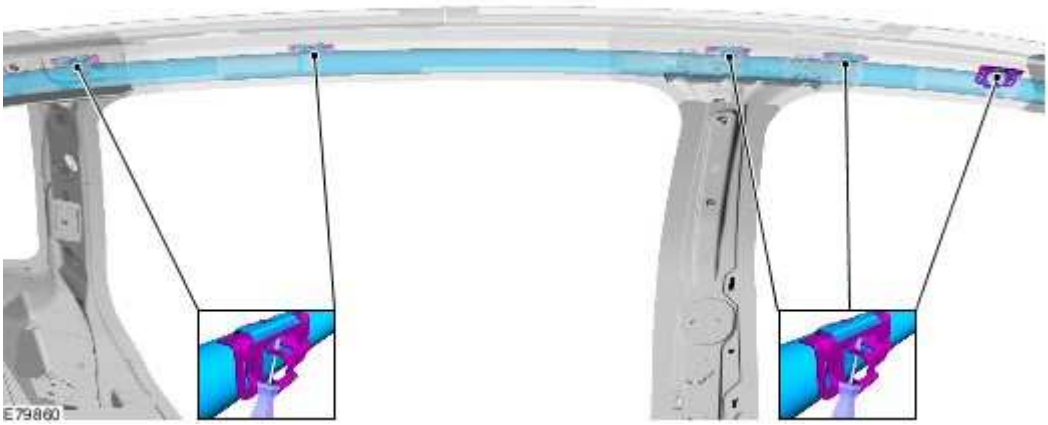
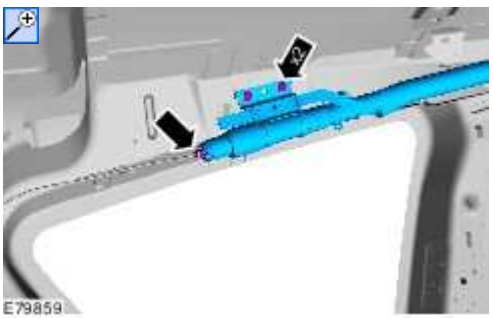




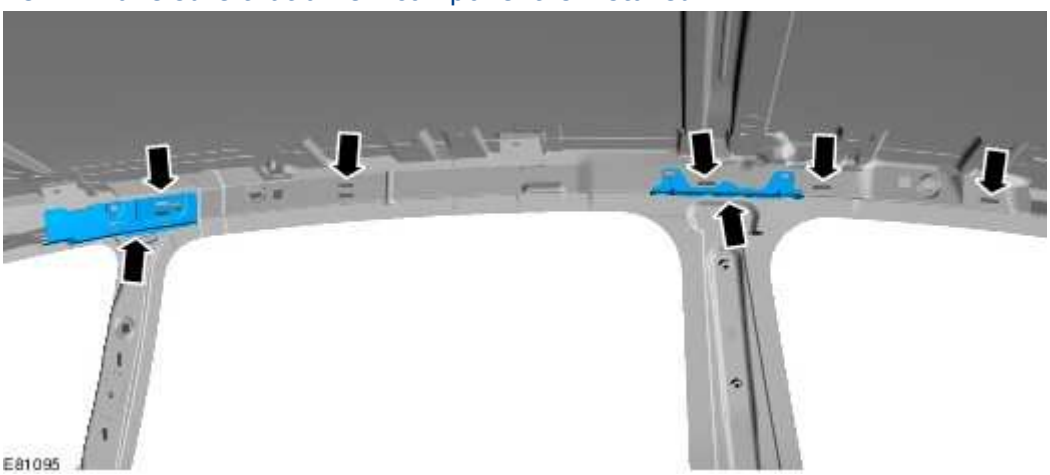
24. NOTE: Not the positic each componen before removal.
    - Rais side curta gain acce the retai clips
    - Mov cent the dow to re the



25.

Installation

NOTE: Make sure that a new component is installed.



1. If the side curtain mo was deploy check the body side curtain mountings ramps for deformatic

2. *Torque:* 6 Nm

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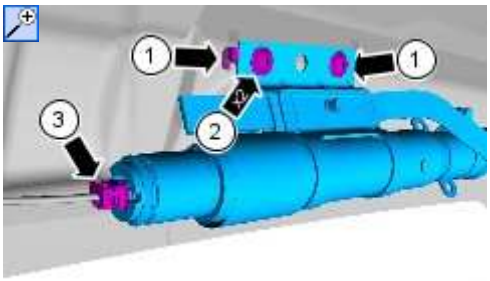
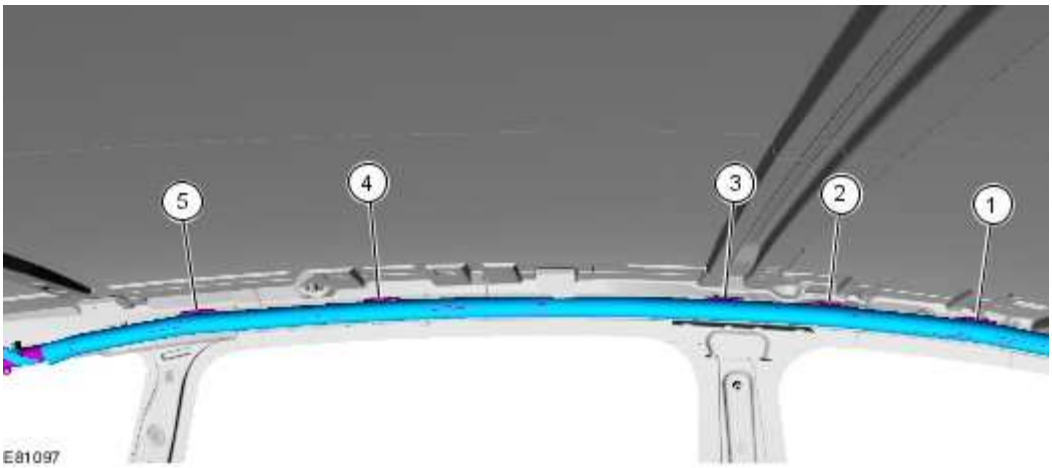


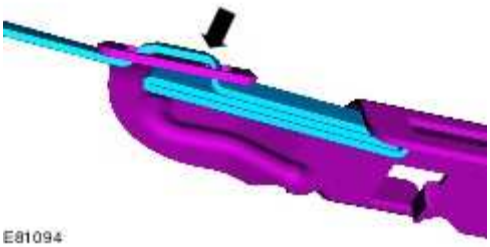
E81096



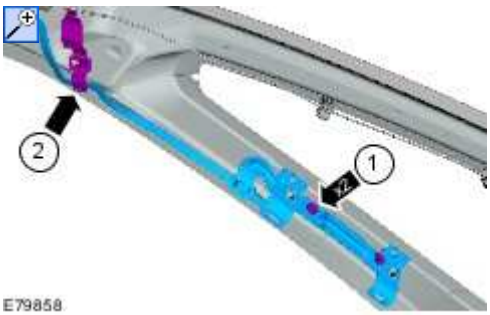
E81097

3. NOTE: Ma
sure that
these
componer
are install
to the not
removal
position.
Attach the
air bag mc
retaining c
the followi
sequence.

4. NOTE: Make sure that this component is installed
the noted removal position.


E81094

5. *Torque:* 10 Nm



E79858

6. Install the headliner.
7. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 C
   Frames and Mechanisms, General Procedures).

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

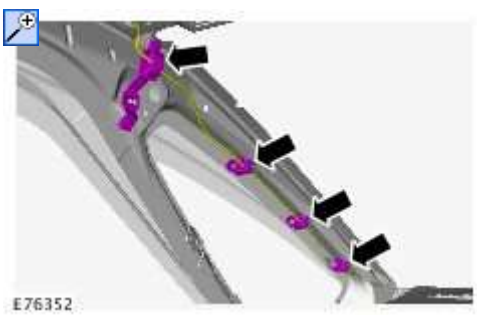
WARNINGS:

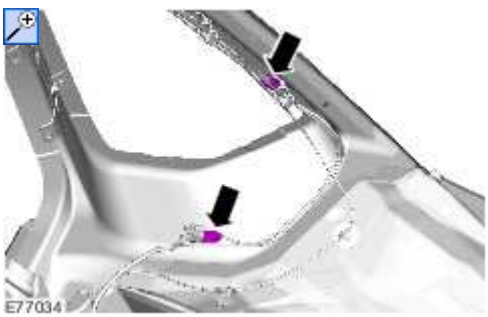
The supplemental restraint system (SRS) is active for a certain length of time after the po supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or remo any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source connected.

Wear safety goggles.

1. Refer to: Supplemental Restraint System (SRS) Hea Safety Precautions (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).
3. Refer to: A-Pillar Trim Panel (501-05 Interior Trim a Ornamentation, Removal and Installation).
4. 

5. 

6.

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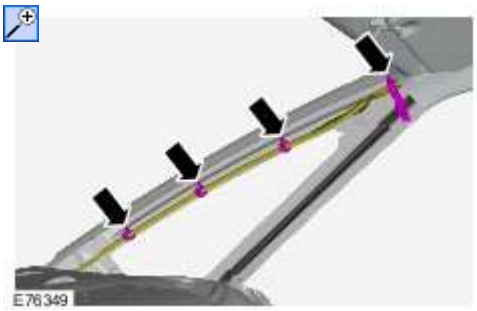
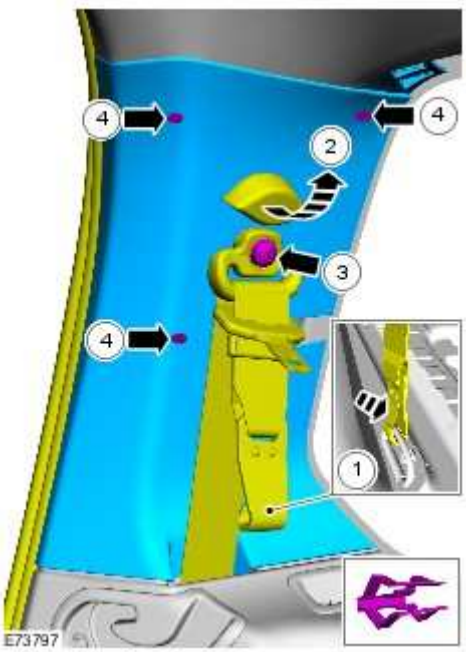


7. Refer to: B-Pillar Trim Panel (501-05 Interior Trim a
Ornamentation, Removal and Installation).
8. Refer to: C-Pillar Trim Panel - VIN Plate Body Style C
M (501-05 Interior Trim and Ornamentation, Remov
Installation).
9. *Torque:* 35 Nm



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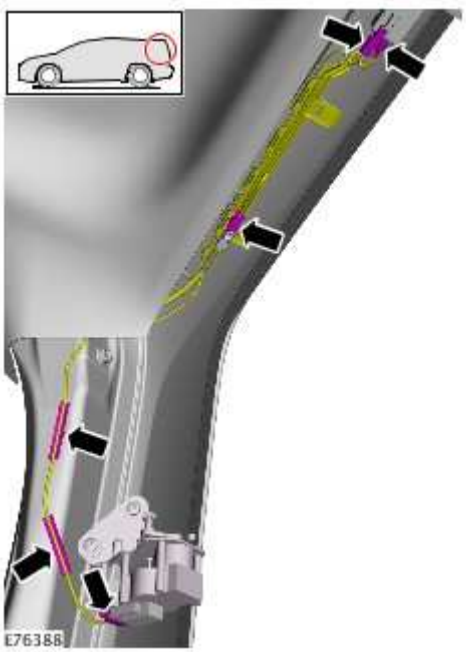

11.

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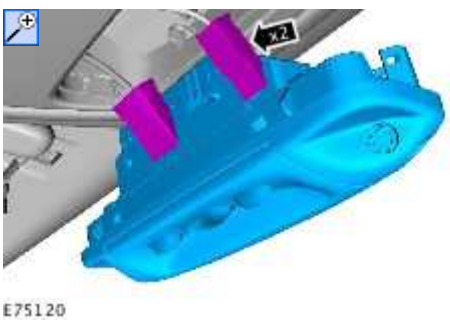
12. *General Equipment:* Flat-bladed screwdriver



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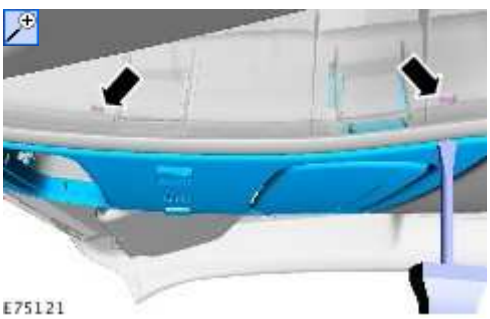

14. *General Equipment:* Flat-bladed screwdriver

15.

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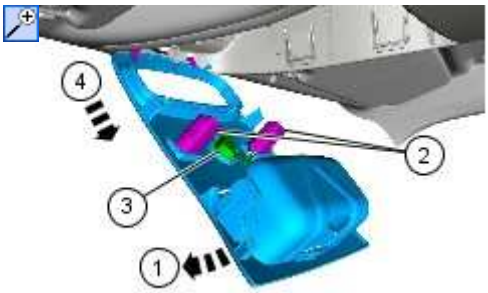
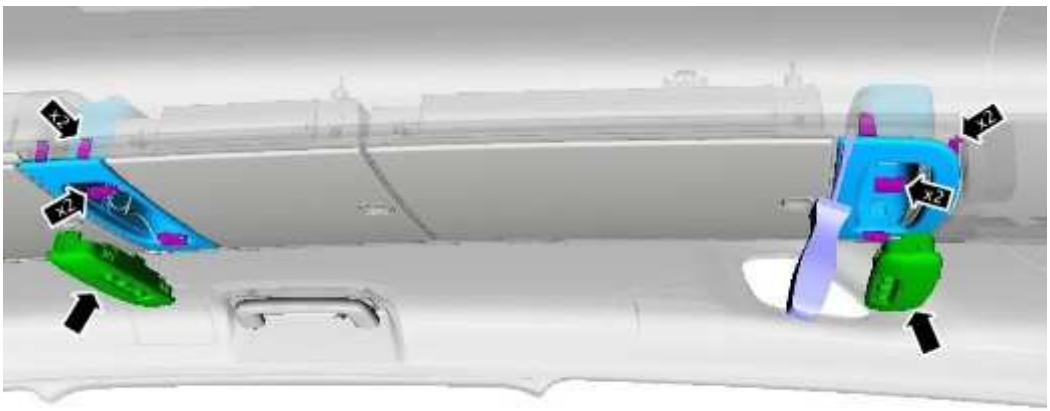
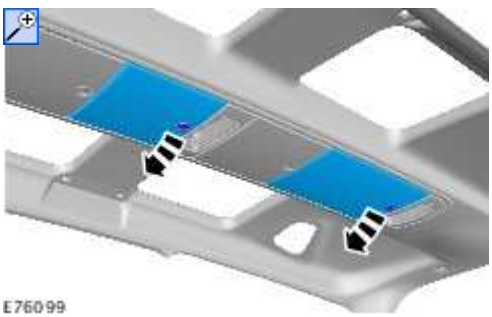


E75122



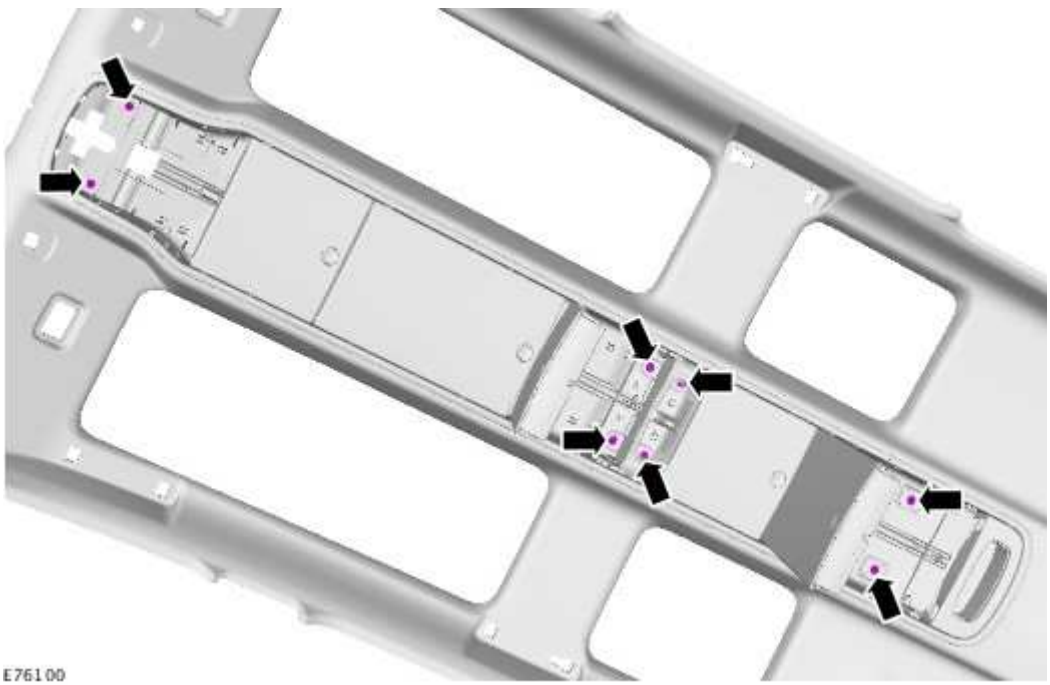
E75123

16. *General Equipment* bladed screwdrive



E76099

17.



E76100

18.

19. If equipped.

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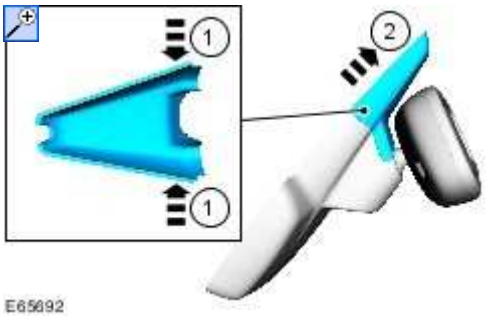
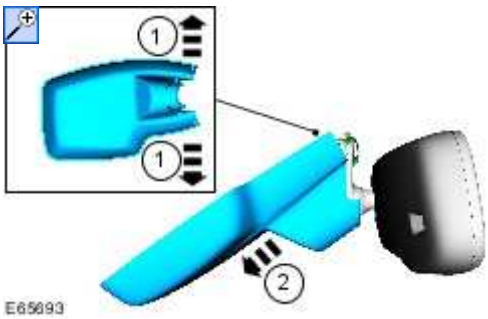
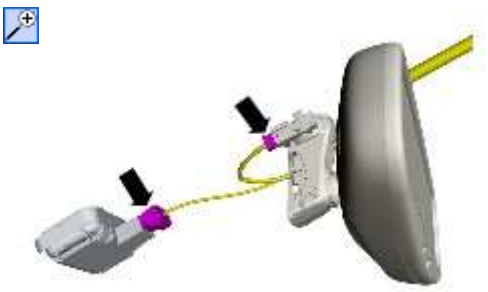


E65892

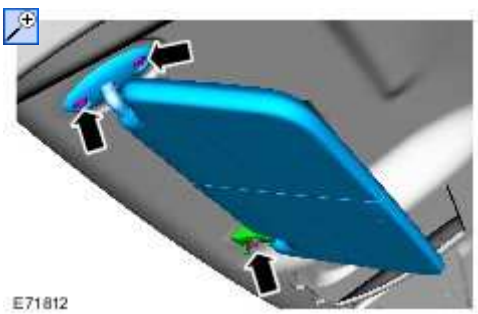


E65893

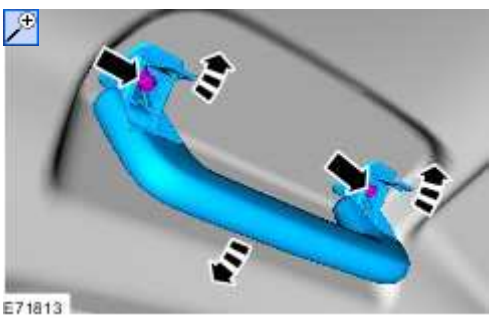
20. If equipped.


E74631

21. If equipped.


E71812

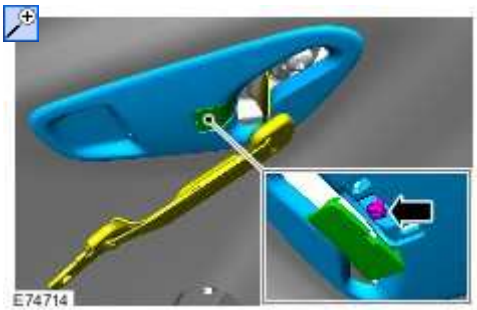
22. On both sides.

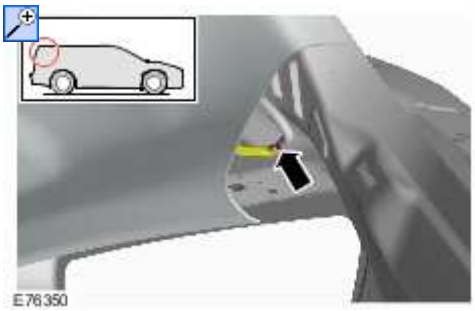

E71813

23. On both sides.

24.

http://vnx.su





25.

26. Recline the front seats backrests.
27. Recline the rear seats backrests.
28. Support the headliner.

29.

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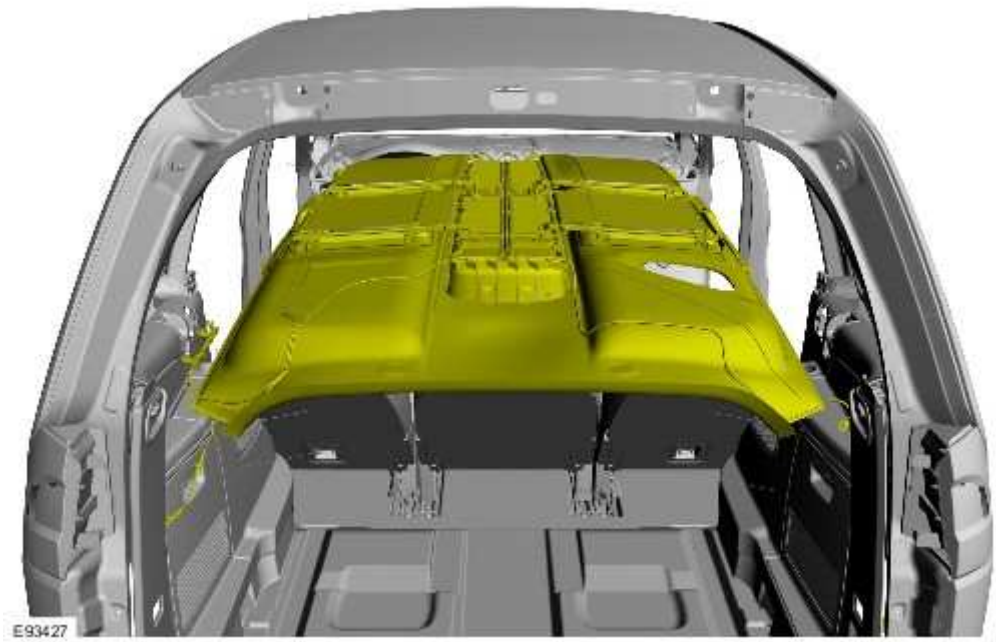
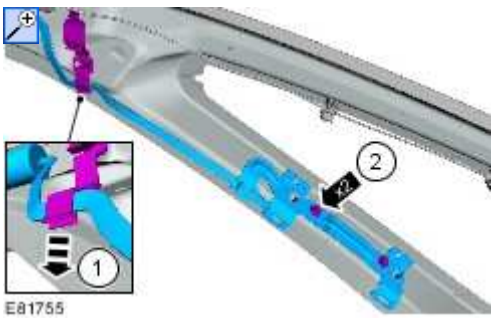
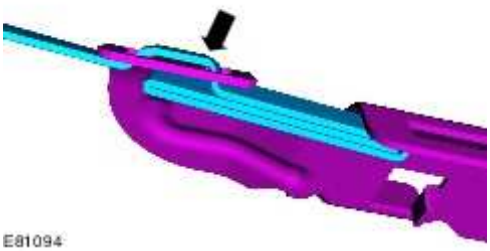
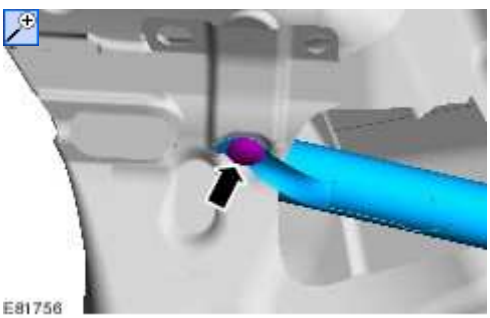




30.

31. NOTE: Note the position of the component before removal.





32. This step is only required when removing the left-ha side air curtain.

33. This step is only required when removing the right-h side air curtain.

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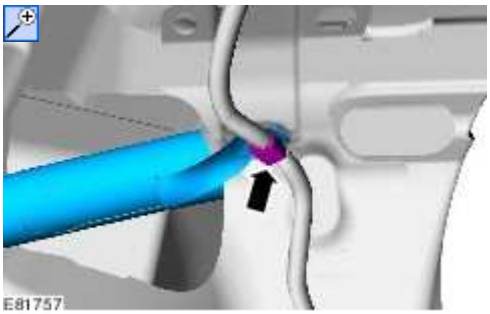
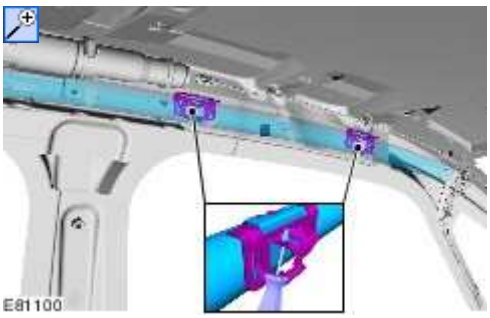
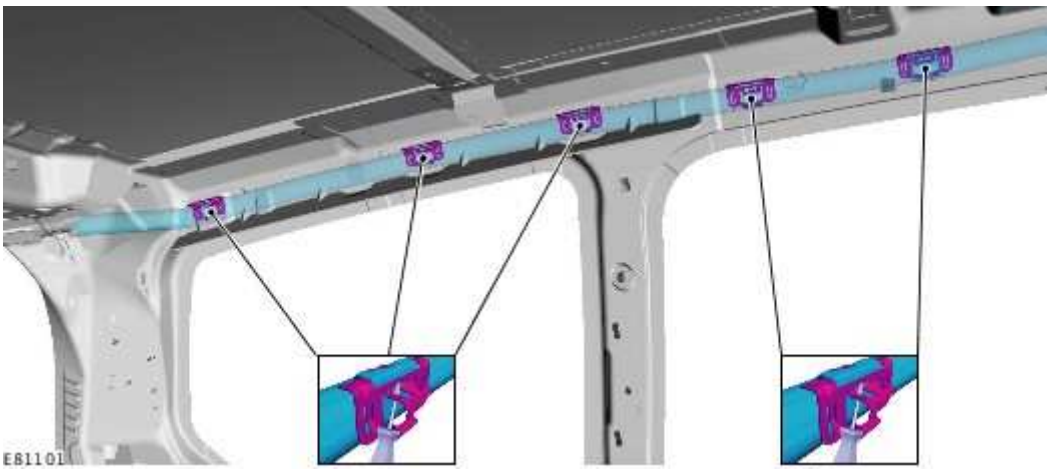
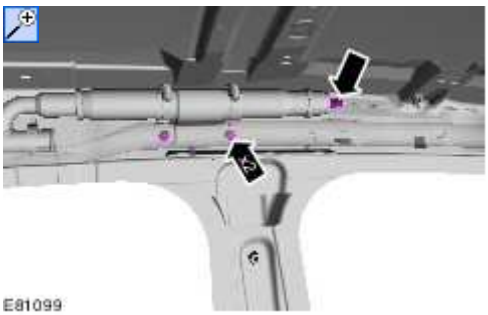




34. NOTE: Note the position of each component before removal.
    - Raise the side air curtain to gain access to the retaining clips.
    - Move the center of the clip downwards to relea clip.



35. NOTE: Not the positic each componen before removal.
    - Rais side curta gain acce the retai clips
    - Mov cent the dow to re the



36.

Installation

NOTE: Make sure that a new component is installed.

1. If the side curtain wa deployed, the vehicle side air cu mountings

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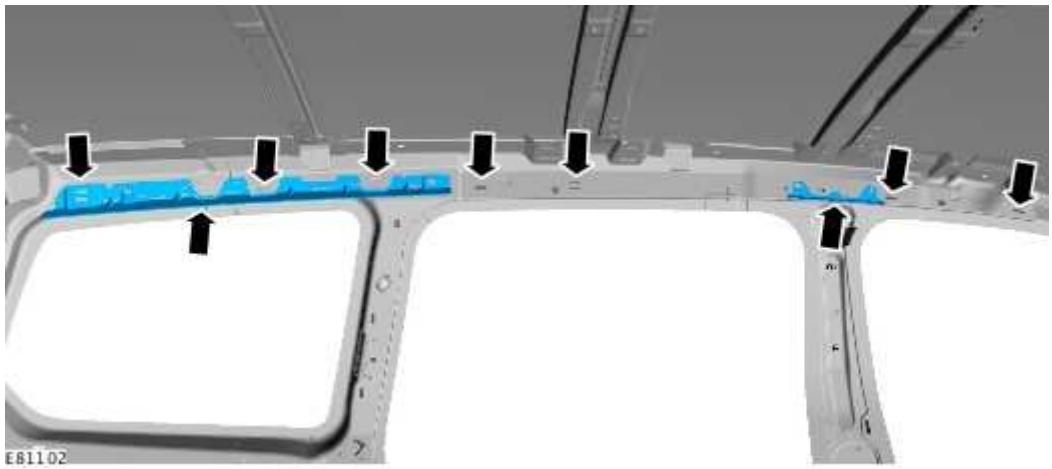

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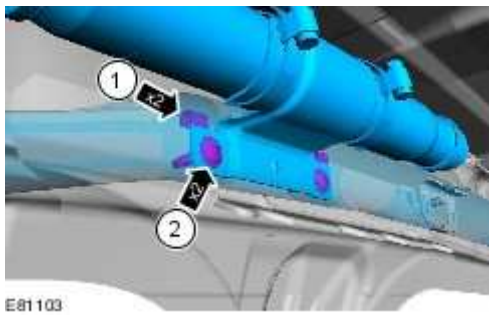
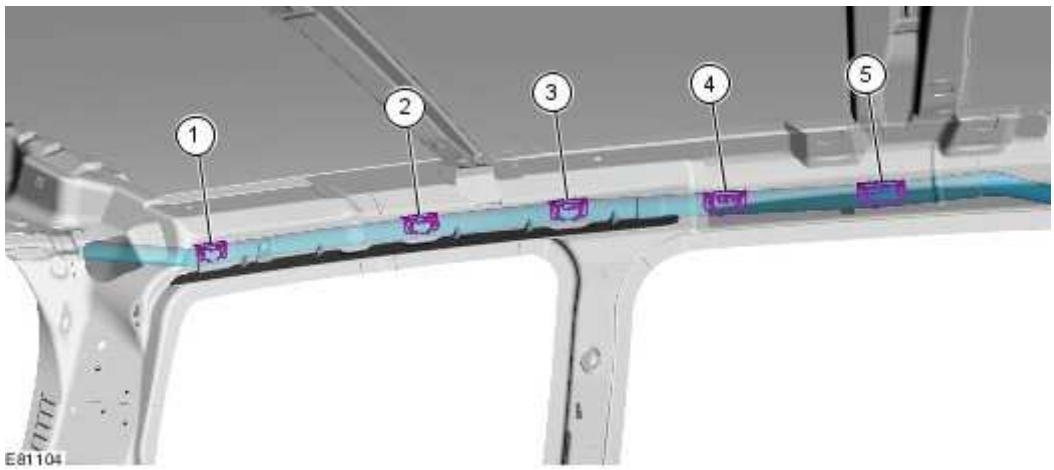
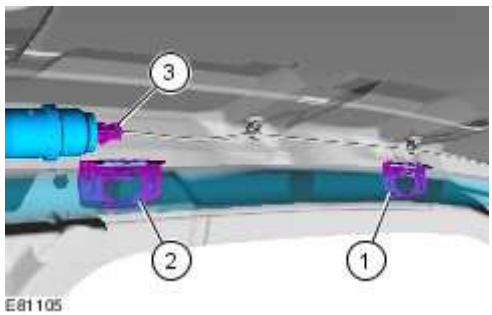
deformatic



2. *Torque:* 6 Nm



3. NOTE: Ma
sure that
these
componer
are install
to the not
removal
position.
Attach the
air bag mc
retaining c
the followi
sequence.



4. NOTE: Make sure that these components are insta
to the noted removal position.
Attach the side air bag module retaining clips in the
following sequence.

5. This step is only required when installing the left-har
air curtain.

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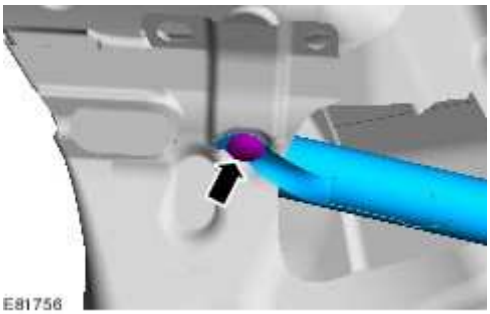
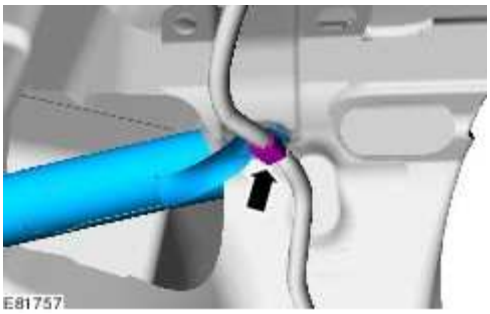
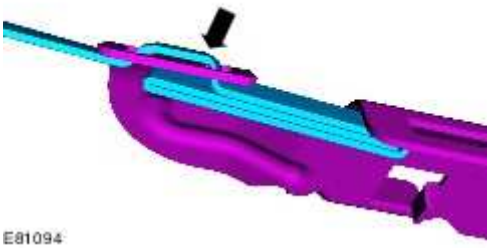




6. This step is only required when installing the right-h side air curtain.

7. NOTE: Make sure that this component is installed the noted removal position.



8. *Torque:* 10 Nm

9. Remove the protective strap from all of the side air b module retaining clips.
10. Install the headliner.
11. Initialize the door window motors.

    Refer to: Door Window Motor Initialization (501-11 C Frames and Mechanisms, General Procedures).

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Removal and Installation

General Equipment

Flat-bladed screwdriver

Removal

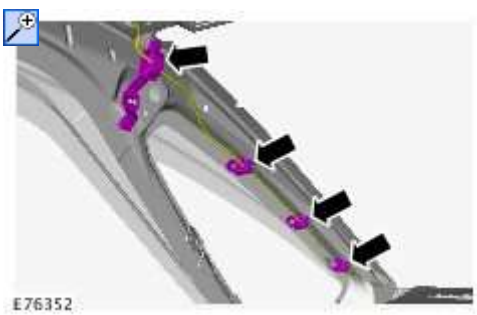
WARNINGS:

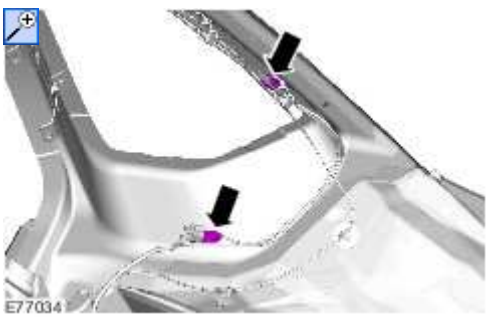
The supplemental restraint system (SRS) is active for a certain length of time after the po supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or remo any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source connected.

Wear safety goggles.

1. Refer to: Supplemental Restraint System (SRS) Hea Safety Precautions (100-00 General Information, Description and Operation).
2. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 B Mounting and Cables, General Procedures).
3. Refer to: A-Pillar Trim Panel (501-05 Interior Trim a Ornamentation, Removal and Installation).
4. 

5. 

6.

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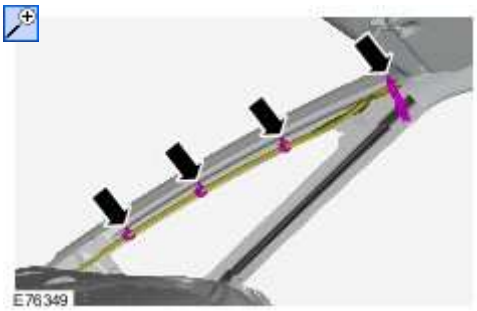
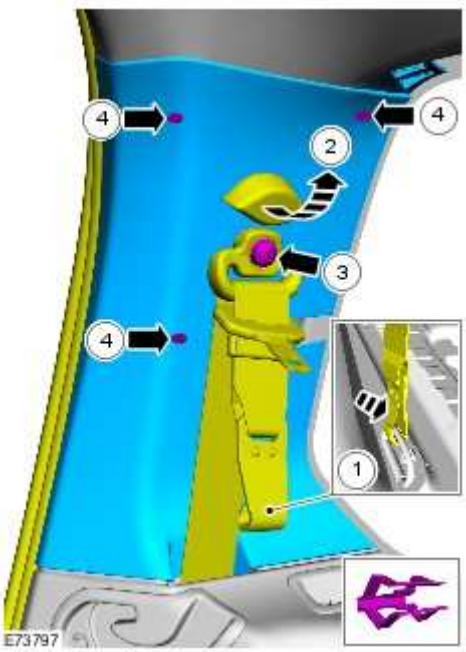
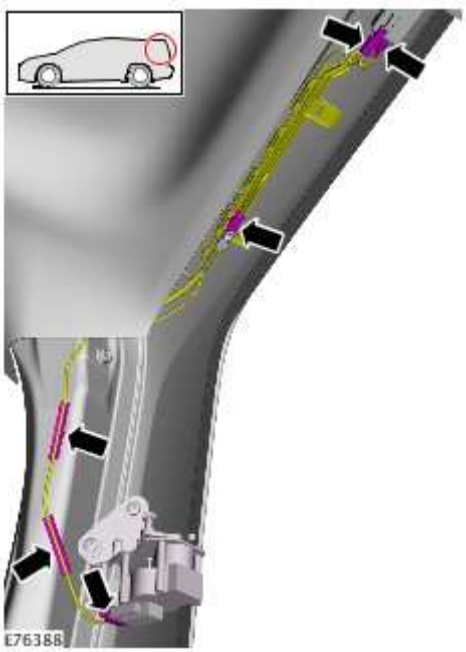


7. Refer to: B-Pillar Trim Panel (501-05 Interior Trim a
Ornamentation, Removal and Installation).
8. Refer to: C-Pillar Trim Panel - VIN Plate Body Style C
M (501-05 Interior Trim and Ornamentation, Remov
Installation).
9. *Torque:* 35 Nm



10.



11.

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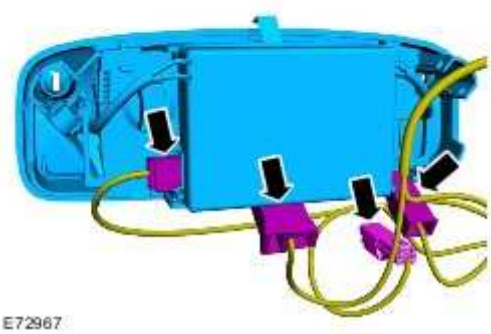
12. *General Equipment:* Flat-bladed screwdriver



13.

14. If equipped.

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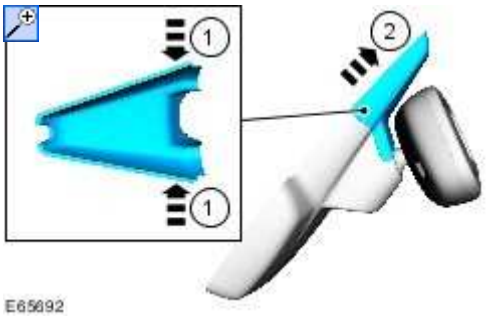
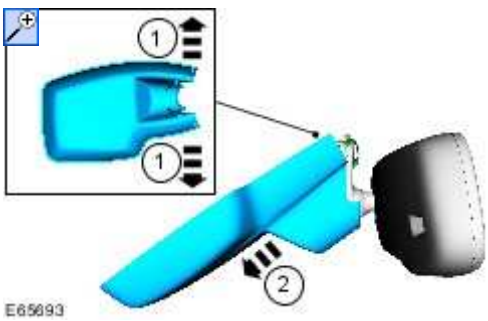
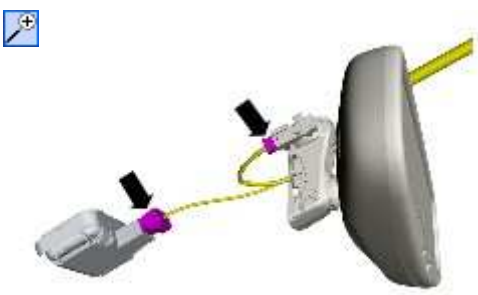


E65892

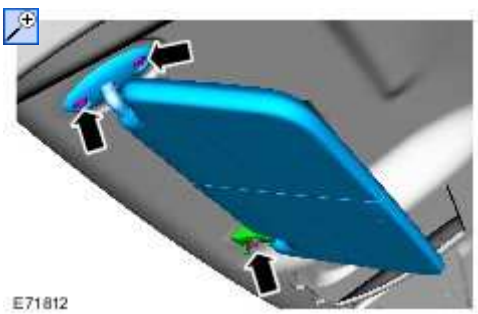


E65893

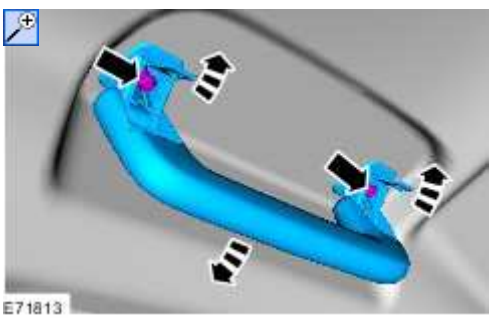
15. If equipped.


E74631

16. If equipped.


E71812

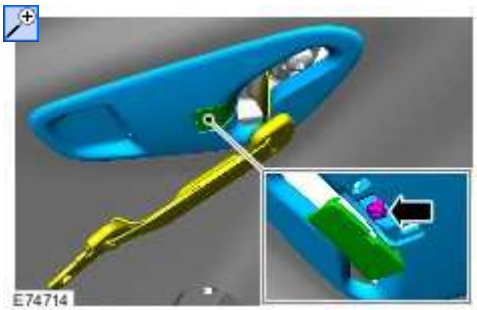
17. On both sides.

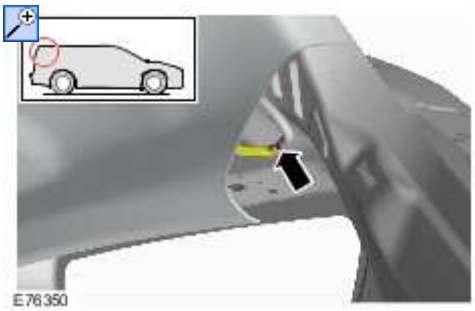

E71813

18. On both sides.

19.

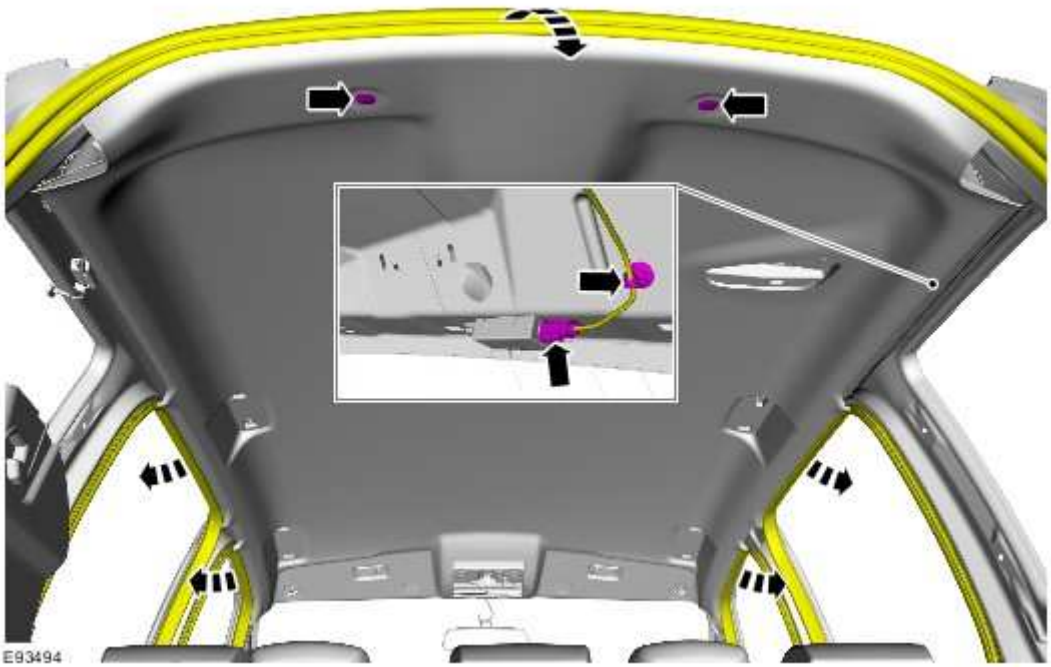
http://vnx.su





20.

21. Recline the front seats backrests.
22. Recline the rear seats backrests.
23. Support headline



24.

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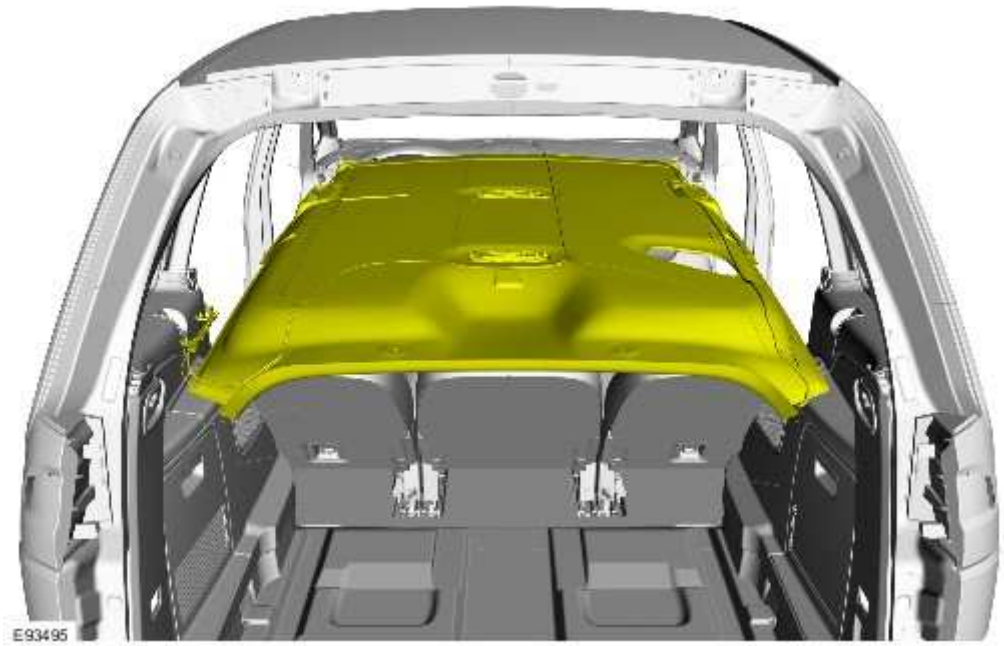
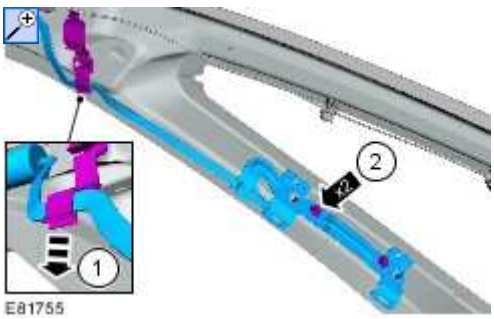
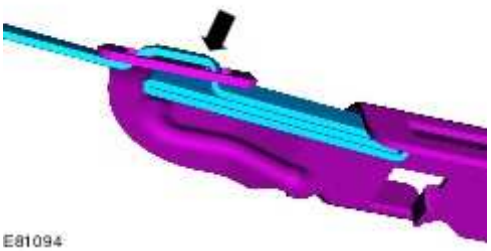
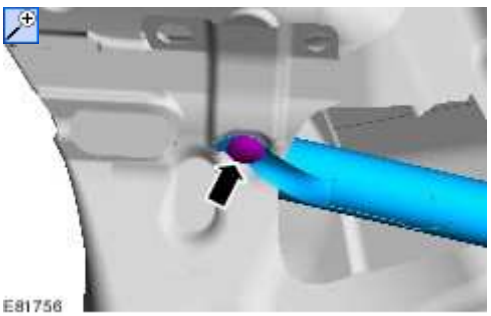




25.

26. NOTE: Note the position of the component before removal.





27. This step is only required when removing the left-ha side air curtain.

28. This step is only required when removing the right-h side air curtain.

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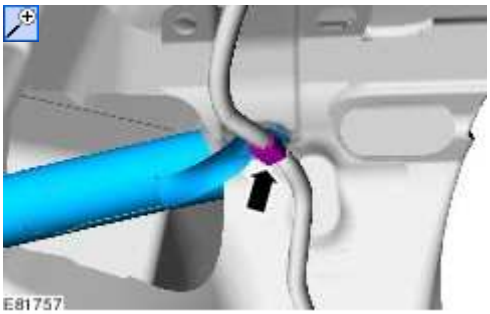
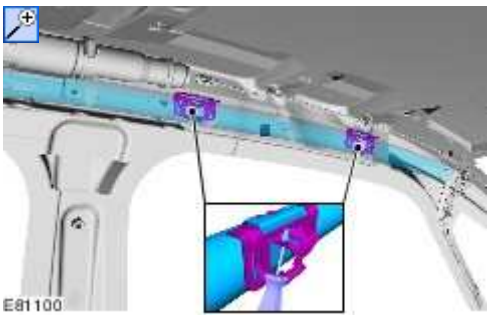
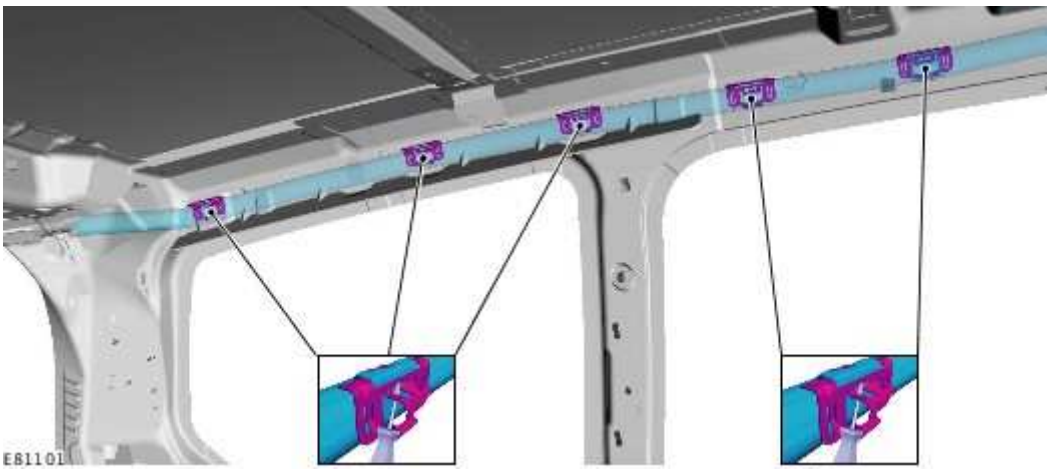
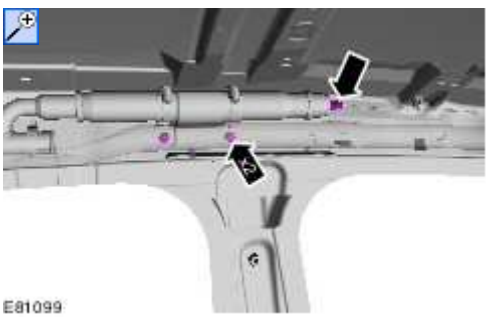




29. NOTE: Note the position of each component before removal.
    - Raise the side air curtain to gain access to the retaining clips.
    - Move the center of the clip downwards to relea clip.



30. NOTE: Not the positic each componen before removal.
    - Rais side curta gain acce the retai clips
    - Mov cent the dow to re the



31.

Installation

NOTE: Make sure that a new component is installed.

1. If the side curtain wa deployed, the vehicle side air cu mountings

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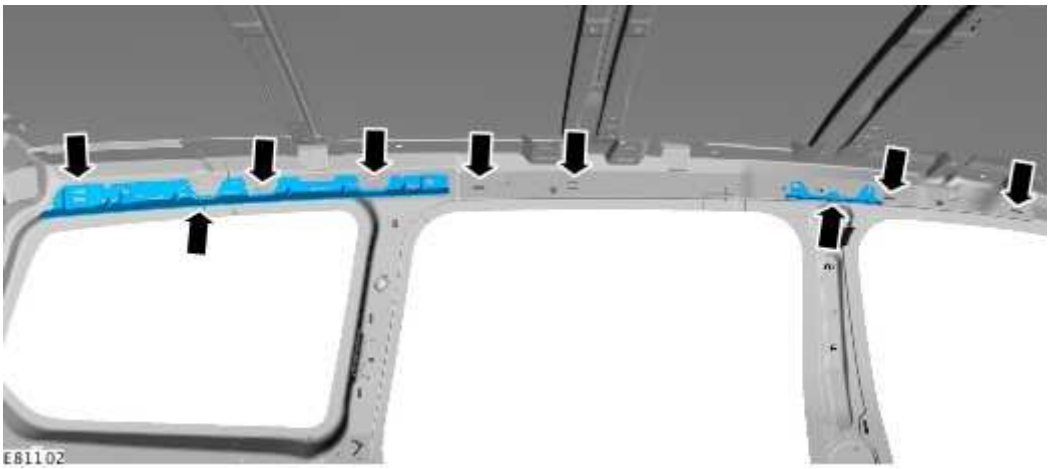

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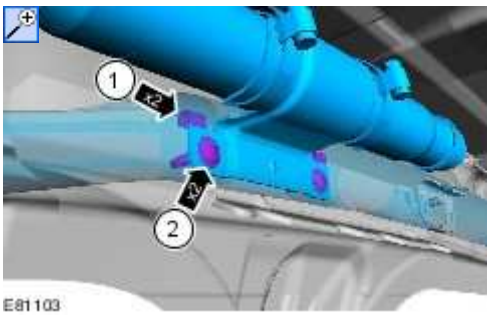
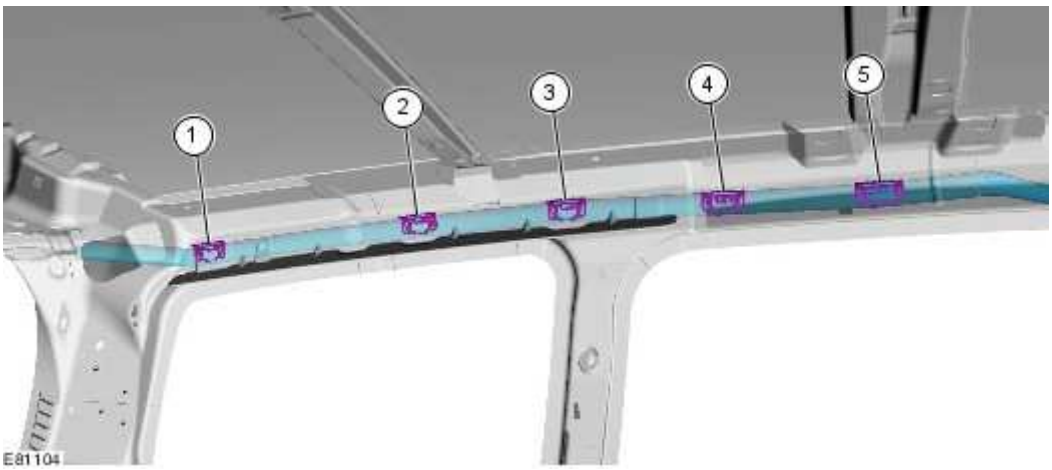
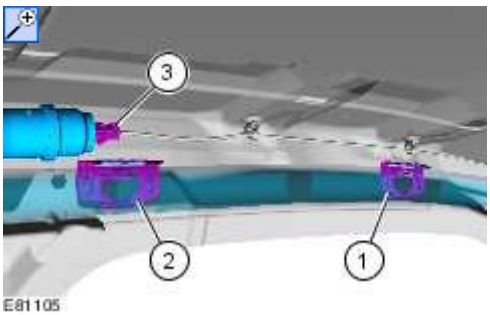


2. *Torque:* 6 Nm



3. NOTE: Ma
sure that
these
componer
are install
to the not
removal
position.
Attach the
air bag mc
retaining c
the followi
sequence.



4. NOTE: Make sure that these components are insta
to the noted removal position.
Attach the side air bag module retaining clips in the
following sequence.

5. This step is only required when installing the left-har
air curtain.

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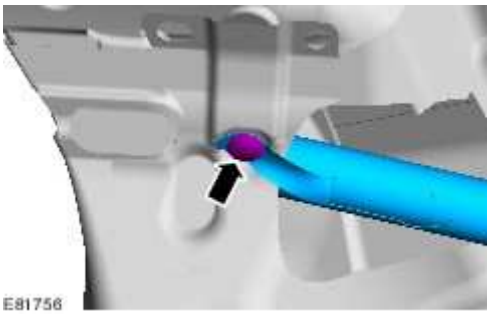
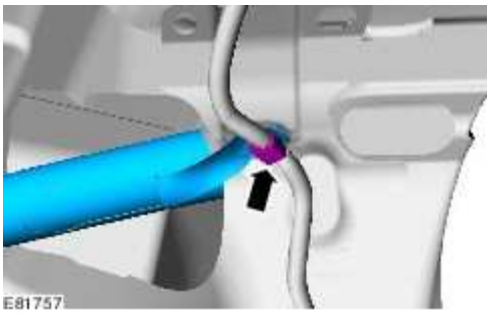
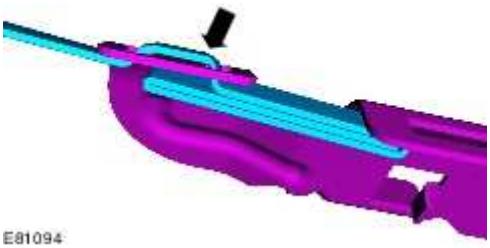




6. This step is only required when installing the right-h side air curtain.

7. NOTE: Make sure that this component is installed the noted removal position.



8. *Torque:* 10 Nm

9. Remove the protective strap from all of the side air b module retaining clips.
10. Install the headliner.
11. Initialize the door window motors.

    Refer to: Door Window Motor Initialization (501-11 C Frames and Mechanisms, General Procedures).

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Removal and Installation

General Equipment

Ford diagnostic equipment

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).
2. Remove the floor console.

   Refer to: Floor Console - VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: M (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console - Vehicles With: Electronic Parking Brake (EPB), VIN Plate Body Style Code: S (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Center Armrest/Manually Adjusted Parking Brake (501-12 Instrument Panel and Console, Removal and Installation).
   Refer to: Floor Console Upper Section - Vehicles With: Manually Adjusted Parking Brake, Vehicles Without: Center Armrest (501-12 Instrument Panel and Console, Removal and Installation).
3. If equipped.

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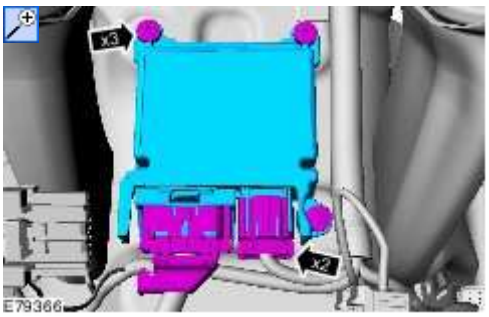
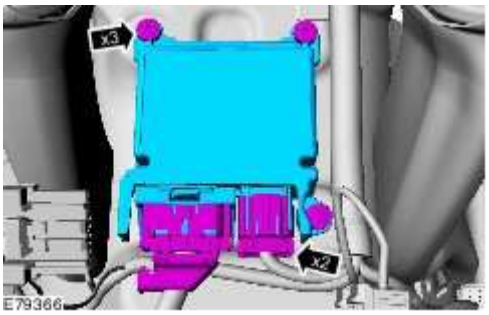


4.

Installation



1. *Torque:* 8 Nm
2. To install, reverse the removal procedure.
3. When a new RCM is installed, configure the RCM using the diagnostic tool.

   General Equipment: Ford diagnostic equipment

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Removal and Installation

Removal

WARNINGS:

The supplemental restraint system (SRS) is active for a certain length of time after the power supply has been disconnected. Wait for a minimum of 3 minutes before disconnecting or removing any SRS components.

Make sure that the vehicle electrical system is fully depowered and no other power source is connected.

Wear safety goggles.

Refer to: Supplemental Restraint System (SRS) Health and Safety Precautions (100-00 General Information, Description and Operation).

NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

   Refer to: Battery Disconnect and Connect (414-01 Battery, Mounting and Cables, General Procedures).

2. Remove the navigation system digital versatile disc (DVD) unit, if equipped.

   Refer to: Navigation System Digital Versatile Disc (DVD) Unit (415-01 Information and Entertainment System, Removal and Installation).

3.

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4.

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Vehicles with air conditioning

5.

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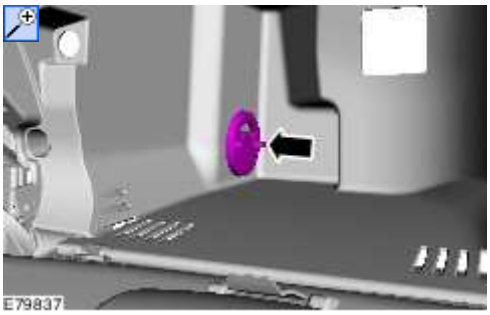
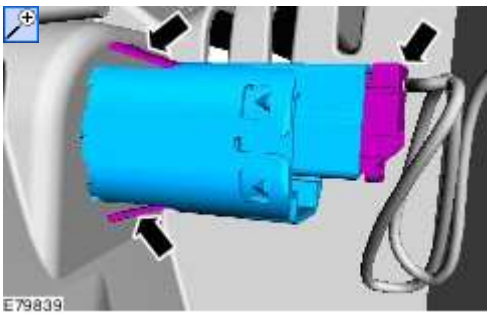


All vehicles

6.



7.

Installation

1. To install, reverse the removal procedure.
2. Initialize the door window motors.

   Refer to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).

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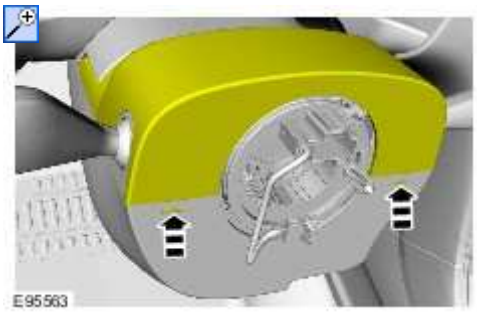
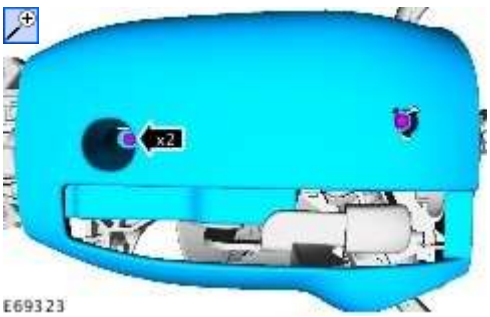
Removal and Installation

Removal

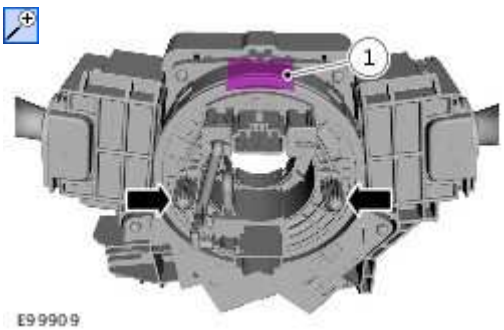
1. Refer to: Steering Wheel (211-04 Steering Column, Removal and Installation).



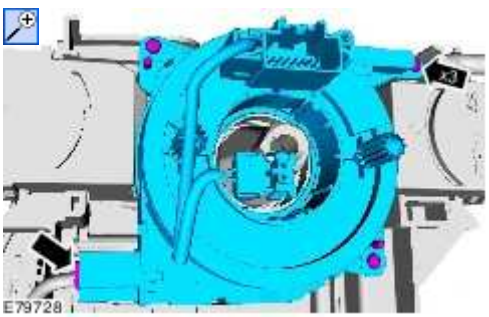
2.



3.



4.
   1. CAUTION: Make sure that the clockspring rotor does not rotate.
      NOTE: This step is not necessary when installing a new component.
      Secure the clockspring rotor with adhesive tape to the clockspring outer.



5. CAUTIONS:

   Make sure that the clockspring pins are not bent or damaged.

   Make sure that the clockspring rotor does not rotate.

Installation

1. CAUTIONS:

   Make sure that the clockspring pins are not bent or damaged.

   Make sure that the clockspring rotor

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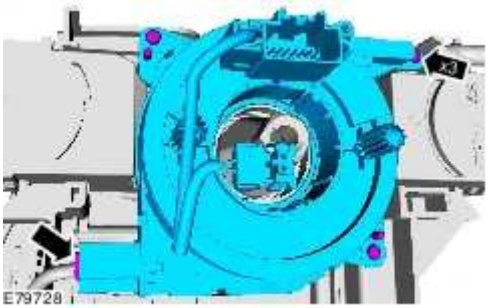
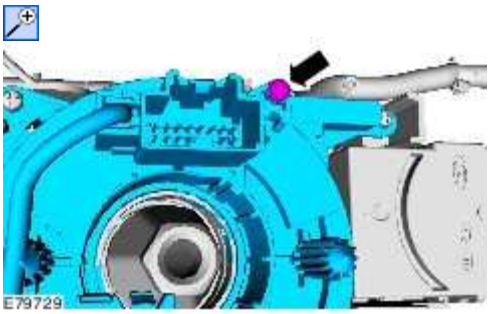
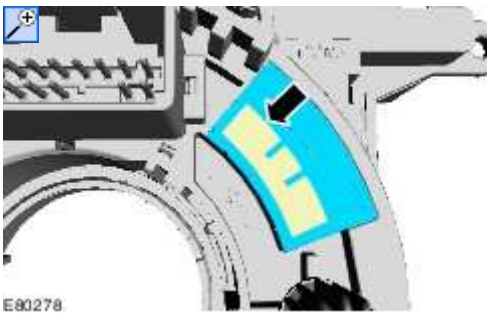


does not rotate.



2. NOTE: This step is only necessary when installing a new component.



3. CAUTION: Make sure that the clockspring pins are not bent or damaged.
   NOTE: This step is not necessary when installing a new component.
   Carry out the clockspring adjustment procedure, if the yellow roller is not visible in the clockspring window.

   Refer to: Clockspring Adjustment (501-20B Supplemental Restraint System, General Procedures).
4. To install, reverse the removal procedure.

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Description	Finis Code	Specification
Underbody protection	5 030 492	-
Anti-corrosion wax	1 219 834	WSK-M7C89-A
Cavity wax	5 030 081	-
Profiled butyl seal	1 128 983	S-M3G4620-A
Weld primer	1 205 996	-
Clinched flange protection	1 136 479	WSK-M4G245-B
Seam sealing compound	1 205 817	WSS-M4G364-A
Body sealing compound	1 143 255	-
Metal adhesive kit	1 203 241	-
Windshield sealant	1 613 838	WSK-M4G329-A
Adhesive spoiler set	1 219 837	-

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Description and Operation

The purpose of this document is to give the vehicle body specialist a general overview of possible repair techniques for body repair on Ford vehicles. Likewise, information about materials and tools to be used is given.

No model-specific information is given. Such information is saved in the respective Ford Etis workshop manual. Supplementary or updated information can be found in the Technical Service Information.

Information on repair techniques, materials or tools, which are not necessary for body repair on Ford vehicles or which are not considered as conventionally in use, are not listed in this document.

Layout:

The general section is divided into the following subject areas:

- How to use the document, with information on the symbols used
- Health and safety information on using materials and tools
- Information on bodywork construction and materials used
- Workshop equipment and use of tools
- Damage Assessment and determining the extent of the repair area
- Explanation of possible repair techniques for body repair
- Possibilities of the repair or remedying leaks, noises

Training:

The Ford Service Organization offers basic and more in-depth training on much of the content of this document. You can obtain an overview of the entire training offering from the Ford Service Organisation or on the Internet at www.ford-training.de.

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Description and Operation

Warnings and hazard notices

Warnings and hazard notices are shown in this literature by WARNING, CAUTION and NOTE indicators. These notices are always shown before a job step which can be associated with an immediate personal or material danger.

WARNING: This notice is used when failure to exactly follow the instructions given in this literature or failure to follow them at all may result in a hazard to persons and/or in persons being injured.

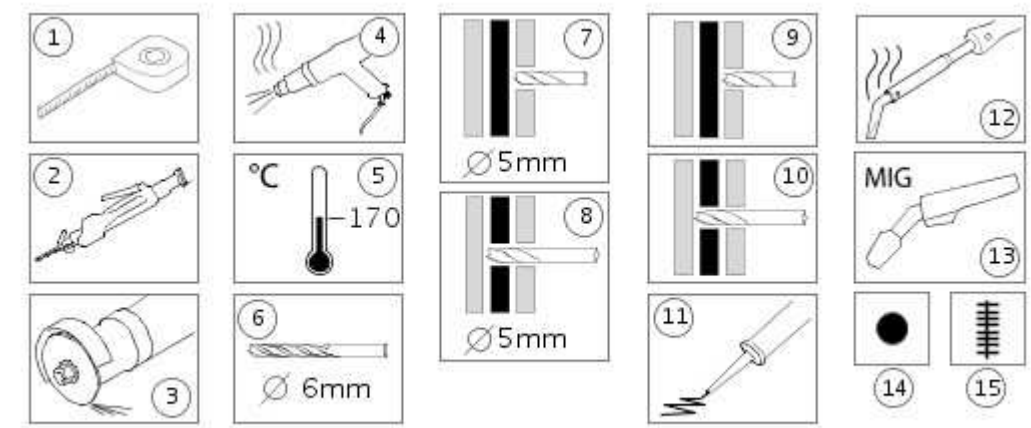
CAUTION: This notice is used when failure to exactly follow the instructions or test procedures given in this literature or failure to follow them at all may result in damage to the vehicle or to components.

NOTE: This notice is used when the operator should be made aware of special or extra information.

Symbols used

Symbols are used to graphically represent additional information about the operation, tool or materials. This information will not be shown separately again in the text.

The symbols used in this and other body repair manuals may be used alone as well as in combination in a diagram.



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Description	Description
1	Measuring tape
2	Saw
3	Abrasive cutter
4	hot air blower
5	Temperature specification (170°C in this example)
6	Drill with 6mm diameter
7	Drill through one panel thickness with a 5 mm dia. drill
8	Drill through two panel thicknesses with a 5 mm dia. drill
9	Drill through one panel thickness
10	Drill through two panel thicknesses
11	Apply substance
12	Soldering iron

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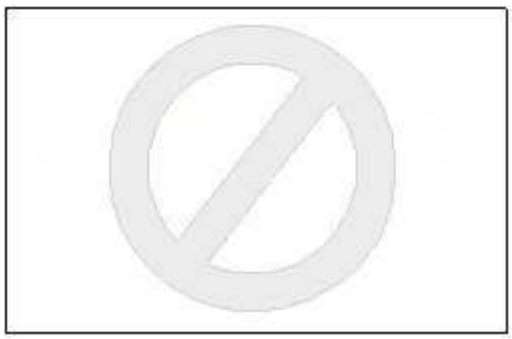
13	Metal-Inert Gas (MIG) weld
14	Resistance Spot Weld
15	Welded seam (full or intermittent seam)

Color coding

Different colors or shading can be used to depict special areas and components.



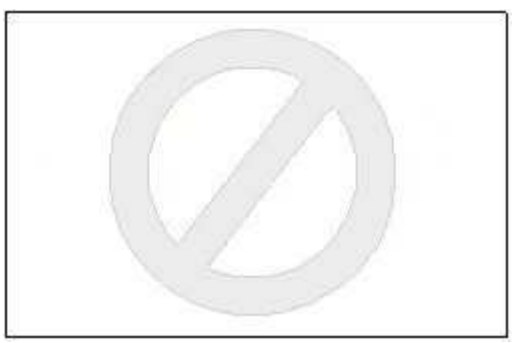
- Blue: Main component which will be removed or installed. Only actual movements will be shown in blue in the diagram.
- Magenta: Materials or fixings, e.g. spot welds or adhesives.

In an assembly operation, the colors show the sequence of removal steps.

- Green: First component or the first partial replacement section.
- Blue: Second component or the second partial replacement section.
- Brown: Third component or the third partial replacement section.

Movement arrows

Necessary work such as clinching flanges or moving lugs etc. will be represented by broken arrows.



Magnified and detailed views

If a detail cannot be clearly seen in the illustration because of its size or location, it is shown enlarged in a separate window.

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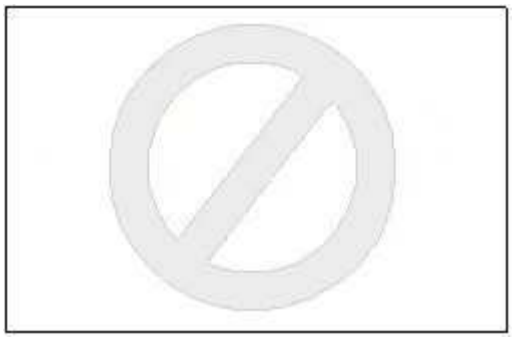
Position lines within a diagram

A position line is used to indicate a special position or a component. A spot weld which must be drilled out through two panel thicknesses is indicated here, different to all the others.



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Description and Operation

General

Appropriate repair methods and their correct implementation are very important for both vehicle operating safety and personal safety.

WARNING: There is danger of injury through:

- High voltage when electrical welding.
  - Do not perform welding work in a damp environment or on a wet substrate. Use suitable insulation underneath.
- Flammable substances in the welding area.
  - Remove flammable substances from the danger area. Remove the fuel tank and, where required, those components which supply fuel.
  - Completely remove the battery before carrying out any welding in that area.
- Welding fumes, which are harmful to health.
  - Always ventilate the workplace well and use an extraction system.
- Welding spatter and UV radiation.
  - Wear protective clothing, gloves and welding mask or welding goggles.
- Pyrotechnic components.
  - Disconnect the battery negative clamp and cover the battery terminal. Remove any airbag components.

All the regulations governing Health and Safety at Work must be complied with during body repairs.

Personal protection

Welding gases and grinding dusts can be harmful to the health. For this reason, make sure that rooms are well ventilated and work using the welding fumes extraction system. Sealants, underbody protection and paint residues must not be burnt down with an unshielded flame, as this will produce gases which are damaging to health. A dedicated extraction system must always be used when welding or brazing.

When working with substances containing solvents, good ventilation must be provided, respiratory protection must be worn and an extraction system must be used.

Do not weld in damp areas, if necessary use an insulation mat. Welding and grinding work near the battery presents the danger of explosion. For this reason, it must be removed before the work is started.

Cutting, grinding and alignment work on metal panels can cause a noise level of 85 to 90 dB (A) or even more. For this reason, you must always wear ear defenders.

The various body areas are subject to very high forces during realignment work. Should any component suddenly become detached during this process, there is a very great danger of injury. For this reason, pulling chains and pulling shackles must be secured with arrester cables.

NOTE: Work on airbag systems may only be performed by persons who have a relevant certificate of competence.
Some special instructions must be followed when working on airbag systems:

- Always stand to the side of it when removing or installing an airbag.
- Always store an airbag or an airbag/steering wheel with the airbag side pointing upwards and in a safe place.
- Only install the airbag again when the vehicle is fully repaired and the complete electrical

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systems has been tested.
- Take into account the location of air curtains and shoulder airbags.

Protection of the vehicle

Protect affected areas from weld spatter and dust during all welding and grinding work on the vehicle. If metallic dust stays on the vehicle for some time, there is the likelihood of film rust formation. Grinding or sanding work produce tiny spots of damage to the paint surface, which may cause corrosion.

For this reason, make sure to:

- Use carbon fibre blankets to protect the vehicle body.
- Use covering film to protect the vehicle body from sanding dust and metal dust.
- Take appropriate measures to protect the interior equipment of the vehicle during any repair work.

In addition, take into account:

- Remove fuel supply components as necessary.
- Protect working areas which are in danger of catching fire with a fireproof blanket.
- The welding must not cause components of the air conditioning system to become heated.
- Removal of any attached components in the space adjoining the repair area.
- Use covering paper to protect the interior from grinding dust.
- Create a definite barrier between the work area and the interior by using a carbon fibre blanket.

Protective equipment

The following protective equipment must always be used:

- Protective helmet or welding mask.
- Ear defenders and breathing protection.
- Protective gloves and safety boots.
- Welding fume extraction.

Electronic components

Increased use of comfort and safety electronics in modern motor vehicles also requires the greatest attention to be paid during body work. Overvoltages produced during welding and in alignment work during bodyshell rectification may cause electronic systems to be damaged. In particular, the safety instructions for performing welding work on vehicles with airbag systems must be adhered to.

NOTE: After disconnecting the power supply and before performing further work, a wait time of up to 15 minutes must be maintained, depending on the vehicle. Work on airbag systems may only be performed by persons who have a relevant certificate of competence.
Pay attention to the following points:

- Disconnect the battery negative clamp and cover the battery terminal.
- Disconnect the electrical connector at the airbag control module.
- If welding is to be performed directly near a control module, it must be removed beforehand.
- Never connect the negative cable of the welder near an airbag or a control module.
- Connect the negative cable of the welder close to the location of the weld.

For additional information, refer to: (501-20B Supplemental Restraint System)

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Side Air Bag Module (Removal and Installation),
Side Air Bag Module (Removal and Installation),
Driver Air Bag Module - Vehicles Built From: 13-07-2009 (Removal and Installation),
Driver Lower Air Bag Module (Removal and Installation),
Passenger Air Bag Module (Removal and Installation),
Air Bag Supplemental Restraint System (SRS) (Diagnosis and Testing).

Liquefied gas vehicles

Alternative fuel vehicles often require special handling in the workshop area. Above all, assembly operations to some extent require particular knowledge when dealing with the special technology and the safety regulations.

NOTE: Only fully trained personnel are permitted to work on alternative fuel vehicles.
These special requirements must be understood and taken into account in the body shop as well.

CAUTION: Danger of fire and explosion. The safety instructions must always be followed when performing service work on fuel/gas systems. Failure to observe this instruction can lead to injury.
If the smell of liquefied petroleum gas (LPG) or compressed natural gas (CNG) is noticed in the workshop, instruct everyone present as follows:

- No smoking and extinguish all naked flames.
- Shut off all electrical and air powered equipment.
- Evacuate the area.
- Ventilate the area.
- Contact the fire control authorities.
- Move the vehicle to a dedicated, well ventilated area.

Alternative fuels require special handling:

- Handle them in a specially dedicated, well ventilated area, which is only accessible to authorized persons.
- Identify the designated area with new warning notices.
- If possible close the main shut-off valve and run the vehicle on alternative fuel until it switches automatically to petrol operation. Only then is it allowed to drive the vehicle into the workshop or service area.
- If possible do not allow any liquefied gas (LPG) to escape.
- The ambient temperatures must not exceed 40°C. For this reason the LPG and CNG fuel tanks must be removed on vehicles with LPG or CNG operation before using a drying oven to dry the paint where the temperature exceeds 40°C.

Avoid situations in which fuel from an LPG or CNG fuel tank can escape. These situations include:

- Extremely hot ambient temperatures.
- Parking near a heating device.
- Raising the vehicle near a ceiling heater.

Refrigerated conversion vehicles

Apart from the special materials used in building the structure of the refrigerated compartment, such vehicles have special energy and refrigeration systems which require special handling during repair.

CAUTIONS:

Danger of injury. Work on the 230<SP>volt system of the refrigeration equipment must only be carried out by trained specialist personnel.

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The refrigeration system is filled with refrigerant R134a. This can cause frostbite if it contacts the skin. Pay attention to the corresponding warning notices and instructions in the chapter Air Conditioning Systems.
NOTE: Work on the refrigerant circuit may only be performed by persons who have a relevant certificate of competence.
Vehicles with a refrigerated compartment are often used to transport foodstuffs. For this reason, additional hygiene regulations must be complied with during repair work.

Aluminum and plastic are used to construct the two different types of compartment found on refrigerated vehicles.

The aluminum conversion is a very stable and technically perfect variant. However, against this the relatively high production costs and a lower payload must be taken into account, because of the weight of the aluminum conversion itself.

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range listed in the Training brochure published by the Ford Service Organization.
The plastic conversion has developed into a light, clean and economical alternative because of constant further development of materials and working techniques.

NOTE: The material combinations, the workmanship and the working methods must comply with the current food hygiene regulations. For this reason, service and repair work on the refrigerated conversion may only be performed by authorized and specially trained technicians.
Refrigerated compartment constructions are often made using both materials. The floor pan is made of structured, slip-proof aluminum panels and the wall and ceiling cladding is made of smooth surfaced plastic elements.

CAUTION: PUR hard foam is flammable. If PUR hard foam is overheated, it will burn on its own with a brilliant yellowish flame. It produces unpleasant choking and toxic fumes. Special measures must be taken when welding the vehicle body.
Polyurethane wall and ceiling elements are manufactured using a sandwich principle. An insulating polyurethane core is coated with food grade ABS plastic on one side.

PUR hard foam does not decompose, is rot resistant and is odorless. These properties make it suitable for use as insulation.

Because of its closed cell structure, water uptake by PUR hard foam is for the most part only a problem at edges. Cut edges or other mechanically worked surfaces must however be sealed with the greatest care.

The conversion to a refrigerated vehicle is performed as made-to-order production. The large surfaces of the wall and ceiling cladding can be changed and are particularly easy to repair.

If access to the back of a body panel section is needed because of body straightening work, in some circumstances it is cheaper to perform a cut-out repair instead of removing an element.

The repair process is fully described in the Student Information booklet Refrigeration System Technology, Transit 2000.5 Freshline.

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Description and Operation

Orderly and responsible waste management is not only very important for the protection of health and the environment, but it also has great importance where saving natural resources is concerned.

In body repair shops, since the introduction of the EU directives on the avoidance of vehicle waste and the promotion of return, re-use and recycling of vehicles and their components (2000/53/EU), more rigorous attention than before is also paid to avoidance and recycling of waste materials.

NOTE: The organization of disposal in the operation must comply with the country specific waste regulations:
In this respect, body repair shops must take into account and comply with the following requirements:

- Separate waste according to its recycling and disposal methods.
- Produce evidence for the correct transport and disposal of waste.

NOTE: The organization of disposal in the plant must comply with the requirements of the Waste Avoidance and Management Act.
The avoidance and recycling of waste must always take priority. However, despite all measures which may be taken, waste cannot be completely avoided.

NOTE: Useable waste which is not allowed in household rubbish, must be disposed of as special waste
All remaining waste must be treated as commercial waste and disposed of according to the local requirements.

Only applies to the EU:

The vehicle manufacturer is also under a legal obligation since the older vehicle legislation came into force throughout Europe in 2002.

This law covers the surrender, withdrawal and environmentally friendly disposal of older vehicles through the manufacturer.

The older vehicle legislation contains all the necessary information for the environmentally compatible disposal of older vehicles, starting with preliminary handling involving the removal of all operating fluids, deactivation of pyrotechnic components, elimination of pollutants and then further handling by dismantling components for re-use and recycling.

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Description and Operation

General

Under bodywork construction, a general distinction is made between monocoque and non-monocoque bodywork. The safety of the occupants is the main consideration for all types of bodywork construction. The front and rear sections are designed so that they absorb the energy of the impact via crumple zones. The use of modern design and manufacturing methods and the use of newly developed body panels (relating to their deformation and strength properties) mean that, despite the continuous weight-savings, all safety-related requirements made of the construction can be met.

Integral body-frame

In this method of construction, coverings, reinforcements, retaining panels and profiles are permanently joined together using a variety of joining techniques (gluing, spot welding, laser welding, soft soldering or brazing). The load-bearing function of the structure must always be achieved in each case.

There is no distinction made between components which are purely subject to bending/torsion or thrust loads and parts which perform sealing/covering functions (as in non-monocoque bodywork for example). In modern passenger vehicles, monocoque bodywork is very widespread and offers the advantages of a lightweight and low-cost construction.

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The rigidity of the bodywork is achieved by a panel skin and panel cross-section with the largest possible profile and therefore the largest resisting torque (such as for instance the rocker panel). Swage lines in the outer area of the bodywork increase the stiffness and the natural vibration frequency, to prevent possible drumming noises. The mounting points for ancillary components such as doors and wings are permanently built into the monocoque bodywork.

High rigidity of the bodywork is vitally important to keep the elastic deformations low at the joins to the ancillary components and to prevent noise when driving. Small gap dimensions are therefore only possible on vehicles with very stiff bodywork. With high bodywork stiffness, the construction can exert an influence on the handling of the vehicle (e.g. on

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poor road surfaces).

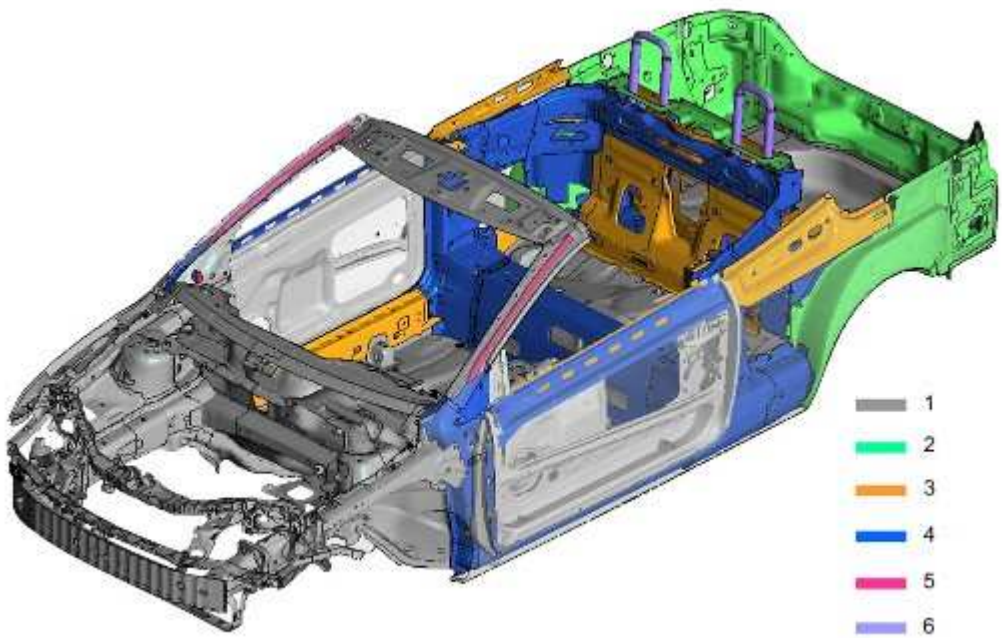
Advantages of monocoque bodywork:

- Weight reduction.
- Economical manufacturing technology.
- High torsional rigidity and high flexural strength.
- Defined deformation behavior at the front and rear.
- Maximum passive safety due to the strong passenger compartment

The protected passenger compartment with strong pillars, rocker panels and doors with integral side impact protection increase occupant protection. Opening of the doors is ensured, even if there is extreme deformation.

NOTE: Repair work must always be performed according to the established workshop literature. All the safety requirements must be guaranteed after any repair work has been performed !

Convertible



E85112

Description	Description
1	Body components adopted from the Focus 2004.75 (07/2004-)
2	Conventional bodywork construction steel
3	High-strength sheet steel
4	Super-high strength sheet steel
5	Maximum-strength sheet steel
6	Aluminium, can be subjected to high stresses

The body of a convertible differs from the principle of the integral body-frame of a saloon due to the lack of a roof construction. The body has a high degree of torsional stiffness. This is achieved by using high, super-high and maximum-strength sheet steel and body reinforcements in specifically-targeted areas.

These reinforcements can be installed in the area of the doors (diagonal braces etc.) or on the underfloor. In contrast to the saloon (or other non-convertibles) with square-section side members (closed profile), these reinforcements have a profile which is open on the underside (U-section).

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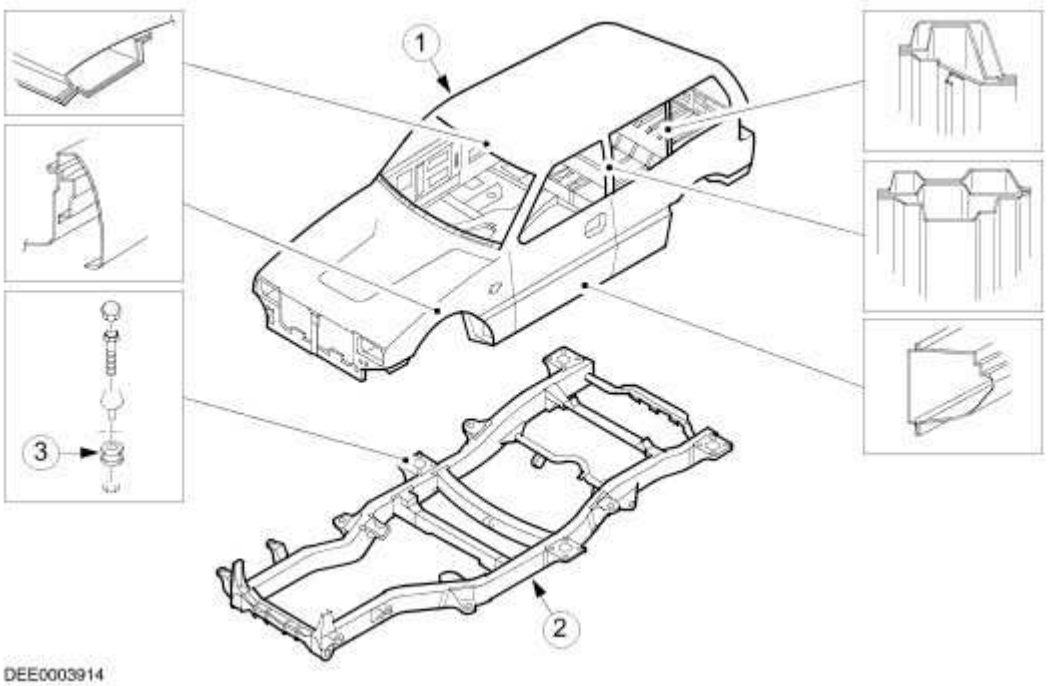
Special constructional changes within the bodywork structure:

- Reinforcing or increase in the thickness of the sheet steel in the pillar area.
- Reinforcing or increase in the thickness of the sheet steel in the floor pan structure (rocker panel area).
- Use of heavily structured reinforcing panels in the rocker panel and pillar area.
- In the area of the windshield frame and A-pillars, thick-walled reinforcing tubes are used (roll-over protection).
- Because there is no roof, the bridge construction principle cannot be used as it is on the saloon for example. Flexural and torsional rigidity must be ensured by other components.

Non-monocoque bodywork

Non-monocoque bodywork is built onto a frame or a chassis. Frames used for this have various construction forms, e.g. the ladder frame or tube frame. Non-monocoque bodywork is the original way of constructing vehicles.



Description	Description
1	Vehicle body.
2	Frame Assembly
3	Bolted connection

The ladder frame is still commonly used today for truck and off-road vehicles. The bodywork is placed on the frame or chassis. The total load which occurs while driving is transferred to the chassis.

More sporting vehicles can be built with non-monocoque bodywork, mostly using a lattice tube frame. Limitations in the design are accepted for the benefit of low weight. The outer skin here is usually made of plastic or alloy. This type of construction is also common in touring car racing for instance.

Special features of non-monocoque bodywork construction:

- Partly large surface panels and high volume shaped parts.
- Thicker materials and greater reinforcements in the frame area.
- Floor pan as frame structure with high torsional rigidity and flexural strength.
- Side panels only make a small contribution to the overall stability of the body.

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Instructions for repair:

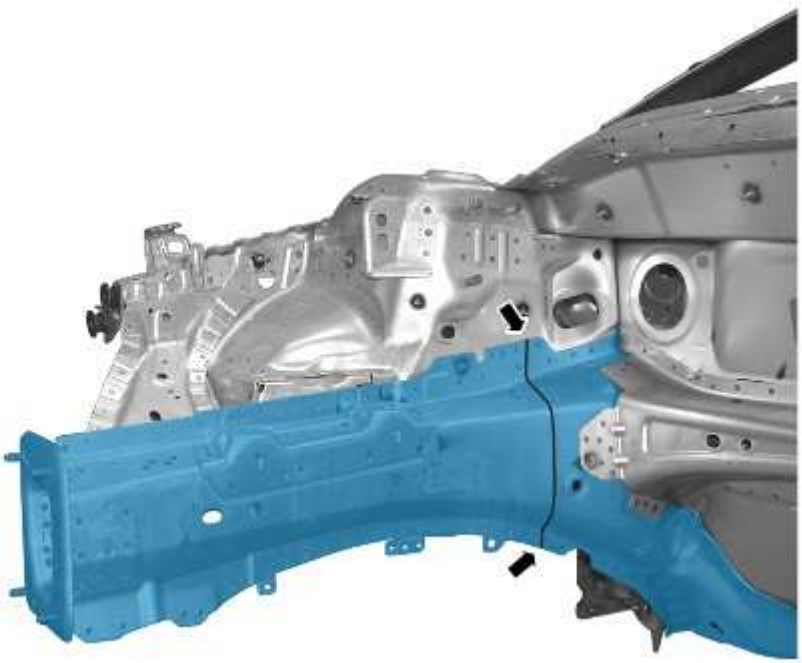
A different repair technique is necessary during repairs. A deformed frame structure requires high suction power during straightening repairs. Frequently, the body also has to be detached from the frame structure in order to carry out separate repair.

Due to the very stable frame structure, please note that the straightening behavior is completely different to that of a passenger vehicle. The frame and the attached body must be repaired independently of each other.

Further information can be found in the respective body repair manual.

Special points:

Tailored blanks



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Blue: Tailored blank

Arrows: Laser weld seam

The term "tailored blanks" describes the connection of two different panel thicknesses and/or strengths in the bodywork carcass. This connection is done using laser weld seams. Cut locations exactly on the laser weld seams are not permitted, as at present no joining techniques are approved for use in repair procedures that would re-create joins of the same quality.

NOTE: No cutting, no welding and therefore no sectional repairs are permitted in the immediate area of the laser weld seams. The model specific requirements are documented in the respective Body Repair Manuals.

Typical application areas are:

- Side member
- Door inner reinforcement/door frames
- Wheelhouses
- Rocker panel inner reinforcement
- Roof rail inner reinforcement

Deformation behavior

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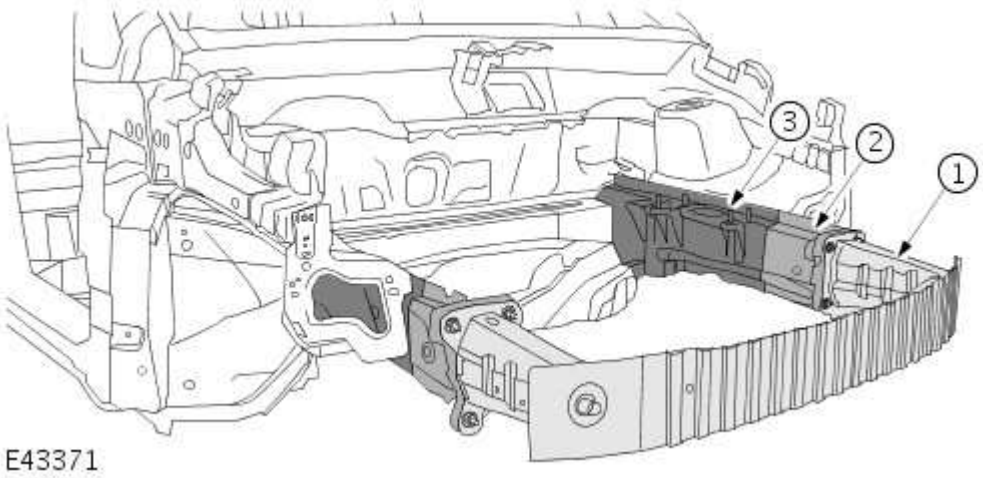

Description	Description
1	Bolted crash element
2	Front side member
3	Rear side member

Different materials and design features lead to staged deformation of the front and rear of the vehicle in an accident.

Crash element:

At the front of the vehicle there is a crash element which is connected to the side member by threaded connections. This crash element can absorb light impacts of up to about 15 km/hr. Because of the threaded connections, the crash element can be changed very quickly.

NOTE: Deformed crash elements must not be straightened or repaired.

Heavier impacts which can no longer be absorbed by the crash element must be absorbed by the side members or the floor pan structure. Depending on the extent of the damage, a part or complete replacement can be performed on the side member.

The rear of the vehicle, like the front of the vehicle, has structures which protect the passenger cell through staged deformation in the event of an accident. The design layouts, however, are adapted to the requirements of the rear area.

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Description and Operation

Assessment of the extent of the damage includes visual inspection and dimensional inspection of the vehicle. In order to correctly determine the extent of the damage caused by an accident, in-depth technical knowledge, practical experience with the technical equipment and the testing and measuring devices is required.

Noticeable damage to the bodywork structure

Positive accidental damage assessment can only be achieved if the service technician is able to reconstruct the effect of an impact on the body structure.

For example:

If the impact occurs on the front left-hand side member, the right-hand side member will usually also have been damaged. Often the length of this side member will not have changed, but because of the rigid body design, it may have become deformed. This damage can be detected through the size of the gap between the door and fender or by measuring the vehicle.

In the case of more severe impacts, in which the front part of the vehicle cannot absorb all of the impact energy, the passenger cell is also used to absorb the energy. Here, the energy is transferred via the A pillar and distributed there. This results in deformations in the roof and the door sill.

NOTE: Because of existing damage to the bodywork structure, damage diagnosis on a vehicle lift may give extra incorrect diagnosis results.
NOTE: Training courses are offered on this subject. For an overview, please refer to the Ford Service Organisation's training course brochure.

If for instance the Ford Focus Coupé/Cabriolet is raised on a vehicle lift, the dead weight of the vehicle will cause the front end to drop by approx. 2 to 3 mm.

The altered door position is clearly recognizable by stiffness of the lock; the door moves upwards. This causes the lock pin to contact the guide element of the door lock.

It is possible to draw conclusions about the extent of the damage through a visual inspection of the external damage. In general, the following areas are to be checked during the visual inspection:

- Outer panel including seam seals for cracks or flakes in the paint caused by the accident.
- Size of the gap on doors and hoods for evenness.
- Freedom of movement of door and hood/tailgate locks.
- The vehicle roof for folds (gap measurement on vehicles with sunroof)
- Dotted flange in door section for deformation and cracked weld spots.
- The side members and crash components for crumpling and folding.
- Trunk floor and floor pan from above and below for crumpling.

No noticeable damage to the bodywork structure

In addition to external indicators such as flaking paintwork or cracks in the underbody protection, it is vital to check for damage to the body structure that is not visible from the outside (hidden body damage) during a damage assessment. Unless ancillary components are removed, it is often impossible to achieve accurate diagnosis of the underlying body parts.

NOTE: In order to determine the damage as accurately as possible, it may be necessary to remove ancillary components in the area of the damage.

Particular attention must be paid to the following components:

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- The A, B and C pillars in the roof area.
- Floor pan.
- Rear ancillary components, such as bumper, lights, etc.
- Trunk floor, spare wheel cavity.
- Rear coverings, such as interior trim, carpet, etc.
- Lower rubber seals, e.g. in door area (welded flange).
- Area under the rear seat.
- Attachment points of transmission system, steering, engine, drive shafts, front and rear axles.
- Electrical components, e.g. the radio (damage through shaking or through voltage peaks).

Non-monocoque bodywork

The chassis and bodywork must always be checked during damage diagnosis on vehicles with non-monocoque bodywork.

It is also important here to inspect closely for damage the impact area and the areas absorbing forces.

With these vehicles, simple inspections can already give an indication of possible deformations.

In addition, you must check for the following for vehicles with frame structures:

- Cracks in the paint on the frame welds.
- Traces of deformation on frame components.
- Check attachment points (silent blocks) for position changes and damage.
- Changed position of rubber seals.
- Fit and function of the ancillary components.

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Description and Operation

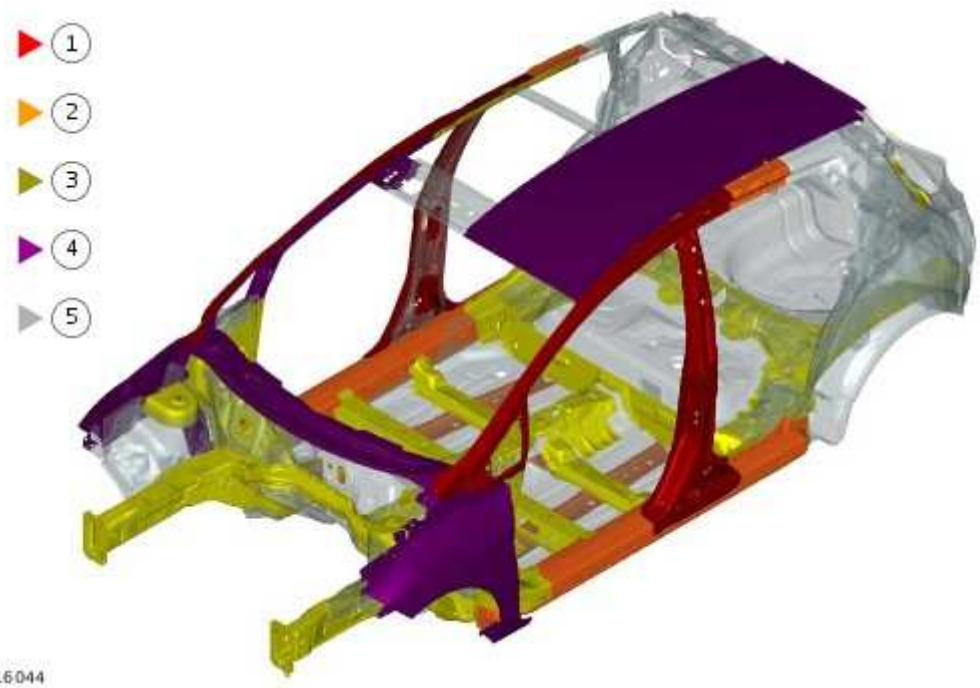
Types of steel

Steel body panels are still the most important materials used in the fabrication of stressed skin vehicle bodies. In addition to the familiar types of steel, reinforced high-strength and also ultra-high-strength special steels are used in vehicle body construction.

Types of steels are classified by their properties of strength and elasticity.

- Normal strength steel has a minimum yield strength of up to about 210 N/mm².
- High strength steels have a minimum yield strength of about 150 to 600 N/mm².
- Ultra-high-strength steels have a minimum yield strength of about 400 to 1200 N/mm².

High-strength and ultra-high-strength steels are mostly installed in safety relevant locations (structural components). Among others, these are side members, pillars, roof frames.



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Pos.	Used type of steel	Application range
1	Ultra High Strengh Steel (UHSS)	Impact carriers, Bumper carriers, Reinforcements ...
2	Extra High Strengh Steel (EHSS)	Frame side member, ...
3	Very High Strengh Steel (VHSS)	Wheel house, ...
4	High Strengh Steel (HSS)	Roof sticks, ...
5	Normal strength steels	Outer Panel, ...

Normal strength steels

Normal strength steels are most often used in body construction. They are relatively soft and are therefore particularly suitable for the deep drawing processes used in body manufacturing. As well as very good reshaping properties, the panels also have a relatively high rigidity.

High strength steel panels

The strength of the material and the nature of the surface can be changed as required by different engineering processes. In order to achieve suitable configuration and a good match between construction specifications and what is possible in production, a large range of high strength panels is available.

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The range of the minimum yield strength is from 180 N/mm² to 460 N/mm². High strength thin steel panels usually have a surface finish. Electrolytic surface sealing is preferred. Within the group of high strength steels, various types of steel are used in body construction:

- **Micro-alloyed high strength steels** for very difficult drawn components such as fenders, the internal components of doors, hoods and luggage compartment lids or load bearing components such as sidemembers, crossmembers etc.
- **Bake-hardening steels** and **phosphorus alloyed steels** for external panel components with higher draw depth and subject to higher operational demands.
- **Isotropic materials** for flat shaped outer steel panels on doors, hoods, luggage compartment lids, roofs.

Ultra-high-strength steels

These steels are predominately used for body structural components which are relevant to safety. Despite the reduced thicknesses of the panels used, weight reduction is often achieved together with greater strength. As with high-strength steels, special types of steel are used in the ultra-high-strength steels group:

- **Complex phase steels** are used for door side impact carriers, bumper carriers and body components relevant to crashes. Besides high strength, they have good cold reshaping properties and are easily welded.
- **Dual phase steels** have the same properties as complex phase steels. Because of their high strengthening properties they are suitable for body reinforcements.
- **Residual austenite steels** and **martensite phase steels** have very high strength levels of up to 1200 N/mm² and are mostly used in body structures relevant to crashes.

Because of the use of such steels, some special points must be taken into account during body repair:

- Increased force required during straightening.
- Strong springback tendency during alignment work.
- Cutting tools have a shorter useful life.
- NOTE: High-strength and ultra-high-strength steel panels must not be heated during straightening work.
  Work without applying heat when carrying out straightening work. Losses of strength will occur at temperatures as low as 400°C. The basic working methods and the tools to be used are the same however.

Coated steel panels

In a similar way to high-strength steel panels, coated steel panels are finding more applications because of the better corrosion protection which they offer. There are basically two different process which are used to apply a zinc layer:

- Hot dip zinc coating (no longer used in vehicle construction).
- Electrolytic zinc plating.

The following points must be noted when welding:

NOTE: Welding fumes are harmful to health. Make certain that the workspace is well ventilated and use welding fume extraction.

- Zinc starts to melt at about 420°C.
- The zinc vaporizes at a temperature of about 900°C.
- The amount of heating determines the damage to the zinc coating, and therefore to the corrosion protection.
- NOTE: Coated panels have a higher electrical resistance, but this can be compensated for by increasing the welding current by 10 - 20% .

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Resistance spot welding is particularly suitable for welding zinc-coated panels, because no widespread warming occurs.

- With electrolytically zinc-plated panels there is no need for any special preparation because the zinc coating does not need to be removed.

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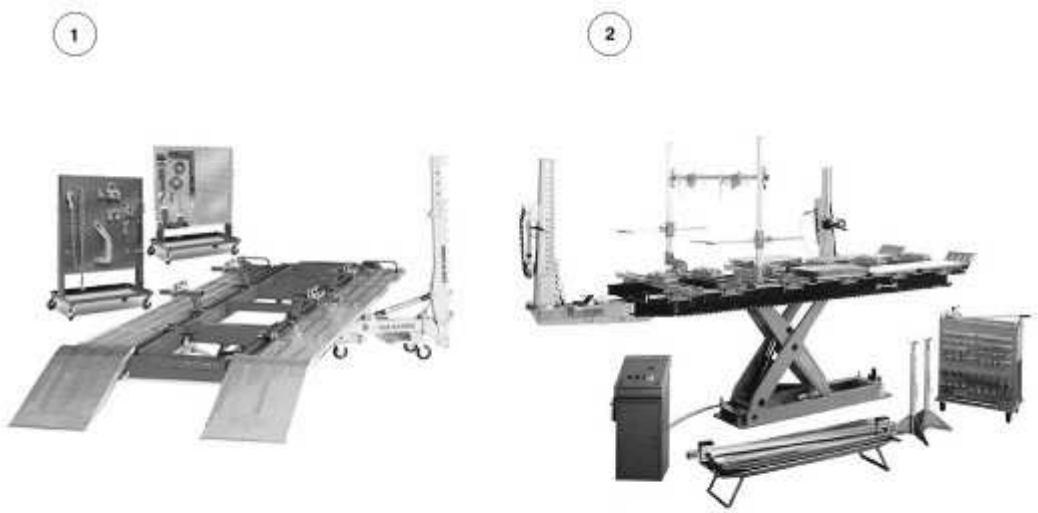
Description and Operation

Alignment systems

NOTE: Please refer to the Ford Service Equipment Catalog for information on the body tools recommended by Ford.
Straightening and alignment repairs are often required to restore a vehicle body to its original shape after accident damage.

Universal aligning and measuring systems and universal alignment angle systems are suitable for this work.



E58852

Description	Description
1	Universal aligning and measuring system
2	Universal alignment angle system

Basically, the aligning and measuring system must satisfy the following requirements:

- Universally applicable to all types of passenger car. Can also be used on light commercial and off-road vehicles.
- Accepts the forces involved during straightening.
- High stability and mobility.
- Can accept all or part of the weight of the vehicle.
- Quick to set up.
- Simple to use.
  - Stationary design with drive-on ramp.
  - Height-adjustable aligning platform.
  - Universal gauge extensions with fast anchoring ability around the whole circumference of the aligning platform.
- Facility to test individual body measurement points, with or without aggregates being removed.

Alignment angle devices survey the vehicle at several points on the body. These are usually points which are also used in production. In addition, a recording over the rocker panels is possible. A measuring system is not needed, because the necessary body points

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are specified with gauges. For this purpose, vehicle specific or universal gauges are available.

Universal alignment systems consist of a vehicle mounting (universal clamps at the rocker panels) and a pulling device. In addition, a measuring system is required.

NOTE: Because universal clamps are used, the rocker panel area must be reworked for optical and corrosion protection reasons after the repair is completed.
Pay attention to the following points:

- Clean the attachment areas.
- Anchor the vehicle free of stress on the relevant system.
- Support the aggregates to take strain off the body.

Measuring systems

In order to exactly diagnose a damaged vehicle body, measuring systems are required. Depending on the measuring method, the systems vary in having mechanical, optical, acoustic and electronic measuring devices. In some cases, hybrid versions of particular systems are found.

NOTE: When working with each measuring system, the manufacturer's instructions provided in the description of the measuring equipment must be followed.
Basically, the measuring systems must meet the following requirements:

- Universally applicable to all types of passenger car. Also can be used on light commercial and off-road vehicles.
- Suitable for all accident damage.
- Fast capture of body measurement points in the underfloor and external areas.
- Data catalog to record all measurement points (length, width and height) both with and without the aggregates being installed.

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range of training offered in the Ford Service Organization training brochure.
Beam compass

The beam compass is a very practical and straightforward aid for measuring bodywork and especially floor assemblies. The beam compass can be used to detect dimensional variations across the length and the width by means of comparison measurements and diagonal measurements.

As a basic principal, body reference points should be chosen which are shown in the body frame measurement data sheet.

NOTE: To be able to determine difference in measurements, the same reference points must always be chosen on both sides. For this purpose the beam compass must be positioned symmetrically.
Comparison measurements can also be made on the outside of the body. Depending on the damage, left/right measurements (symmetry measurements) and diagonal measurements can be made using the beam compass, telescopic rod or a measuring tape.

Laser measuring systems

These systems use laser beams which are projected in one or more planes.

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E59220

By the use of two parallel laser heads which can be turned, symmetrical points of a vehicle body can be tested and compared. Using the linear scales which are attached to the measuring points, the measurement data is read off with the aid of the projected laser beams.

The integral inclination gauge also allows differences in height to be quickly checked.

Mechanical measuring system

The use of mechanical measuring equipment is an easy and effective way to check a vehicle frame and chassis assembly quickly, exactly and reliably.

In many cases an assessment of the damage can be made with the help of this system, without the need for elaborate setting up.

E59888

Because of its self-centering mount, measurement can be carried out by one person.

Further advantages:

- Fast deployment.
- Simple to use.
- Can be extended using adapters, measuring probes and measuring tubes.

Measuring systems which are firmly mounted on an aligning platform require more work in setting them up. They are used to constantly check measurements during alignment work.

This type of mechanical measuring system has measuring scales and measuring slides in three measuring axes. So that the body can be measured, the vehicle is secured on the aligning platform base frame using four universal chassis clamps. The exact fixing points are given in each respective data sheet.

Ultrasonic and mechanical-electronic measuring systems

These measuring systems can be combined with all current aligning platforms. In addition these measuring systems can be used independently of an aligning platform by using a vehicle lift or suitable support stands.

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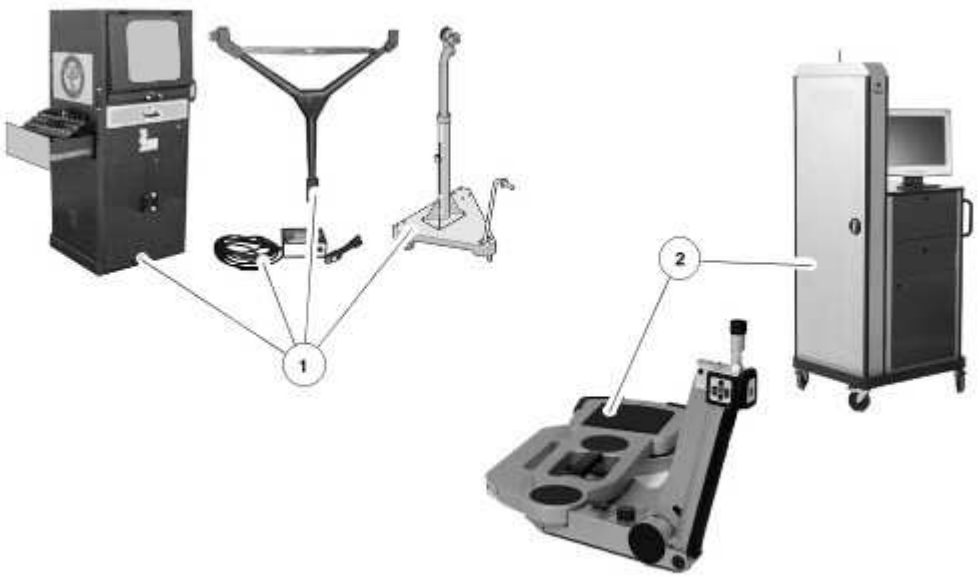

E59221

Description	Description
1	Ultrasound measuring instrument
2	Mechanical-electronic measuring system

Acoustic or ultrasonic measuring systems use ultrasonic emitters and sensors to survey a body.

To do this, ultrasonic emitters are mounted on the vehicle using special attachments. During the measuring process the ultrasonic emitters constantly send out signals which are received by sensors (microphones) and then passed to a computer. The measurements are displayed on the computer screen and are compared with the required values supplied by the vehicle manufacturer.

The ways in which mechanical-electronic measuring systems can be used are similar to those of the acoustic measuring systems. They can also be set up on a suitable understructure, without an alignment jig. After this system has been arranged under the vehicle floor and adjusted to three undamaged vehicle measuring points, the measuring arm is brought up to the required measuring points and the readings compared with the reference values. The data is transmitted to a computer where it is evaluated and the results displayed on a screen.

Welding gear

As in the past, the dominant process in body construction is resistance welding, in particular spot welding. Depending on body type, up to 5000 spot welds are applied, either by welding robots or in the multi-point welding machine.

Resistance spot welding permits very high energy to be concentrated on a relatively small area of the workpiece in the shortest possible time and when high pressure is applied, a permanent joint is formed. During repairs the resistance spot welds used in production must be re-created accordingly.

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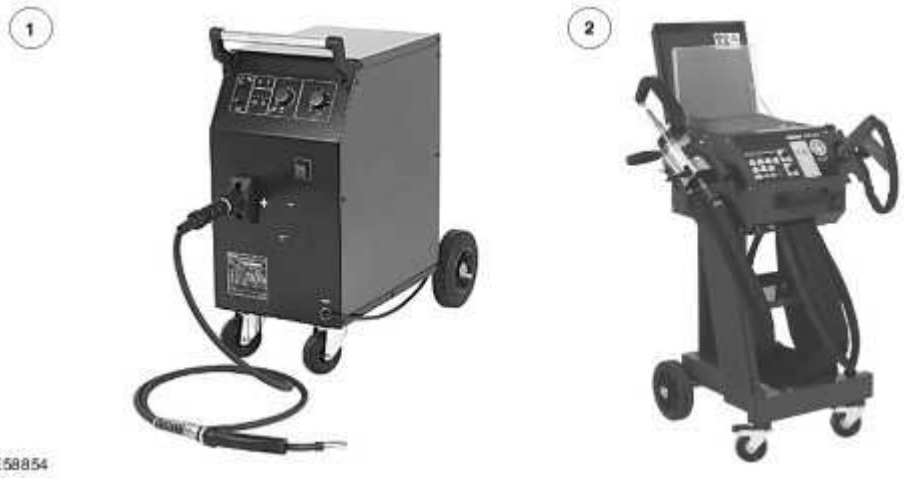

Description	Description
1	MIG welding machine
2	Resistance spot welding machine

NOTE: If a suitably powerful welding machine is not available and multi-layer panel joints with a total thickness of over 3 mm need to be made, puddle welding must be used.
Although in principle, high and super high-strength panels are adequately or well suited to resistance spot welding, considerable problems may arise because of low welding power, especially where thicker panels or three layers of panel must be welded together in the workshop. In particular, older welding equipment does not have the latest welding technology nor welding power and therefore cannot reliably join panel thicknesses greater than 3 mm.

Equipment with inverter technology allows better spot weld quality because of a constant high welding current. In addition the high welding current makes shorter welding times possible and the electrodes therefore have a longer working life. Inverter welding is a further development of electrode welding.

Further advantages of the new inverter welding equipment are:

- good welding performance with constant quality, even with high switch-on times
- recognition of and compensation for disruptive factors: e.g. primer, adhesive, rust-prevention paint
- own and pre-set welding programs which can be saved and called up
- quality confirmation through logging of all important welding data
- fast changing of spot welding clamps or spot welding guns as required

The following functions can be controlled and monitored by programming the welding equipment:

- Control of the start conditions by resistance measurement (dirt, paint, bodywork adhesive, shunt circuit through the next spot weld).
- Ensuring the optimum welded connection.
- Checking the energy balance, resistance and quality.

In the case of resistance spot welded connections, faults in the weld are difficult to see from the outside. It is therefore absolutely vital to know the particular properties of the welding machine being used. A test weld with subsequent peeling test will provide information on the quality of the weld. The spot weld itself must not separate, it must tear away leaving a hole.

In the production of vehicle bodies, MIG welding plays a minor role as a joining technique. It is used for components subject to high demands, such as threaded plates for axle mountings, or at locations which cannot be spot welded for access reasons.

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Description and Operation

General

Before starting accident repair work, make sure that the necessary spare parts and repair material are available.

Planning

NOTE: The body interconnection is to be maintained if possible. Repair is preferred to renewal of body components. Furthermore, check if it is possible to perform a partial repair.
During planning the following job steps must be observed and adhered to:

- Determine the repair method taking into account the information made available in ETIS.
- Work out which repair components will be needed and obtain them.
- Establish what disassembly work is needed.
- Check for specific features such as airbags, route of water drain hoses, electric cables and the location of NVH elements.
- Cut out the old parts (only when the new parts are waiting ready).
- Prepare the joint locations.
- Attach the new parts.
- Prepare the area of the repair for painting (grinding welded beads).
- Perform any solder work which is required at the repair location.

Chronological sequence of repair

NOTE: Refer to each vehicle specific chapter in the workshop literature for details on the individual points.
The actual sequence of repair can be divided into the following steps:

Job steps for the coachbuilder:

- Straightening
- Establish separating cuts and mark them.
  - Take into account the requirements given in the repair instructions.
  - Place the new part ready for use and include it in the repair plan.
- Separate and remove the old part.
  - Take into account the special features particular to the vehicle.
- Prepare the joint locations.
  - - Sand and align the weld flanges.
  - Apply corrosion protection measures.
  - Offer up the new part.
- Attach the new component.
- Rework the welded joints (grind welded seams).

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Description and Operation

General

If there is concern that the body has been deformed, the body must be measured. Several measuring procedures and tools can be used for this purpose.

With simple measuring systems, it is possible in most cases to draw a conclusion about the extent of the damage through a quick measurement without time-consuming assembly work (straightening jig).

NOTE: For the floor pan and the exterior of the vehicle, measuring data is contained in the vehicle-specific repair instructions for each vehicle. Manufacturers of measuring and straightening jigs create data sheets for this purpose for each vehicle.
Data sheets with the body frame dimensions for body measurement are specified in the model-specific repair instructions in each case. Pay attention to the position of the measuring probes for each of the measurements given. A tolerance of ± 3 mm applies to all specified dimensions.

Measuring points that are specified in a curve are to be measured so that the greatest distance from the opposite measuring point is reflected. For exact determination of the measuring points, enlarged sections are shown.

Example of measuring the vehicle superstructure

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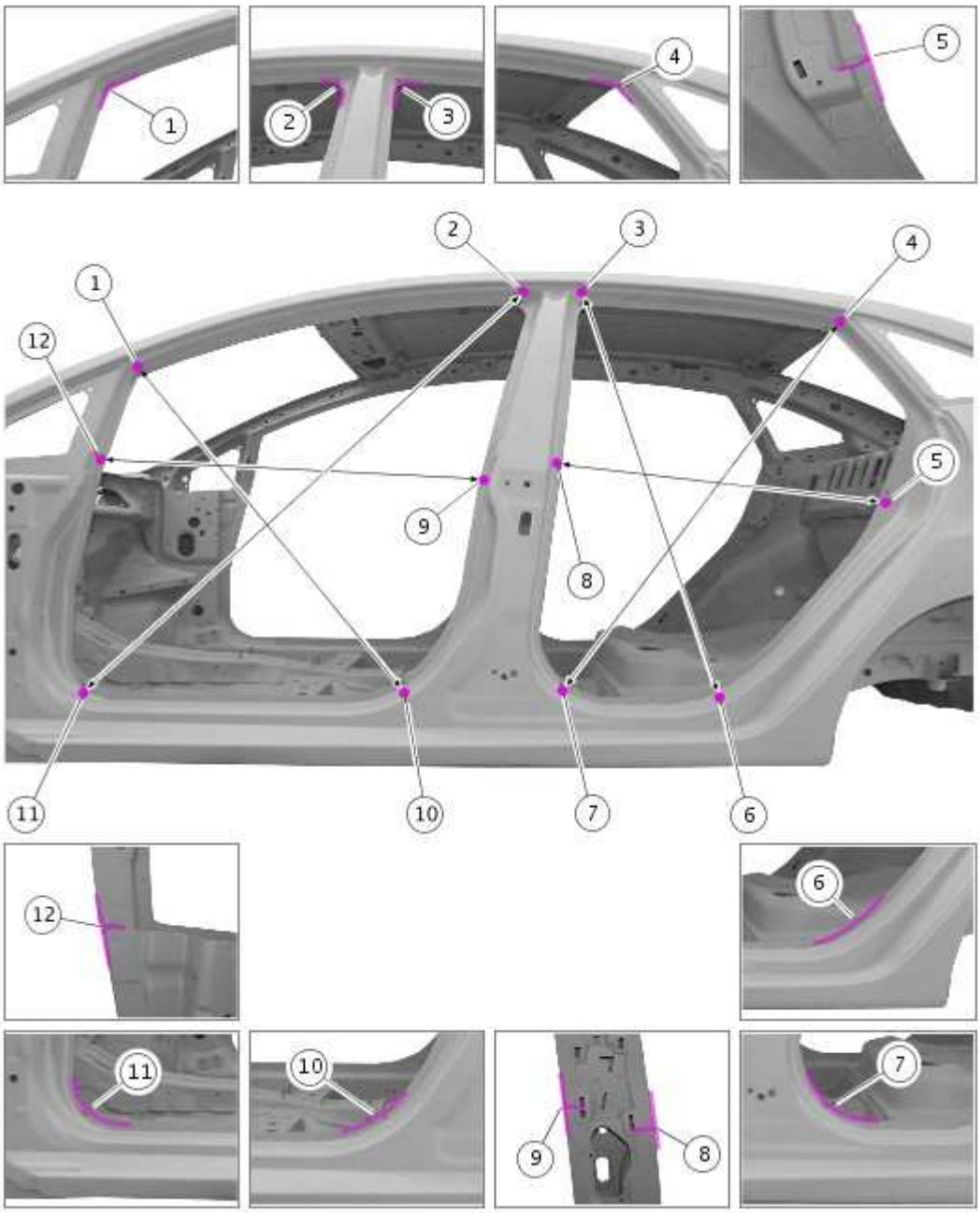

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Example of measuring the floor pan

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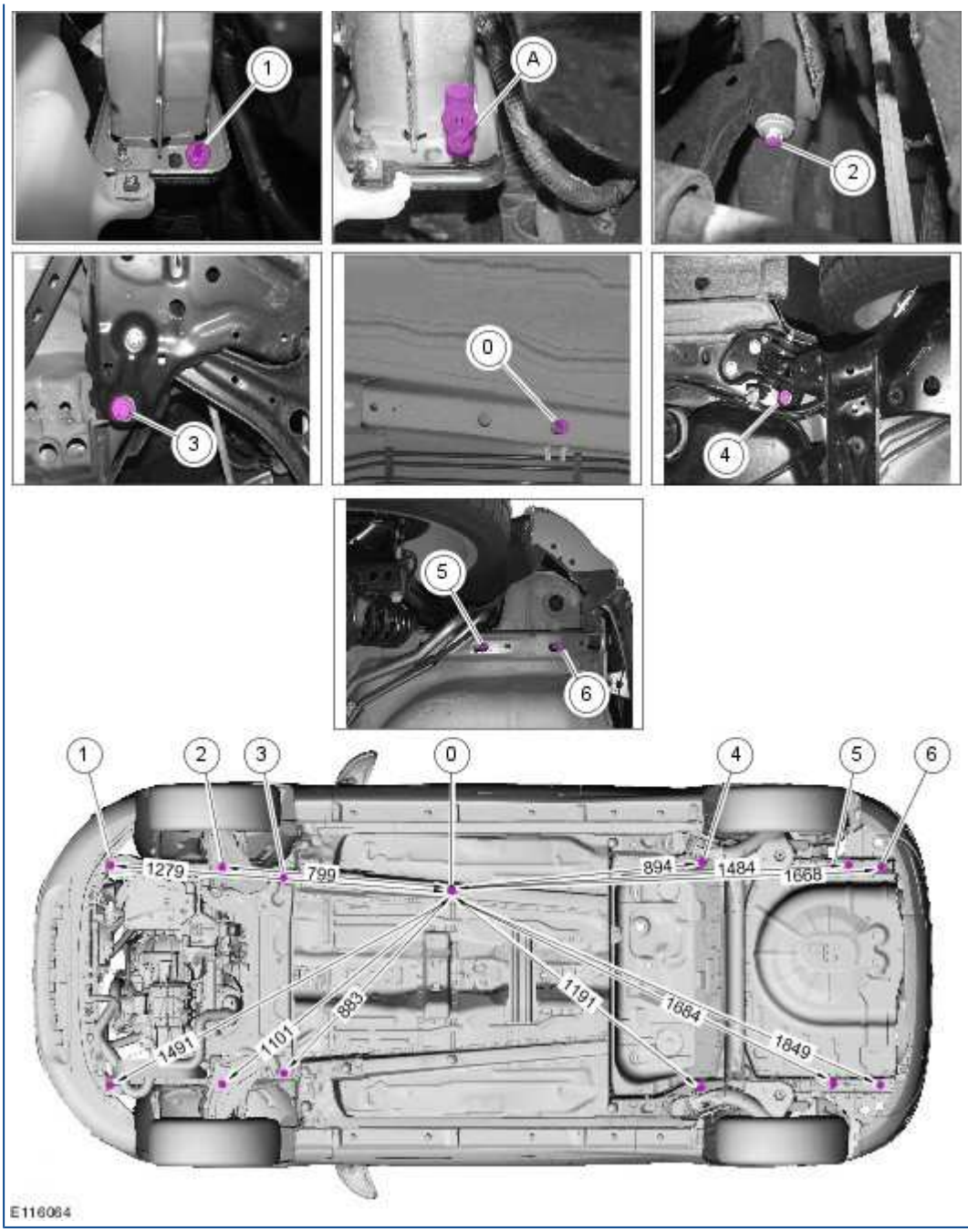
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Description and Operation

General

Straightening repairs are often required to restore the original body shape. To do this, the vehicle must be placed on a straightening jig so that a pulling device can be used.

NOTE: Basic and advanced training courses are offered for the following contents. For an overview of all training courses offered, please refer to the Ford Service Organisation training course brochure.
Straightening is considered as the process of pulling out the deformed body parts, up to cutting out the parts that need replacing. If distorted components remain on the vehicle, then the term alignment work is used.

Body straightening requires practice and experience. Before starting body straightening, the exact direction of impact must be determined. The straightening force must be applied in the opposite direction to that of the impact. Only in this way can it be guaranteed that the original shape will be achieved again.

Note the following points during the process of body straightening:

- Secure the pulling unit with a safety cable.
- Do not remove bonded glass prior to straightening.
- Never apply heat during straightening.
- If necessary, open doors or hoods/lids/liftgates during straightening.
- Check dimensions and gaps continuously during straightening.
- High-strength steel panels have a stronger tendency to retain their deformed shape.
- During the straightening repairs, monitor the attachment of the pulling unit to the vehicle.
- Carry out the straightening work in several stages, never in one pulling process. This prevents the risk of overstretching and of joints tearing out.
- During individual straightening steps (under a pulling load), relieve tension by striking the deformed areas with an aluminum hammer while they are still under tension.

Special features of non-monocoque bodywork

Straightening is different to monocoque body construction because of separate straightening for bodywork and chassis.

If only the body is damaged in an accident, light straightening repairs can be carried out while still mounted on the chassis.

NOTE: With strong straightening forces, these bolted connections may be damaged (bodywork to chassis frame). Monitor the bolted connections continuously during the straightening work. Holding clamps or alignment angles must be attached directly to the chassis frame.

Straightening of chassis frames

NOTE: High-strength steels must not be heated.
If the body and chassis frame have to be straightened, they must first be separated from each other.

The following conditions must be met:

- The repair must be economically justified.
- The production quality and stability of a frame must be achieved again after carrying out the repair.
- In principle, the driving and operating safety of the vehicle is paramount.
- Cold straightening of deformed areas with sharp edged folds cannot be carried out.

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- Straightening with the application of heat (welding torch) requires much experience and accurate knowledge of the behavior of steel panels when heated.
- The temperature and duration of application of the heat are to be considered in particular.
- Individual components of the frame, such as cross members, brackets, etc. can be replaced.

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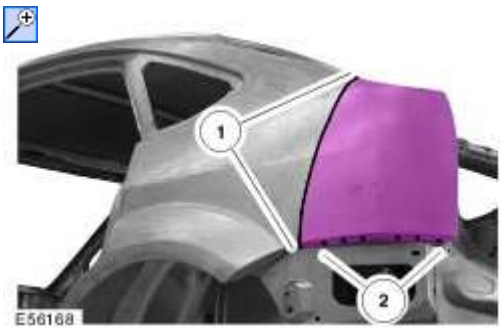
Description and Operation

NOTE: Basic and advanced training is offered for the following contents. For an overview of all training courses offered, please refer to the Ford Service Organisation's training course brochure.
Repairs always mean intervention in the body shell structure and thus also intervention in the vehicle's passive security system.

NOTE: From an economic perspective, the possibility of a partial replacement (sectional repair) must be considered when assessing an accident-damaged vehicle.

Partial Replacement



Item	Description
1	Join area
2	Original welding

Decision criteria

The following are always crucial for the decision:

- How economical the repair is.
- Retention of the original join.

In addition, Ford must have given its approval for a sectional replacement solution in the damaged area. For those partial replacements approved by the factory and described in the model-specific body workshop literature/technician's information, some spare parts (service parts) specially prepared for partial replacements are offered through the spare parts sales department.

Sectional replacement (sectional repair) means the replacement of a section of the body shell structure. Sectional repairs fulfill their purpose above all if the replacement of a complete part is too time-consuming and thus not economical. Approved sectional repairs are clearly defined in the model-specific body literature. These requirements must be complied with.

Depending on the damaged areas, further facts are to be taken into account when deciding for or against partial replacement:

- Severance cuts should be as short as possible.
- The effort for follow-on work on the connections must not be too great.
- It must be possible to reproduce the optical path of visible edges on door openings.
- Inner reinforcement panels must not limit the straightening work.
- Inner reinforcement profiles in the pillar areas must allow for separation.
- The Ford regulations for partial replacements on structural frame sections must be taken into account.
- The large surface welding seams at the connections must be restored.

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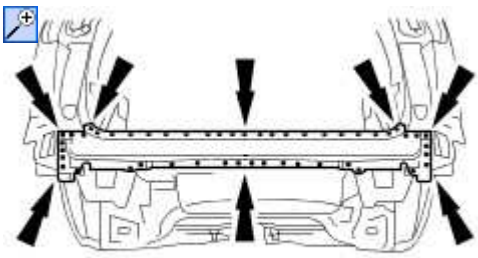
Advantages of a partial replacement

A partial replacement repair offers many advantages for a professional repair of accident damage:

- Repairs can be made both in the outer panel area (e.g. side frame) and in the inner areas (e.g. structural member, trunk floor).
- The repair can be limited to the actual damaged area.
- Reduction of repair costs, as aggregates and other components can usually remain in the vehicle.

Complete replacement

In a complete replacement, the original connections are largely reused.



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A complete replacement is advantageous if the damaged body part can be detached from its original connections and a completely new part can be fitted without creating additional joints (e.g. liftgate).

A complete replacement is necessary if there is no sectional replacement solution.

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Description and Operation

The corrosion protection provided in production must be carefully maintained and reproduced during body repair work, in order to ensure the long-term warranty for Ford vehicles.

NOTE: Please take the notes in the model-specific repair descriptions into account. Please also note the manufacturer's instructions when handling the different anti-corrosion agents.
Only Ford original bodywork components and Ford approved repair materials are to be used for body repairs. The Ford logo is stamped onto every Ford original spare part.

Panel coatings and corrosion protection

Body steel panels are provided with a coating for corrosion protection purposes. The coating material is predominantly zinc in a variety of composition forms. Aluminum is also used to some extent. Basically, all types of steel sheet can be coated.

A variety of coating processes are used:

- Hot dip zinc coating (no longer used in vehicle construction).
- Electrolytic zinc plating.
- Organic coating.
- Hot dip aluminum coating.

NOTE: Welding fumes are harmful to health. Make certain that the workspace is well ventilated and use welding fume extraction.
The following points must be noted when welding:

- Zinc starts to melt at about 420°C.
- The zinc vaporizes at a temperature of about 900°C.
- The amount of heating determines the damage to the zinc coating, and therefore to the corrosion protection.
- Resistance spot welding is particularly suitable for welding zinc-coated panels, because no widespread warming occurs.
- With electrolytically zinc-plated panels there is no need for any special preparation because the zinc coating does not need to be removed.

NOTE: Coated panels have a higher electrical resistance, but this can be compensated for by increasing the welding current by 10 - 20% .

Corrosion protection measures during repair work

CAUTION: Always be extremely careful when handling solvents, sealants and adhesives. Some products contain substances harmful to health or give off harmful or poisonous vapors. Always follow the manufacturer's instructions. If there is any doubt as to whether a particular solvent is suitable, it must NOT be used.
All Ford bodywork components have a cathodic primer. Moreover, most parts are zinc-plated on one or both sides. If possible, these protective layers must not be damaged.

Before welding

Interior surfaces of new bodywork components which will no longer be accessible after installation must be painted beforehand. The welding flanges are treated with a special welding primer. The joint areas are not always accessible from inside later. Therefore, prepare these areas so that no soot is produced by burning paint during welding.

NOTE: In order to ensure that the corrosion protection produced in production is not

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destroyed, the working area must be kept as small as possible.
NOTE: Do not touch cleaned bare metal any more with the bare hands. The dampness of your hands will corrode the metal.

Procedure:

- Remove the primer or paint/zinc layer in the welding area using a tress wire brush to prevent the formation of soot from the paint.
- Thoroughly clean the welding area with a metal cleaning agent and rub dry.
- Coat the welding flange with welding primer on all sides and allow to dry.

NOTE: The welding primer must only be applied thinly to the spot welding area, to minimize spattering when welding.

After welding

During repair work, body panels are often heated at very high temperatures, which results in the destruction of the corrosion protection.

Reworking of the affected areas is therefore vital:

- Grind the welded seams flat and clean thoroughly with silicone remover. Dry with a lint-free cloth.
- If the join area is accessible from the inside, the transition area to the paint must be abraded for all types of join so that good adhesion of the primer is achieved later.
- If the join area is not accessible from the inside, the cleaning and sanding work is not done. For this reason, ensure that there is as little contamination as possible in the area of the repair. This allows the cavity wax applied later to penetrate the join area without hindrance.

NOTE: Only apply a small amount of panel cleaner to the cleaning cloth when cleaning the repair area. Make sure that no cleaner reaches the connecting flange, so that the welding primer is not washed away again.

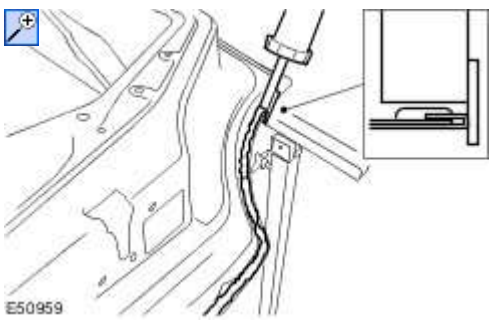
Priming after welding

Primer is applied to the welded flanges after cleaning. A check must also be made that the production corrosion protection is present in the area of the flanges. Any damage must also be re-primed.

Sealing work

Depending on the type of repair, the clinched flanges on the hood, doors, tailgate and trunk lid must be sealed with clinched flange sealer.

Clinched flange protection with flat nozzle



Clean the clinched flange area of the new component with silicone remover and dry with a lint-free cloth.

The sealant must be applied to the dry primed surface (i.e. dip priming as for delivery).

Apply clinched flange protection to the clinched flange using one of the flat nozzles

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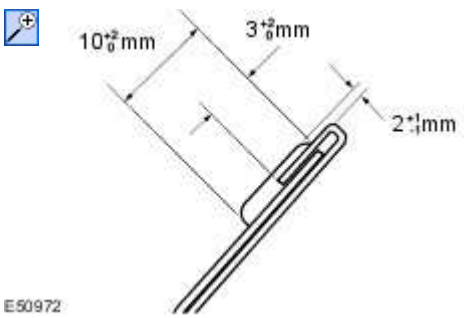
supplied. The nozzle must be cut to the necessary width beforehand and the guide stop cut as required.

During application the clinched edge must be covered with an overlap of at least 3 mm. The beginnings, ends and edges or interruptions in the sealer bead need to be reworked by forming with a brush or a spatula, to ensure a 100% tight sealing of the flange.

The speed and angle of application are decisive for a good appearance and a bubble-free bead. Always apply the sealer with as few as possible interruptions to avoid sealer rework. Never use solvents or thinners as this will considerably slow down the hardening process of the sealer.

For an application thickness of 3 mm of the clinched flange sealer it is recommended to allow to dry over night at room temperature. A minimum hardening time of 5 hours is required anyhow before a 2-component primer can be applied.

Clinched flange protection applied to the correct width and thickness.



Underbody protection/stone chip protection

The underbody protection is used as corrosion protection and must also be applied such that it matches the original condition, from a visual perspective.

Two main application methods are used in production:

- The underbody protection is applied as a sprayable sealing compound.
- In the area around the structural members, the underbody protection is sprayed on and spread across a wide area.

Because of the coarse surface structure of the stone chip protection material, it is recommended to only perform a repair over the whole surface, if there is damage over visible areas. Otherwise there is the danger of serious irregularities on the surface.

The thickness and appearance of the underbody protection and stone chip protection must be matched to the original. Special spray guns are used to work the materials for this reason. A test spray must always be performed beforehand however, to determine the correct appearance and layer thickness.

Cavity protection

After painting work has been completed, a general check is made of the work that has been done. Before final reassembly of the vehicle, the cavity wax protection in the area of the repair must be renewed. Cavity wax protection must be performed carefully so that the quality of the repair conforms with Ford standards:

- Guide the cavity wax probe carefully in the area of the repair so that targeted corrosion protection is achieved.
- Pay special attention to edges and swage line on stepped joints, the wax must cover the inner edge areas.
- The cavity wax must flow along the stepped sheets so that the wax is drawn between them by capillary action.

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A hole may be drilled in a suitable place for areas which are not accessible for the application of cavity wax. The diameter depends on the size of plugs available. When this is done it is vital to make sure that no drilling swarf remains in the cavity (rust will form if any remains). The edge of the hole must be treated with cavity wax. Finally close with a plug and seal with underseal.

Only on components with clinched flange edges:

After painting, the inner clinched flange edge must be sealed as far as is possible with cavity wax. For this, the repaired component should be positioned upright and corrosion protection wax sprayed into the water drainage holes and/or the thread holes for the hinges in both directions (50 ml corresponds to about 20 seconds spraying time).

For doors, tilt and turn the component to spread the corrosion protection wax over the whole edge of the flange.

Wax application

Corrosion protection for the floor pan (example)

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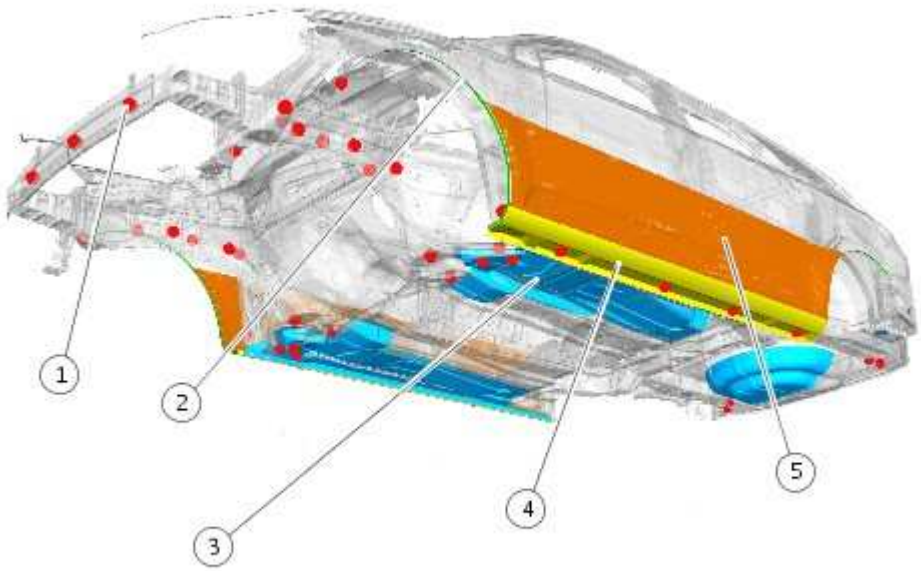

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Item	Description
1	Injection points for cavity wax protection
2	PVC stone chip protection at the wheel arches
3	PVC underbody protection
4	PVC stone chip protection
5	PU primer

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Description and Operation

Modern vehicle bodies are protected from corrosion by elaborate measures. Multilayer coatings on the panel surface prevent direct contact between the metal and oxygen, and so protect it from corrosion.

In the long-term however, corrosion on a vehicle cannot be completely prevented.

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range of training in the Training Brochure issued by the Ford Service Organization.

What is corrosion?

Corrosion is destruction of a subsurface caused by chemical or electrochemical effects which operate from the outer surface.

If the protective layers become damaged, electrochemical conversion processes are initiated, which allow the metal to oxidize. This leads to the formation of corrosion.

The following factors lead to corrosion:

- Mechanical damage such as stone chips and scratches which penetrate through to the steel panel.
- Damp interiors.
- Unfavorable weather or environmental conditions, as may occur in areas with high humidity, high salt content in the air or serious air pollution due to aggressive gases and dusts.
- Insufficient corrosion protection after repairs.
- Lack of care by the vehicle owner of the painted and corrosion proofed surfaces or areas on the vehicle.

In order to maintain long-term corrosion protection, the vehicle must be checked at regular intervals.

In doing so, the follow areas must be inspected and any damage rectified:

- Damage to the paint surface cause by scratches or stone impact must be suitably rectified according to the specifications.
- Damage to the PVC underbody protection or the PU stone chip protection must be refinished.
- Damage to the PVC underbody protection or the PU stone chip protection must be refinished.
- Incomplete or damaged sealing at clinched flanges must be renewed.
- Check the cavity protection and renew it if incomplete.
- Poorly installed or damaged covers and stone chip protection fixtures must always be renewed.
- Check seals and seal carriers for wear and correct mounting. Any damaged seals must be renewed.
- All rubber grommets and blanking plugs must be present and correctly installed.
- A damp or wet floor inside the vehicle indicates that there are leaks in the bodywork. The interior must be dried out and the leaks must be completely rectified.

The corrosion formation can vary in extent.

With rust film or edge rust formation, the surface of the paint has small traces of corrosion present. The traces of corrosion can possibly be removed in such cases by polishing the paint surfaces. If this is not possible however, the traces of corrosion must be rectified by using a touch-up technique.

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If the corrosion is just starting, with up to 1 mm rusting below (in the form of a dot or a line) the damage is rectified as follows:

- Clean the defective location.
- Mechanically remove the rusting which is starting below the surface.
- If the area is small, apply primer and allow it to dry, then use the paint pencil to touch up the area - if not, respray the damaged area.

If rust is already under the paint finish to the steel panel, then the whole paint finish in the affected area must be sanded away.

Furthermore, the existing traces of corrosion in the body panel must be carefully and completely removed.

Finally a new paint finish must be applied in this area. In the case of rusting through, the affected body panel is already completely destroyed. Such damage requires complete or at least partial replacement.

NOTE: : In the general section there are several chapters which present the techniques necessary for a professional corrosion repair.
The outcome of this is the following repair sequence:

- Remove the rusted-through part.
- Remove the remaining traces of corrosion.
- Offer up the new part.
- Prepare the joint areas.
- Weld the new part into place.
- Produce the corrosion protection.

For a professional repair it is essential to reproduce the corrosion protection during and after the repair.

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Description and Operation

Sealants, adhesives, cavity wax and underbody protection materials are used during the various body repairs. In this area Ford offers a range of products which have been tested and matched to each other.

CAUTION: Always be extremely careful when handling solvents, sealants and adhesives. Some products contain substances harmful to health or give off harmful or poisonous vapors. Always follow the manufacturer's instructions. If there is any doubt as to whether a particular solvent is suitable, it must NOT be used.

Clinched flange protection

One-component adhesive/sealer which can be applied by brush or spraying, based on MS polymer, with a flat nozzle for application and with the following properties:

- Can be sanded
- Permanently elastic
- Non-corrosive
- Very good adhesion
- Rapid hardening and resistant to ageing
- Can be over-painted with almost all proprietary paints

Seam sealant T Anthracite

One-component sealer based on MS polymer, for sealing joints and seams, with the following properties:

- Silicon-free
- Solvent-free and low-odor
- suitable for gluing HVH elements into position in their respective body areas

Body sealant T beige

Sealer with the following properties:

- Stable
- Contains solvent
- Especially suitable for visible seams
- After hardening can be overpainted with two-pack paint

Underbody Coating

Underbody protection is necessary for permanently elastic corrosion protection of vehicle

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underbodies. It is very durable and has good resistance to abrasion,

Cavity wax

This touch-proof, transparent corrosion protection wax is used for the preservation of cavities and flange joints.

Anti-corrosion wax

Anti-corrosion wax is a coating material which can be applied in fine spray, forming a very thin and grease-like protective film, therefore offering very good corrosion protection.

2-component metal adhesive

For joining metal to metal and plastic to metal. The adhesive reduces droning noises and improves corrosion protection.

Windshield sealant

Solvent-containing, stable sealing material. The sealer is permanently elastic and does not form a skin on the surface.

1-component window glass adhesive kit

For direct glazing. The vehicle is ready to drive after 6 hours (passenger airbag). Prevents contact corrosion.

2-component window glass adhesive kit

For direct glazing. The vehicle is ready to drive after 1 hour (passenger airbag). The adhesive is not an electrical conductor and permits interference-free radio reception. Prevents contact corrosion. Using a 150ml additional cartridge, the adhesive can also be used for large windows or to produce a double seam of adhesive.

PU glass adhesive

150ml additional/replacement cartridge for direct glazing using 2-component window adhesive kit. Suitable for double beads or larger windows. Also suitable for sealing NVH elements.

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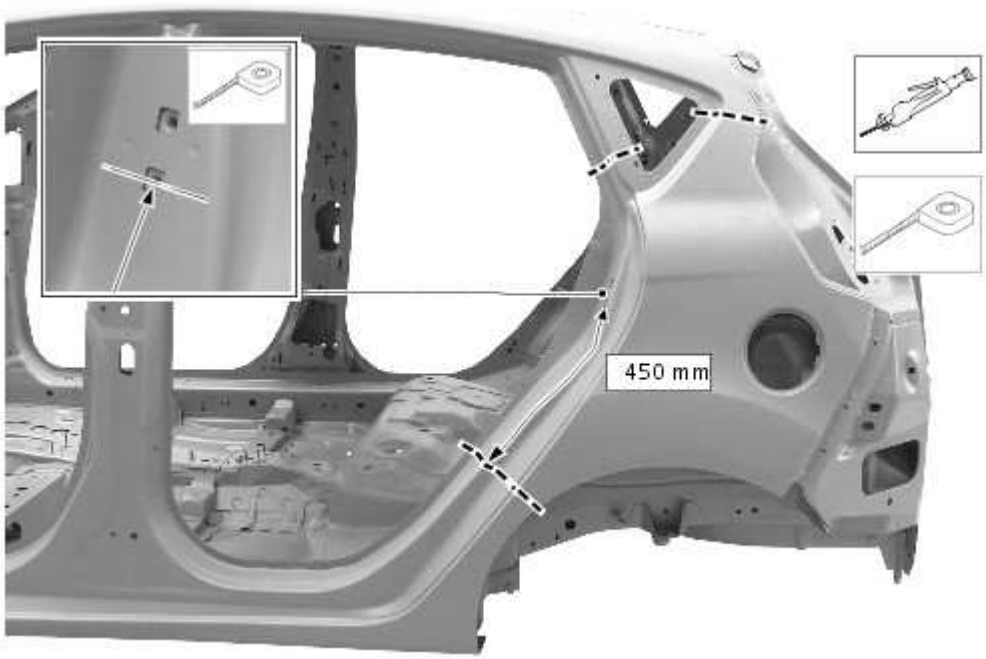
Description and Operation

NOTE: Without exception, before starting work you must read the safety and warning instructions in the chapter "Safety Instructions". In addition, pay attention to the warning instructions of the particular equipment manufacturer.
NOTE: After all separation work, make certain that the metal swarf is completely removed from the vehicle body.
Possible cut lines (example)



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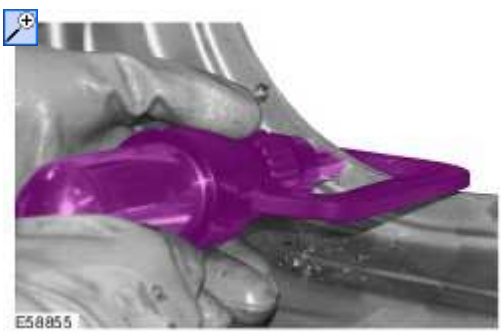
Depending on the separating tools used, there are some fundamental points to bear in mind:

- Only start the cutting work once the new part is to hand.
- Compare the new part with the old part for shape and size.
- The straightening work must be completed before any body components to be replaced are cut out.
- Before separation work is started, all welded connections which cannot be seen must be freed of underbody protection, sealant etc.

Spot weld milling tool

Resistance spot welds are separated using a spot weld drilling machine or a spot weld milling tool.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NOTE: Steplessly variable machines increase the working life of the cutting tool. Use of a suitable lubricant can increase this even further.
A spot weld milling tool usually has an adjustable depth stop and a safety fixing system. These prevent the machine from drilling too deep and the cutter from slipping while working.

Rod sander

Another option for separating resistance spot welds is to use the rod sander.

If spot welds and MIG welds are difficult to reach, a rod sander may offer an alternative.

Short stroke saw

The short stroke saw is suitable for separating vehicle body components and for making a separating cut for partial repairs.

NOTE: In order not to damage panels, wiring harnesses, hoses or similar components which lie behind, remove them beforehand as necessary.
The narrow design of the saw blade permits cutting in tight curves. Straight cuts require a relatively great deal of practice.

Orbital saw

Where use of the short stroke saw is difficult because of the body construction, the orbital saw can be used.

The cutting depth of the orbital saw can be set. This allows separating cuts to be made, despite panels or other components lying in danger behind. Straight cut lines can be more

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easily made using the orbital saw.

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Description and Operation

General

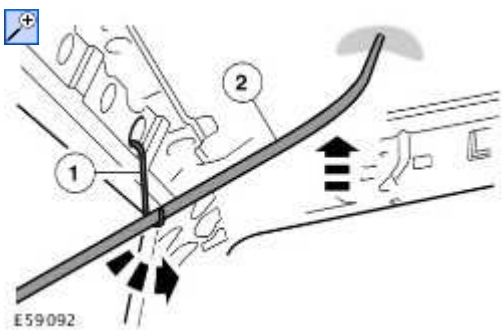
Smaller scale body repairs, where damaged panels do not need to be replaced, can often be carried out by realignment work. Whether the repair is economical however, often depends on the accessibility of the affected body area.

NOTE: Basic and in-depth training courses are offered on the topics which follow. An overview of the complete range of training offered is provided by the Ford Service Organization Training brochure.
During damage assessment, the following technical points must be taken into account:

- Small mild dents (without damage to the paint), which are in areas that make access from the inside possible, can be rectified using undamaged paint panel beating.
- If the inner side of the damaged area (with paint damage) can be accessed, then conventional panel beating techniques can be used.
- If the damaged area has no access from inside, then it can only be rectified using outside panel beating techniques.

Dent removal using special panel beating levers

NOTE: In the Undamaged Paint Dent Removal section, you will find more information on pressure techniques.



Description	Description
1	Deflection by a hook arrangement
2	Pressure tool

This panel beating technique with pressure is mainly used to rectify smaller dents as a result of hail impact, transportation or parking, without the paint being damaged.

Small dents are removed from the inside of the body panel by pushing them outwards in a mechanical process using panel beating levers.

Because of the great variety of shapes of these levers, it is possible to use this panel beating technique on almost all areas of the vehicle body.

Dynamic puller with counter bearing

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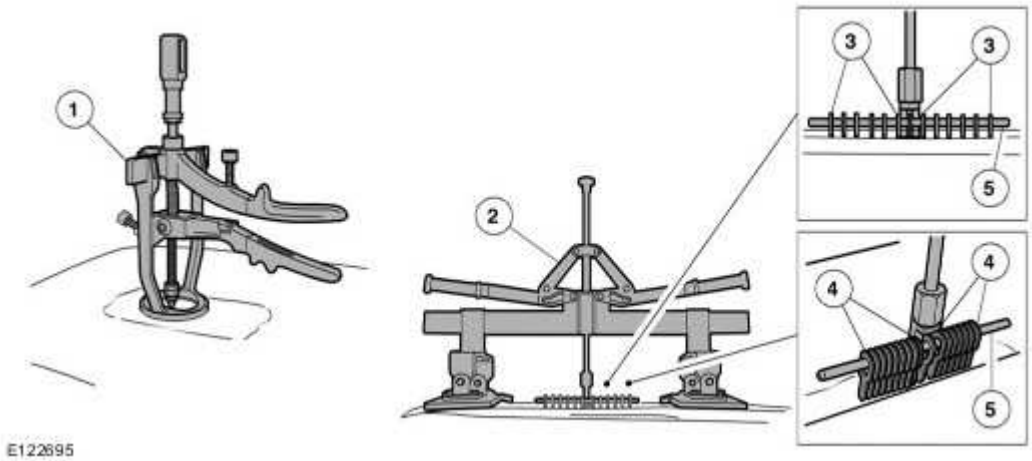

Description	Description
1	Puller device for minor damage, with integral copper electrode
2	Puller device for more extensive damage
3	U-washers spot-welded in place
4	Puller bits spot-welded in place
5	Attachment for U-washers or puller bits

This method can be used to reshape dents or more extensive damage from the outside.

For minor damage, the copper electrode in the tool is secured onto the panel surface by spot-welding and the puller device is used to pull out the damage without jolting.

For more extensive damage, puller bits or U-washers (depending on the application area) are spot-welded to the panel surface and the area pulled out using the puller device.

Because of the versatile puller and the variable counter bearing, a wide variety of damage can be worked and rectified using this repair method.

Because of the mechanical lever operation, the variable counter bearing and the optimum controlled application of power, this external dent removal system allows dents in almost all vehicle body areas to be pulled out.

Hollow leveling (removing dent without a dolly)

Hollow leveling can only be used on areas which are accessible from the rear.

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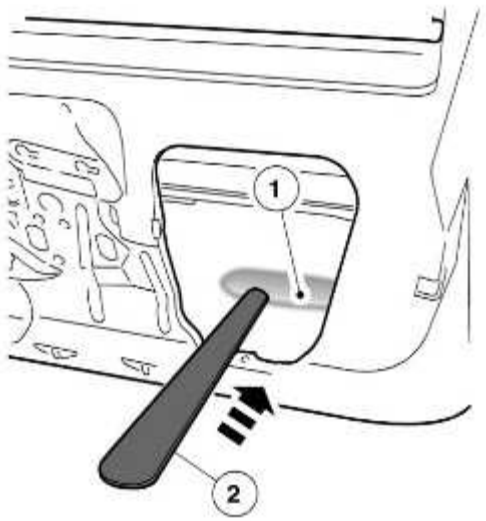

ES 9088

Description	Description
1	Center of dent
2	Spoon

During hollow leveling, the dent is removed from the inside a using suitable panel beating tool and applying knocking or pressing movements. High spots around the edge of the dent area are flattened with blows from the aluminum or wooden headed hammer.

The usual tools are for instance hammers of various designs, dollies, levering irons and various spoon irons. The correct choice of tool is made depending on the shape of the dent and the access which is possible.

Dent removal using hammer and dolly

Panel beating can only be performed using a hammer and dolly if access can be gained from the rear side.

ES 9089

Description	Description
1	Aluminum hammer
2	Box file

The purpose of the dolly in this case is to transfer the force of the impacts from the hammer to the steel panel which is in between. As this is done, the deformed body panel is smoothed (dressed) and the tension fields in the body panel are removed.

The favored tool for this repair process is the aluminum hammer and as opposite support the universal hand dolly. To rectify minor panel damage, the box file should be used as opposite support. Because of its serrated surface, the box file prevents normal stretching of the body panel which would otherwise occur.

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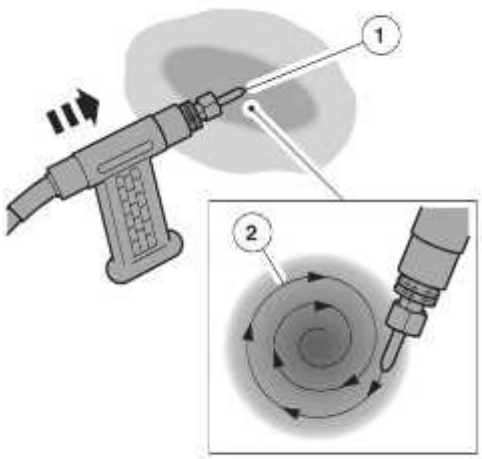
Heat-induced material shrinking

Material shrinking, also called settling in, can be performed in a variety of ways depending on the extent of the damage and the access to the repair area.

These repair processes differ depending on the type of heating and subsequent working of the heated surface. They sub-divide into two basic processes:

- Heating using a carbon electrode.
- Heating using the oxy-acetylene torch.

In the carbon electrode process the working is done exclusively by warming. In this case the access to the repair position is only from the outside.



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Description	Description
1	Carbon electrode
2	Spiral shaped heating pattern

If the damage is concentrated in a spot and is in the form of a more rigid raised area, then the carbon electrode must be replaced by a copper electrode. As heat is applied, slightly more pressure is applied to the raised area.

In the method using heating by the oxy-acetylene torch, material shrinking is achieved by a combination of heat and mechanical working of the damaged area.

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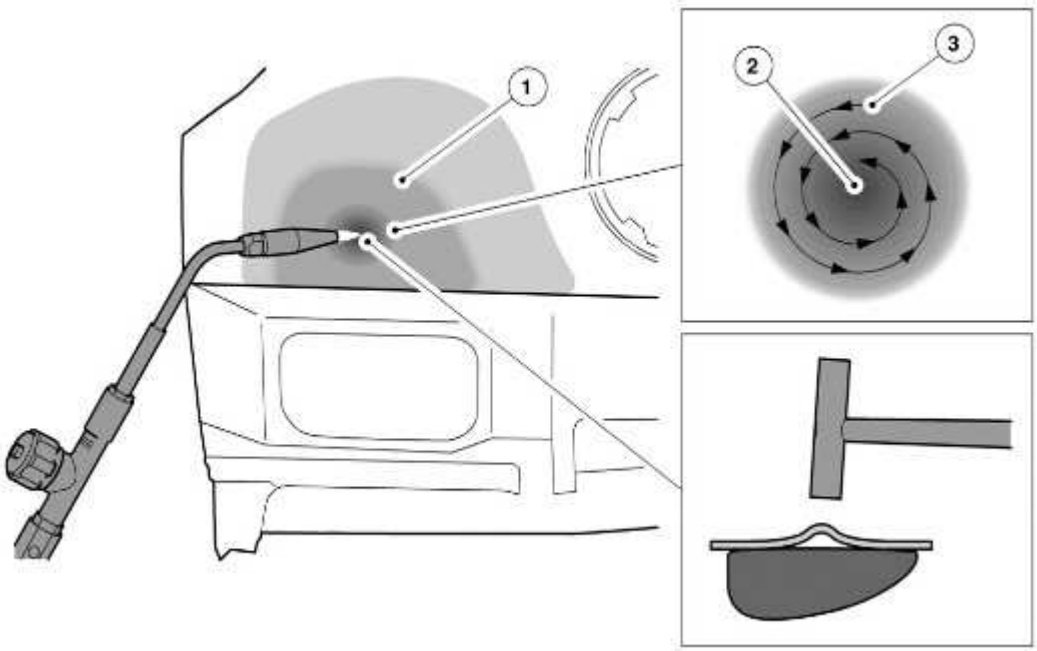

Description	Description
1	Overstretched area
2	Point heating using the oxy-acetylene torch
3	Spiral shaped knocking back with dolly

The repair area must always be accessible from both sides, so that the heated area can be properly worked mechanically.

The combination of heating and mechanical working is very effective.

As soon as the warm point is established, hammering is immediately started using the aluminum hammer together with a suitable dolly on the inside of the repair surface, working in spiral movements towards the warm point. This causes material to build up in the center of the warmed area.

Lead loading

Despite good external panel beating techniques, it is not always possible to rectify every surface unevenness. For this reason, application of lead loading is an important part of panel beating.

CAUTION: Poisonous gases and dust can be produced when working solder. Use an extraction unit and, if required, a protective mask.
NOTE: Since 07/2003, lead compounds have been ruled out for production. Appropriate lead-free tin solders and pastes must also be used in the workshop.
Typical application areas:

- Body components with limited or no access from the rear.
- Body components with very narrow cross-section.
- Body components which are particularly exposed or which can move.
- Weld seams of partial repairs.
- Rocker panel areas, wheel arch edges, side panel areas.
- Doors, hood, luggage compartment lid.
- Swage lines and joint areas.

Tin has the following advantages:

- Excellent bonding on bare metal surfaces.

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- Good moulding properties.
- Good properties for the production of shapes and contours.
- Permanent shape.
- Heat expansion is the same as steel.

To create a basis for the actual lead loading process, a lead loading paste is first applied to the panel. The paste is then heated and wiped away with a cloth. Now the tin can be applied and moulded with a brazing block.

After the repair site has cooled down, it is worked using for example the body plane until the surface is smooth and has no transitions.

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Description and Operation

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range listed in the Training brochure published by the Ford Service Organization.

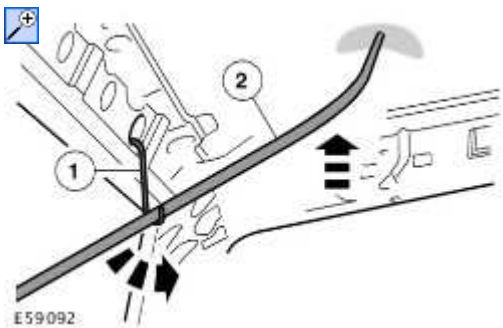
General

Application is restricted to body surfaces which are accessible from both sides. This repair technique is seldom feasible on double-skinned body components or closed body profiles. The same applies to edge areas, swage lines and seams on body components, which are very dimensionally stable.

The following characteristics must be present for a dent to be removed:

- The diameter must be no more than 50 mm.
- No material stretching in the centre of the dent.
- Repair area must be accessible

Furthermore, sufficient experience in the use of special tools and knowledge of materials are also requirements for a successful repair.



Item	Description
1	Deflection by a hook arrangement
2	Pressure tool

Mild dent

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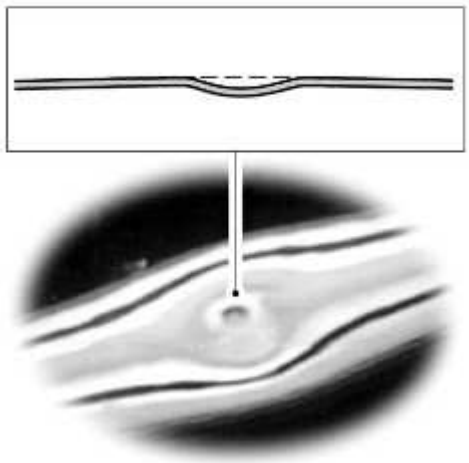

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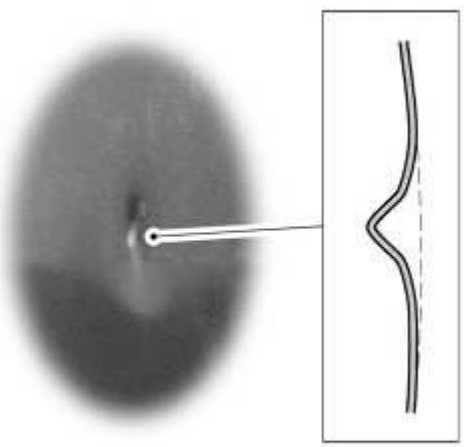
Satisfactory repair results are only possible on mild dents with little depth and small deformation radii. Therefore this repair method is particularly suitable for hail, parking and transportation damage.

Dent with material stretching



E59161

If strong and direct force during the damage process causes the material to stretch in the middle of a dent, then the result is a small and sharp edged dent. Such damage cannot be rectified without visible deformation.

Advantages of a planishing technique:

- Economical in time and materials
- The original paint is retained
- Environmentally friendly (no sanding or painting work)

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While carrying out the repair, the following itemized repair route and process flow must be complied with:

1. **1.** Damage diagnosis
2. **2.** Repair preparations
3. **3.** Perform repair
4. **4.** Paint finishing, corrosion protection and quality control

In order to ensure corrosion protection, all inner areas of the repair must be treated afterwards. Where it is possible, the paint is repaired. In every case the inner area of the repair must be treated with cavity wax.

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Description and Operation

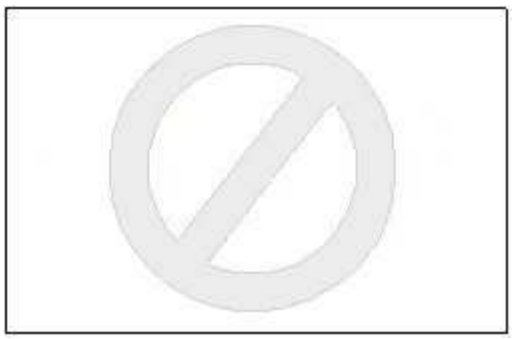
Welding

Before welding work is performed on a vehicle body, all safety measures for the protection of people, modules and electrical components must be observed.

NOTE: Before beginning the work, please refer to the safety instructions and warnings in the chapter Safety Instructions. Please also note the warnings of the respective equipment manufacturer.
Resistance spot welding and MIG welding are the most common techniques used in body construction. During repair work, the welded connection must be restored to be equivalent to the original.

Resistance spot welding.

NOTE: Before starting the work, please refer to the chapter on safety instructions.



In doing so, the repair welds must match the standard of those produced in production in number and diameter.

Preconditions for resistance spot welding:

- The panels to be welded overlap.
- The weld spot is accessible on both sides for the electrodes.
- The shape and alignment of the weld electrodes is correct.
- The resistance welding equipment is powerful enough to be able to reproduce the production spot weld diameter.

NOTE: The welding equipment settings and the adjustment of the individual parameters are to be made in accordance with the device manufacturer's specifications.
Well-prepared welding flanges are a prerequisite for a problem-free welded joint. This means:

- The welding flanges must lie perfectly flat to one another.
- The welding flanges must be clean and free of oil or grease on both sides.
- Welding primer (zinc-coated and conductive) must be applied as corrosion prevention.

Only in limited cases can welding errors in resistance spot weld joints be detected from the outside . Therefore, a test weld should be carried out before each repair weld. The peel test carried out after the welding gives information on the quality of the welding. The spot weld must not flake off.

MIG welding

Basically, three methods of MIG welding are used:

- Puddle weld.

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- Continuous bead welding
- Intermittent bead welding

Fields of application

- Any joins that are MIG welded in production must also be replaced by MIG welds.
- Puddle welding may be used in certain cases, if there is insufficient access.
- If the overall panel thickness is greater than 3 mm, without correspondingly powerful spot welding equipment, puddle welding should be used.
- When dealing with any MIG brazed joints which are present, follow the vehicle-specific repair instructions.

NOTE: The increased application of heat during MIG welding destroys the corrosion protection layers over a much larger area than during resistance spot welding. For this reason, greater care must be taken when applying the corrosion protection afterwards.
Welding repairs can only be carried out properly if the equipment is set up correctly and all welding-related preparations are complied with accurately.

- Please note the instructions of the respective welding equipment manufacturer.
- The hose assembly must be untwisted.
- The core must be free from particles of wire debris.
- The gas and current nozzles must be free of slag and scale residue.
- Pay attention to the quality of the welding wire and the gas flow rate.
- Ensure that the joint surface is perfect.
- Prepare a bare metal joint surface.
- Maintain the correct gaps (root formation).
- Produce a test weld.

Plug Weld

Special features to note when puddle welding:

- The panels to be joined must lie perfectly flat to one another.
- The panel flanges must be treated with corrosion protection. The position of the weld must be bare.
- Prepare the holes depending on the thickness and number of the panels. The hole size should be 6-10 mm, or match the original weld spot.
- Start the welding procedure on the panel at the bottom so that the hole is filled completely.

Continuous bead welding

A welded joint with a full seam is suitable for joining highly profiled body parts. Pillar and sill areas are typical application areas.

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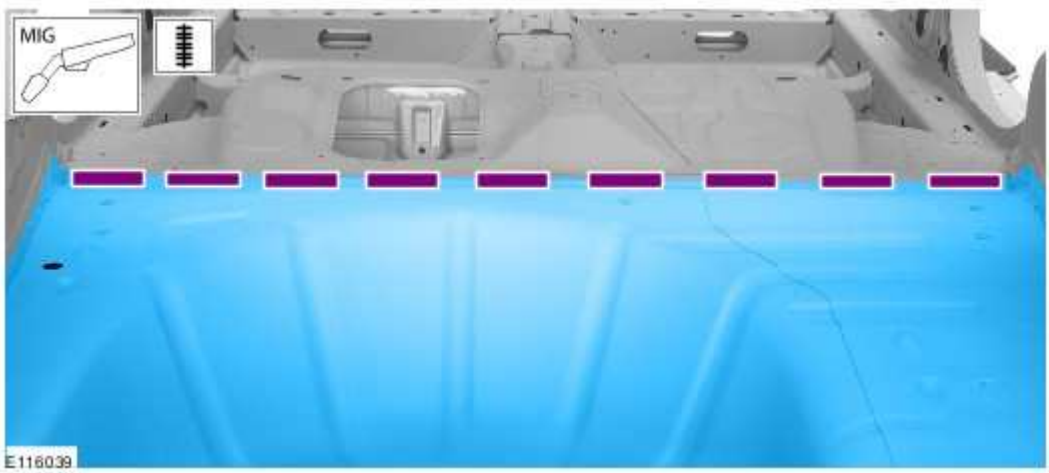
Special features to note during bead welding:

- Both parts of the panel must be bare on both sides over a width of 5 mm.
- Align the parts precisely with clamps.
- To prevent the panel from warping, tack longer joints before welding them.

Intermittent bead welding

Intermittent bead welding is used when the connecting flanges are stepped. This form of seam is mainly used on the external panel area for sectional repairs.



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Special features to note when intermittent bead welding:

- Weld gap.
- Spot weld interval.
- Apply alternate tack welding across the entire length of the seam. This keeps warping to a minimum.

MIG brazes

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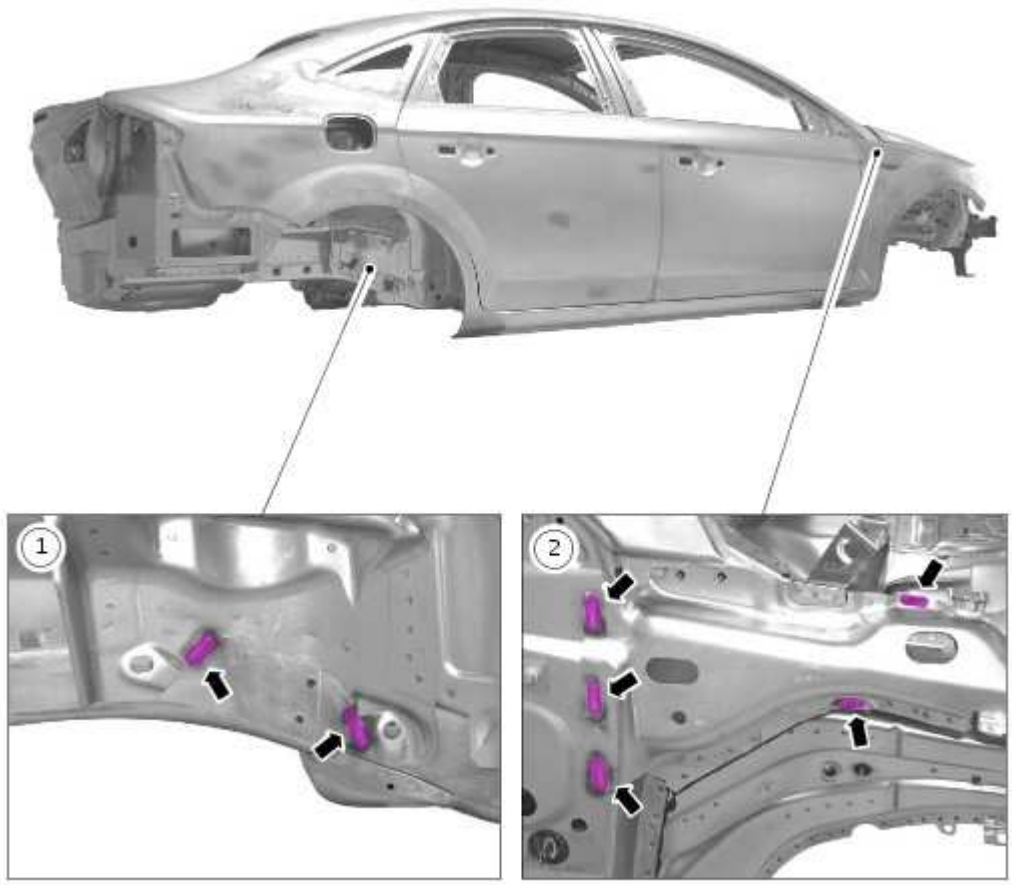

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Description	Description
1	Rear side member / wheelhouse reinforcement
2	Apron panel reinforcement / A-pillar

Metal Inert Gas (MIG) brazing is increasingly used in production for certain body areas.

In areas where resistance spot welding is not possible due to limited space or higher strength requirements, MIG welding was previously used.

Increasingly, these MIG welded seams are being replaced by MIG brazes. The temperature range used during MIG brazing is significantly lower. This keeps the damage to the anti-corrosion zinc layer on zinc-coated panels to a minimum.

This results in the following advantages of the MIG brazed seam:

- No corrosion of the brazed seam.
- Low erosion of the zinc coating in the joining area.
- Low level of heating and thus little warping.
- Easy finishing of the brazed seam.
- Good for bridging gaps.

NOTE: MIG welds must not be carried out on or near existing MIG brazed seams as even the smallest amount of brazing solder can result in a reduction in the strength of the weld seam.
MIG brazing requires a new generation of welding equipment and training in the technique.

Joining techniques

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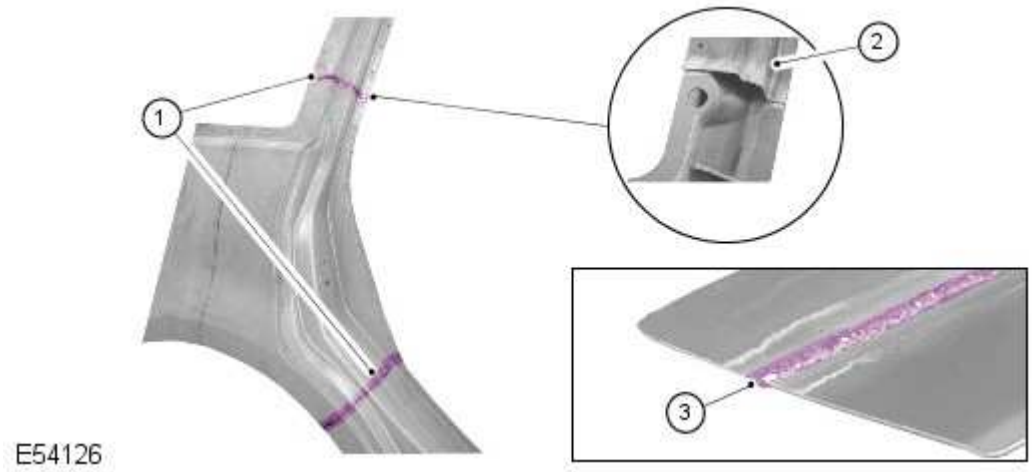
Butt joints



Description	Description
1	Join areas
2	Profile
3	Full seam

The butt joint is a joining technique frequently used in body repairs. The butt joint is typically used for repairs in the pillar and rocker panel area.

Areas that are suitable for the use of the butt joint:

- short seam lengths.
- highly profiled structures.

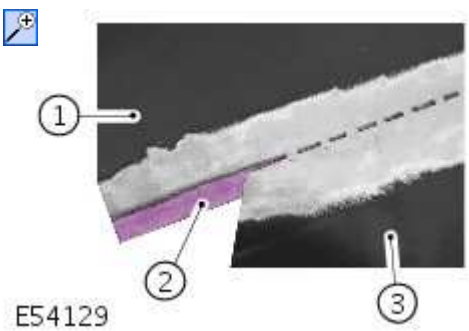
The edges of the panels to be joined are placed against each other and are joined with a full seam in whilst maintaining a required welding gap (welding gap same as panel thickness).

NOTE: The butt joint requires a high degree of accuracy and care when trimming and cutting. For correct execution of the welding, an exact, even welding gap must be maintained.

Preparation of the joint areas includes:

- Sanding the connection areas bare on both sides.
- Removal of the zinc layer in the welding area.
- Carrying out welding tests on an equivalent sample panel before the actual welding, if necessary.
- Tack welding in the join area: From the edges to the centre, then check the shape.
- Joining new and old parts with a full seam weld.

Joggled joint



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Description	Description
1	Body part
2	Joggled area
3	New panel

The joggled joint variant is restricted to body areas with a good surface condition without beads/swage lines or profiles. A sectional replacement with a joggled joint is welded using a continuous seam. This procedure is used, for example, at the transition from the side panel to the rocker panel (3-door vehicles).

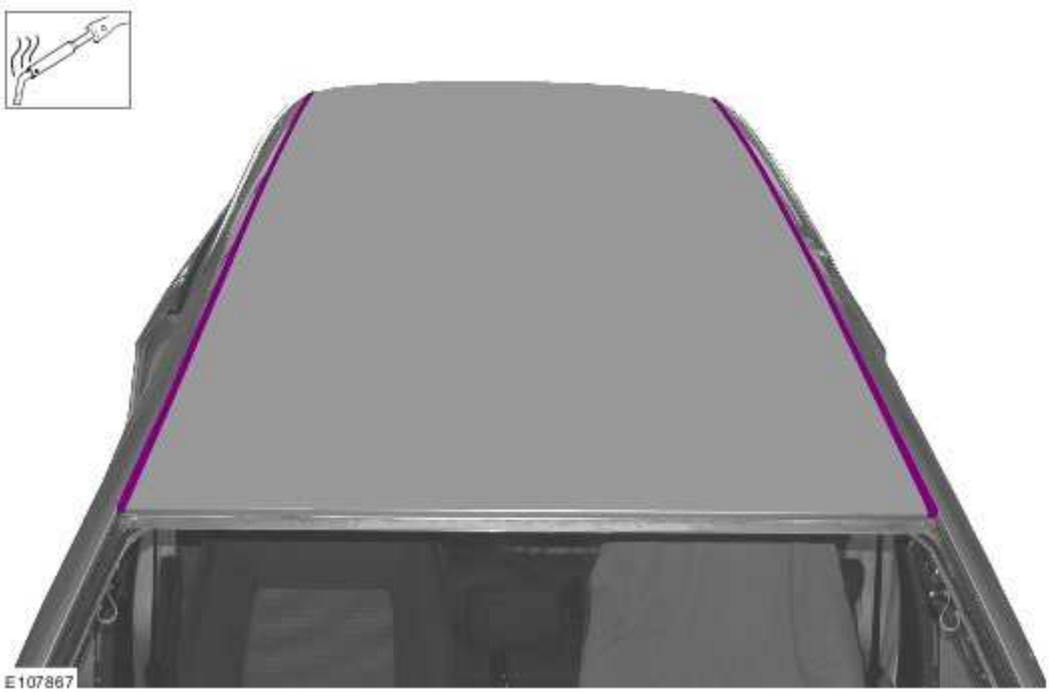
When cutting the new part, slight measuring tolerances are permitted, as these are covered by the joggled area.

Preparation of the joint areas includes:

- Sanding the connection areas bare on both sides.
- Removal of the zinc layer in the welding area.
- Preparation of a joggled strip.
- Carrying out welding tests on an equivalent sample panel before the actual welding, if necessary.
- Joining the new and old panel with continuous seam welding.
- Lead loading the weld seam.

Soft soldering

WARNING: The roof repair may only be carried out in Ford-approved special workshops and only by specially trained personnel.
NOTE: The roof is secured to the side walls with laser soldered seams in production. When repairs are carried out, these laser-soldered seams must be replaced by soft-soldered seams.



WARNING: Poisonous gases and dust can be produced when working solder. Use an extraction unit and, if required, a protective mask.
NOTE: Ford offers basic and in-depth training on the following topics.
NOTE: Areas for soft soldered joints require careful preparation. It is extremely important that the joint surfaces are exactly aligned and that a bare metal joint surface is prepared.

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This means:

- Thorough cleaning of the surfaces to be brazed.
- Close contact of the panels at the brazing position.
- Use the soldering iron to warm the location of the seam to be joined.
- The liquid brazing material is drawn between the panels through capillary action.

Rivets

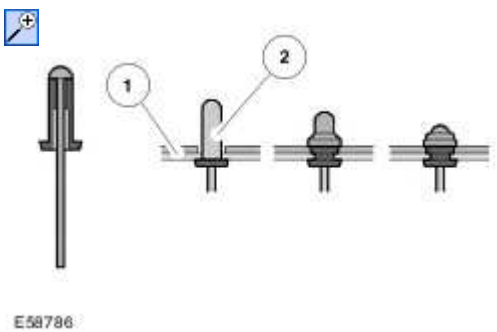
With riveting, two or more panels are joined together using a joining element (rivet). In body construction, pop rivets and punched rivets are used.

Advantages of riveted connections:

- Metallic and non-metallic materials can be joined together.
- Different thicknesses of materials can be used.
- The material does not have to be heated, and therefore does not warp.
- Low level of preparation required.

NOTE: For detailed instructions on the procedure, please refer to the equipment manufacturer's operating manual.
Disadvantage:

- During dismantling procedures, swarf/rivet remains can fall into inaccessible cavities, which can lead to rattling and rusting.



Description	Description
1	Panels
2	Pop rivet

Pop rivets are used if only one side of the panel is accessible. In this process, overlapping panels are drilled and connected with a pop rivet.

Pop rivets can be inserted pneumatically, hydraulically or manually with rivet guns.

Bonding

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Description	Description
1	Butt joints
2	Bonded connection

Bonded connections are used more and more in modern body designs. Here, a distinction is made between bonds for stabilization purposes and bonds for adhesive strength. Bonds for stabilization purposes are found on clinched flanges and on cross beams in doors or on the roof.

WARNING: Risk of poisoning! Adhesive can be harmful to health. Ventilate rooms well and use breathing protection. Where possible, work with an extraction unit.
NOTE: Adhesives are chemical products and are subject to the safety regulations of the manufacturer.
Please refer to the specifications in the general part of the particular manual for information on the repair adhesive which is to be used.

Advantages of glued joints:

- They are air and watertight.
- High corrosion protection
- Different materials can be connected.
- Bonding can be combined with resistance spot welding.

NOTE: The quality of the bonded connection is largely dependent on the care taken during preparatory work. When gluing bodywork parts, follow the work instructions from the adhesive manufacturer.

Bonding and welding

On some vehicle models, (such as the Ford Ka), bonding is combined with resistance spot welding. This connection technique has the following advantages:

- Tight, anti-corrosion connection seam.
- High strength due to additional resistance weld spots.

Please note the following points during the repair work:

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- Only use adhesive suitable for welding (conductive).
- Carry out resistance spot welding on the connection flanges before the adhesive hardening process.
- Carry out test welding with the adhesive applied.
- If MIG welding is carried out during a sectional repair on a connection flange with adhesive material, the adhesive material must be applied at a distance of approx. 10 mm from the weld spot.

Bonding and riveting

As with welding, bonding can also be combined with riveting. This connection technique has additional advantages. These are:

- Metallic and non-metallic materials can be joined together.
- Different thicknesses of materials can be used.
- The material does not have to be heated, and therefore does not warp.
- The rivet connection stabilizes the connected components during the adhesive hardening phase.

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Description and Operation

General

The proportion of plastics used in vehicle construction continues to rise. Up to now damaged plastic components often had to be replaced. These days, plastic repairs are becoming more and more widely accepted because of the increasing cost of spare parts.

NOTE: Plastic adhesives are chemical products and are subject to the safety instructions of the manufacturer.
In repair work, the material properties of plastics are highly significant. There are two main groups:

- Thermoplastics.
- Thermosets.

NOTE: Elastomers make up a third group of plastics. These are not mentioned below because they have no plastics repair applications.

Thermoplastics

Heat causes thermoplastics (also called TP polymers) to transform from the solid state into the thermoelastic state and then into the thermoplastic state. When thermoplastics are cooled, they return to solid state.

Brief description	Plastic
ABS	Acrylonitrile butadiene styrene copolymer
PA	Polyamide
PC	Polycarbonate
PP	Polypropylene
PP/EPDM	Polypropylene/ethylene propylene diene copolymer
PC/PBT	Polycarbonate/polybutylene terephthalate
Hard PVC / soft PVC	Polyvinylchloride

Thermosets

Thermosets (also called TS polymers) are much harder and more brittle than thermoplastics. Their strength remains largely unchanged when they are heated. Thermosets are destroyed when heated above the critical temperature. Also, the original state will no longer be restored on cooling.

Brief description	Plastic
GRP	Glass reinforced plastic
PUR	Close-meshed cross-linked polyurethane
PUR	Wide-meshed cross-linked polyurethane

Plastic identification

Normally the appropriate identifier is marked on the plastic components used in vehicle construction.

The capital letter sequences used for this are standardized in DIN EN ISO 1043-1 and DIN ISO 1629 (for rubber) and can be looked up in the tables which they contain. In addition the string of characters provides information about the exact mixture ratio and the proportion of certain fillers.

Examples of the identification of plastics

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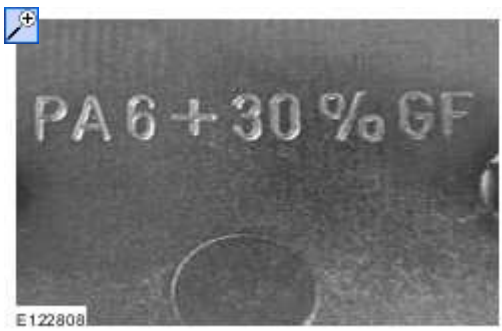

NOTE: The identification of the type of plastic is necessary for the plastic welding process in order to determine the correct welding rod (welding material) to use.
If an identifier is missing or cannot be made out, the following easy to perform tests will help:

Visual Inspection

Visual inspections mainly serve to identify PUR and GRP materials. Thermoplastic components are often painted and are therefore difficult to identify.

Identification characteristics:

- When PUR cracks or similar damage occurs, pores of foam can be seen.
- GRP can be recognized by the glass fiber structure on the inside.

Mechanical test:

The plastic group can be determined by a sound test:

- Degree of hardness - the higher-pitched the sound, the harder the plastic.
- Elasticity - the more muffled the sound, the higher the elasticity of the plastic.

Sanding test

In this a place is chosen which will not be visible later, and the finger belt sander is used to sand the plastic.

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The plastic group can be determined using the pattern of the dust:

- Thermosets produce a white dust.
- Thermoplastics smear and do not produce dust.

Float test in water:

Take a small piece of plastic from the component to be repaired and test whether it floats on water (PP-EPDM, HD-PE, PP) or sinks (PVC/U, PVC/P, ABC, PC).

Nature of the surface

The surface of plastics can be categorized as rigid (PVC-U, PVC-P) and waxy (PP/EPDM, HD/PE, PP).

Adherence test using welding rod

Heat a welding rod that is identified with the type of material and the plastic component using the hot air gun. Press the welding rod onto the plastic component to be welded. When the welding rod cools down, if it remains stuck to the component or can only be removed with great difficulty, then it can be assumed that the two are made of the same plastic. When pulling away from PP/EPDM, HD/PE and PP, this can lead to strings.

CAUTION: Danger of poisoning! When burned, most plastics release vapors harmful to health. Ventilate the room well and use respiratory protection. Where possible work using an extraction system.

Burning test

Every plastic has a characteristic behavior and smell when burned. Using a knife, cut off a small piece from the component to be repaired, remove any dirt and paint residues and set light to the small chip. Now observe the burning behavior. Compare the color, type and smell of the smoke with the results from the following table.

Short description	Plastic recognition using a burning test
ABS	Blackish smoke, the material drips like a candle when burning and smells like wax.
PA	No smoke, draws filaments, smells like burnt horn.
PC	Yellowish, sooty smoke. Smells sweetish.
PP	No smoke, the material drips like a candle when burning and smells like burnt oil.
PP/EDM	No smoke, the material drips like a candle when burning and smells like burnt oil.
PC/PBT	Hard and shiny, burns yellow, fluffy soot.
Hard PVC / soft PVC	Blackish smoke and acrid smell.

Safety instructions

In addition to the general safety instructions, the relevant regulations and accident prevention legislation must be observed.

NOTE: Without exception, before starting work you must read the safety and warning instructions in the chapter "Safety Instructions". In addition, pay attention to the warning instructions of the particular equipment manufacturer.
Information sheets, safety notices and guidelines for the processing of adhesives containing isocyanate, polyester resin, adhesives, solvent and thinners provide more details on their use.

The following instructions must always be followed:

- Polyester resin, adhesive, solvents and thinners are inflammable and must not be used

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near naked fire or flames.
- Sawing and grinding operations must only be carried out in rooms equipped with extraction systems.
- If no rooms with extraction systems are available, only use tools with extraction equipment.
- Protective equipment such as gloves, protective goggles, aprons and breathing masks are essential.

Because of the various compositions of plastics, repair work to plastic parts involves a variety of repair methods.

The following methods are used:

- Thermoplastic straightening.
- Plastic welding.
- Plastic adhesive bonding.
- Plastic lamination techniques.

Thermoplastic straightening

Damage to thermoplastics can be rectified by heating using the hot air gun (temperature about 100°C) while the deformation is pressed out until the shape is regained.

Plastic welding

Splits formed in plastic bumpers are typical possible plastic repairs.

NOTE: Do not carry out plastic welding in the area of fixed foam backing. The foam backing will usually be destroyed and the function of the component is then no longer guaranteed.
If repair using adhesive methods is not possible because of unfavorable conditions at the rear of the repair location, plastic welding is a possible repair process.

There are two methods of welding: hot air draw welding and hot air fanning welding.

Plastic welding set

Item	Description
1	Various welding rods
2	Scraper (heart-shaped)
3	Hot air blower (approx. 1500 W)
4	Clamps
5	Welding nozzles

In addition to the components listed, plastic welding requires tools already found in the workshop such as scrapers, sanders, face cutters etc.

As with all other welding processes, only certain material combinations can be joined together using plastic welding.

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range listed in the Training brochure published by the Ford

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Service Organization.
NOTE: The manufacturer's data must be taken into account when choosing welding materials and the correct temperature setting of the hot air gun.
Repair sequence during plastic welding:

- To prepare the location for welding, remove paint residues and sand the weld area.
- If parts of the material have been pushed in by an impact, the damaged area can be brought back to shape by heating.
- Drill out the ends of the split to stop it spreading further. Machine the location of the weld into a 90° V-shaped groove, to accept the welding rod.
- Lay the welding rod in the groove.
- Perform the welding. Hot air draw welding or hot air fanning welding.
- Rework the weld seam. After cooling, sand the raised weld seam.
- Clean the sanded repair surface using plastic cleaner. Apply plastic primer thinly to the repair surface and paint it.

Despite good preparation and the correct choice of welding materials, weld faults may occur.

The following points must be noted when welding plastic:

- Weld together like with like:
  - With very few exceptions, only the same materials can be welded together, e.g. PP with PP.
- Correct temperature:
  - The correct choice of temperature is important for the success of the repair. The plastic must be warmed until it plasticizes (dough-like, soft).

Guideline values for welding temperature:

Brief description	Plastic	Temperature
ABS	Acrylonitrile butadiene styrene copolymer	360°
PA	Polyamide	400°
PC	Polycarbonate	370°
PP	Polypropylene	280°
PP/EPDM	Polypropylene/ethylene propylene diene copolymer	280°
PUR	Polyurethane	300°
Hard PVC	Polyvinylchloride	340°
Soft PVC	Polyvinylchloride	370°

- Even pressure:
  - When rod welding, the pressure is applied by pressing on the welding rod.
- Steady speed:
  - To achieve a good weld, care must be taken that the working speed is steady.

Possible causes of weld faults:

- Deformation caused by overheating of the repair area or tensions in the material while welding the component.
- Plastic material too thin.
- Poor weld joint because the weld temperature was too low or the welding speed was too fast.
- Welding different materials together.
- Weld seam dropped because the split gap was too wide or the welding temperature was too high.

A good weld is recognized by a slightly raised, smooth and even weld bead on the surface of the component.

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The weld bead must only be worked once it has fully cooled down.

Plastic adhesive bonding

Adhesive bonding of plastics has some advantages over welding methods:

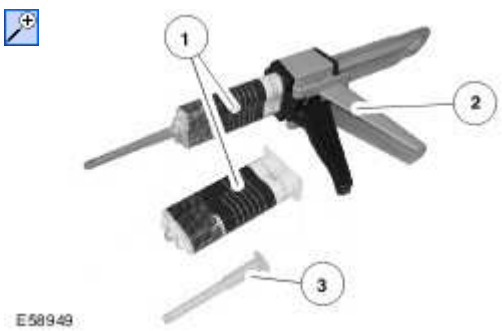
- Within the group of thermoelastic plastics, all semi-rigid ancillary components (such as bumpers, front grilles, etc.) can be repaired without identification.
- A two-component polyurethane based adhesive is used for all thermoplastic parts.
- Reinforcement strips can be attached behind splits (split length up to max. 100mm) and openings to ensure the original strength properties.

Tools and equipment also familiar from paint repairs can be used in making adhesive repairs to thermoplastic components.

Angle grinders and belt sanders can be used to grind out scratches and splits. Orbital sanders with extractors are used for fine sanding.

The infrared heater is used to provide fast and certain drying throughout.

Plastic adhesive set



Item	Description
1	2-component adhesive
2	Cartridge gun
3	Mixing tube

Apart from the components shown, other materials may be needed to bond plastics, depending on the repair position.

For large scale repairs, it may be necessary to insert reinforcement panel strips and reinforcement matting as fixing aids.

Repair sequence during plastic adhesive bonding:

NOTE: Follow the manufacturer's guidelines when using adhesives.

- Prepare the location of the bond. Remove paint residues and sand the area to be bonded. Drill out the ends of the split to stop it spreading further. Prepare the bond location into a V-shape and clean it with plastic cleaner.
- Apply the adhesive. The two-component adhesive is applied to the cleaned and primed repair location using a hand gun. Spread and smooth the adhesive using a flexible plastic spatula.
- Rework the bond location. After cooling, sand the raised adhesive. Clean the sanded repair surface using plastic cleaner. Apply plastic primer thinly to the repair surface. Apply paint.

GRP repairs

GRP material is hard and brittle in its strength properties. Because of these material properties, splits and openings often result in cases of serious damage.

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The stability of GRP parts is impaired if the glass fiber reinforcement is cracked. The component must be replaced in cases of serious damage that affect the structure.

Minor damage (such as abrasion, splits up to 80mm, holes up to approx. 60mm diameter, etc.) can be repaired to a technically and visually perfect standard, provided that the damage does not occur in heavily used or hard-to-reach areas.

To ensure perfect repair results, observe the following points:

- The room temperature should be at least 15°C and the air should be as dry as possible.
- The repair location must be thoroughly dry and clean.
- Before the repair, the GRP part being repaired must be dried using an infrared heater or in a drying oven.
- In cases of large splits and fractures, the strength of the outer skin can be re-established by backing with a reinforcement material.

Tools and equipment from the paint shop can be used to carry out repairs to GRP parts. Angle grinders and belt sanders can be used to grind out scratches and splits. Orbital sanders with extractors are used for fine sanding.

GRP repair set

Item	Description
1	Polyester resin
2	Glass fiber mats
3	Hardener

Scissors, paintbrush and cleaning materials are other materials which will be needed to perform a GRP repair.

NOTE: Follow the manufacturer's instructions when using the repair materials.
The repair process for a GRP repair is as follows:

- Prepare the repair location. Remove paint residues and sand the repair area.
- Drill out the ends of the split to stop it spreading further.
- The repair location must be sanded by hand. If machine working is attempted, the resin will be heated so much that the surface structure will be changed. The result is inadequate adhesion.
- Perform the GRP repair. Apply polyester resin thinly to the repair location. Lay the glass fiber mat in place and apply polyester resin over it again.
- Rework the location of the repair. Sand away any polyester resin which stands proud after it has hardened.
- Clean the sanded repair surface using plastic cleaner. Apply plastic primer thinly to the repair surface and after it has dried apply the paint finish.

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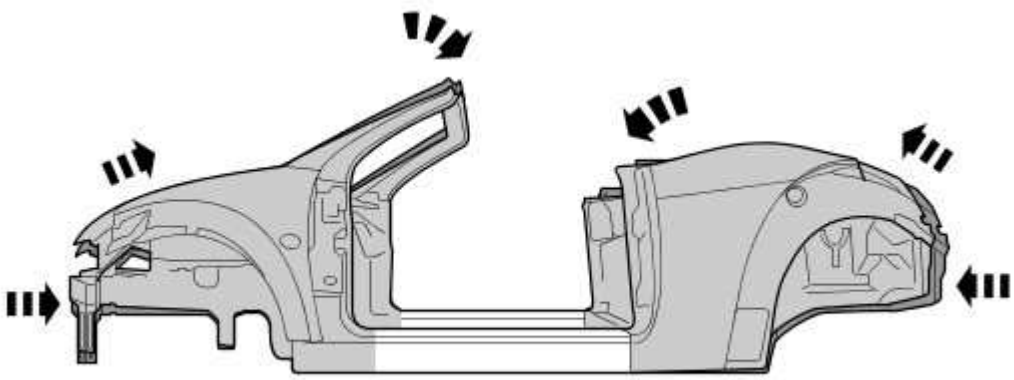
Description and Operation

Cabriolet vehicles

The body of a cabriolet vehicle is different to the self-supporting body of a saloon car because of the special roof construction (folding top). The stability requirements must therefore be ensured by construction changes within the body structure.



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These are for instance:

- Longitudinal and torsional reinforcing components which compensate for the lack of the roof.
- Reinforcements to the floor assembly, particularly in the rocker panel area.
- Reinforcements in the pillar areas.
- High-strength and ultra-high-strength steel panels with single panel thicknesses of up to 2.5 mm, which in combination can become up to 6mm thick (e.g. reinforcements in the floor area, rocker panels).

If deformation to load carrying components occurs, the stability of the whole body shell can be adversely affected.

On a cabriolet, accident damage repair to the components mentioned above is considerably different in certain aspects compared with the usual repairs (closed body construction):

- A model specific alignment angle system must always be used during straightening and repair work, securing using clamps at the rocker panel area is not always adequate for the cabriolet.
- To avoid damage to the doors, they must always be open during straightening work. In the case of more severe damage, additional tension and compression spindles must be used to stabilize the door cut-outs (between the A- and B-pillars).
- In load bearing areas such as the rocker panels, side members and floor pan, increased straightening forces are necessary due to the additional reinforcements.
- NOTE: Additional information on welding can be found in the section Welding Equipment and Joining Techniques.
  High-power welding equipment for panel thicknesses in overall combination of up to 6 mm total material thickness.
- The fitting accuracy and longitudinal rigidity of the affected component is especially important to ensure that the doors, door windows and the roof fit and close correctly.

Liquefied gas vehicles

Alternative fuel vehicles often require special handling in the workshop area. Above all,

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assembly operations to some extent require particular knowledge when dealing with the special technology and the safety regulations.

NOTE: Only fully trained personnel are permitted to work on alternative fuel vehicles.
These special requirements must be understood and taken into account in the body shop as well.

CAUTION: Danger of fire and explosion. The safety instructions must always be followed when performing service work on fuel/gas systems. Failure to follow these instructions may result in personal injury.
NOTE: You will find further information about working on liquefied gas vehicles in the section Health and Safety Information.

Refrigerated conversion vehicles

Apart from the special materials used in building the structure of the refrigerated compartment, such vehicles have special energy and refrigeration systems which require special handling during repair.

CAUTION: Danger of injury. Work on the 230<SP>volt system of the refrigeration equipment must only be carried out by trained specialist personnel.
NOTE: Work on the refrigerant circuit may only be performed by persons who have a relevant certificate of competence.
Vehicles with a refrigerated compartment are often used to transport foodstuffs. For this reason, additional hygiene regulations must be complied with during repair work.

Aluminum and plastic are used to construct the two different types of compartment found on refrigerated vehicles.

The aluminum conversion is a very stable and technically perfect variant. However, against this the relatively high production costs and a lower payload must be taken into account, because of the weight of the aluminum conversion itself.

NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range listed in the Training brochure published by the Ford Service Organization.
The plastic conversion has developed into a light, clean and economical alternative because of constant further development of materials and working techniques.

NOTE: The material combinations, the workmanship and the working methods must comply with the current food hygiene regulations. For this reason, service and repair work on the refrigerated conversion may only be performed by authorized and specially trained technicians.
Refrigerated compartment constructions are often made using both materials. The floor pan is made of structured, slip-proof aluminum panels and the wall and ceiling cladding is made of smooth surfaced plastic elements.

CAUTION: PUR hard foam is flammable. If PUR hard foam is overheated, it will burn on its own with a brilliant yellowish flame. It produces unpleasant choking and toxic fumes. Special measures must be taken when welding the vehicle body.
Polyurethane wall and ceiling elements are manufactured using a sandwich principle. An insulating polyurethane core is coated with food grade ABS plastic on one side.

PUR hard foam does not decompose, is rot resistant and is odorless. These properties make it suitable for use as insulation.

Because of its closed cell structure, water uptake by PUR hard foam is for the most part only a problem at edges. Cut edges or other mechanically worked surfaces must however be sealed with the greatest care.

The conversion to a refrigerated vehicle is performed as made-to-order production. The

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large surfaces of the wall and ceiling cladding can be changed and are particularly easy to repair.

If access to the back of a body panel section is needed because of body straightening work, in some circumstances it is cheaper to perform a cut-out repair instead of removing an element.

The repair process is fully described in the Student Information booklet Refrigeration System Technology, Transit 2000.5 Freshline.

NOTE: You will find further information about working on vehicles with a refrigerated compartment in the section Health and Safety Information.

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Description and Operation

Body repairs usually require a significant level of intervention in the existing body shell structure. The corrosion protection, seals and NVH components are destroyed and must be replaced.

To prevent the vehicle quality from being reduced due to a poor quality repair, all repairs carried out in all repair sections must be inspected during and after the accident repair.

Simply checking the vehicle at the time of delivery is not sufficient to guarantee the repair quality. Rather, continuous checking of the work carried out is recommended.

NOTE: Logs of the acceptance of individual operations are a useful tool for quality assurance. A comprehensive final inspection can be carried out based on a final acceptance log.
In the process, the entire repair sequence must be split into meaningful sections, with the creation of check points to which particular attention must be paid.

The following are some possible sections:

- During and after body work.
- Final assembly, ancillary components, functional tests.
- Vehicle delivery.

NOTE: The following points offer an indication of possible test logs. They can be combined and supplemented differently, depending on the individual operating procedures.

During and after body work the following areas should be checked:

After completion of the body repairs, the following areas should be checked:

- Manufacturing inspection for functionality and originality in the accident area.
- Check snug fitting of metal panel parts (welding and screw connections).
- Check snug fitting of ancillary components (doors, hoods, glazing).
- Check surface condition of the welded seams.
- Check seals, blanking plugs, NVH components.
- Check corrosion prevention measures
- Check that the repair work is in the correct condition for painting.

Final assembly, ancillary components, functional tests

After final assembly, not only a visual inspection is required, but also the functionality of many components must be checked:

- Check repair area for originality.
- Check ancillary components for correct installation.
- Check precision fitting of all parts.
- Check that the doors and flaps are working correctly.
- Check that all mechanical parts, such as the window winder are working correctly.
- Check for leaks in the repair area.

Vehicle delivery

Vehicle delivery again offers the opportunity of checking the repair quality. In the process, the following points are to be checked again:

- Corrosion protection, sound damping matting and rubber seals.
- Check for traces of leftover paint.

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- Check the cleanliness of the vehicle.
- Functional check of the mechanical and electrical components.
- Road test the vehicle.
- Check for noise, vibration and harshness (NVH).
- Check for wind noises.

After repair work on the body and vehicle, not only the visual restoration of the damaged vehicle, but also the functional restoration must be guaranteed.

Customers are making increasingly high demands of vehicles, particularly in terms of driving comfort. Customers find noise, vibrations and harshness (NVH) as well as squeaking and rattling annoying, particularly after repair work. It is therefore important that the condition of the vehicle at the time of production be restored after an accident repair.

After body repairs, the entire repair area must be checked for any water leaks. It is crucial that a leak test be carried out as part of the final inspection so that water leaks can be detected and eliminated even before delivery of the vehicle to the customer.

The requirements of the vehicle manufacturer are to be taken into consideration during all inspections. Only in this way can it be guaranteed that the vehicle quality is not reduced through insufficient repair quality.

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Description and Operation

Water leaks can occur after body repair work, but can also occur on new vehicles. The test methods described below allow the various causes to be identified. In all cases, a systematic and logical procedure is required to locate water leaks.

General

When searching for faults, it must be taken into account that water can enter the vehicle passenger compartment in various ways and circumstances. Therefore, it is sometimes not sufficient to perform a water test on a stationary vehicle.

Before beginning extensive checks, a thorough visual inspection must be carried out. The following points are to be taken into account in the process:

- Check the clearance and accurate fit of ancillary components such as the trunk lid and doors.
- Check for correct installation and possible damage to sealing elements such as blanking plugs, seals and rubber door seals.
- Check that the water runoff openings and pipes are free of obstructions

Test method

Water test

NOTE: Do not use a power washer. Use a normal garden hose with a spray nozzle or sprinkler head. Make certain that all windows and doors are completely closed.
Water leaks into the vehicle passenger compartment cannot usually be located immediately, as the water often spreads across a large area. For this reason, the passenger compartment must be dried before the leak tests. Any ancillary components that block the view must be removed. During the water test, the vehicle is sprayed or sprinkled with water at the suspected location of the leak. At the same time, a second person checks the passenger compartment for places where water enters the vehicle. Depending on the test and the vehicle, it may take some time before there is any sign of water entering the vehicle. We recommend laying blotting paper under the location being tested so that the water entry can be localized.

Example: Water test with sprinkler head (rain test)

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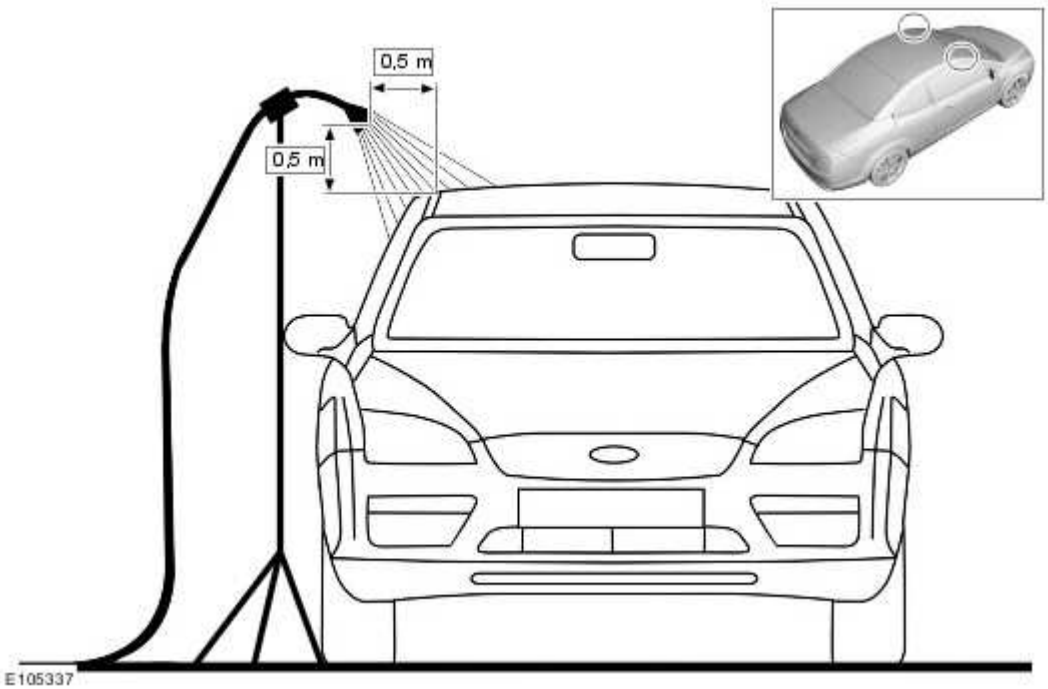

Car wash test

Certain leak problems only appear in a car wash or can only be simulated there. The concerned area of the passenger compartment should be inspected with a torch during the wash procedure.

Road Test

Some leaks only appear when the vehicle is moving. If no leaks are detected during the above-mentioned tests, road tests should be carried out on wet roads:

- At various speeds.
- On various road surfaces (asphalt to cobbles).
- With loaded or unloaded vehicle.
- Driving through puddles (splash water).

Test with UV lamp

A leak test can also be performed using a UV lamp and a special contrasting agent. The advantages of using contrast agent are:

- No need to dry out wet areas beforehand.
- The water entry and its subsequent path can be seen more clearly.
- No need to remove most ancillary components from the vehicle.

NOTE: The equipment manufacturer's instructions must be followed when using a UV lamp and contrast agent.
Procedure for using a UV lamp.

- Wet the test area with clear water from the outside.
- Prepare test liquid and apply it from the outside using a suitable water sprayer.
- Illuminate the relevant area from the inside using the UV lamp. The test liquid which enters will make the leak visible.

Chalk/powder test

This test checks the contact surfaces of seals on doors, hatches and lids.

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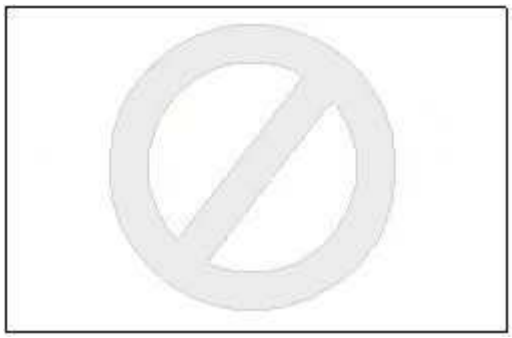
Process using a door seal as an example:

To do this, the door seal is coated with powder or brushed with chalk. A thin layer of grease is applied to the contact area of the seal. The door must then be slowly closed and reopened. The width and continuity of the imprint can now be checked on the seal.

Smoke test

Flow checking device



Description	Description
1	Test pipe
2	Test pipe opener
3	Puffer ball

Operating principle

The flow checking device is a set made up of a flow-testing pipe, a test pipe opener, puffer ball and closing-off caps for the pipe.

The test pipe contains a filling layer which is impregnated with fuming sulfuric acid. When air is blown through the pipe by the puffer ball, sulfuric acid is emitted as an aerosol in the form of a white smoke.

NOTE: Pay attention to the instructions for use and the safety directions issued by the manufacturer. The smoke test can only be performed in a draft-free environment.
This test can be used to detect leaks visually. Procedure:

- Break off both tips of the pipe in the pipe opener, in exceptional cases in the top of the packaging.
- Insert the pipe into the puffer ball so there are no leaks.
- Close the hole in the puffer ball with your thumb and press the air contained in the ball through the pipe.
- Set the ventilation blower in the passenger compartment to the highest setting.
- Close all doors so that a slight overpressure can build up in the passenger compartment.
- Move the smoke pipe along the outside of the body to the areas to be checked.
- Leaks can be detected through the irregular movement of the smoke.

Stethoscope test

This procedure is very similar to the smoke test. Instead of the smoke pipe, move a stethoscope past the areas of the body that are at risk. Leaks can now be detected acoustically.

Stethoscope

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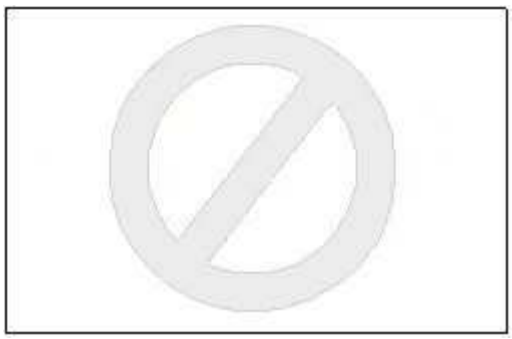
Ultrasonic detection

This test uses ultrasonic waves to locate the positions of leaks. When an ultrasonic transmitter is placed inside the vehicle, it sends out ultrasonic waves. A leak is located by running a detector along the suspected area. The position with the loudest reception of the escaping ultrasonic waves is the location of the leak.

Procedure:

- Place the ultrasonic transmitter in the vehicle.
- Completely close the vehicle.
- Search the exterior of the vehicle using the detector.
- The detector provides a simple indication of a leak.

Ultrasonic test device



Workflow for tracing water entry

Stage	Testing	Result	Action
1st	Ask customer for a detailed list of possible reasons for the water entry. Does this information allow the cause of the leak to be identified?	Yes	Dry out the vehicle and repair the damage. Perform a water test as a check (see test method).
		No	Step 2.
2nd	Perform an initial visual inspection on the vehicle. Look for signs of water entry. Can the cause of the leak be identified immediately?	Yes	Dry out vehicle. Repair damage. Perform a water test as a check (see test method).
		No	Step 3.
3rd	Is it possible that water is getting into the vehicle through a seal (door seal, trunk lid seal)?		Check the seal for damage. Check the creation of the seal using the chalk test (see test methods). Step 4.
		No	Step 5.
4th	Is the contact area for the seal adequate?	Yes	Step 5.
		No	Perform work as described under Areas with possible water leaks - Door seals. Dry out vehicle. Repair

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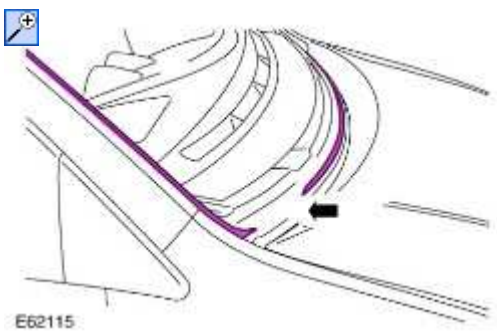
			damage. Perform a water test as a check (see test method).
5th	Before starting any further work, use the VIN to look for model-specific information in eTIS. Perform Oasis query and check TSIs. Does this information allow the cause of the leak to be identified?	Yes	Dry out vehicle. Repair the damage using the information found. Perform a water test as a check (see test method).
		No	Step 6.
6th	Establish the extent of the damage. To do this, expose wet areas. Remove parts. Investigate the suspected area for signs of water. Does an investigation of the suspected area allow the cause of the leak to be identified?	Yes	Dry out vehicle. Repair leak. Perform a water test as a check (see test method).
		No	Step 7.
7th	Check exterior areas (seals, seal welds). Check interior areas: Signs of water, plugs, seal welds. Can the cause of the leak be identified?	Yes	Dry out vehicle. Repair leak. Perform a water test as a check (see test method).
		No	Step 8.
8th	Perform water test or ultrasound test. Can the cause of the leak be found?	Yes	Dry out vehicle. Repair leak. Perform a water test as a check (see test method).
		No	The water entry may only occur under dynamic driving conditions. This requires intensive tests to be repeated with the corresponding climatic influences (rain).

Possible complaints and corrective actions

NOTE: Water leaks and changed vehicle acoustics can have similar causes. For this reason, information from the Wind noise or Noise, vibrations, roughness chapters may be useful in identifying the fault.
An outline of the possible complaints due to water leaks is provided below. The causes of water leaks and the possible remedies are presented using selected examples. They are intended to provide troubleshooting tips and suggestions for the user but do not represent an exhaustive faults list.

Glued windows

A broken pasted seam can cause water to enter around the window. A broken pasted seam can be located using a water test or by carefully blowing compressed air onto the inside of the window seal.



Corrective action

Broken adhesive seams **-Arrow-** can be sealed from inside using PU glass adhesive.

If this seal does not resolve the problem or the broken pasted seam is too extensive, it is necessary to remove the window and glue it back into place.

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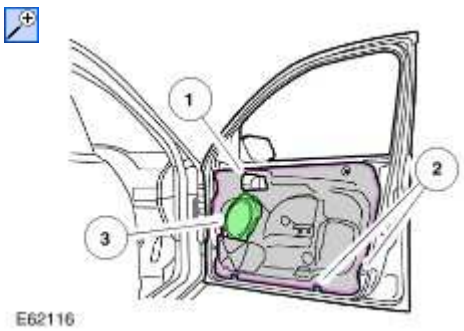
Door seals

If water appears at the bottom of the door, it is possible that the door seal behind the door trim is damaged. If the door is intact, water can enter through the window weatherstrip and flow out through gaps on the underside of the door. If the door seal adhesion is faulty or the door seal is damaged, water can get into the interior.



Description	Description
1	Seal/adhesion
2	Clips
3	Door speaker

Fastening bolts could be loose or clips incorrectly positioned on door modules.

Corrective action

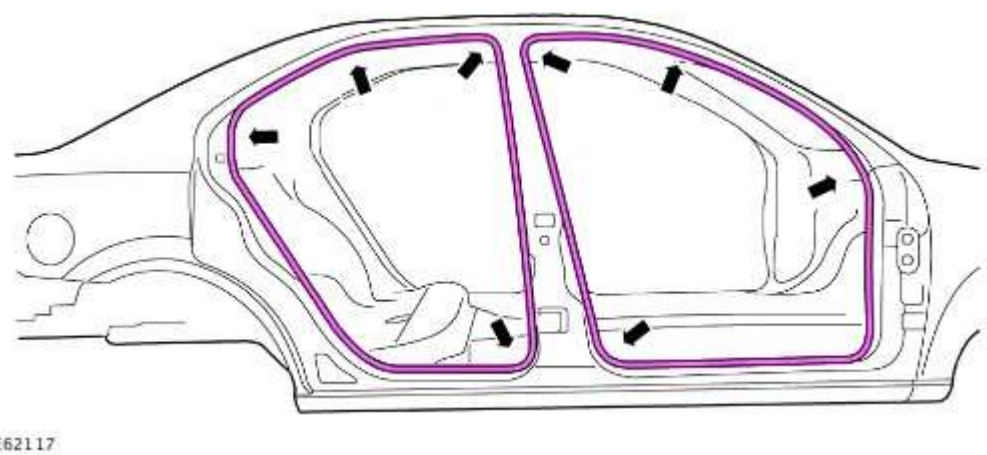
Depending on the door seals used, different sealing methods can be used.

NOTE: The drainage holes on the underside of the door may not be blocked - if they are, clean them. Defective films and foam seals must be replaced.
Once the adhesive surfaces have been cleaned, plastic films must be stuck with double-sided adhesive tape or replaced.

Leaky foam seals are sealed with Butyl tape or replaced.

Plastic door modules are fitted with a weatherstrip, which cannot be replaced. Seal the leaky point with Butyl tape or replace the part.

Door weatherstrip



Leaks can be caused by badly fitted seals. In particular, areas with radii **-Arrow-** must be thoroughly checked.

Door seals can develop leaks due to:

- Damaged or expanded seals.
- Ageing.

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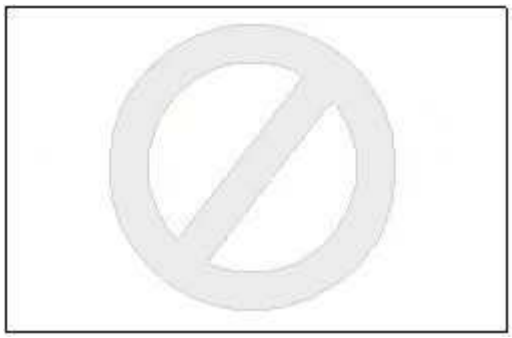
- Insufficient contact pressure.
- Inadequate contact area for seal on body part.
- Uneven welded flange thickness because of several layers of body panels or production tolerances.
- Kinks.

The contact pressure of a seal can be determined using a strip of paper. If a strip of paper trapped in the closed door can be pulled out easily, the contact pressure is too low.

To resolve

- Replace damaged or aged seals. Prevent kinks.
- The contact pressure can be changed by adjusting the catch bolt or correcting the panel flange.
- Even out the uneven welded flange thicknesses. Properly repair any paint damage that occurs. If the bodywork flanges are very uneven, appropriate alignment work must be performed. Pay particular attention here to the new corrosion protection which needs to be applied afterwards.
- If water entry is caused by a spot weld (burr on the surface), this must be rectified and appropriate corrosion protection applied.

Tailgate sealing rubber

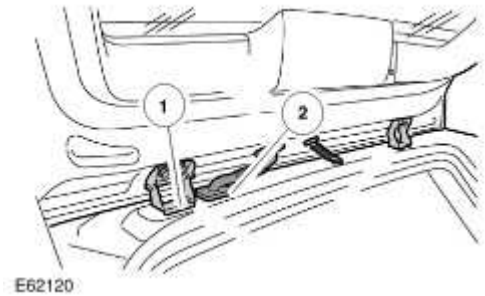


Leaks at the tailgate rubber seal have the same causes and remedial measures as for door rubber seals. Especially vulnerable areas -arrows- must be thoroughly checked.

Rubber grommets / plugs

Rubber grommets or plugs are fitted at numerous points on the body. They are frequently used as seals for cables, hoses or actuating links. Rubber plugs are frequently used for gaps caused during production.

Example: Possible problem locations in the tailgate area



Description	Description
1	Hinge seal
2	Cable duct

Leaks can be caused by badly fitted or damaged rubber grommets and plugs.

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Damaged cable insulation can also cause leaks.

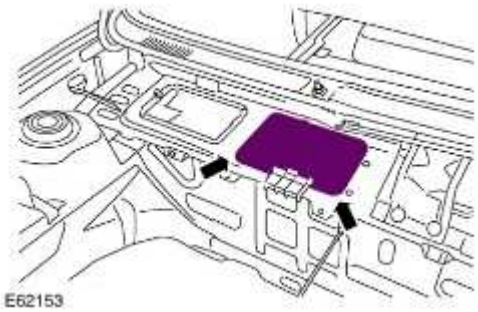
Where components are bolted on, water can enter if there are inadequate seals at the connection point.

To resolve

- Correctly fit rubber grommets / plugs. During fitting, ensure that the sealing lips are not trapped and are applied properly.
- The contact area of the rubber grommets / plugs can also be sealed with PU sealing compound.
- Replace the damaged rubber grommets and repair the damaged cable insulation.
- Smooth the panel deformations in the contact area of the plugs.

Heater housing/ventilation

Loose butyl sealing strips, damaged sealing surfaces or a trapped carpet can cause leaks around the heater housing / ventilation **Arrow**. Badly positioned or badly fitted hoses can also be responsible for water entry. Water drains must not be blocked



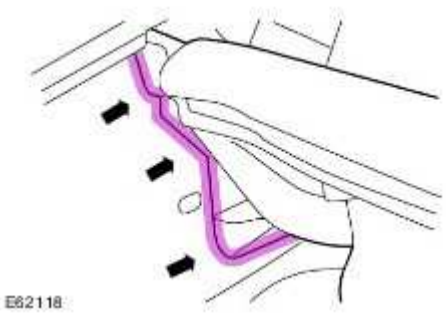
NOTE: A large quantity of water flows through the water tank. If there are leaks in this area, it is essential to ensure that the water drainage mechanisms function correctly. Drainage openings may not be blocked or stuck. Leaves and other dirt must be removed before troubleshooting.

Corrective action

Before the actual repair, make sure that the water drains are not blocked or stuck.

Remove the heater housing / ventilation and fit a new Butyl sealing strip. Damaged sealing surfaces must first be adjusted. A trapped carpet must be removed.

Seal welds



PU sealing beads are applied to welded or riveted connections **Arrows** to seal the interior of the vehicle. Incorrectly applied or damaged seal welds can allow moisture to penetrate into the interior of the vehicle. It is also possible that sealing beads whose shape and size appear to be intact actually have poor adhesion.

Corrective action

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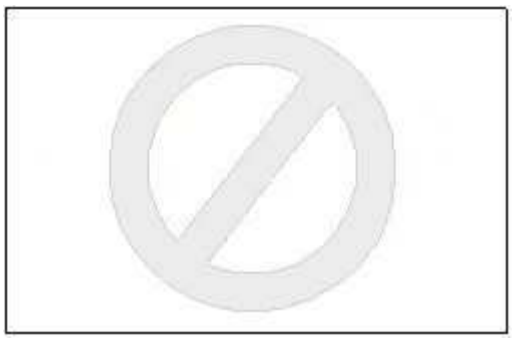
Incomplete seal welds must be supplemented with PU sealing compound. Damaged seal welds must be removed and re-applied properly. Make sure that any residual moisture is effectively removed before a new seal is applied.

Attached parts

The add-on parts include:

- Exterior mirros, handles, controls.
- Mouldings, roof mouldings, lettering.
- Roof aerial, roof rack or connections for roof rack systems.
- Bumper mountings.
- Injection nozzles, door contact switches, bump stop rubber.
- Control unit seals.
- Tail lamps.
- All kind of screwed connections (pedal block, door and tailgate hinges)

Example: Possible water entry points at the rear lamp



Description	Description
1	Clips
2	Gaskets.
3	Rubber grommet

Add-on body parts must be fitted with seals, grommets or sealing compound to prevent water entry. However, even when a sealing system is fitted, the screw thread may still cause leaks.

Corrective action

Seals must be tested and, if necessary, replaced. Check contact surface and adjust if necessary. Points sealed with sealing compound must be thoroughly cleaned and the seal replaced. Check grommets and replace if necessary. At all screwed connections, seal the thread with an appropriate sealing material.

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Description and Operation

Wind noises as well as other general noises are dealt with under Noise, Vibration and Harshness (NVH).

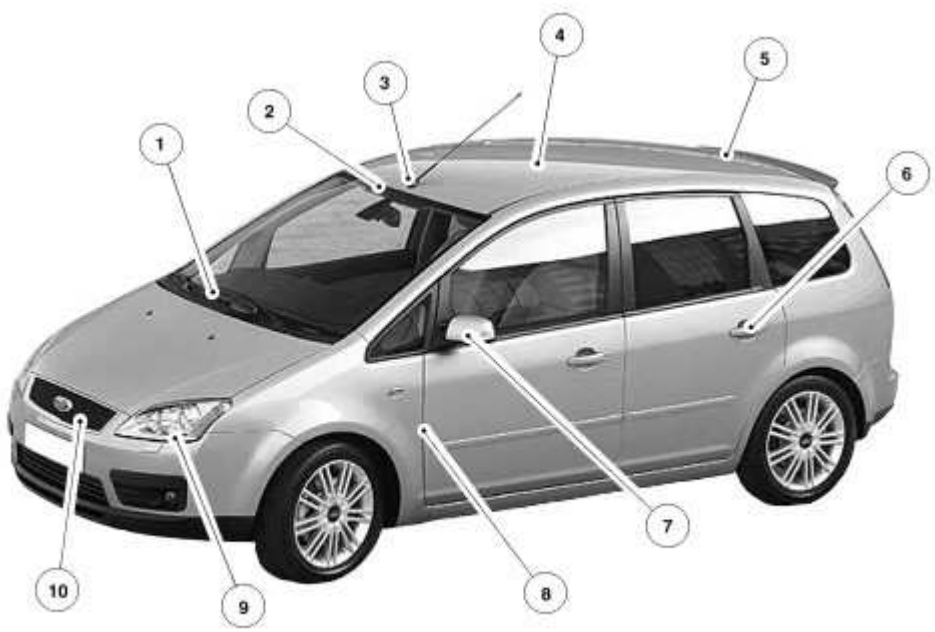
NOTE: Basic and in-depth training is offered on the following topics. You will find an overview of the complete range of courses in the Training Brochure issued by the Ford Service Organization.
Due to the continuous reduction in drivetrain noises, wind noises have come to the fore in the vehicle and are perceived to a greater extent by the customer.

There are various causes of wind noises. They can be due to the design of the vehicle, or they can occur after a repair. They are mostly caused by poorly mounted components, which must be located and installed in the correct position.

General information

In order to carry out targeted diagnosis, it is important to know the basics of noise formation and sound transmission.

Potential areas of wind noises



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Item	Description
1	Wiper arms
2	Windscreen seal
3	Antenna/antenna base
4	Sun roof/roof rail
5	Tailgate
6	Door handles
7	Exterior Rear View Mirror
8	Door seals
9	Headlamps
10	Radiator grille.

Noises are categorized according to their type and formation as follows:

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"Normal" air flow noises:

Normal air flow noises are caused by air blowing against even, flat vehicle surfaces, such as the roof, doors and side windows. When the vehicle is moving fast, air layers (turbulence) form, which cause variations in air pressure. These variations in air pressure spread in the form of sound waves and are transferred to the vehicle interior via the side windows and seals.

Noises caused by deviations in air flow and circulation around separate components:

If air flows over an edge on a vehicle, the air flow cannot follow the shape of the surface, but separates at the edge. Eddies are formed, which collapse again after a certain time or distance. The associated fluctuations in air pressure create a corresponding sound wave which is noticeable by for instance a rushing noise at the A-pillar or the outside mirror.

Turbulence and the associated radiation of noise can also occur at the vehicle underbody. Air circulation around small components and also flow through small gaps (e.g. the radiator grille) cause the rushing noise to change to a whistling, which rises and becomes louder as the vehicle speed increases.

Noises caused by vibrating seals:

Seals which do not make firm contact at the door or window area can be made to vibrate by pressure variations outside the vehicle, which in turn mean noise radiating into the interior of the vehicle.

Noises caused by air flowing out:

Noises caused by air flowing out are created by leaks at the vehicle interior sealing system, when stationary air mixes with flowing air. As a result, the noise increases as the speed of the air flowing out increases. Example: Letting air out of a tire.

Cavity noises:

Cavity noises are those created when the air volumes found in bodywork cavities are caused to vibrate by an opening located in the airflow. The frequency of the tone does not vary with the vehicle speed but depends on the volume of the cavity and the size of the opening. Example: Blowing across the top of a bottle.

Wind noises overview:

Workshop diagnosis

Assessment	Type of wind noises	Place of origin
Normal	"Normal" wind noises	Roof, side windows
Normal	Noises caused partly by changes in the direction of air flow and by air flow around separate components	A-pillars, outside mirrors, antennas
Serious	Noises caused by vibrating seals	Door gaps too large, door/window seals not making firm contact
Serious	Air escape and air passage noises	Leaks in the bodywork/sealing system
Serious	Cavity noises	Unsealed bodywork cavities

Those noises listed under "Serious" indicate a possible source of the fault.

Workshop diagnosis

There are two ways that the level of noise in the vehicle interior can be reduced and the character of the noise can be improved through assessment and diagnosis in the service department:

- Reducing the intensity of the noise sources.
- Reducing the noise transfer routes.

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Before carrying out repair work, a visual inspection of the vehicle must be carried out. The gaps in the doors, the sunroof and at all other body parts must be checked in particular.

When the doors are adjusted to fit exactly, development of wind noises at high speeds can often be eliminated (lifting of doors off the seals). Furthermore, the following points should be noted:

- The windows and doors must be fully closed.
- The air guides and air grilles must be correctly seated.
- All of the trim strips and plastic components must be firmly fixed down without gaps.
- All blanking plugs present.

Test method

The test procedures given in the chapter Noise, Vibration and Harshness can also be used to diagnose wind noises.

Road tests

Wind noises can usually only be localized by road tests

NOTE: There should always be two people present during road tests to find noises. A driver who reconstructs the situation causing the noise, and a person to carry out the checks.
The following points should be taken into account for such road tests:

- Check that the tire pressure is correct.
- Remove non-standard ancillary components from the vehicle.
- Choose a dry, flat road with as little traffic as possible.
- Carry out the road test in all speed ranges. Use a high gear so that the engine noise is low.
- Do not perform a road test near any sound reflecting objects.

If it is difficult to detect the noise sources, the search can be made easier by masking potential areas.

Chalk/powder test

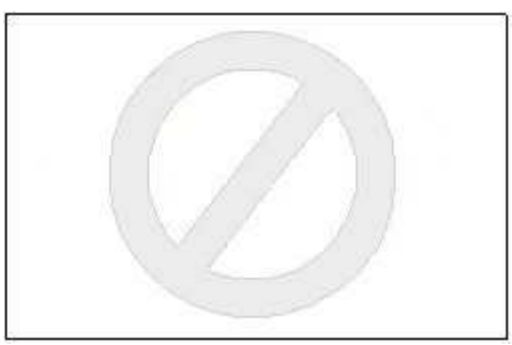
This test checks the contact surfaces of seals on doors, hatches and lids.

Process using a door seal as an example:

To do this, the door seal is coated with powder or brushed with chalk. A thin layer of grease is applied to the surface against which the seal makes contact. The door must then be slowly closed and reopened. The width and continuity of the imprint can now be checked on the seal.

Smoke test

Flow checking device



Item	Description

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1	Test pipe
2	Test pipe opener
3	Puffer ball

Mode of operation:

The flow checking device is a set made up of a flow-testing pipe, a test pipe opener, puffer ball and closing-off caps for the pipe.

The test pipe contains a filling layer which is impregnated with fuming sulfuric acid. When air is blown through the pipe by the puffer ball, sulfuric acid aerosol is emitted in the form of a white smoke.

NOTE: Pay attention to the instructions for use and the safety directions issued by the manufacturer. The smoke test can only be performed in a draft-free environment.
This test can be used to detect leaks visually.

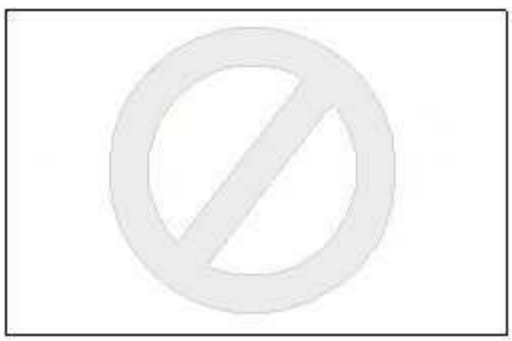
Procedure:

- Break off both tips of the pipe in the pipe opener, in exceptional cases in the top of the packaging.
- Insert the pipe into the puffer ball so there are no leaks.
- Close the hole in the puffer ball with your thumb and press the air contained in the ball through the pipe.
- Set the ventilation blower in the passenger compartment to the highest setting.
- Close all doors so that a slight overpressure can build up in the passenger compartment.
- Move the smoke pipe along the outside of the body to the areas to be checked. Leaks can be detected through the irregular movement of the smoke.

Ultrasonic test

This test searches for leaks in the system of seals or rather acoustic bridges. When an ultrasonic transmitter is placed inside the vehicle, it sends out ultrasonic waves. A leak is located by running a detector along the suspected area. The position with the loudest reception of the escaping ultrasonic waves indicates places where noises occur.

Ultrasonic test device



Procedure:

- Place the ultrasonic transmitter in the vehicle.
- Completely close the vehicle.
- Search the exterior of the vehicle using the detector.
- The detector provides a simple indication of a leak.

Stethoscope test

Stethoscope

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Diagnosis

Wind noises often have similar causes as the general NVH noises. For instance, a windshield which is incorrectly bonded in position can cause normal driving noises to become more noticeable.

Asking the customer detailed questions and a road test together with the customer are the requirements for a targeted diagnosis.

NOTE: Take the customer concern seriously. But do not confirm that a noise is a problem until you are sure that it is something which is not normal for the vehicle series.

Possible questions:

- How long has the noise been there?
- Has any work been done on the vehicle?
- Where does the noise come from?
- In which driving situation does the noise appear?
- Is there any special situation in which the noise appears?

Remember that a noise is often more or less noticeable depending on where you are sitting in the vehicle.

Stage	to test	Result	Reference or Action
1st	Road test the vehicle with the customer. First let the customer drive to demonstrate the noise, before you drive the vehicle yourself. Check that the concern is justified. Is this a noise which gives cause for concern?	Yes	Step 2.
		No	Explain the noise and tell the customer what is causing it. Possibly offer a comparable vehicle for a road test.
2nd	Visually inspect the vehicle. Look for loose, damaged or missing components. Check that the vehicle is to standard production series specification. In particular, check for any after-market components which may have been installed. Depending on the type of noise, check the suspected area. Could a cause of the noise be found?	Yes	Eliminate the noise or carry out a repair as the case may be. Check whether the measures have been successful.
		No	Step 3.
3rd	Before starting any further work, use the VIN to look for model-specific information in eTIS. Perform Oasis query and check TSBs. Can a cause for the noise be determined based on the information available?	Yes	Take the action specified in the Oasis or TSB information. Check whether the measures have been successful.
		No	Step 4.
4th	Localize the noise. In doing so, check whether it is an unusual noise or if it is a usual driving noise that is more noticeable because of inadequate sealing. Is it an	Yes	Step 5.

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	unusual noise?		
		No	Step 7.
5th	Determine the source of the noise. Can the cause be determined?	Yes	Eliminate the noise or carry out a repair as the case may be. Check whether the measures have been successful.
		No	Step 6.
6th	Determine the path of the noise using the stethoscope. By way of a trial, mask the suspected area or components or remove them. Can the cause be determined?	Yes	Eliminate the noise or carry out a repair as the case may be. Check whether the measures have been successful.
		No	Step 7.
7th	Check the vehicle for inadequate or damaged seals. The sealing of a vehicle can be checked using the stethoscope, the powder test, the smoke test and the ultrasonic detector. (See under test method.) Could a leak be detected?	Yes	Renew the seal or perform the appropriate repair as necessary. Check whether the measures have been successful.
		No	Step 8.
8th	Under certain circumstances there may be a constructional problem which is not yet known about. Record the problem in an Express Service Report and send it on by the usual method.		

Possible concerns with corrective measures

NOTE: Instructions on general noise are summarized separately in the Noise, Vibration and Harshness section. These can be useful when searching for the causes of wind noises.
There follows an outline of the possible concerns relating to wind noises. Selected examples are given showing the causes of wind noises and the ways in which they can be eliminated. They are intended to provide troubleshooting tips and suggestions for the user but do not represent an exhaustive faults list. The topics are subdivided by the different groups of components.

The test procedures described in the Noise, Vibration and Harshness section can be used when troubleshooting.

Seals

In general, seals are very important when eliminating wind noises. Special attention should always be paid here to the possible causes of wind noises.

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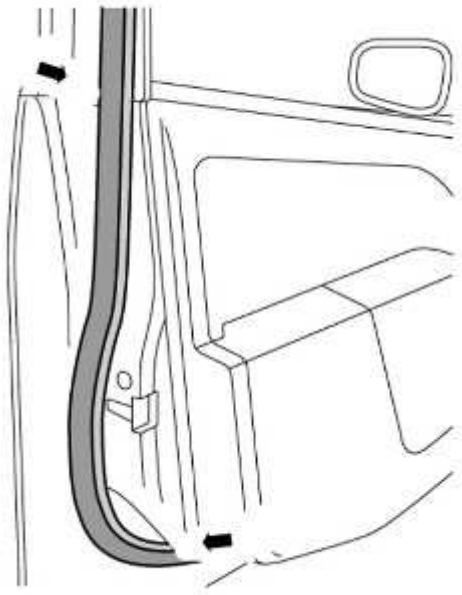

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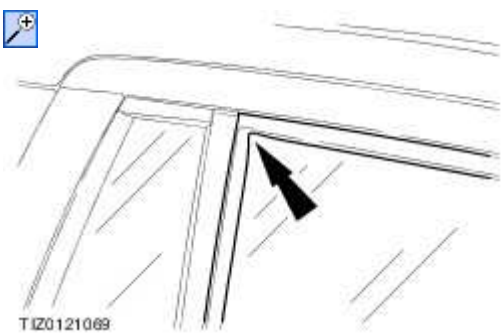
Take the following points into account:

- Seals age, i.e. they become porous and with time they lose their original elasticity. If the vehicle is relatively old and there are already visible signs of distortion or damage to a seal, then it should be replaced.
- At high speeds the doors or hatches may lift slightly from the seal surfaces because of variations in air pressure. Wind noises are caused when the preload on the sealing surface is not sufficient. The preload depends on the installation position of the components, the elasticity of the seal and the location of the sealing flange.
- The contact surface of the seal must be sufficient. This can be checked using the chalk test. If the specifed width of the contact surface is not known, you must determine it on another component of identical construction.
- A bulging seal carrier indicates that the sheet metal of the retaining flange is uneven.
- Seals must be correctly installed. Special attention must be paid at corners **-arrow-** that the installation follows the contours.
- The seal must not show any kinks or folds or any other damage.
- Seals must seal all around their circumference. Gaps in seals result in openings which lead to an increased incidence of noise. In this respect, it is especially important to pay attention to the seals in the area of the windows.

Remedial Action

Renew older seals which no longer have adequate preload. Deformed or widened retaining flanges must be reworked and provided with a new seal.



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The corner areas **-arrow-** of a seal must be properly seated. In some circumstances, a butyl sealing strip must be affixed to support the sealing at a corner.

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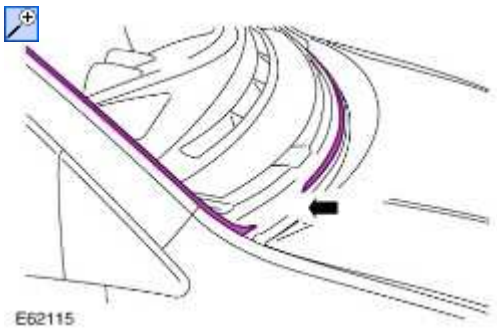
Bonded joints

Glass is usually installed today using a bonded joint. Gaps in the bonded joint can lead to noises in the vehicle interior. If there are noises which are believed to be associated with window glass, the following points should be checked:

Gap in window bonding



- The window must be bonded without any gaps **-arrow-**. Leaks can be found using the ultrasonic tester or compressed air carefully blown from inside onto the window glass bonding.
- The installed position of the window glass must be correct. It must not have been bonded into a position which is too low or offset to one side.
- The sealing or trim strips must fit tightly and the glass must be mounted so that it is fully enclosed. If a sealing or trim strip has not been applied with enough pressure, high air speeds can cause it to lift up. This can lead to wind noises at higher speeds. Apply masking tape to these areas for test purposes.

Corrective measures

Leaking areas of the window glass bonding material can be sealed using PU sealing compound. Pay special attention at the front windshield, that any breaks in the bonding are not too large. Otherwise the glass must be removed and bonded in place again.

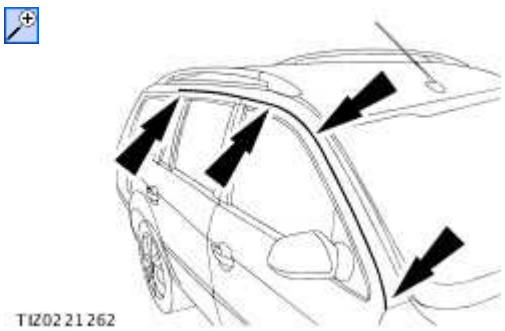
The installed location of a window glass cannot be corrected. It must be removed and bonded into place again.

Replace the trim strips or secure the lip seal using PU adhesive.

Gaps, edges

Door gaps and edges are places where air turbulence can form. This causes noises which can be perceived as troublesome.

Gaps and edges - problem areas



Doors, hood and tailgate can cause wind noises because of gaps **-arrow-** which are too large. If the components are not installed flush to the bodywork or the neighboring component, air break edges can arise, which in turn can create a wind noise.

The sun roof may be the cause of whistling noises in the roof area. The sun roof may be

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incorrectly adjusted or the seal on the sun roof may be damaged.

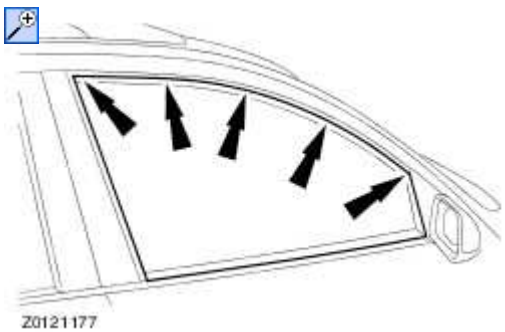
Noises from the door area could come from a window which does not fully close. Side guides (seals) can also be the cause of wind noises.

The covers of window frames can be incorrectly mounted or aligned. The quarter-lights in doors must also be checked for correct installation.

Corrective measures

Check the gaps and adjust them according to the specifications. If there are problems at the sun roof, correct the adjustment and if necessary replace the seals.

Problem area at side windows



Side windows which do not fully shut **-arrows-** must be adjusted. If the vehicle is equipped with electric window regulators, the remedy may be to perform the window regulator learning process again. In all cases, make certain that the glass enters far enough into the seal.

Ancillary Components

Components installed on the bodywork may cause noises when they are not correctly mounted.

When troubleshooting it may be helpful to remove the suspected component or, when this is not possible, to mask it off with suitable covering tape.

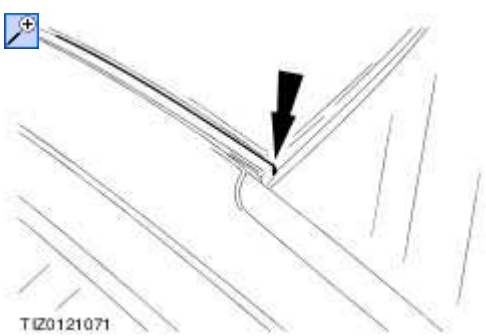
Roof moldings, roof rail, roof antennas

Moldings and roof moldings must touch the bodywork along their whole length without any gap. Check the end sections in particular. These must neither have any splits nor stand away from the bodywork.

Noises may come from the roof rail if the seal between it and the roof is not correctly installed or is cracked. Gaps at the mounting grooves of the carrier can also create wind noises.

The roof antenna and antenna foot seal must be correctly secured. The seal must lie completely on the roof and must not be damaged.

Roof moldings mounting



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If the original mounting points of the roof moldings are in good condition, the fixing can be improved using silicone sealant -arrow- if necessary. Align or renew the seals of the roof rail. Reduce the clearances of the mounting grooves.

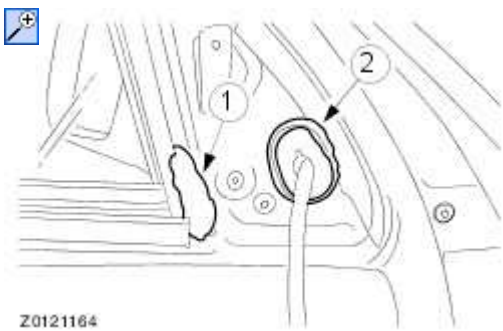
Corrective measures

If the original mounting points of the roof moldings are in good condition, the fixing can be improved if necessary using silicone sealant **-arrow-**.

Exterior mirrors

Exterior mirrors or covers of exterior mirrors which are not correctly mounted cause noises. The cover must lie evenly on the component and must not lift during driving. There are ducts present on the doors for the electrical or mechanical adjusters for the exterior mirrors. If there are leaks, wind noises will be caused. Holes can also be present at the transition to other components.

Exterior mirror seals



There are ducts present on the doors for the electrical or mechanical adjusters for the exterior mirrors. If there are leaks, wind noises will be caused. Holes can also be present at the transition to other components.

Remedial Action

If there is inadequate sealing of the foam seals **-2-** they must be replaced or supplemented with suitable material. Transitions to other components can be sealed with butyl sealing compound **-1-**.

Moldings, covers, door handles, windshield wiper arms

Moldings and covers especially tend to cause wind noises because of their location. These components interrupt smooth bodywork surfaces and air turbulence therefore arises at the edges. If there are noise concerns in the area of the doors, check especially for gaps and projections. Moldings must not stand away from the bodywork or the door. There must not be any gaps or discontinuities at the location of joints.

Incorrectly adjusted windshield wiper arms can cause wind noises. Especially if they are too far over the glass surface when in the rest position.

Wind noises in the transition area between the air cowl cover and the wing or the windshield can be caused by an incorrectly installed air cowl cover. At high air speeds the air cowl cover may lift and noises will then occur.

Because of their necessary mechanical features, door handles have a range of openings and edges which allow noise to be generated. The door handle can be masked off for testing purposes. If a reduction in wind noises is noticed, inadequate sealing may be the reason for the noises.

Remedial Action

Openings which are used to secure trim panels must be checked for leaks. Any leaks found can be rectified using butyl strips.

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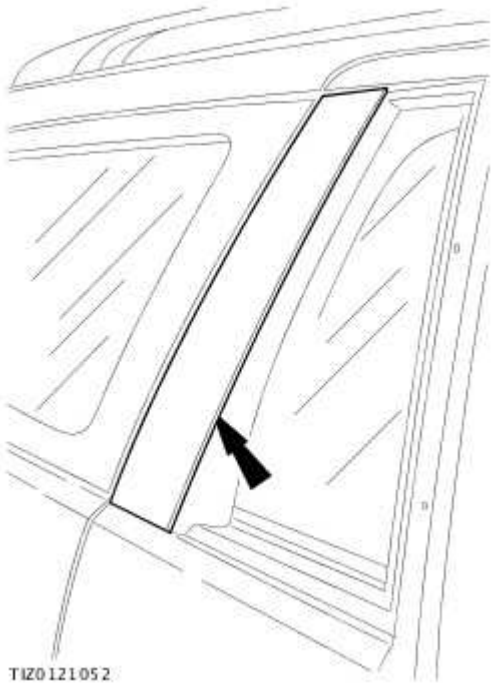
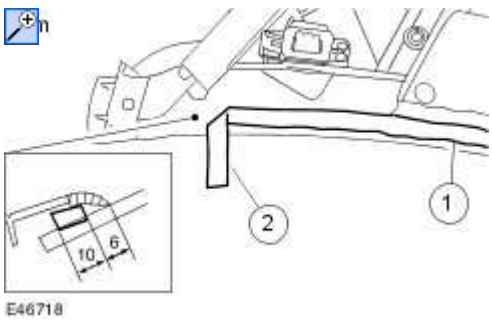


Loose or damaged outer trim on the pillars **-arrow-** must be secured or replaced.



A butyl sealing strip **-1-** can be laid underneath the cover in the transition area between the air cowl cover and the wing or windshield.

The sealing of the door handles must be renewed when required. In addition, noise absorbing material can be applied to the back of the door handles.

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Description and Operation

Noise, coming from the vehicle and which can be heard inside and outside the vehicle.

Vibrations, oscillations that are felt and noticeable inside the vehicle.

Harshness, noises which come from the vehicle and which can be heard, felt and noticed inside and outside the vehicle.

These terms are grouped together under the title Noise, Vibration, Harshness, or NVH for short.

The task of vehicle development and production is to ensure that noises caused by the vehicle do not disturb the driver and passengers. Moreover, the the external noises emitted by the vehicle must not exceed the thresholds set by law.

NOTE: Basic and advanced training courses are offered for the following contents. For an overview of all courses offered, please refer to the Ford Service Organisation's training course brochure.

Noise types and causes

Noises in and around the vehicle are assigned specific descriptions:

- Humming and droning are perceived as low tones.
- Buzzing and whirring are middle tones.
- Howling, whistling, squeaking are assigned to the high tones.

Low to middle tones are considered to be unpleasant. They are palpable and noticeable as oscillations and vibrations throughout the body. Loud howling and whistling is painful to the ears.

A noise usually consists of a superimposition of different tones which spread as oscillations.

Each of these oscillations has a specific oscillating time and can be measured in frequencies. The frequency describes the number of oscillations per second. The frequency unit is specified in Hertz (Hz).

The human ear can perceive frequencies between 20 and 20000 Hz.

Where the different notes come from in a vehicle:

- Low notes are mostly produced by the engine.
- Low tones can also be produced by the roadbed, particularly on rough surfaces. This is a form of droning which can be felt by the vehicle occupants as vibration or roughness.
- High tones however, which are experienced as howling or whistling noises, are often air currents (wind noises) or come from ancillary components such as the generator, power steering pump or drivebelt.
- There are also clattering noises which can occur when driving over an uneven road. These jerking noises are produced by, for example, the shock absorbers, chassis components or loose articles inside the vehicle.

Noises can already be contained where they occur or, if this is not possible, can be confined with suitable measures.

The basic procedures here are the damping of oscillating parts, the insulation of components or the absorption of the noises through appropriate materials.

Damping

If a damper is installed next to an oscillating mass, the characteristic of the damper will

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reduce the movement of this mass accordingly (e.g. bumper on chassis).

Damping affects the resonance of an object or system.

Isolation

In oscillation technology, the term isolation means decoupling (separation) of components and systems. An engine is mounted in sprung elements, so that as little oscillation as possible is passed to the vehicle.

In automotive technology, the isolation technique used is nearly always rubber mounting. Rubber has a large internal damping capacity. The elasticity of the rubber acts like a spring.

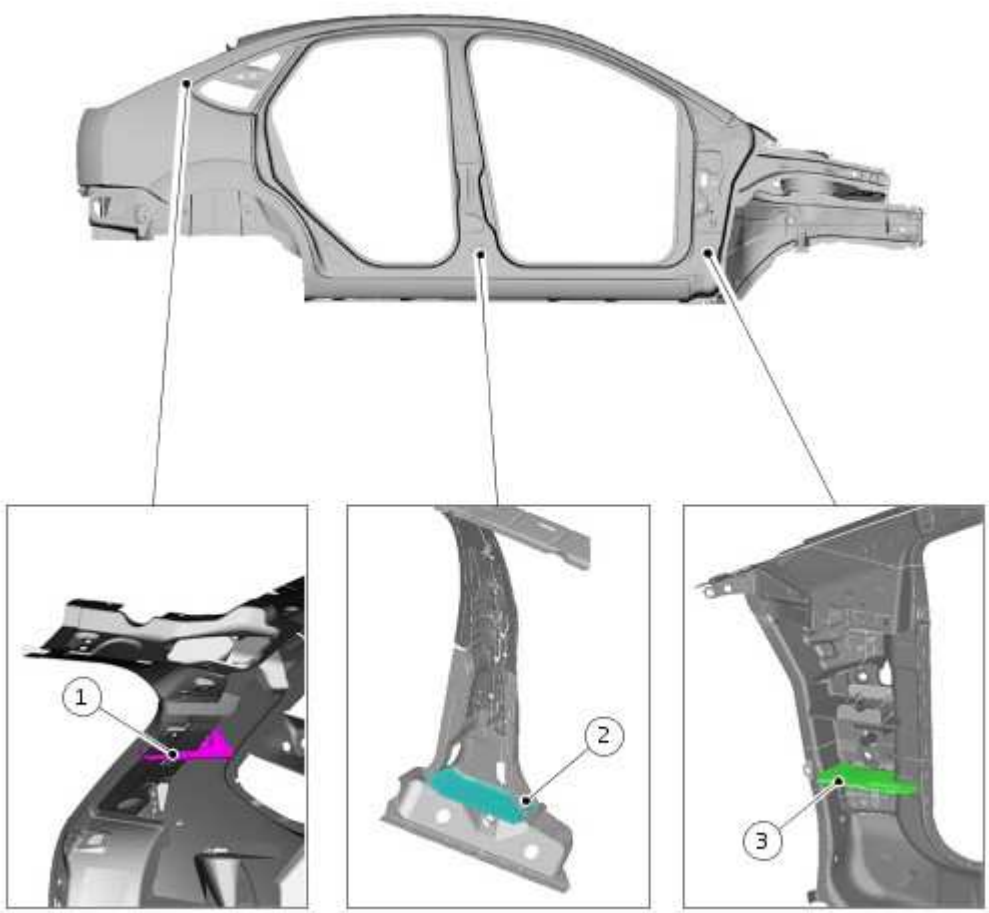
Absorption

Sound waves are reflected from hard surfaces Through the use of absorption material, sound waves hit soft surfaces and are absorbed by them.

The composition and thickness of the material used plays an important role here. A soft surface, depending on its composition, absorbs the sound waves and reduces their energy.

NVH elements

NVH elements are installed to prevent airborne sound transfers to the passenger compartment in different body cavities.



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Item	Description
1	C-pillar area
2	B-pillar area

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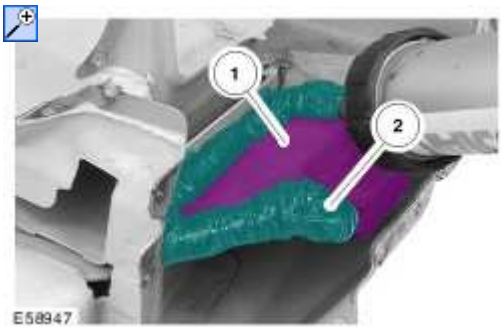
3	A-pillar area

On the Focus 2004.75 (07/2004-) these elements are located in the cavities of the A, B and C pillars. On the estate version, they are also located in the D pillars.

The NVH material consists of a carrier plate which has compressed isolation material at the edges. In the drying system of the painting equipment used in production, the body is heated to approx. 170° C. At this temperature the isolation material expands to seal the gap between the carrier plate and the bodywork.

NOTE: NVH elements must not be damaged during work on the vehicle body. NVH elements deformed through impact must always be replaced. PU adhesive must always be applied to the edges of new and reused NVH elements during repair work.



Item	Description
1	NVH element
2	PU adhesive

For the exact installation position of an NVH element, please refer to the vehicle-specific repair instructions.

If an NVH element is to be reused, the bonding on the body panel must be detached. To do this, the body panel must be heated in the area around the NVH element. The bonding can be detached at approx. 170° C. The damaged panel part can now be carefully dismantled.

Before installing the new panel part, a PU adhesive must be applied to the contact areas between the panel and the NVH element.

Test techniques, measuring devices

The shortest route to an accurate diagnosis results from:

- general information on the problem vehicle and a comparison test with a vehicle of the same construction, without NVH problems.
- vehicle history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of probable causes.
- application of diagnosis procedures in which the vehicle is split into corresponding areas.

The diagnosis and correction of noise, vibration and harshness concerns requires:

- general information on the problem vehicle and a comparison test with a vehicle of the same construction, without NVH problems.
- vehicle history, including repair history and usage patterns.
- condition history, especially any relationship to repairs or sudden change.
- knowledge of probable causes.
- application of diagnosis procedures in which the vehicle is split into corresponding areas.

NOTE: The diagnosis of droning problems is one of the most difficult tasks in the NVH area. With the exception of installed components under stress, a certain diagnosis of droning problems (or boom) on customer vehicles makes great demands on the automotive technician. The performance of measuring equipment and their practice-

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orientated application can only be obtained through suitable instruction (NVH training). The successful use of these devices requires a great deal of experience on the part of the user.
The diagnosis and correction of noise, vibration and harshness concerns requires:

- a road or system test to determine the exact nature of the concern.

Analysis of possible causes:

- checking of the cause and elimination of the faults found.
- a road test or system test to make sure the concern has been corrected or brought back to within an acceptable range.
- It is often very difficult to locate noises that are audible in the passenger compartment based on the problem description provided by the customer and the road tests performed. The direction of the noise can be detected subjectively, but the source of the noise cannot be found.

NOTE: For a selection of simple test tools, see the wind noises section.

Electronic NVH tester

NOTE: Before using the NVH tester in the service, the service technician should take part in an NVH training course to ensure effective use of this device during the road test. A description of the function and application of the NVH tester is enclosed with the device.
The measuring device described below is used for diagnosis of the solid-borne sound and solid-borne sound transmission paths. The device is particularly suitable for medium and high frequency noise analyses. It principally enables noise diagnosis in the area of solid-borne sound and helps to identify solid-borne sound transmission routes.

In order to obtain a positive diagnosis of droning problems (low frequency noises) and their sources, you must have sufficient experience of how to use this measuring device.

The device works according to the following operating principle: Accelerometers (transmitters) are fitted on various vehicle components or body areas. The signals recorded here can be listened to one after the other on headphones or speakers via the different channels. Simultaneous illustration of several or all measuring channels (for comparison) is only possible visually on the display of the measuring device.

Layout and operation:

- The test device has six different channels for noise diagnosis.
- Each channel is marked in color on the terminal, cable and test device.
- The solid-borne sound recorded is transmitted to the test device or the headphones by the magnetic accelerometers (transmitters).
- There is an amplifier on the test device with which the signal strength and the corresponding channel can be set.
- Only the noises from a transmitter are transferred to the headphones.
- All connected cables can be visually illustrated individually or simultaneously on the display.
- The test device saves the recorded data.

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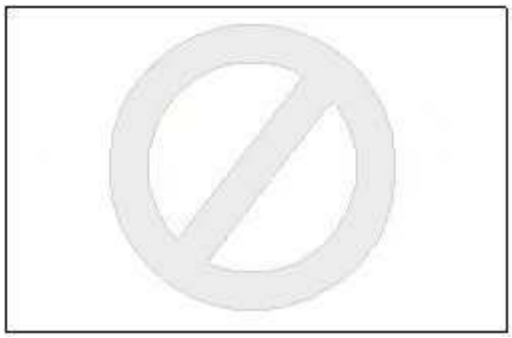
- The recorded data can be imported to a PC and evaluated.

The NVH tester is equipped in addition with mobile magnetic sensors which are particularly suitable for the following noise tests:

- Internal noises at the dashboard
- Engine noise
- Electrical noises (sparking/voltage transmissions)
- Wind noises
- Vacuum - leaks

Chassis noise tester (chassis ear)



Used to diagnose solid-borne sound and its transmission routes. The device is particularly suitable for medium and high frequency noise analysis and principally enables noise diagnosis in the area of solid-borne sound and helps to identify solid-borne sound transmission routes.

In order to obtain a positive diagnosis of droning problems (low frequency noises) and their sources, you must have sufficient experience of how to use this measuring device.

Layout and operation:

The test device has six different channels for noise diagnosis. This means that six microphones equipped with clamps can be attached to different components on the vehicle. The emitted or transmitted solid-borne sound will be transferred from microphone to the headphones. There is an amplifier between the microphone and the headphones at which the signal strengths and the corresponding channel can be set.

Only the noises from one microphone are transferred to the headphones. Each channel is color-coded on the clamp, cable and amplifier.

NOTE: In order to be able to relate the positions of the different microphones during the test process, they are entered in a special test sheet according to their colors.
Microphones, clamps and cables must be carefully routed and attached.

Test process (example for transmission noise):

- Attach microphones to various positions on the transmission or mountings. This first allows the source of the noise to be determined, and then the possible transfer routes.
- A road test can be performed after all the clamps have been attached to the vehicle and all the cables connected to the amplifier.
- Firstly, all the channels are switched through one after the other in neutral, to check the operation of the different channels as well as the noise level in neutral.
- During the road test, all channels are listened to in the different gears, engine speeds, vehicle speeds and loads. This procedural method permits unambiguous diagnosis of the cause of the noise and the route of the noise until it enters the bodywork structure.
- The characteristics of the noise which is the cause of the concern should match those of the noise which is heard. This means compare the sound.
- Depending on the input signal level, there may be a great deal of difference in the noise level in the individual channels.

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- Always set the amplifier volume to zero before switching to another channel.
- In order to be able to make any comparisons, the volume settings of the different channels must be recorded on the test sheet.

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Anti-corrosion protection for body work

Detail	Part Number	Specification
Underbody protection	5 030 492	WSS-M99P9999-A1
Cavity wax	5 030 081	WSS-M99P9999-A1
Anti-corrosion wax	1 219 834	WSK-M7 C89 A
Clinched flange protection	1 136 479	WSK-M4 G245 B
Weld primer	1 205 996	-

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Description and Operation

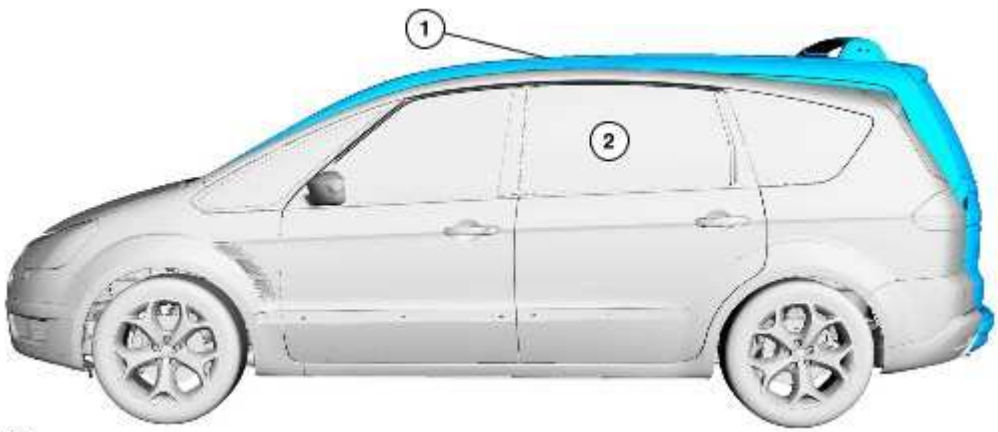
Introduction

Note the fitted position of the special washer. It will be based on the CD platform, which will also form the basis for future models. Two independent vehicle variants are initially available on this CD platform - the Galaxy with its internal designation LMV (Luxury Multipurpose Vehicle) and the S-MAX with its internal designation SAV (Sport Activity Vehicle).

Design features

The main differences between the body of the S-MAX and the body of the Galaxy lie in the roof section and in the rear end of the vehicle. The roof of the S-MAX is flatter overall, while the rear is shorter and more sloped. Consequently, there are differences in the shape and size of all of the glass surfaces of the S-MAX and Galaxy.

Vehicle variants



E68927

Item	Part Number	Description
1	-	Galaxy
2	-	S-MAX

Crash element

At the front of the vehicle there is a steel plate crash element connected to the side member by threaded connections. This crash element can absorb light impacts of up to about 15 km/hr. Because of the threaded connections, the crash element can be changed very quickly. The front crash element is identical on both vehicle variants.

NOTE: Deformed crash elements must not be straightened or repaired.
Heavier impacts which can no longer be absorbed by the crash element must be absorbed by the side members or the floor pan structure. Depending on the extent of the damage, the side members can be replaced in whole or in part (see subsection 501-27).

A steel cross member is also installed at the rear of the vehicle using threaded connections. This forms a connection between the ends of the two side members and therefore contributes to an increase in passive safety in the event of rear end impact. This bolted-on crossmember absorbs the impact energy of minor impacts and thus prevents deformation of the side members and therefore the body structure. More severe impacts at the rear are absorbed by the rear panel, the reinforcement of the rear panel, the side members and the luggage compartment floor panel. It is possible to perform partial replacements of the side members and the luggage compartment floor panel (see subsection 501-30).

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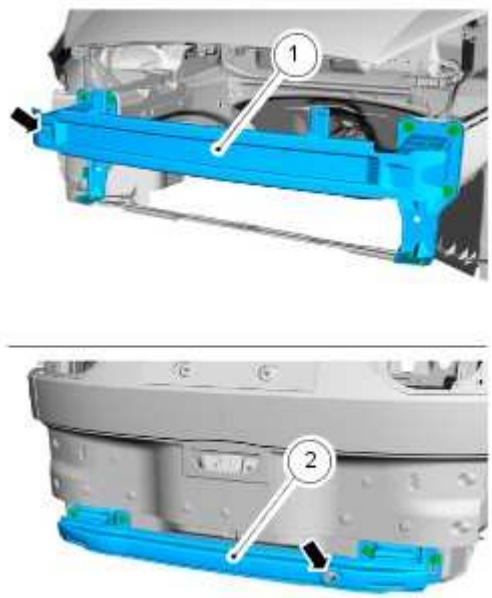
The crash element can be changed very quickly because of the threaded connections. The rear crash element is identical on both vehicle variants.

The mounting for the towing eye is integrated in the front and rear crash element.

Crash element



E75988

Item	Part Number	Description
1	-	Front
2	-	Rear
Arrows	-	Mountings for the towing eyes

Laser weld seams on the side members

Laser weld seams are located on the front and rear side members. These laser weld seams are use to join body components of different material quality and different material thickness to each other.

Cut locations exactly on the laser weld seams are not permitted, as at present no joining techniques are approved for use in repair procedures that would re-create joins of the same quality.

NOTE: In the event of damage or repair work in these areas, the corresponding requirements is subsection 501-27 and 501-30 must be taken into account.
Location of the laser weld seams at the front end (S-MAX and Galaxy)

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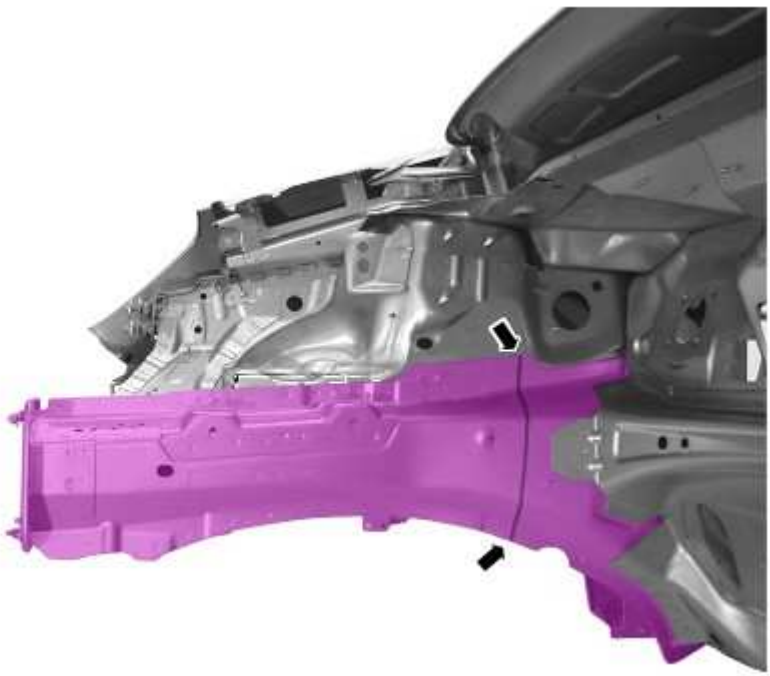
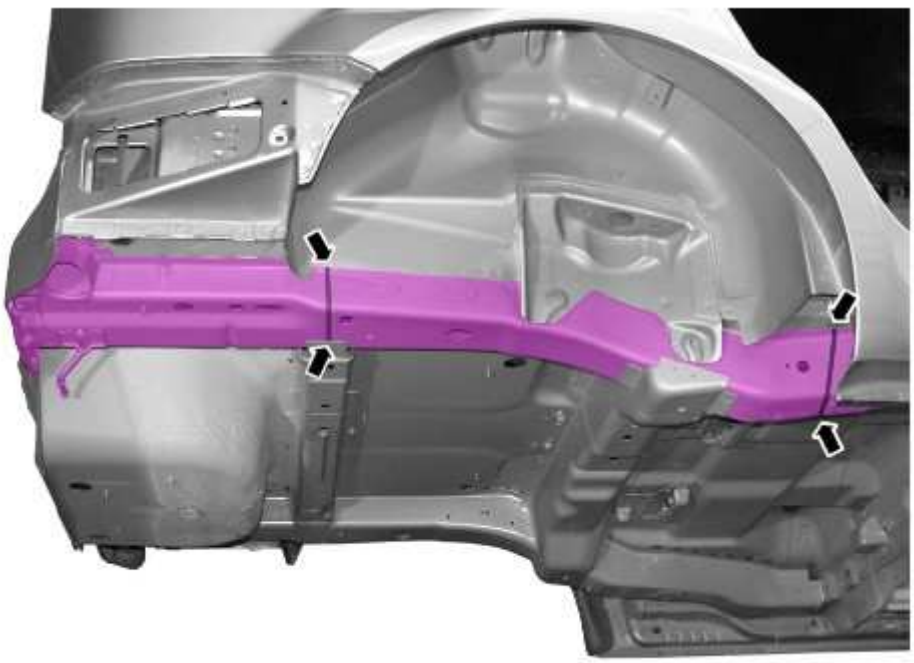


E75989

Location of the weld seams at the rear end (S-MAX and Galaxy, illustration shows S-MAX)



E75990

MIG brazed joints

Production MIG brazed joints are found on both vehicle variants (S-MAX and Galaxy) in the following areas: apron panel reinforcement to A-pillar, rear side member to wheelhouse reinforcement and quarter panel to rear lamp mounting panel.

MIG brazed areas (S-MAX and Galaxy, S-MAX shown)

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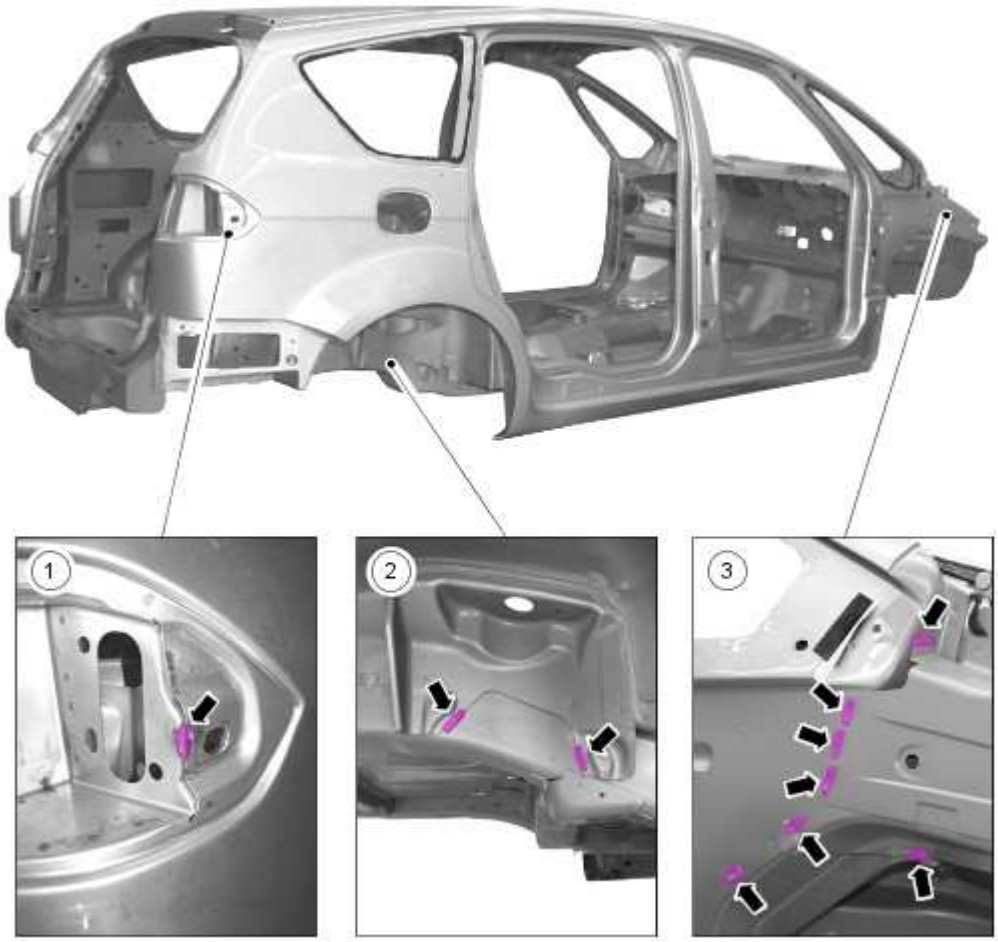

E75991

Item	Part Number	Description
1	-	Quarter panel / rear lamp mounting panel
2	-	Rear side member / wheelhouse reinforcement
3	-	Apron panel reinforcement / A-pillar

These MIG brazed joints must be replaced by MIG welds at another place if a repair is performed.

NOTE:

- These MIG welds must not be carried out on or near existing MIG brazed seams as even the smallest amount of brazing material can result in a reduction in the strength of the weld seams.
- When performing repairs in these areas of the body, the relevant requirements is subsection 501-27, 501-29 and 501-30 must be observed.

High strength and super high strength steel panels

High strength and, in some cases, super high strength steel panels are used on both vehicle variants (S-MAX and Galaxy).

NOTE: The instructions for working on high strength steel panels given in subsection 501-25 must be followed during body repair work.
The A and B-pillar reinforcements are made of super high strength Usibor steel (1500). These components must only be replaced as a complete part during repairs. Replacement of partial sections is not permitted, as the required MIG continuous seam in the cut area

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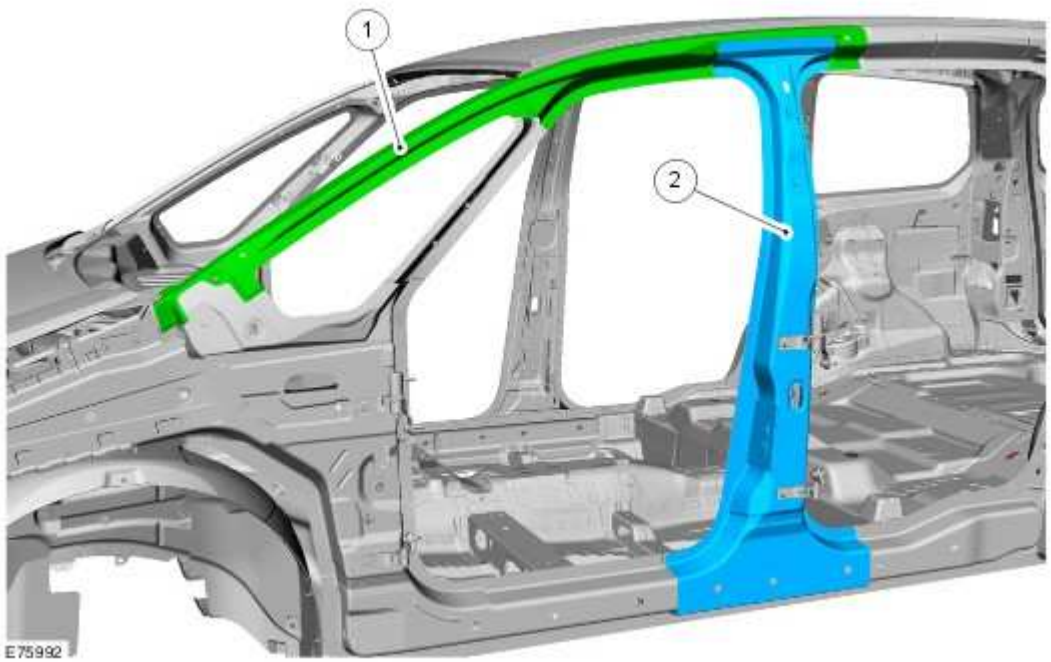
would lead to structural changes in the steel which would cause a significant loss of strength.

Due to their strength, it is not always possible to process these components with conventional body repair tools. Additional preparations are required for MIG puddle welding.

NOTE: The corresponding requirements in section 501-29 must be followed when performing repairs in these areas of the body.
Super high strength steel panels (S-MAX and Galaxy, Galaxy shown)



Item	Part Number	Description
1	-	A-pillar reinforcement
2	-	B-Pillar reinforcement

Galvanised body panels

On S-MAX and Galaxy vehicles, all external and corrosion prone steel body panels are galvanised on both sides.

The roof and some internal reinforcement panels on the floor pan and on the A-, B- and C-pillars are not zinc plated.

NOTE: The instructions for working on zinc plated steel panels given in subsection 501-25 must be followed during body repair work.
Further corrosion protection measures

Clinched flange sealer is not applied to the hood, tailgate and the doors until after the dip priming stage.

When applying clinched flange sealer as part of body repair work, an overlap of the clinched outer panel of at least 2 mm must be taken into account in addition to the width of the seam.

NOTE: When body repairs are performed or if these components are renewed, this procedure must be observed.
Clinched flange sealing

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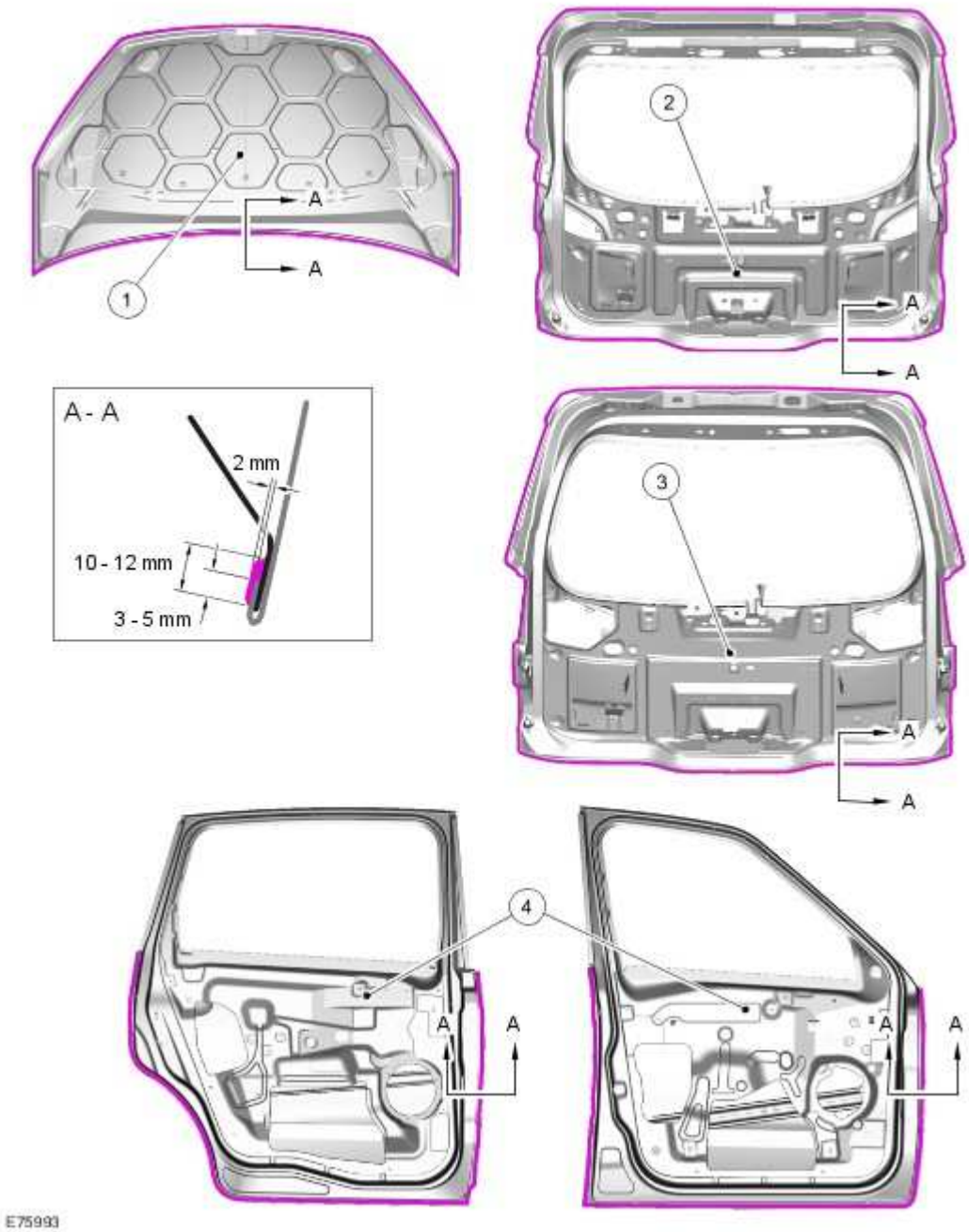

Item	Part Number	Description
1	-	Hood, S-MAX and Galaxy
2	-	Tailgate, S-MAX
3	-	Tailgate, Galaxy
4	-	Door, front and rear, S-MAX and Galaxy
A - A	-	Sectional view of the clinched flange seals (seam height and width indicated)

Further corrosion protection measures are performed on the bodywork.

NOTE: The original corrosion protection must be re-created after working on the bodywork.

Cavity protection on the doors, S-MAX and Galaxy

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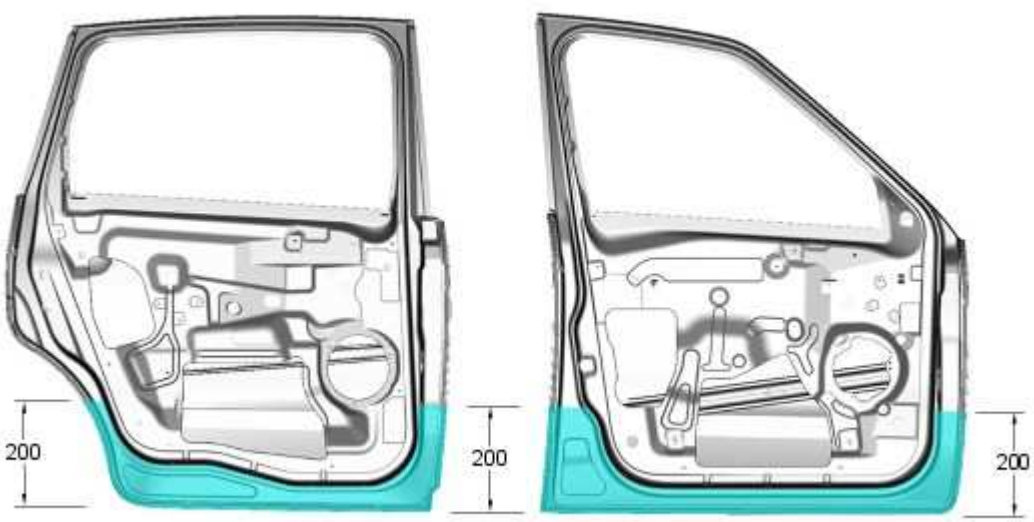

E75994

Anti-corrosion protection on the floor assembly, S-MAX

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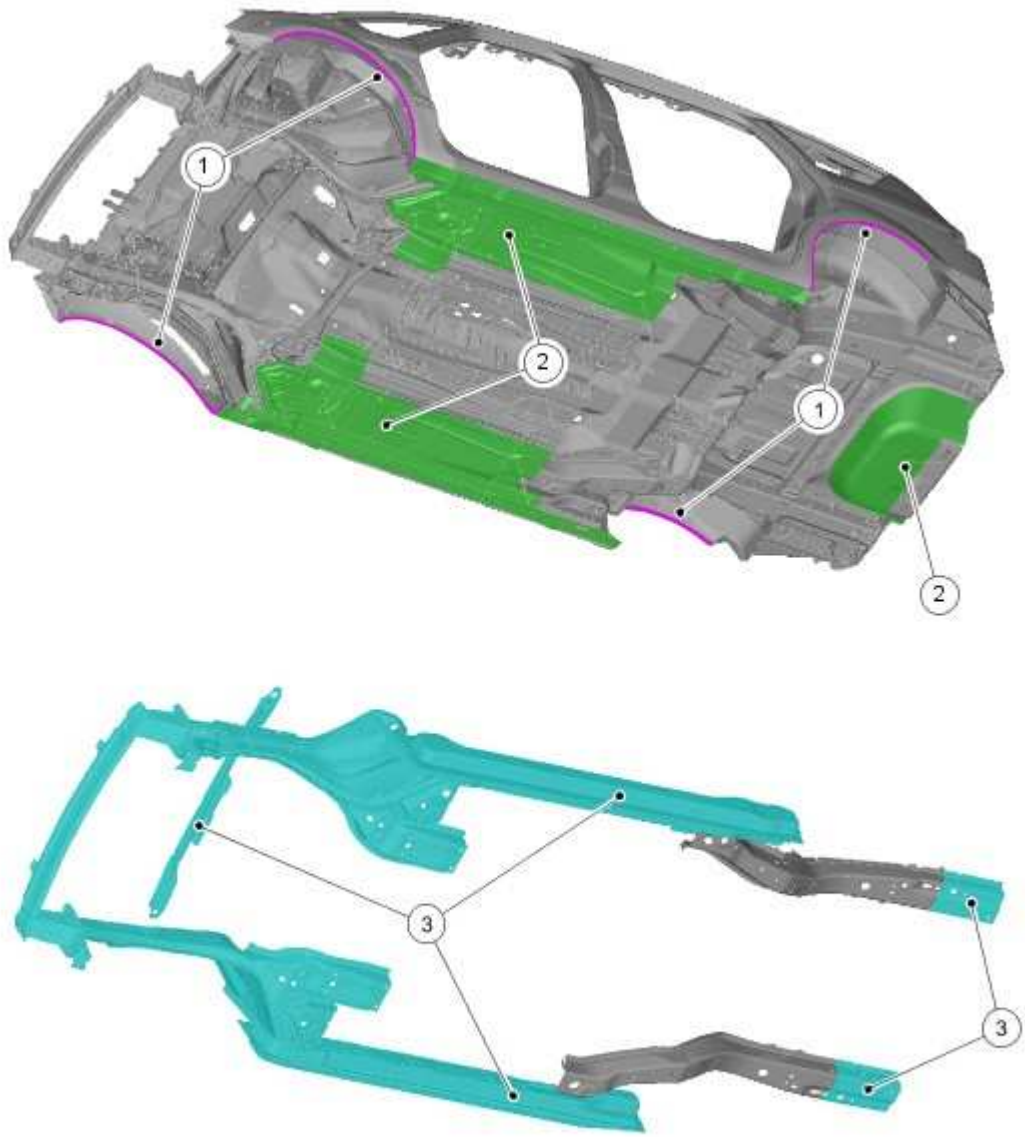

E75995

Item	Part Number	Description
1	-	PVC stone chip protection
2	-	PVC underbody protection
3	-	Cavity wax injection

Corrosion protection for the floor assembly, Galaxy

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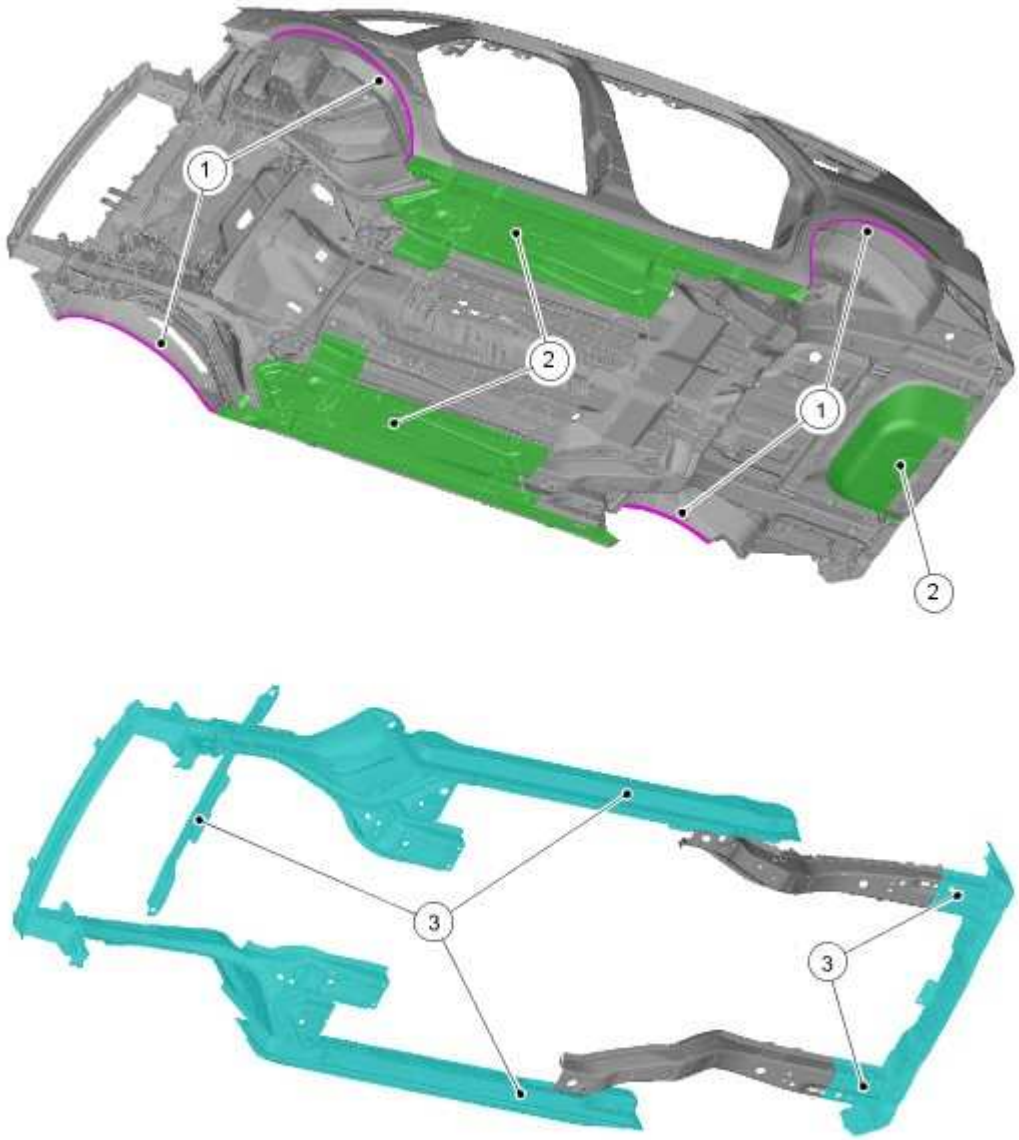

E81426

Item	Part Number	Description
1	-	PVC stone chip protection
2	-	PVC underbody protection
3	-	Cavity wax injection

Protective PVC film is bonded to the quarter panels in the area of the rear door apertures on S-MAX and Galaxy vehicles.

NOTE: This protective film needs to be replaced when performing body repairs or renewing the rocker panel or quarter panel.
Protective PVC film

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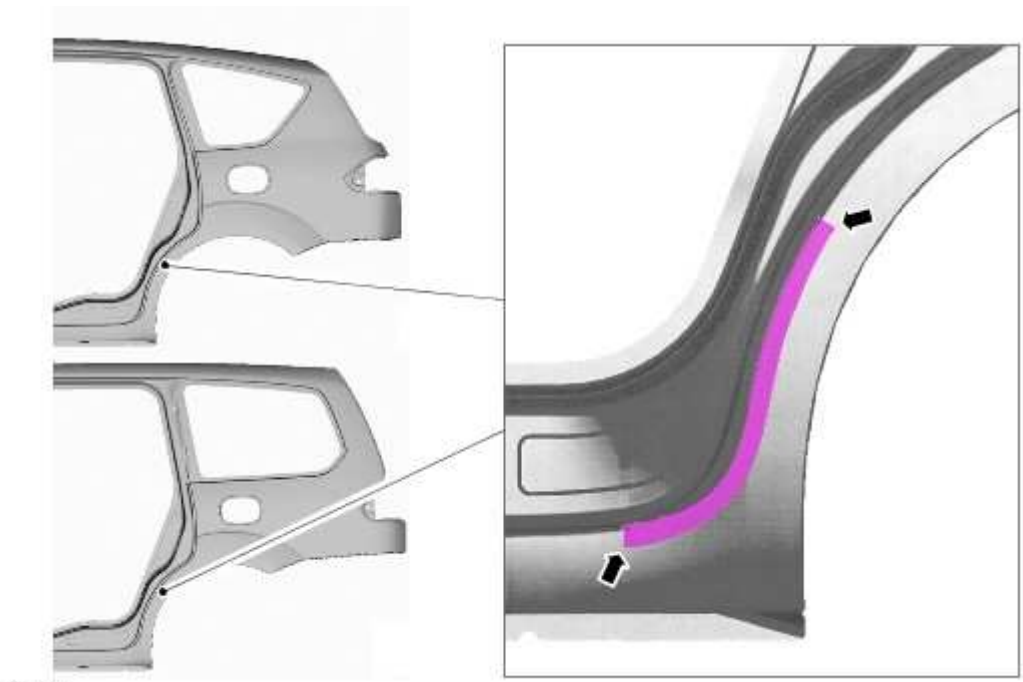

Sheet metal parts for partial replacement

Various service sheet metal parts are available for sectional replacement.

Parts overview, S-MAX (side view)

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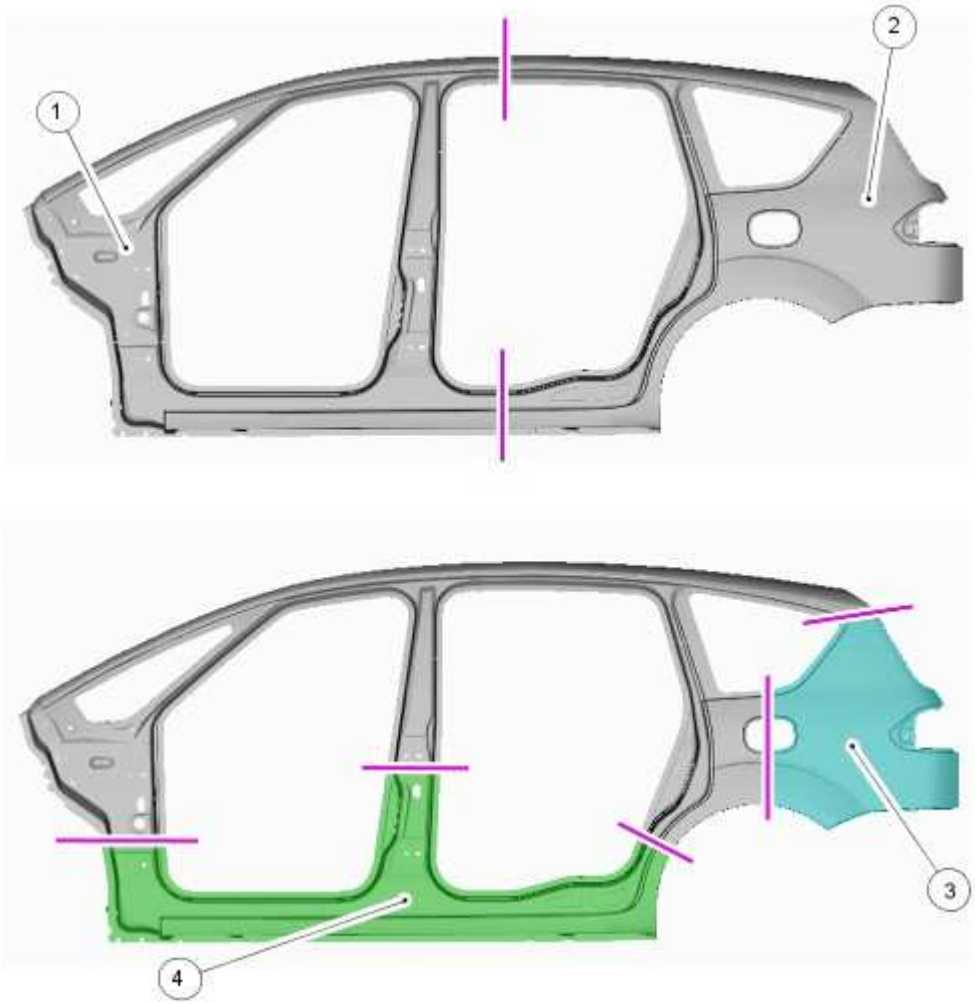

E75996

Item	Part Number	Description
1	-	Front quarter panel
2	-	Rear quarter panel
3	-	Repair panel, rear quarter panel
4	-	Rocker panel

Parts overview, Galaxy (side view)

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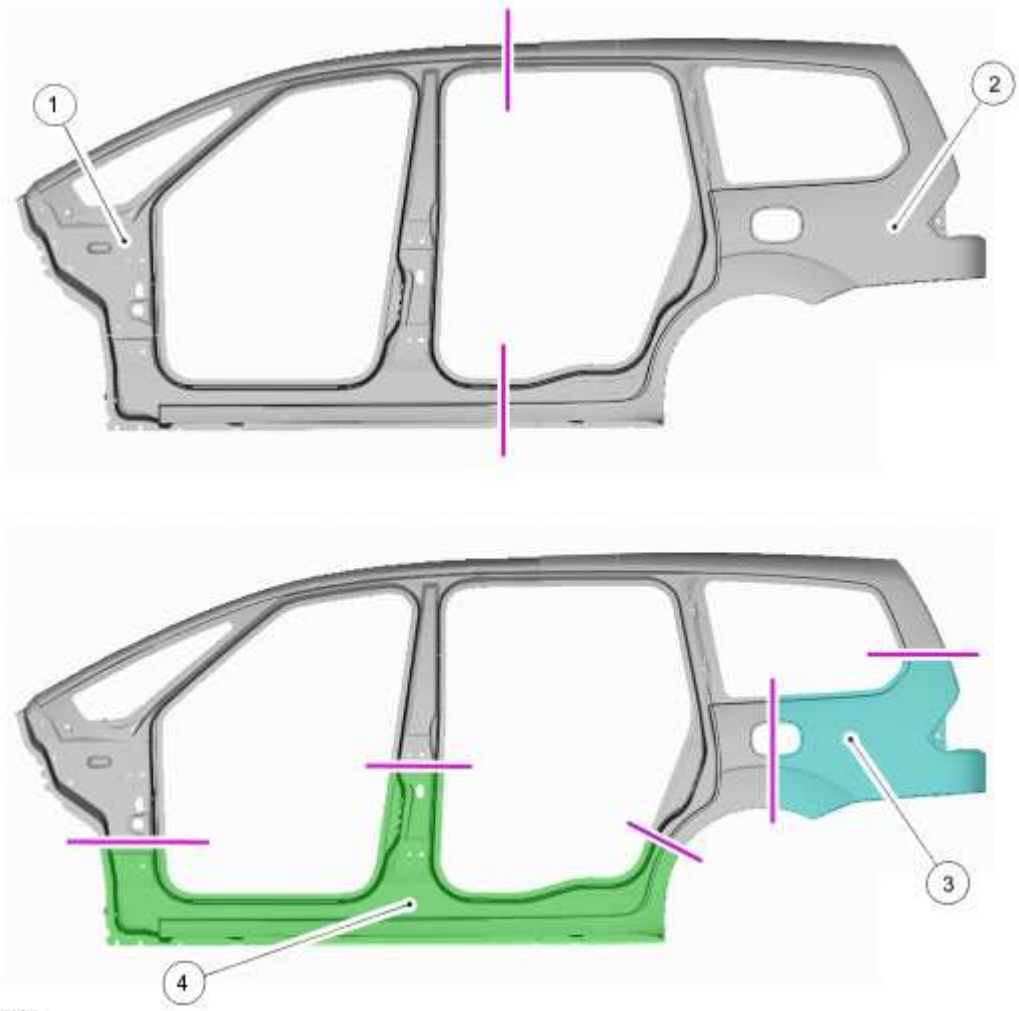

E76164

Item	Part Number	Description
1	-	Front quarter panel
2	-	Rear quarter panel
3	-	Repair panel, rear quarter panel
4	-	Rocker panel

Parts overview, S-MAX and Galaxy (rear floor assembly)

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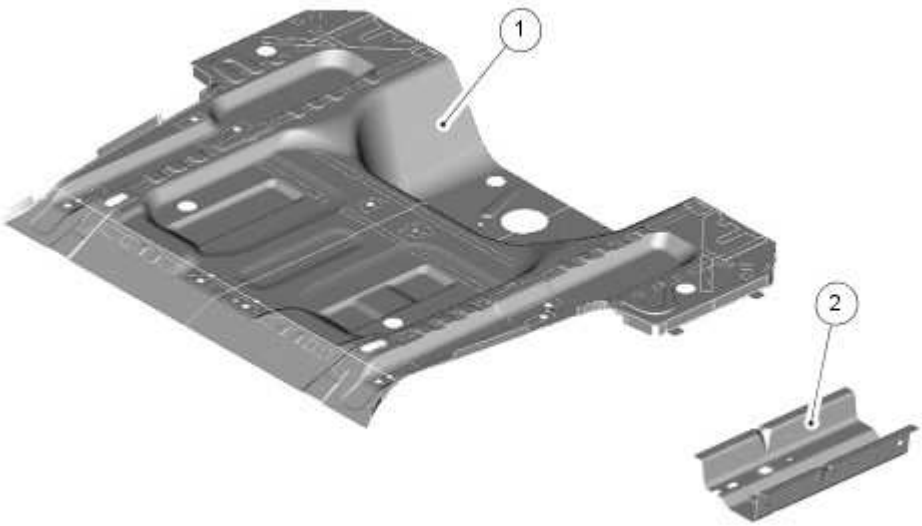

E75997

Item	Part Number	Description
1	-	Luggage compartment rear floor panel
2	-	Rear side member

NVH elements

NVH elements are used in various body cavities to prevent the transfer of noise to the vehicle interior.

NOTE: NVH elements must not be damaged during work on the vehicle body. In the event of repair work in these areas, the corresponding requirements in subsections 501-27 to 501-30 must be taken into account. Deformed NVH elements must always be renewed.
Installation locations on the A-pillar, S-MAX and Galaxy

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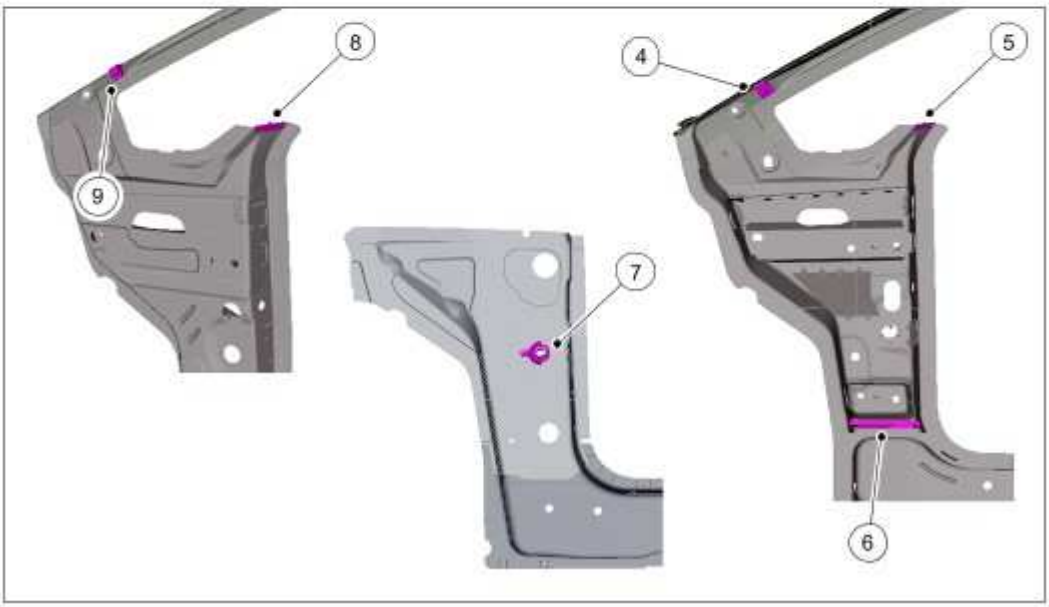

E75998

Item	Part Number	Description
1	-	Outer A-pillar / A-pillar reinforcement
2	-	A-pillar inner reinforcement
3	-	Inner rocker panel (self-adhesive sealing strip)
4	-	Outer A-pillar / A-pillar reinforcement
5	-	Outer A-pillar / inner A-pillar
6	-	A-pillar reinforcement / inner A-pillar
7	-	Inner A-pillar / mounting for instrument panel bracket
8	-	A-pillar reinforcement / inner A-pillar
9	-	A-pillar reinforcement / inner A-pillar

Further installation locations, S-MAX and Galaxy

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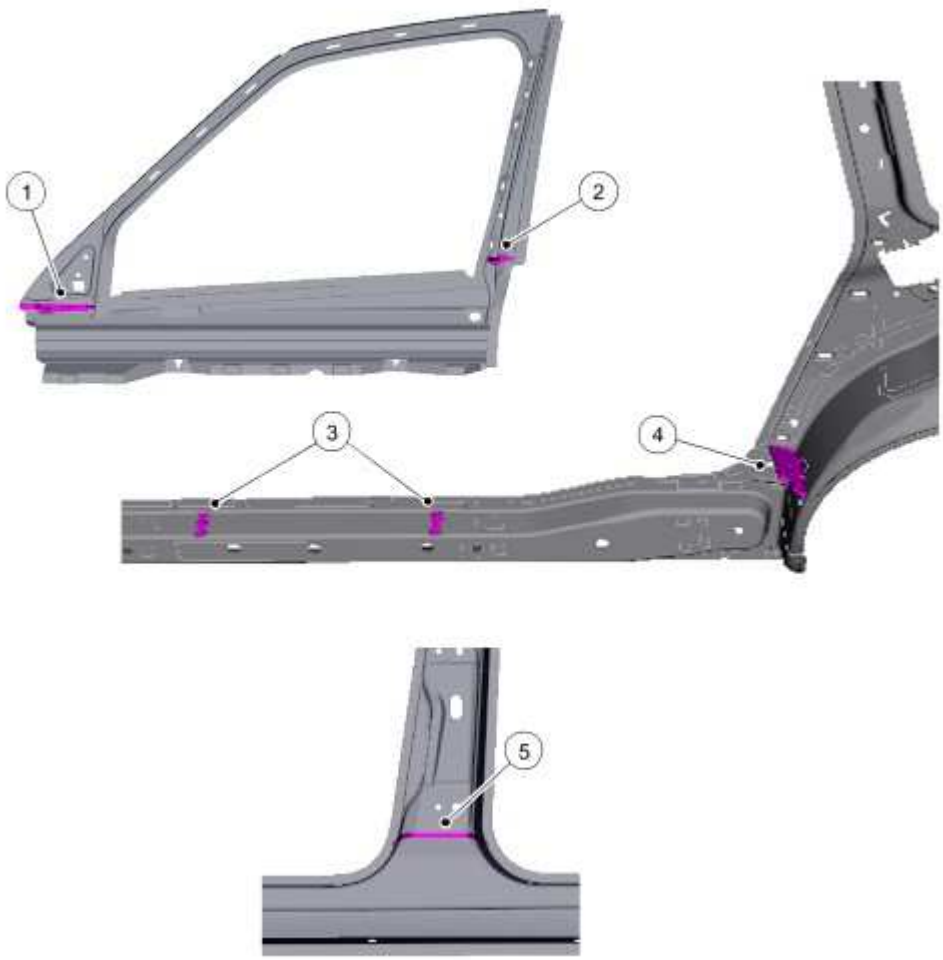

E75999

Item	Part Number	Description
1	-	Door outer panel / door inner panel
2	-	Door outer panel / door inner panel
3	-	Rocker panel / inner rocker panel reinforcement
4	-	Quarter panel / inner quarter panel with wheelhouse
5	-	Outer B-pillar / B-pillar reinforcement

Installation position between the wheelhouse and the suspension strut turret reinforcement, S-MAX and Galaxy

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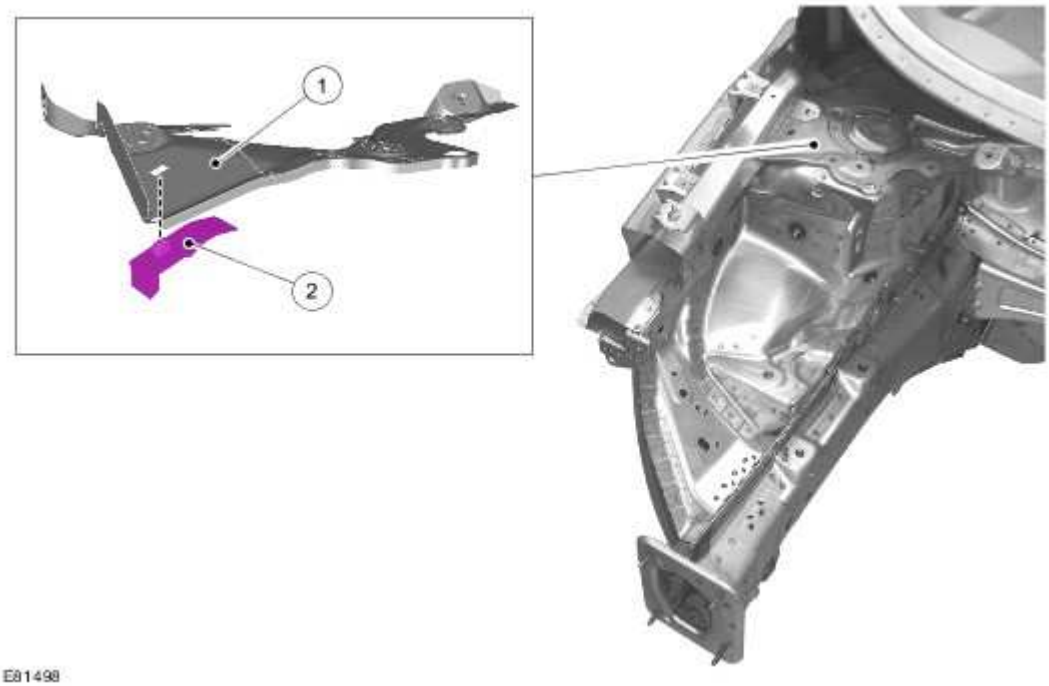

E81498

Item	Part Number	Description
1	-	Strut tower reinforcement
2	-	NVH element, inserted from below

Installation positions on the quarter panel and inner quarter panel, S-MAX

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E81495

Item	Part Number	Description
1	-	Inner quarter panel / quarter panel
2	-	Quarter panel / water drain panel
3	-	C-pillar reinforcement / inner quarter panel
4	-	D-pillar reinforcement / water drain panel reinforcement

Installation positions on the quarter panel and inner quarter panel, Galaxy

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E81496

Item	Part Number	Description
1	-	Inner quarter panel / quarter panel
2	-	Quarter panel / water drain panel
3	-	C-pillar reinforcement / inner quarter panel
4	-	D-pillar reinforcement / water drain panel reinforcement

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General Procedures

1. Frame dimensions, S-MAX (quick measurements using the Allvis system)
   - All dimensions are measured from the middle of the hole or bolt head or from the edge of the panel, using the Allvis system, with component assemblies installed.
   - A tolerance of ± 3 mm applies to all measurements given. All detailed illustrations correspond to the left-hand side of the vehicle.
   - Measuring point 4 is used as the zero point for additional diagonal measurements.

   Allvis specifications

Point of measurement	adapter	Height setting of the test probes
1	25 mm (probe)	330 mm
2	25 mm (probe)	190 mm
3	25 mm (probe)	50 mm
4		
5	35 mm (probe)	160 mm
6	25 mm (probe)	170 mm
7	25 mm (probe)	270 mm
8	25 mm (probe)	350 mm
9	25 mm (probe)	350 mm

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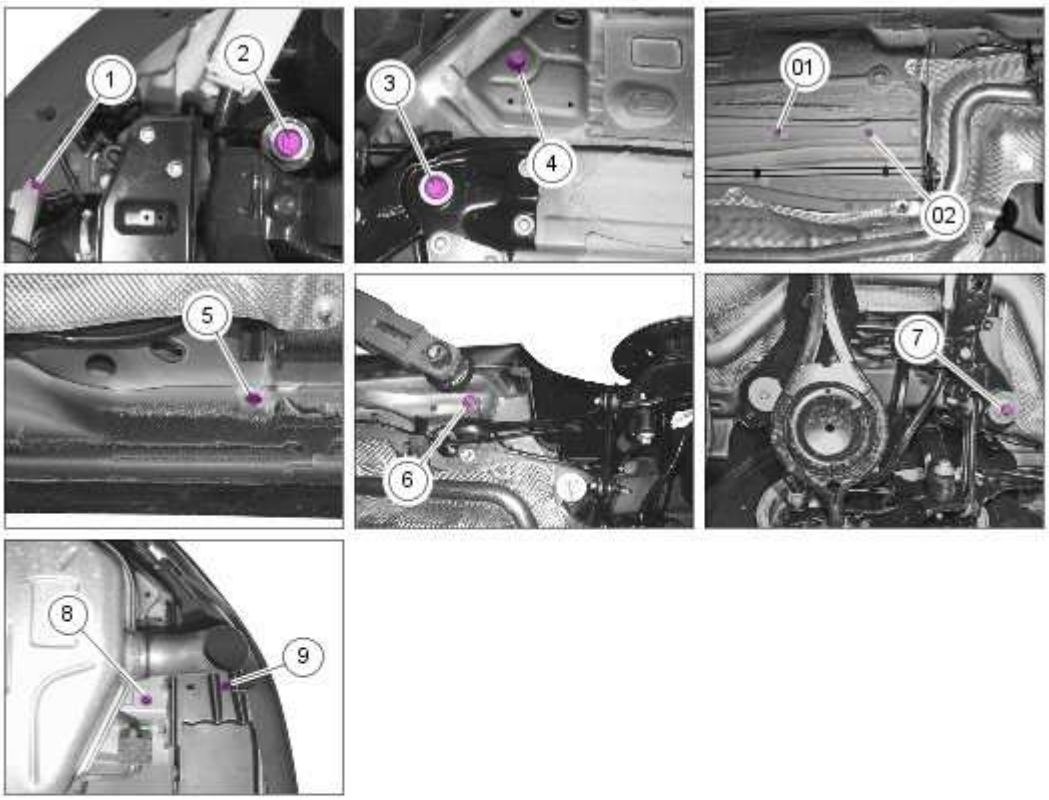

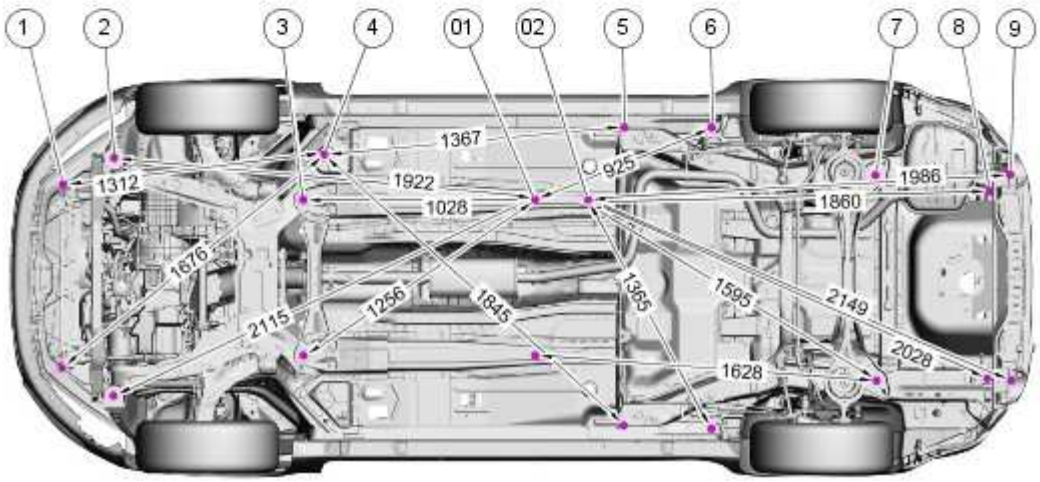

E79534

2. Frame dimensions, Galaxy (quick measurements using the Allvis system)
   - All dimensions are measured from the middle of the hole or bolt head or from the edge of the panel, using the Allvis system, with component assemblies installed.
   - A tolerance of ± 3 mm applies to all measurements given. All detailed illustrations correspond to the left-hand side of the vehicle.
   - Measuring point 4 is used as the zero point for additional diagonal measurements.

   Allvis specifications

Point of measurement	adapter	Height setting of the test probes

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1	25 mm (probe)	330 mm
2	25 mm (probe)	190 mm
3	25 mm (probe)	50 mm
4		
5	35 mm (probe)	160 mm
6	25 mm (probe)	170 mm
7	25 mm (probe)	260 mm
8	25 mm (probe)	350 mm
9	25 mm (probe)	350 mm

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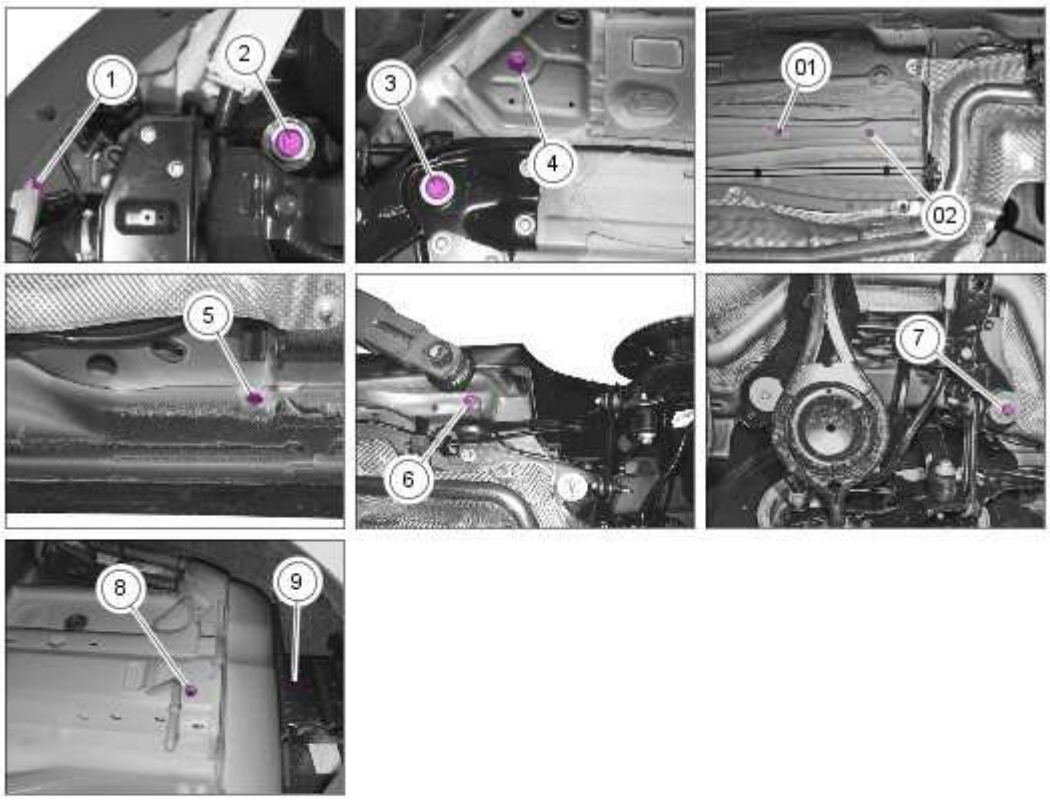

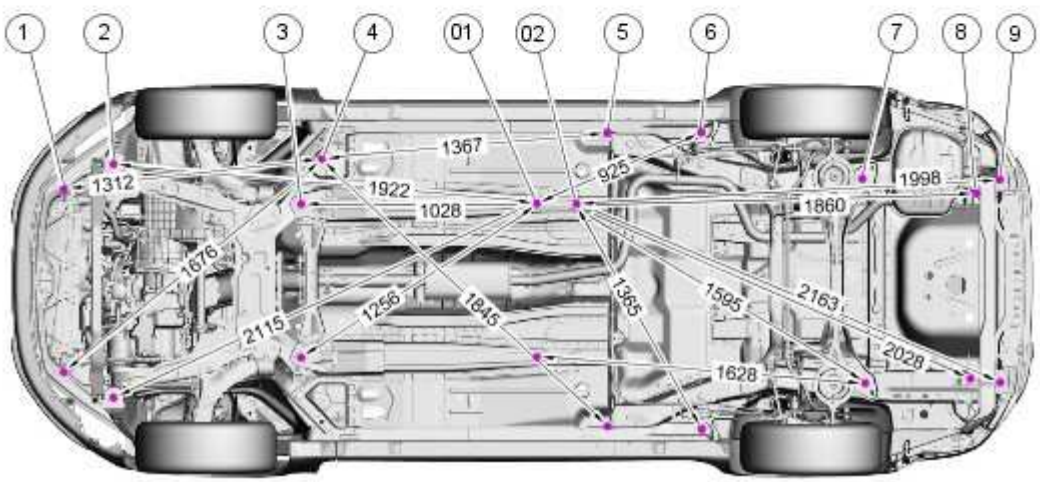

E79535

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General Procedures

1. Front end body dimensions, S-MAX
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the centre of each hole or panel edge using a symmetrically adjusted measuring gauge.

   Measuring points and dimensions

1 -3 = 435 mm	1 -8 = 1546 mm
1 -4 = 555 mm	1 -9 = 1316 mm
1 -5 = 792 mm	1 -10 = 1700 mm
1 -6 = 1480 mm	2 -9 = 1134 mm
1 -7 = 1564 mm	

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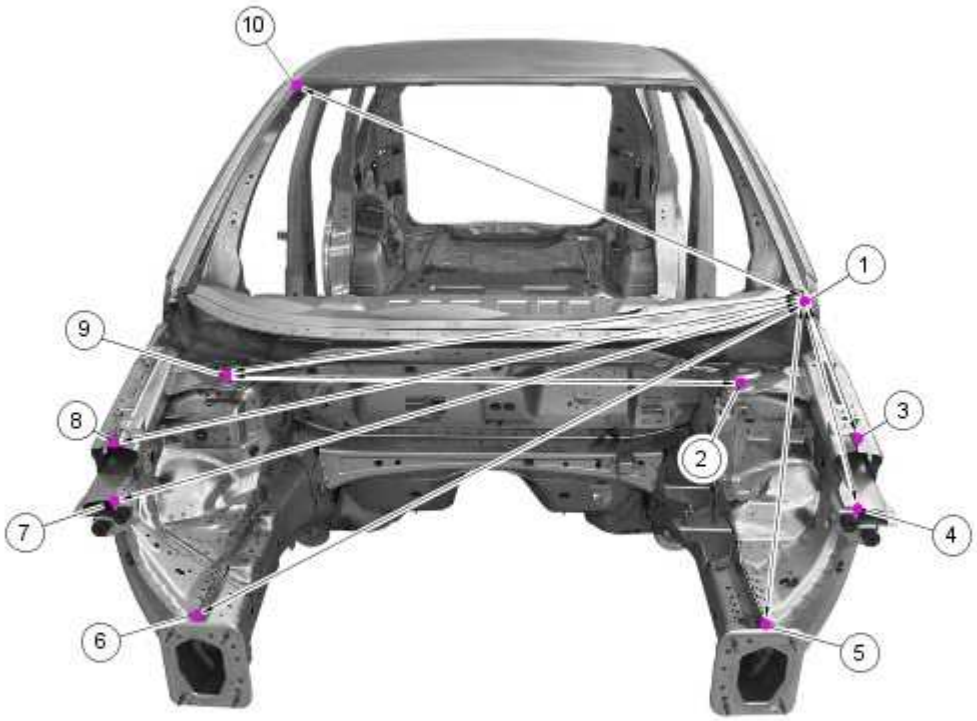

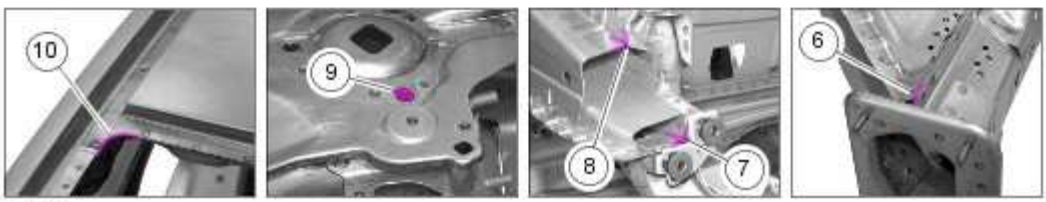

E79536

2. Front end body dimensions, Galaxy
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the centre of each hole or panel edge using a symmetrically adjusted measuring gauge.

Measuring points and dimensions

1 -3 = 435 mm	1 -8 = 1546 mm
1 -4 = 555 mm	1 -9 = 1316 mm
1 -5 = 792 mm	1 -10 = 1658 mm
1 -6 = 1480 mm	2 -9 = 1134 mm
1 -7 = 1564 mm	

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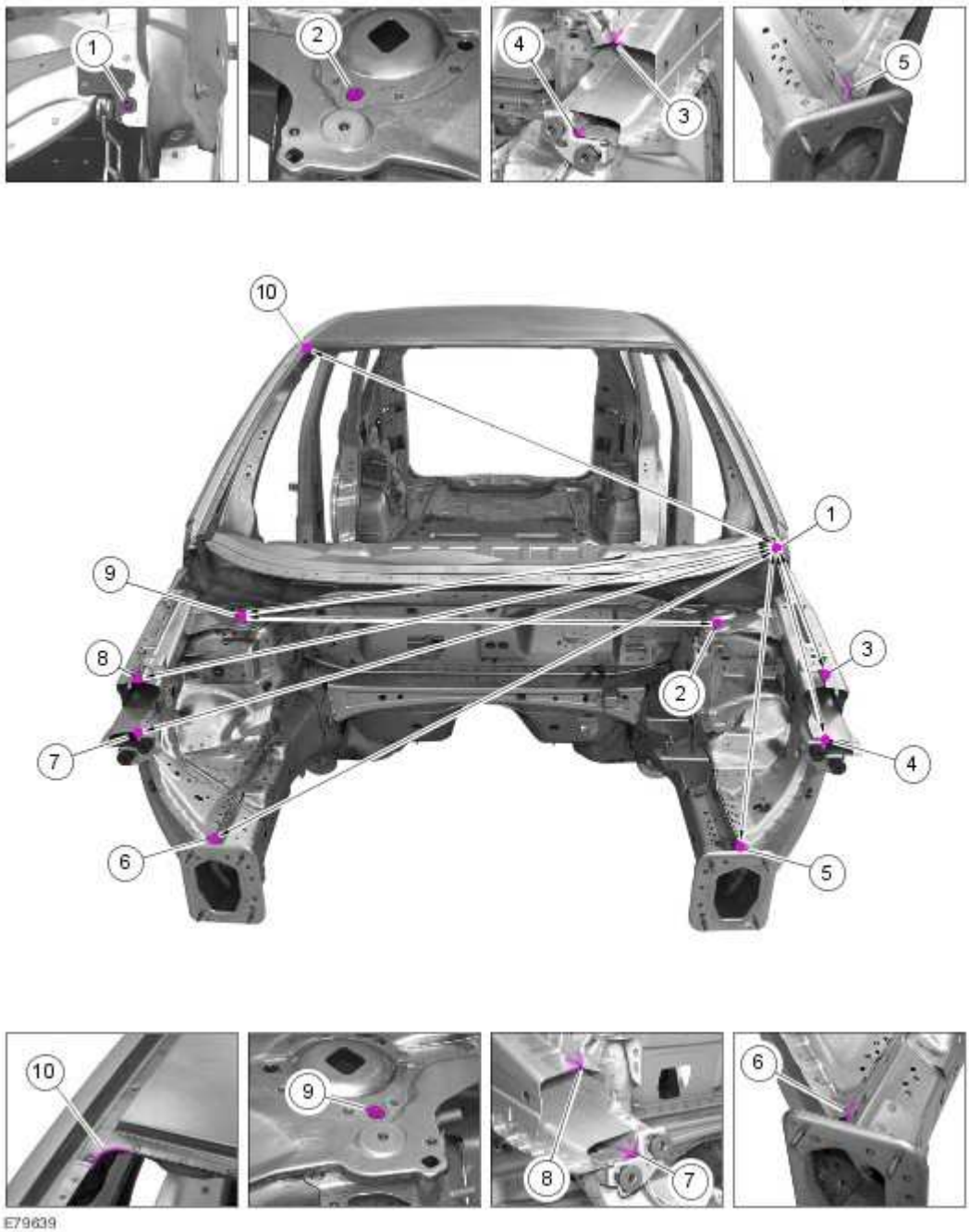

3. Body dimensions (side view), S-MAX
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the edge of the steel panel using a symmetrically adjusted measuring gauge.
   - Measuring points 1, 3, 4, 5, 7, 8, 11 and 13 are measured in the curve and represent the greatest distance to the measuring point opposite.
   - The detailed view of measuring point 12 is shown from above.
   - The detailed views of measuring points 2, 6, 9, 10 and 14 are shown looking from the vehicle interior outwards.

   Measuring points and dimensions

1 -11 = 965 mm	5 -8 = 1310 mm

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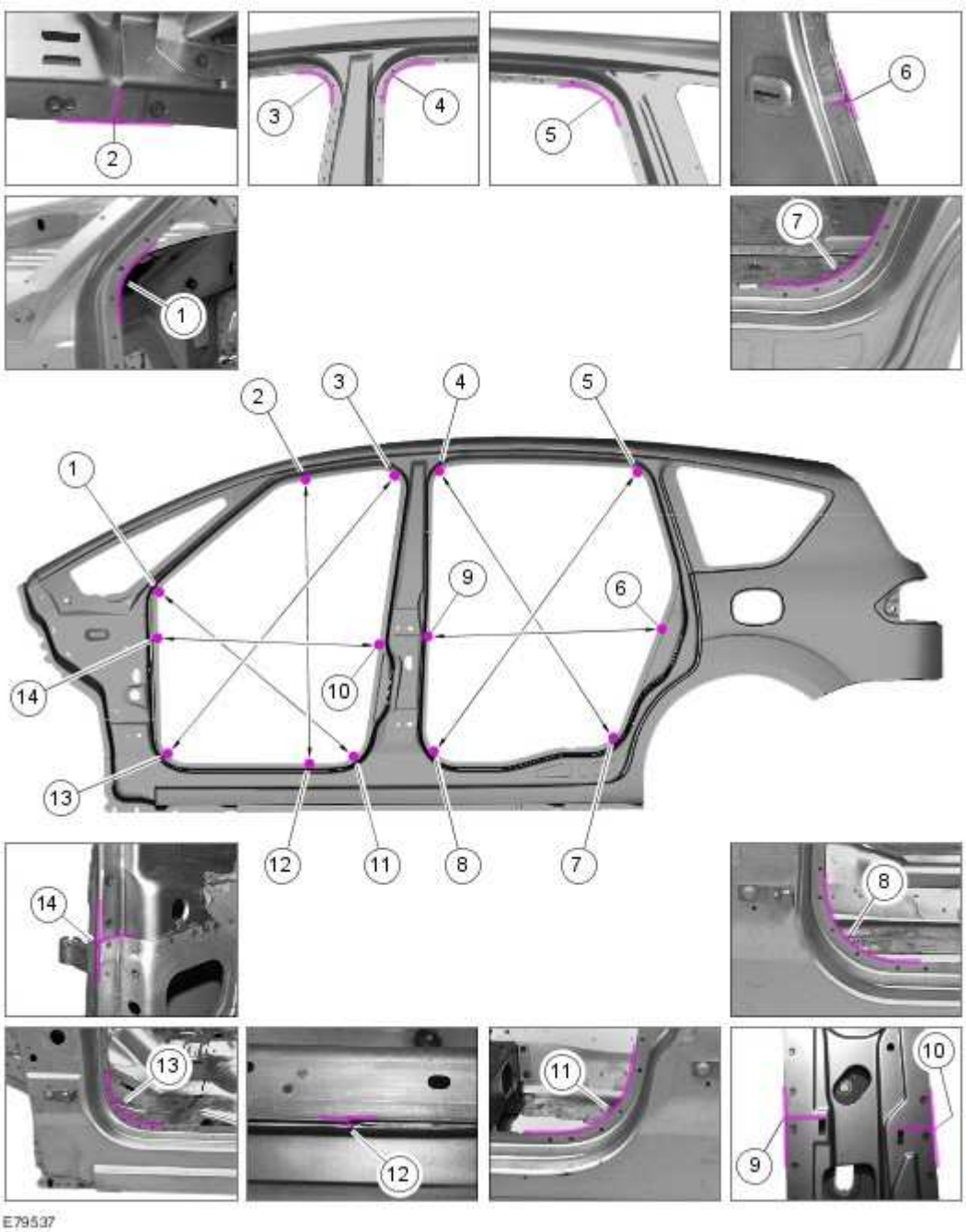
2 -12 = 1078 mm	6 -9 = 860 mm
3 -13 = 1362 mm	10 -14 = 835 mm
4 -7 = 1204 mm	



4. Body dimensions (side view), Galaxy
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the edge of the steel panel using a symmetrically adjusted measuring gauge.
   - Measuring points 2, 3, 4, 6, 7, 10 and 11 are measured in the curve and represent the greatest distance to the measuring point opposite.
   - The detailed views of measuring points 1, 5, 8, 9 and 12 are shown looking from the vehicle interior outwards.

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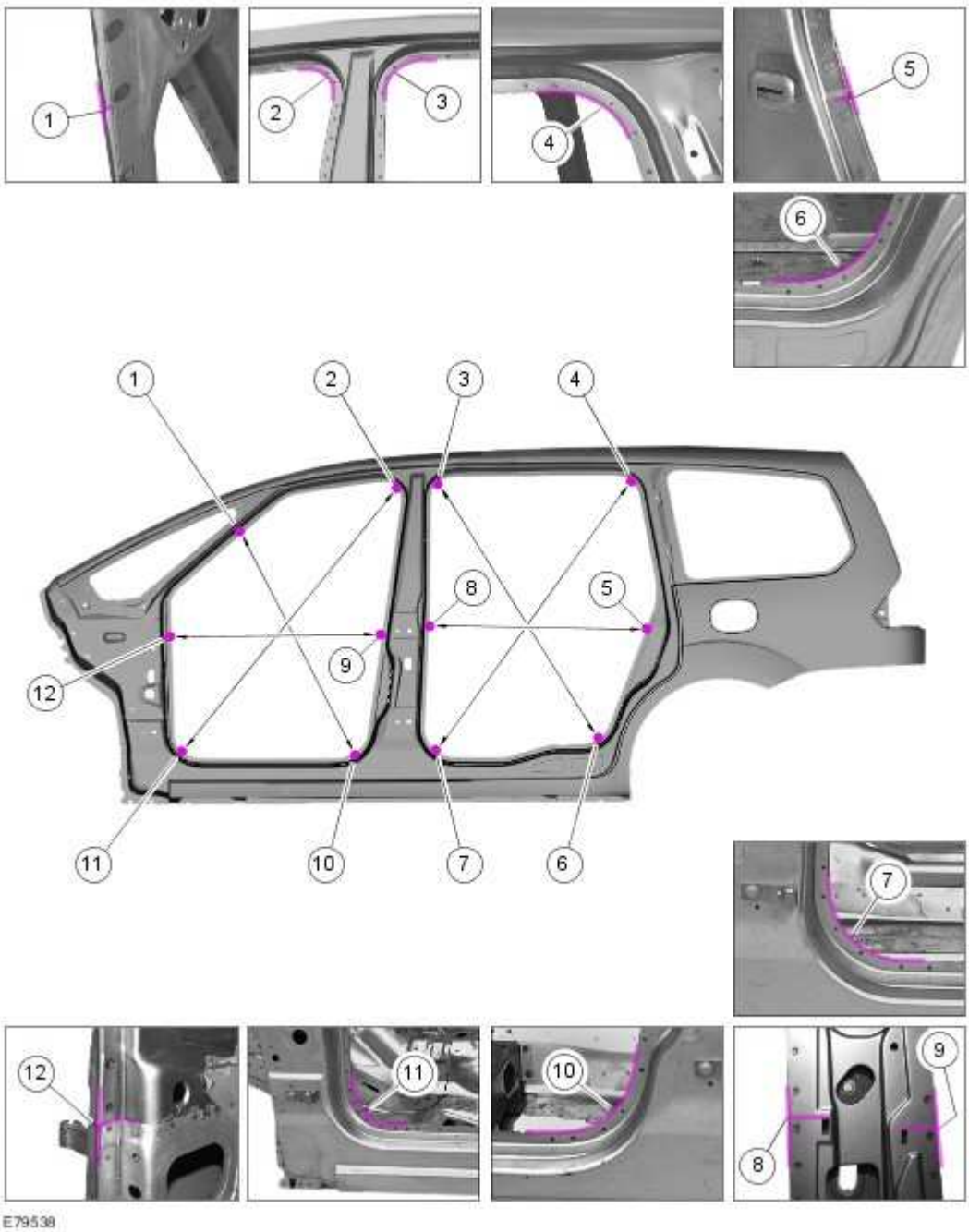
Measuring points and dimensions

1 -10 = 1062 mm	4 -7 = 1365 mm
2 -11 = 1393 mm	5 -8 = 859 mm
3 -6 = 1230 mm	9 -12 = 837 mm



5. Rear body dimensions, S-MAX
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.

   Measuring points and dimensions

1 -4 = 1193 mm	3 -6 = 1451 mm
2 -5 = 1021 mm	

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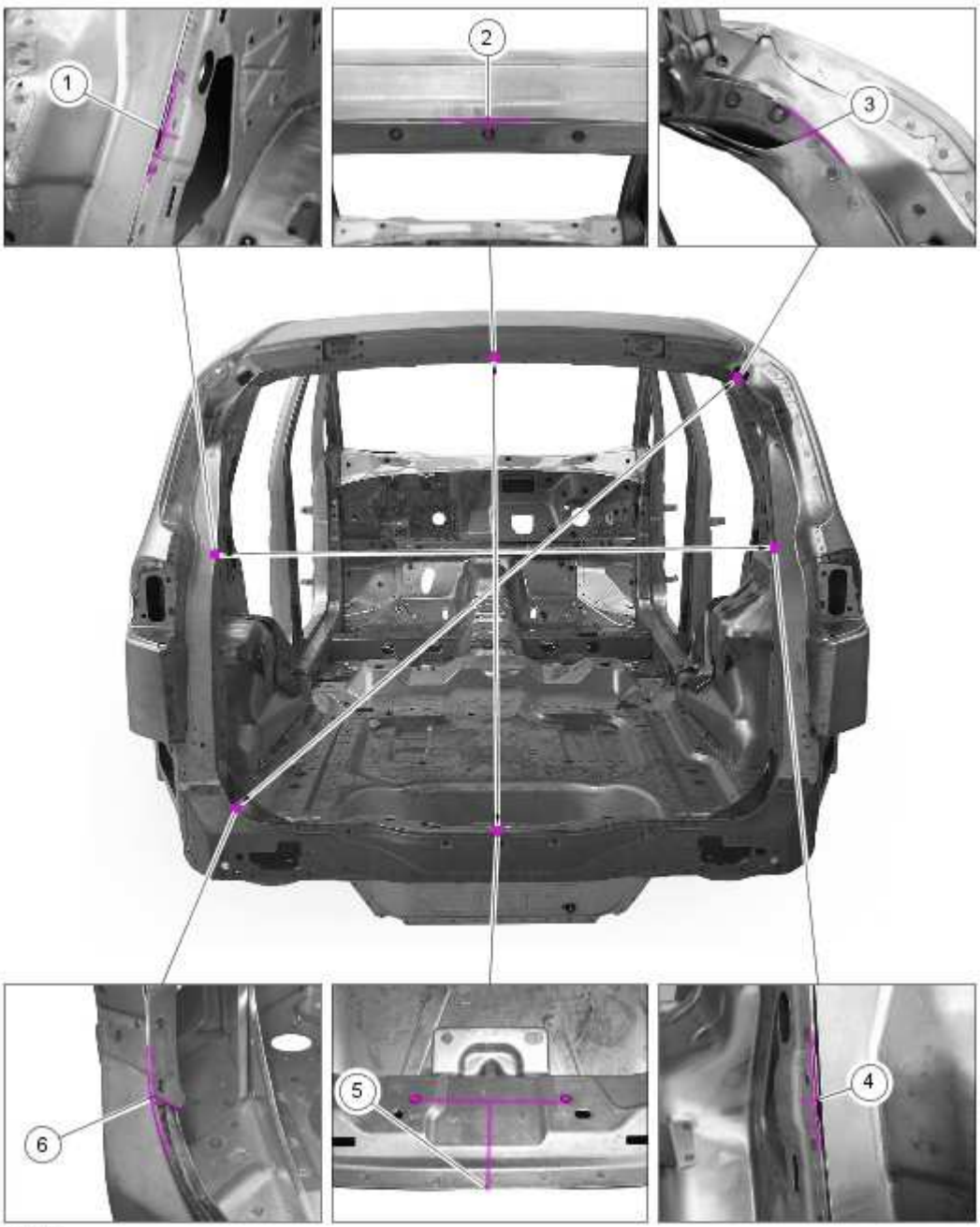

E79539

6. Rear body dimensions, Galaxy
   - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.

   Measuring points and dimensions

1 -4 = 1240 mm	3 -6 = 1456 mm
2 -5 = 1105 mm	

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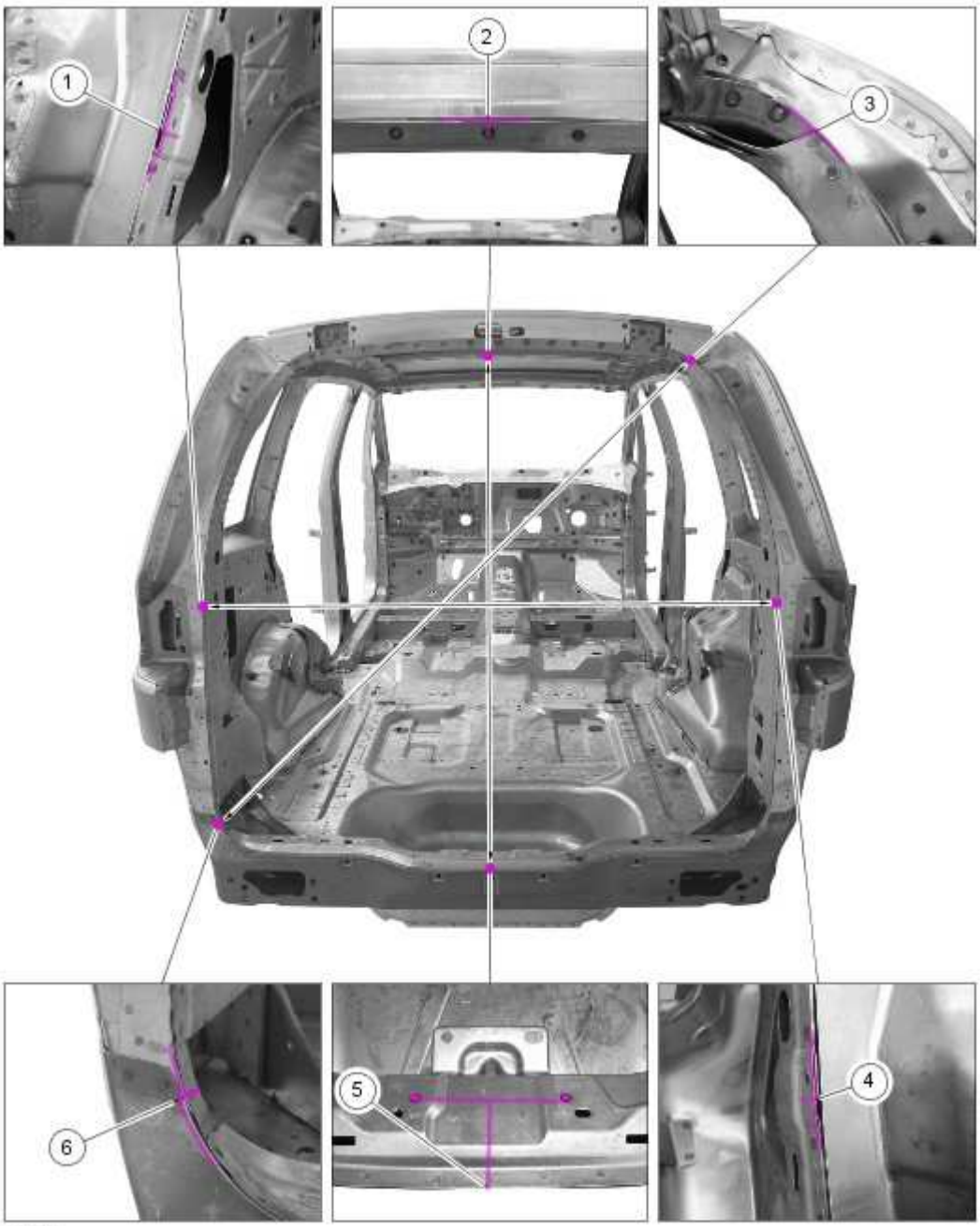

E79540

7. Passenger compartment body dimensions, S-MAX
    - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.

    Measuring points and dimensions

1 -4 = 1508 mm	5 -6 = 1498 mm
2 -3 = 1476 mm	

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E79541

8. Passenger compartment body dimensions, Galaxy
    - All dimensions with tolerance ± 3 mm. All dimensions were determined starting from the center of the welded flange using a symmetrically adjusted measuring gauge.

      Measuring points and dimensions

1 -4 = 1508 mm	5 -6 = 1498 mm
2 -3 = 1476 mm	

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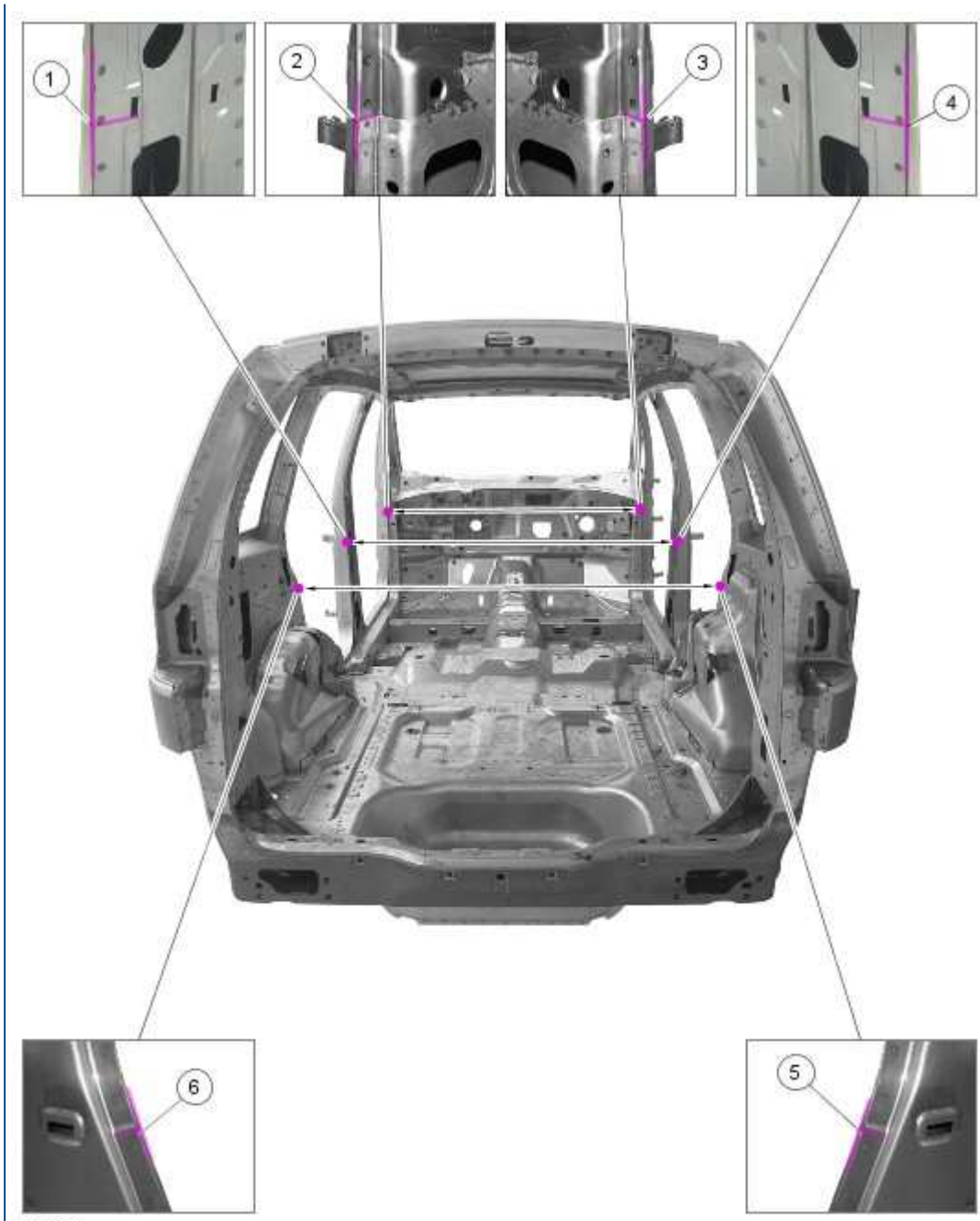

E79542

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Lubricants, Fluids, Sealers and Adhesives

	Part Number	Specification
PU glass adhesive (150 ml)	1 102 109	WSK-M11 P57-A1

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Removal and Installation

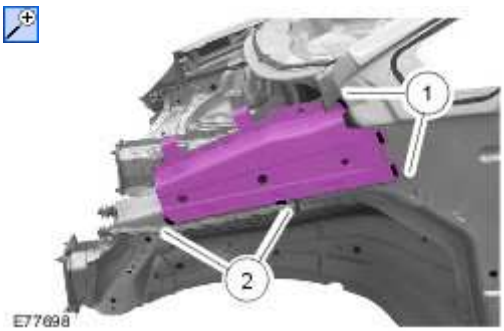
1. **Replacement parts**
   - Outer apron panel reinforcement
   - Inner apron panel reinforcement

Removal

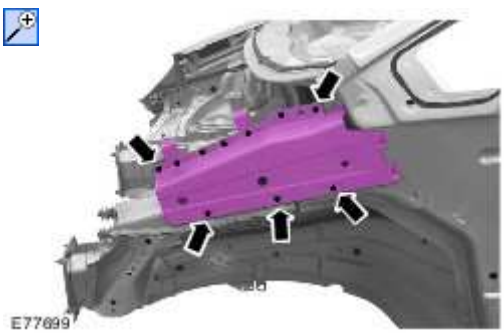
1. General information
   - Necessary removal work: Door, hood, fender, bumper, hood closing panel, crossmember with crash elements, headlamp and wheelhouse liner.

NOTE:

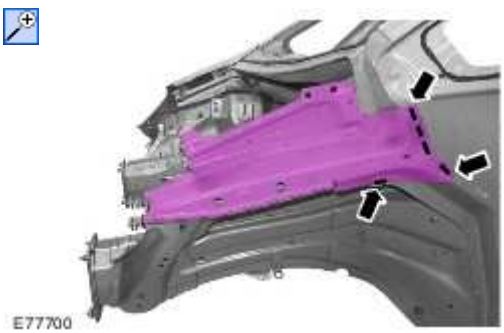
- If possible, it is better to perform a partial replacement of the outer and inner apron panel reinforcements rather than a full replacement, as this offers significant time savings in terms of the installation work required in the inner A-pillar area.
- The partial replacement options shown (see illustrations E77709 and E77710) do not require the MIG weld seams on the A-pillar to be separated.
- The repair shown only describes a complete replacement in full.



2. Outer apron panel reinforcement
   1. Grind out the MIG brazed joints.
   2. Grind out the MIG weld seams.



3. Outer apron panel reinforcement
   - Mill out the spot welds.



4. Inner apron panel reinforcement
   - Grind out the MIG brazed joints.

5. Inner apron panel reinforcement
   - Mill out the spot welds.

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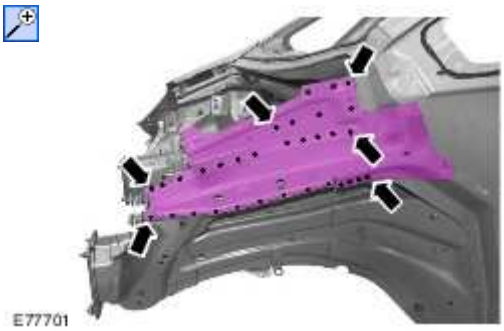
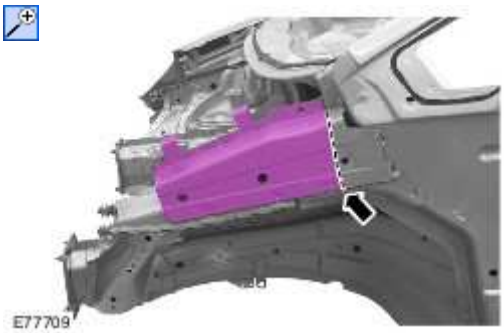
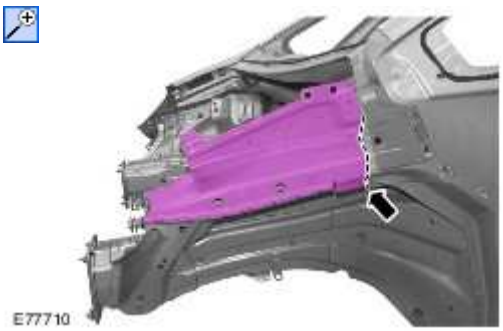




6. Partial replacement, outer apron panel reinforcement
   - Cut location for partial replacement.



7. Partial replacement, inner apron panel reinforcement
   - Cut location for partial replacement.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.
NOTE:

- The factory-installed MIG brazed joints must be replaced by MIG welds in a different position if a repair is performed.
- These MIG welds must not be carried out on or in the immediate vicinity of existing MIG brazed seams as even the smallest amount of brazing solder can result in a reduction in the strength of the weld seam.

1. NOTE: For the reasons described above, when preparing the inner apron panel reinforcement the existing openings need to be enlarged by 10 mm (see illustration E77702).
   Inner apron panel reinforcement
   - Mill out the openings with a spherical cutter.

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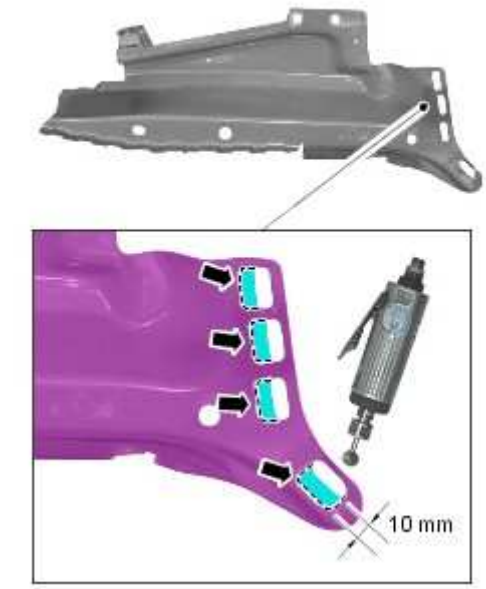
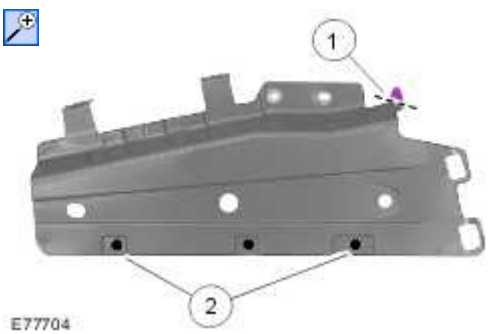


E77702

2. NOTE: Similarly to the inner apron panel reinforcement, when preparing the outer apron panel reinforcement the existing openings need to be enlarged by 10 mm (see illustration E77703).
   Outer apron panel reinforcement
   - Mill out the openings with a spherical cutter.

E77703



E77704

3. Prepare the outer apron panel reinforcement
   1. Cut off the sheet metal tabs, leaving a residual flange of approx. 5 mm.
   2. Drill holes for puddle welding.

4. NOTE:
   - During installation the new inner apron panel reinforcement is welded to the A-pillar cover panel and the A-pillar

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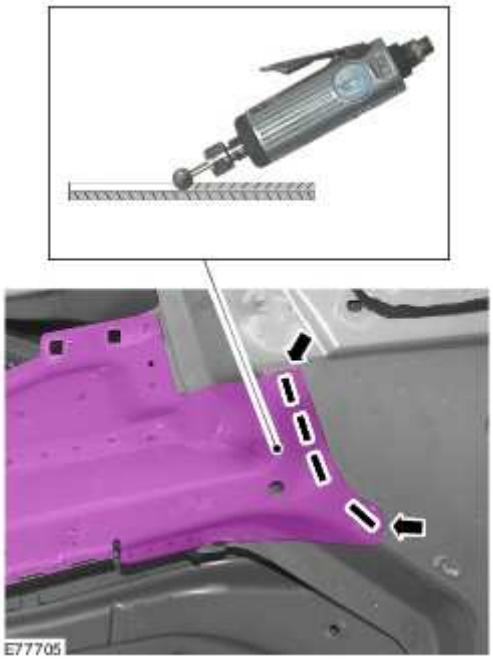
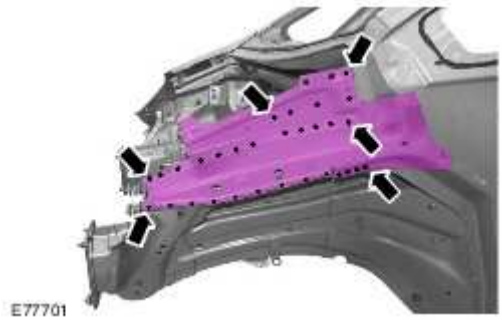
reinforcement.
    - The areas on the A-pillar cover panel need to be ground right through with the aid of the spherical cutter so that the A-pillar reinforcement underneath becomes accessible.

Prepare the A-pillar

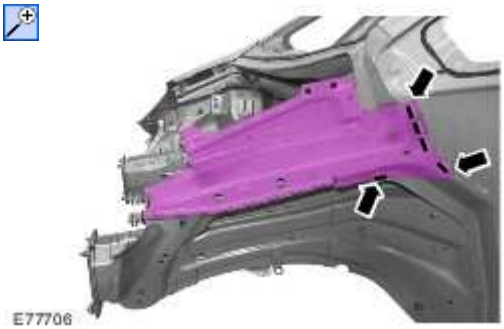
- Grind the welding zones on the A-pillar as required.



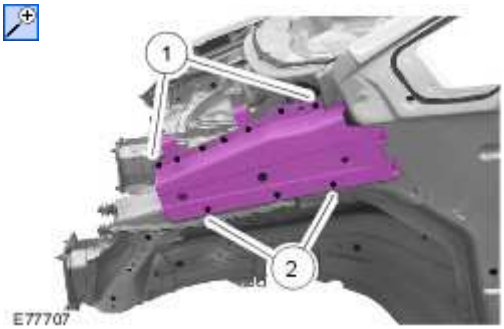
5. Inner apron panel reinforcement
    - Resistance spot weld.



6. Inner apron panel reinforcement
    - Intermittent MIG weld.



7. Outer apron panel reinforcement
    1. Resistance spot weld.
    2. Puddle weld.



8. Outer apron panel reinforcement
    - Intermittent MIG weld.

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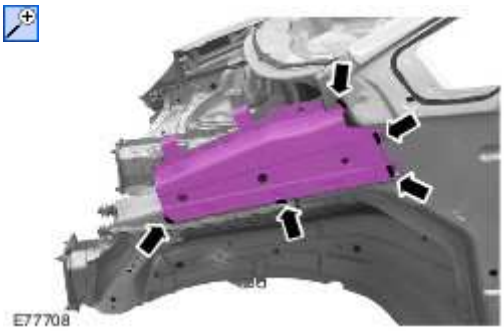

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Removal and Installation

General Equipment

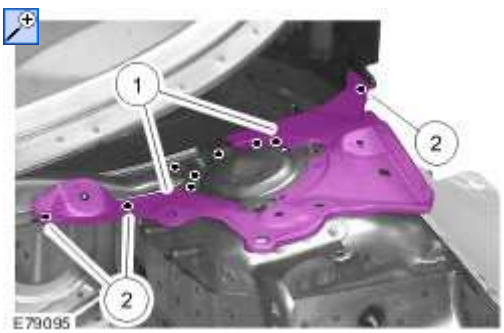
Measurement and alignment angle system

1. **Replacement parts**
   - Inner side member
   - Outer side member with apron panel
   - Strut tower reinforcement
   - Longitudinal member flange plate
   - NVH element

Removal

1. General information
   - The apron panel reinforcement needs to be removed before the repairs can be started.
   - Necessary removal work: Radiator, engine/transmission unit, crash padding and A-pillar trim.
   - Reposition the carpeting and the wiring harness away from the working area.

2. Apron panel
   1. Mill out the spot welds.
   2. Mill out the spot welds (two panel thicknesses).



3. Strut tower reinforcement
   1. Mill out the spot welds (two panel thicknesses).
   2. Mill out the spot welds.

4. Strut tower reinforcement
   - Heat the area (approx. 170° C) and release the NVH element.

5. Side member, bottom
   1. Mill out the spot welds.
   2. Mill out the spot weld (two panel

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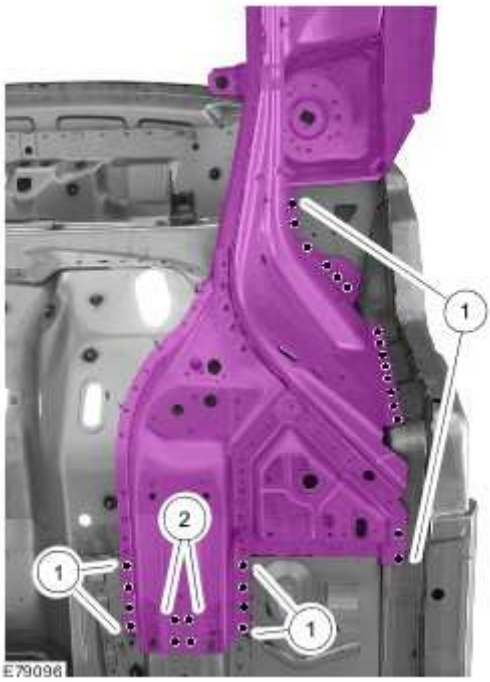
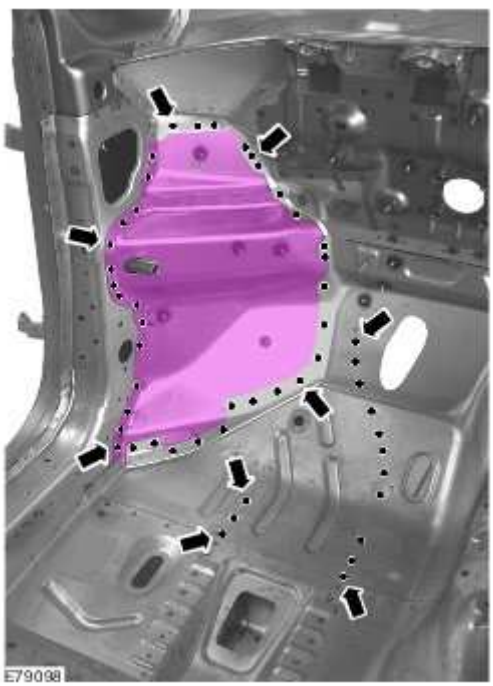
thicknesses).



6. Bulkhead crossmember
   - Mill out the spot welds.



7. Bulkhead, inner
   - Mill out the spot welds.

8. Bulkhead, inner
   - Mill out the spot welds (two panel thicknesses).

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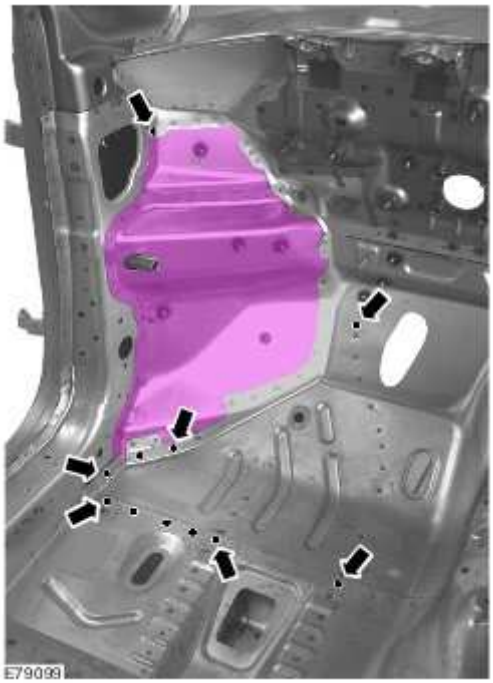

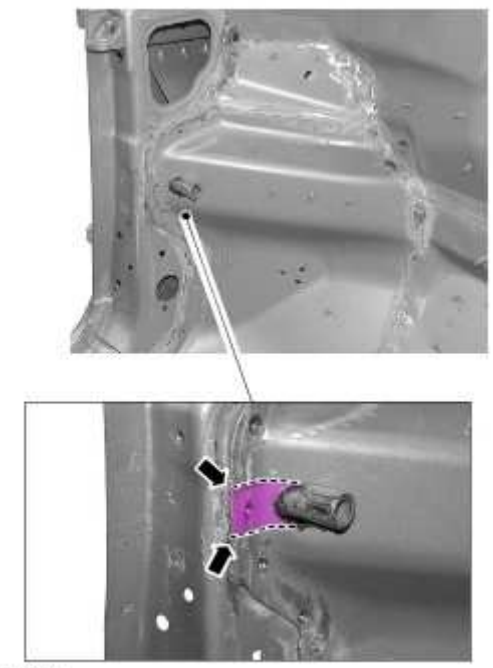

9. NOTE: In order to enable removal of the complete side member with apron panel, a partial section needs to be cut out at the apron panel.
   Bulkhead, inner
   - Cut points.

10. Bulkhead, inner
    - Heat the area (approx. 170° C) and release the NVH element.

Installation

NOTE:

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- Fit the outer side member with the apron panel and the inner side member and secure them with the alignment angle.
- Accurate positioning of the suspension strut turret is necessary for subsequent alignment of the axle geometry.
- Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

E79101

1. Outer side member with apron panel
   - Drill holes for puddle welding.

E81753

2. Inner side member
   - Drill holes for puddle welding.

3. NOTE: In order to enable installation of the inner side member, a partial section needs to be cut out at the apron panel.
   Side member with fender apron panel
   - Cut points.

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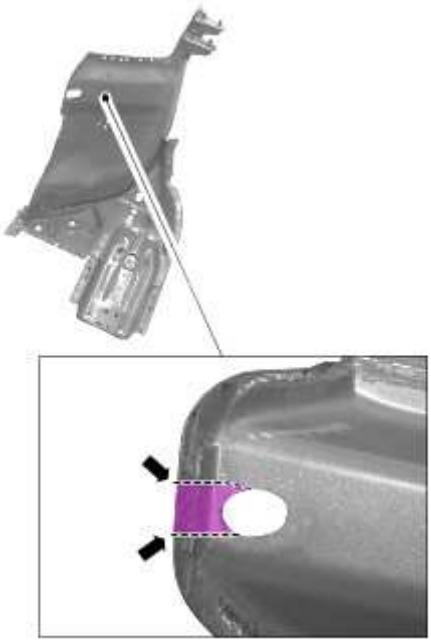

E79102

E81882

4. NOTE: Use a measuring and alignment system to ensure accurate positioning of the suspension strut turret.
   Mounting points for the suspension strut

E81808

5. Bulkhead, inner
   - Apply PU glass adhesive to the NVH element.

6. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
   Bulkhead, inner
   - Drill out by one panel thickness.

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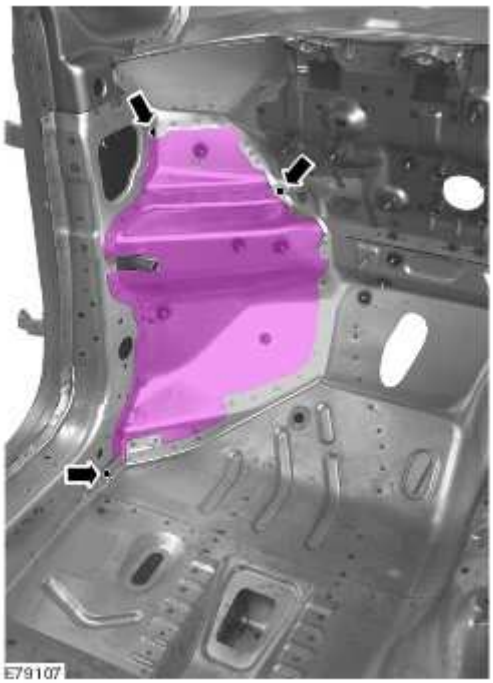

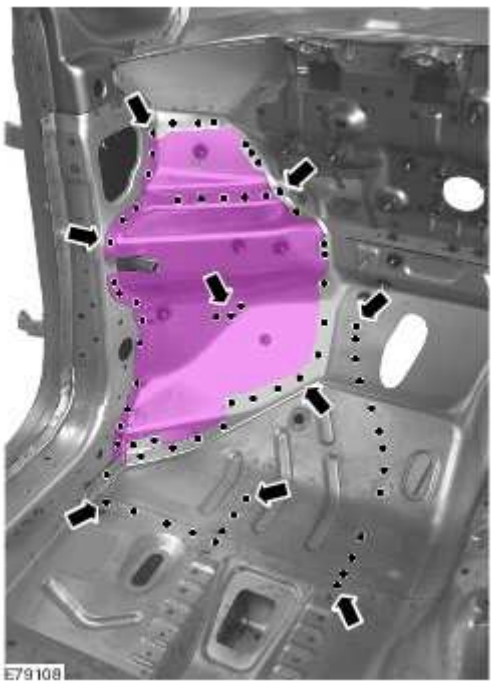

7. Bulkhead, inner
   - Puddle weld.

8. NOTE: In order to ensure that complete sealing is achieved, the remaining openings on the mounting tube for the instrument panel bracket need to be sealed with body sealant.
   Bulkhead, inner
   - Continuous MIG weld seam.

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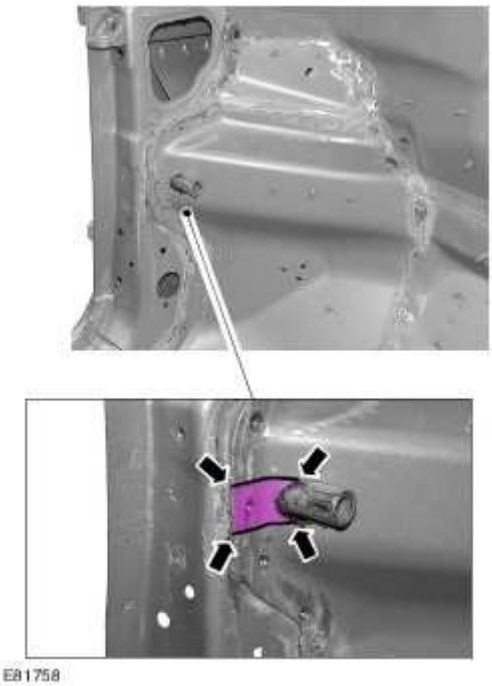
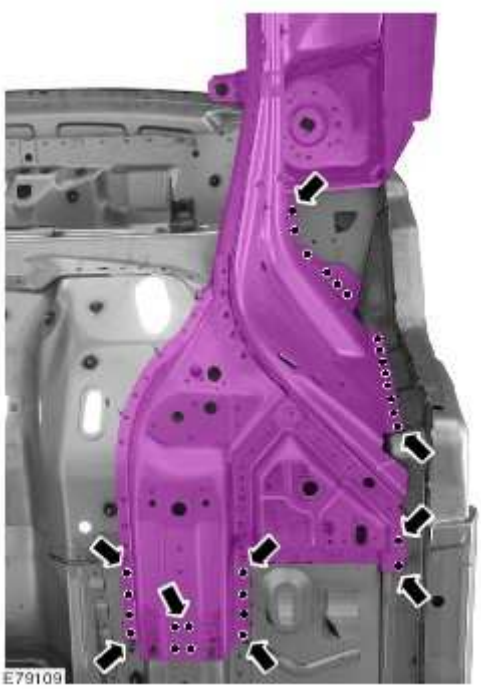

E81758

9. Bulkhead crossmember
   - Puddle weld.

E79097

10. Side member, bottom
    - Puddle weld.


E79109

11. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
    Apron panel
    - Drill out by one panel thickness.

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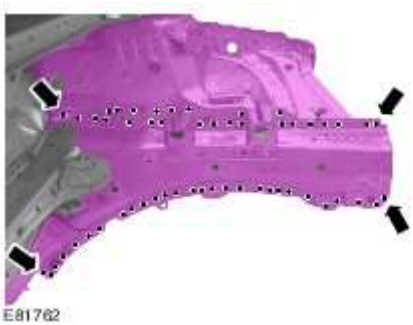
12. Apron panel
    - Puddle weld.



13. Inner side member
    - Resistance spot weld.

14. Suspension strut turret
    - Puddle weld.

15. Suspension strut turret
    - Surface grind the MIG spot welds.

16. Strut tower reinforcement
    - Drill holes for puddle welding (10 mm diameter).

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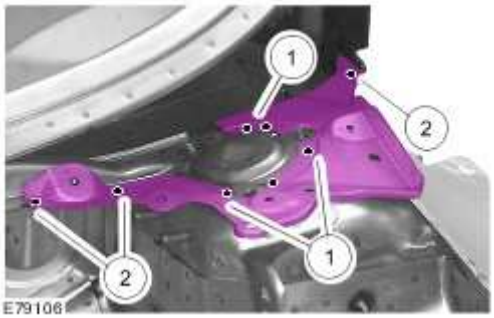
E79103

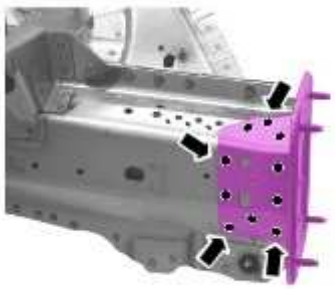
E81752

17. NOTE: Working from the inside, insert the NVH element at the suspension strut turret reinforcement using PU window adhesive and secure it with the plastic clip.
Strut tower reinforcement
    - Apply PU glass adhesive to the NVH element.



E79106

18. Strut tower reinforcement
    1. Puddle weld.
    2. Resistance spot weld.


E81763

19. NOTE: Fit the longitudinal member flange plate using the straightening angle.
Longitudinal member flange plate
    - Resistance spot weld.

E81764

20. Longitudinal member flange plate
    - Resistance spot weld.

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Removal and Installation

General Equipment

Measurement and alignment angle system

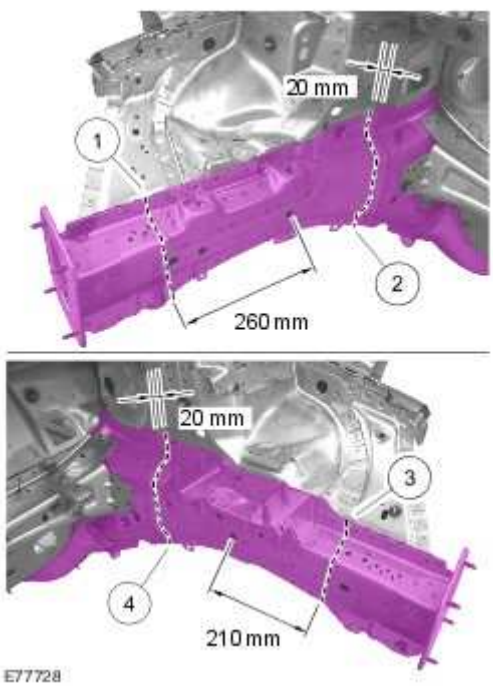
1. NOTE: The required partial replacement sections need to be cut out from the outer side member with apron panel or from the inner side member.
   Replacement parts
   - Inner side member
   - Outer side member with apron panel
   - Longitudinal member flange plate

Removal

1. General information
   - Necessary removal work: Bumper, hood, fender, hood closing panel, headlamps and crossmember with crash elements.

WARNING:

- Due to the positions of inner reinforcements, it is very important that the dimensions quoted for the separating cuts at positions 1 and 3 on the inner side member are accurately met.
- The rear separating cuts must not be made on the existing laser weld seams. The indicated distances at positions 2 and 4 must be satisfied in the event of a partial replacement.



2. Overview of cutting options
   1. Inside of the member at the front (right-hand side)
   2. Inside of the member at the rear (right-hand side)
   3. Inside of the member at the front (left-hand side)
   4. Inside of the member at the rear (left-hand side)

3. Inner side member
   1. Separating cut.
   2. Mill out the spot welds.

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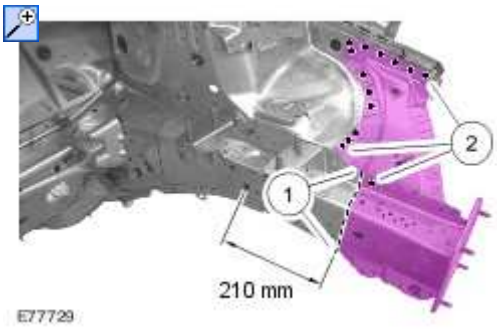

4. Side member, top
    1. Grind out the spot welds.
    2. Mill out the spot welds from below.
    3. Grind out the spot weld (two panel thicknesses).

5. Outer side member
    - Mill out the spot welds.

6. Outer side member
    - Mill out the spot welds (two panel thicknesses).

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. NOTE: The required partial replacement section needs to be cut out from the inner side member.
   Inner side member
    - Separating cut.

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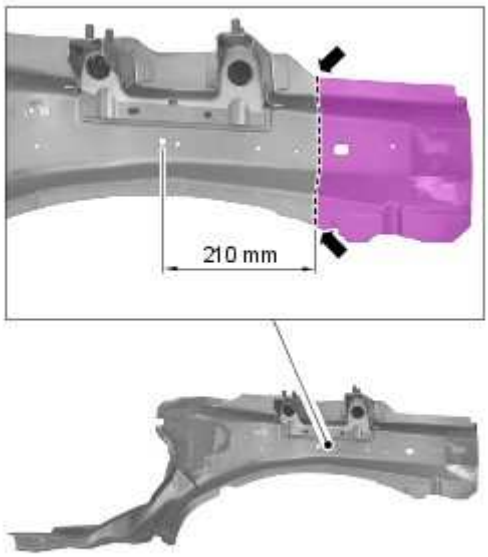
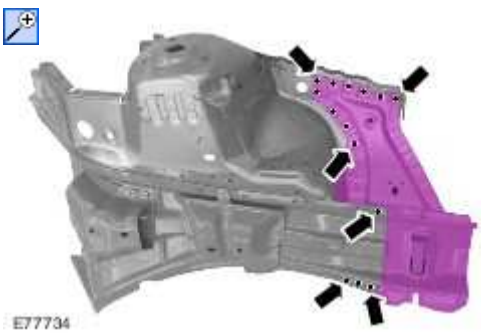


E77733



E77734

2. NOTE: The required partial replacement section needs to be cut out from the outer side member with apron panel.
   Outer side member with apron panel
   - Mill out the spot welds (Ø 10 mm).

E77735

3. Outer side member with apron panel
   - Mill out the spot weld (Ø 10 mm, two panel thicknesses).

E77736

4. Outer side member
   - Mill out the spot welds (Ø 10 mm).

5. Outer side member
   - Mill out the spot welds (Ø 10 mm, two panel layers).

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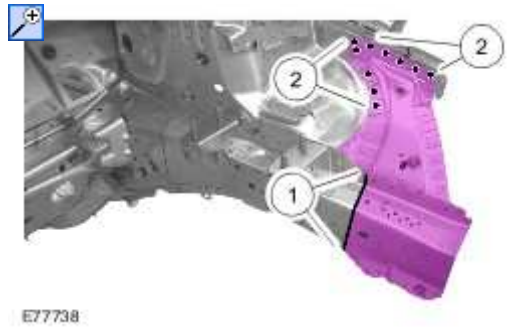
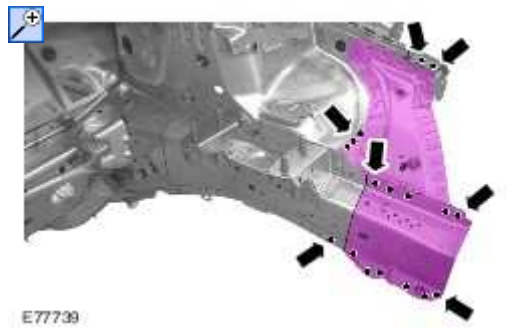
E77737



E77738

6. Inner side member
    1. Continuous MIG weld seam.
    2. Puddle weld.


E77739

7. Inner side member
    - Resistance spot weld.

E77740

8. Outer side member
    - Puddle weld.

E77741

9. Outer side member
    - Resistance spot weld.

10. NOTE: Fit the longitudinal member flange plate using the straightening angle.
    Longitudinal member flange plate
    - Resistance spot weld.

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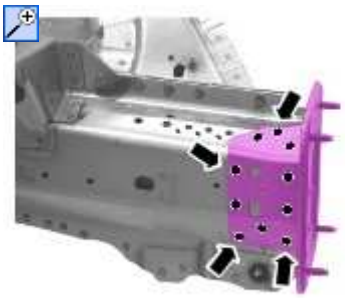

E81763

E81764

11. Longitudinal member flange plate
    - Resistance spot weld.

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Removal and Installation

Removal

NOTE: Equipment:
Measurement and alignment angle system.

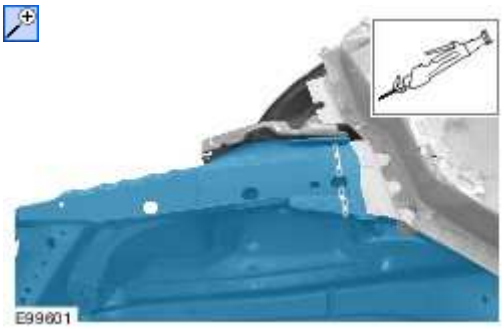
1.

- **Replacement parts:**
- Inner Side Member
- Outer Side Member with Apron Panel
- Longitudinal Member Flange Plate

2.

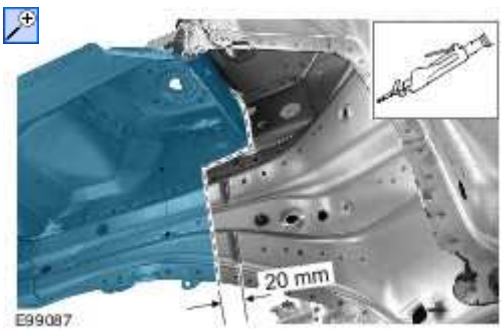
- **Necessary removal and installation work:**
- Fender Apron Panel Reinforcement

  Refer to: Fender Apron Panel Reinforcement (501-27 Front End Sheet Metal Repairs, Removal and Installation).
- Strut Tower Reinforcement
- Reposition the carpeting and the wiring harness away from the working area.



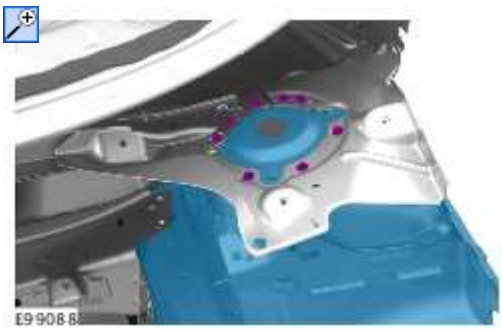
3.

- **Apron Panel - Rough Cut**
- Mark the cutline and cut the Apron Panel.



4.

- **Front Side Member Outside - Rough Cut**
- NOTE: Stated dimension is minimum dimension!
  Mark the cutline and cut the Front Side Member.



5.

- **Strut Tower**
- NOTE: Mill out the spot welds from below.
  Mill out the spot welds.

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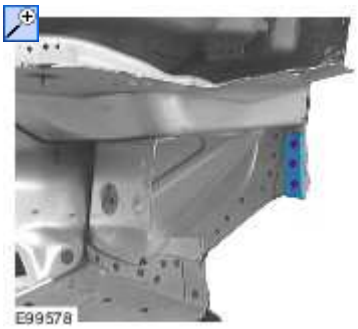
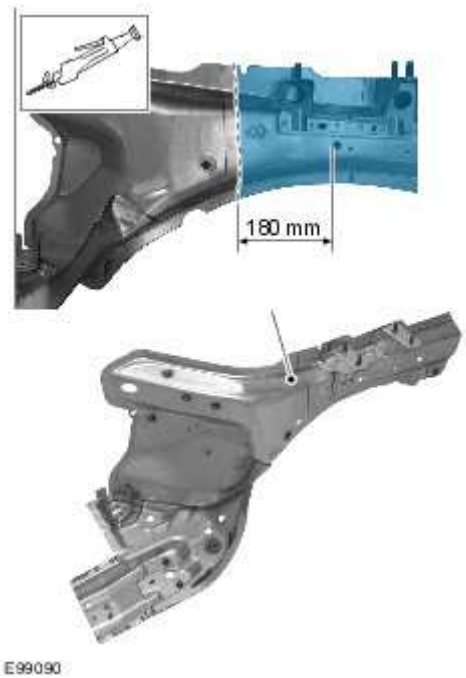


6.

- **Front Side Member - Residual Part**
- Mill out the spot welds - Remove residual part.

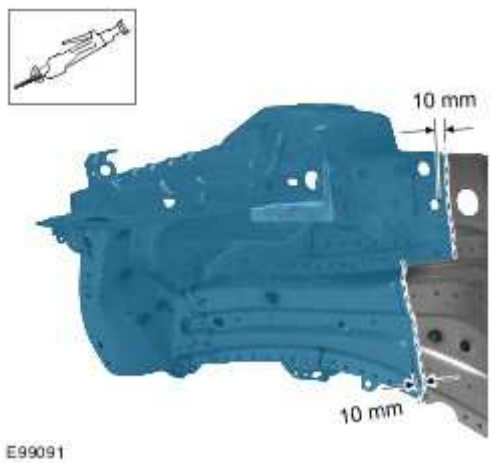
Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the manufacturer's welding equipment instructions and sub-section 501-25 must be followed.
Refer to: Tools and Equipment for Body Repairs (501-25 Body Repairs - General Information, Description and Operation).



1.

- **Preparation of the Inner Front Side Member**
- NOTE: The specified dimensions must be met when making the separating cuts.
  Mark cutline and cut the front side member.



2.

- **Preparation of the Outer Front Side Member**
- NOTE: The specified dimensions must be met when making the separating cuts.
  Mark cutline and cut the front side member.

3.

- **Tack-weld Inner Front Side Member**
- NOTE: Fit in the Inner Front Side

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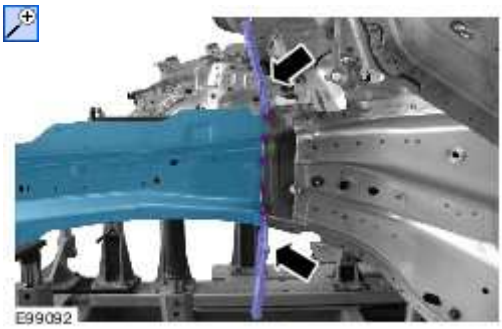
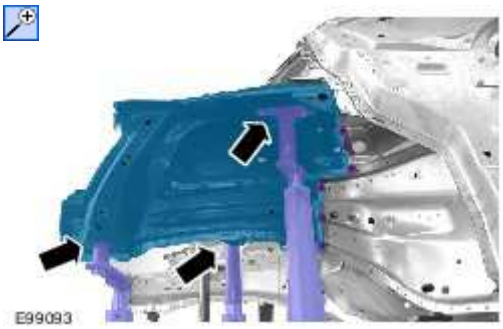
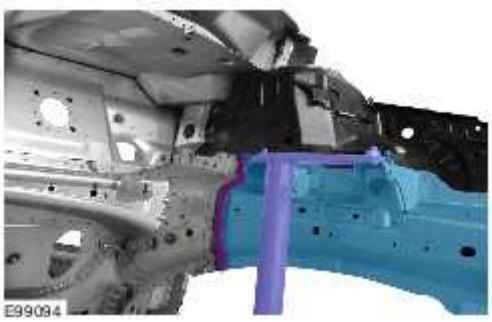


Member using the alignment angle system.
Locate inner side member with clamps and MIG weld - tack-weld.



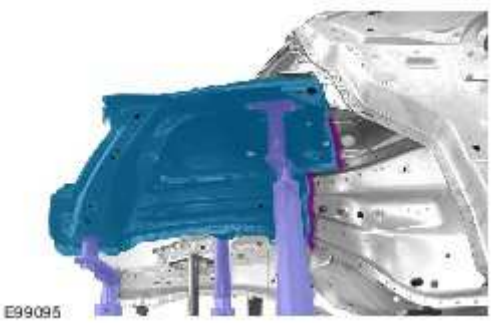
4.

- **Tack-weld Outer Front Side Member**
- NOTE: Fit in the Outer Front Side Member using the alignment angle system.
  Locate outer side member with the alignment angle system and MIG weld - tack-weld.



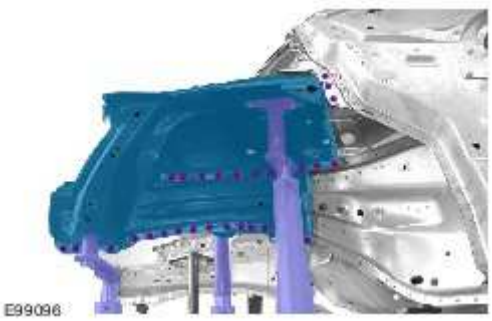
5.

- **MIG weld Inner Front Side Member**
- Continuous MIG weld seam.



6.

- **MIG weld Outer Front Side Member**
- Continuous MIG weld seam.



7.

- **Resistance spot weld Front Side Member**
- Resistance spot weld - Panel thickness partly 3 mm and greater!

8.

- **Resistance spot weld Strut Tower**
- Resistance spot weld - Panel thickness partly 3 mm and greater!

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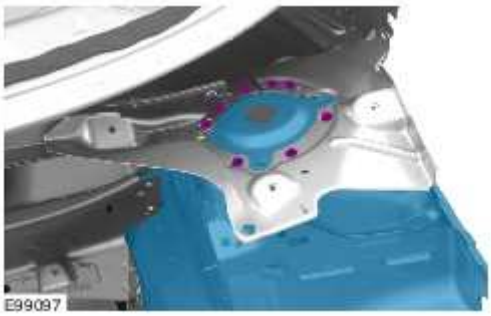

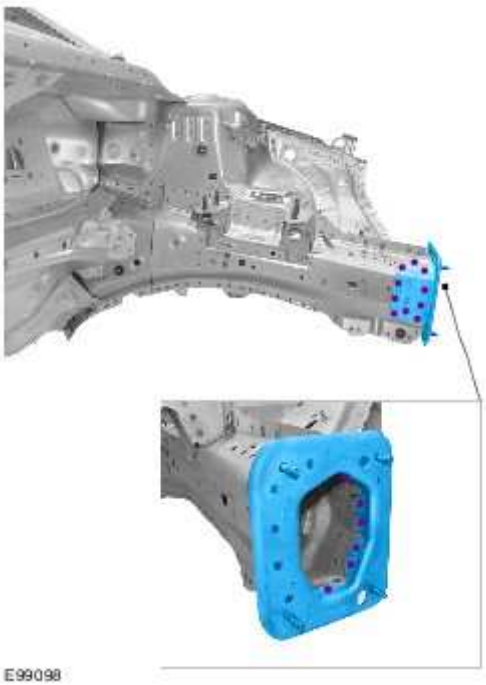

9.

- **Longitudinal Member Flange Plate**
- NOTE: Fit in the Longitudinal Member Flange Plate using the alignment angle system.
  Resistance spot weld - Panel thickness partly 3 mm and greater!

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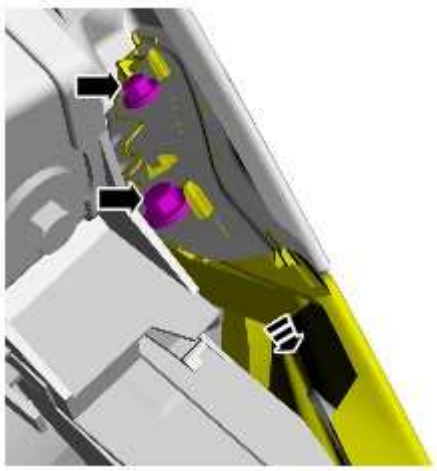
Removal and Installation

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).
   Refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
   Refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

2.



3.

4.

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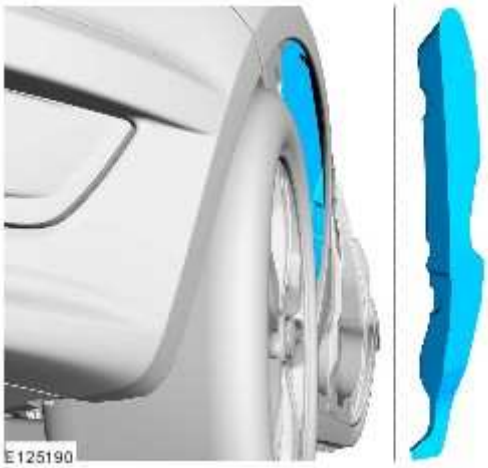
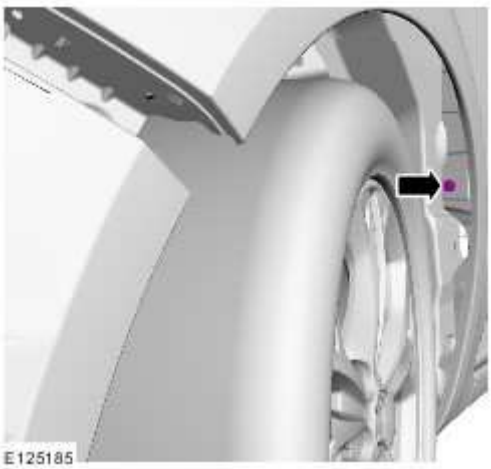
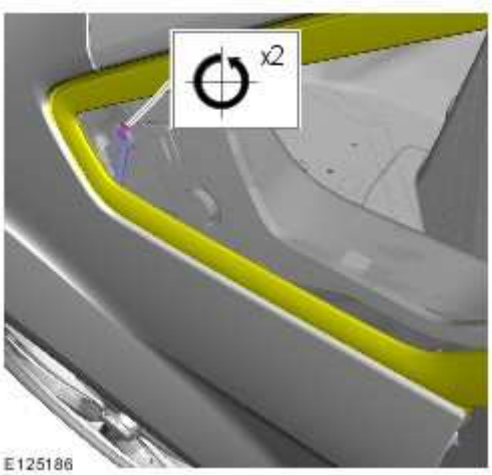


5.



6. *Torque:* 10 Nm



7. *Torque:* 10 Nm

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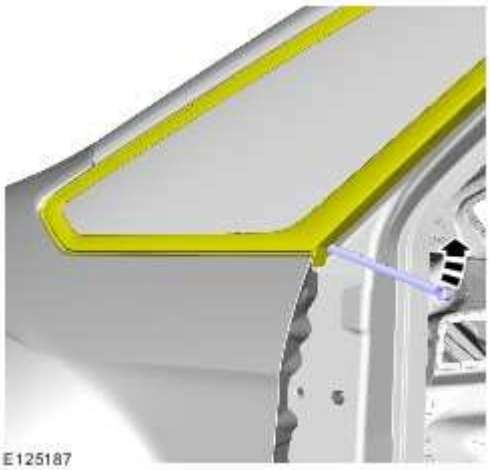
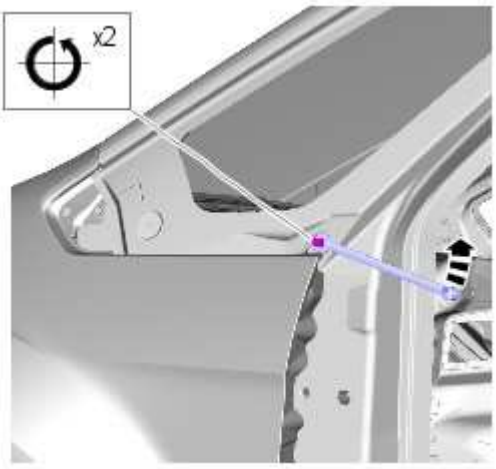
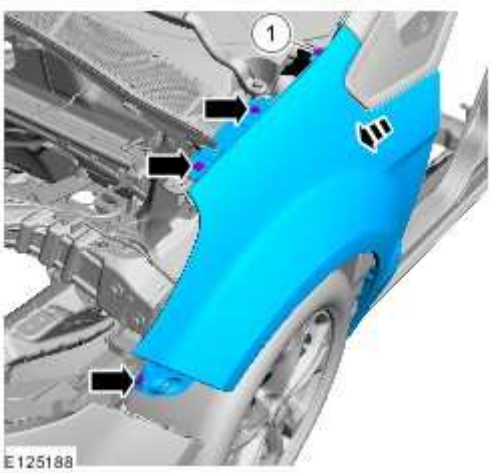




8.

9.

1. *Torque:* 10 Nm



Installation

1. To install, reverse the removal procedure.

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Lubricants, sealants and adhesives

	Part number	Specification
PU glass adhesive (150 ml)	1 102 109	WSK-M11 P57-A1

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Removal and Installation

1. **Replacement parts**
   - Roof panel

Removal

1. General Notes
   - Necessary removal work: Tailgate, doors, windshield, side windows, headliner, interior trim panels and rear lights.
   - Move the wiring harness away from the working area.
2. Roof panel
   - Mill out the spot welds.

3. Roof panel
   1. Grind out the spot welds starting from the front side of the vehicle..
   2. Heat the bonded areas from the outside (approx. 170° C).

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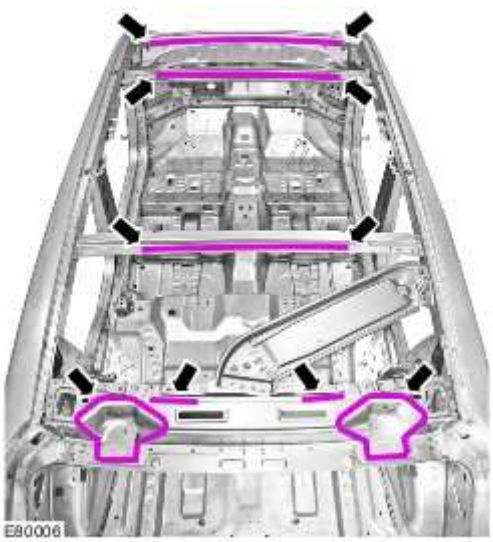
Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: In order to achieve a complete seal in the area of the tailgate mountings, a sufficient quantity of PU glass adhesive needs to be applied.
   Prepare the bonded areas
   - Apply PU glass adhesive to the roof crossmembers and the tailgate mountings.

2. Offer up the roof panel and weld in place.
   - Resistance spot welding.

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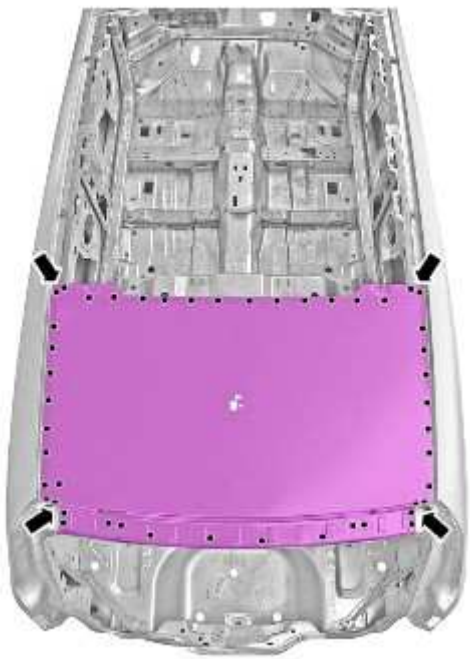
Removal and Installation

1. **Replacement parts**
   - Roof, front partial section
   - Roof, rear partial section

Removal

1. General Notes
   - Necessary removal work: Panoramic roof, tailgate, doors, windshield, side windows, headliner, interior trim panels and rear lights.
   - Move the wiring harness away from the working area.
2. Roof (rear partial section)
   - Mill out the spot welds.



E80019

3. Roof (rear partial section)
   1. Grind out the spot welds starting from the front side of the vehicle..
   2. Heat the bonded areas from the outside (approx. 170° C).

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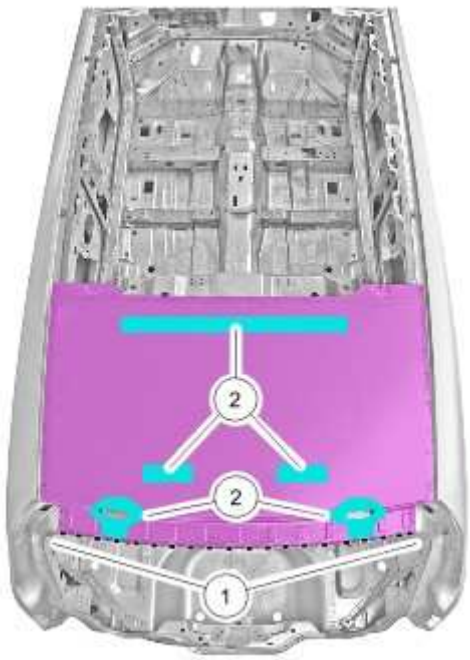
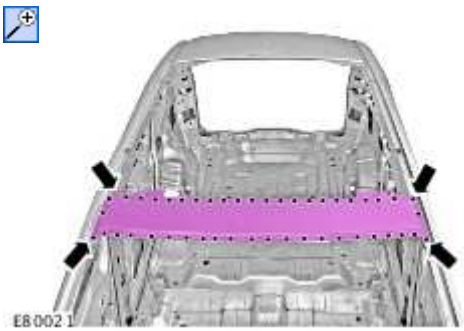


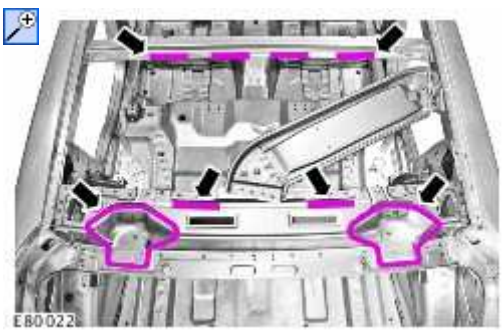
E80020


E80021

4. Roof (front partial section)
   - Mill out the spot welds.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.


E80022

1. NOTE: In order to achieve a complete seal in the area of the tailgate mountings, a sufficient quantity of PU glass adhesive needs to be applied.
   Prepare the bonded areas (rear partial section)
   - Apply PU glass adhesive to the roof crossmembers and the tailgate mountings.

2. Fit the roof and weld it in place (rear partial section)
   - Resistance spot welding.

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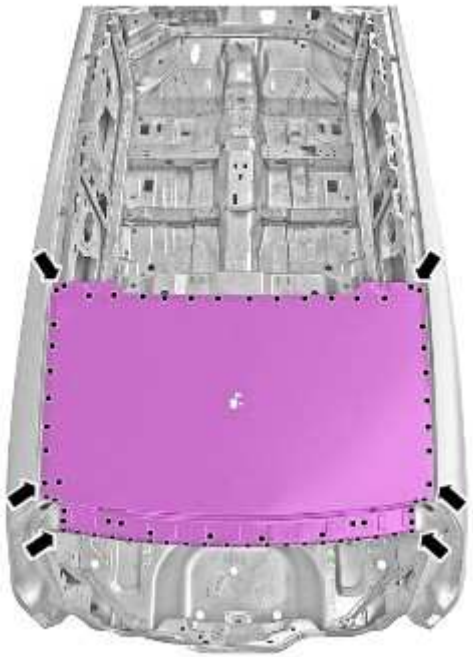
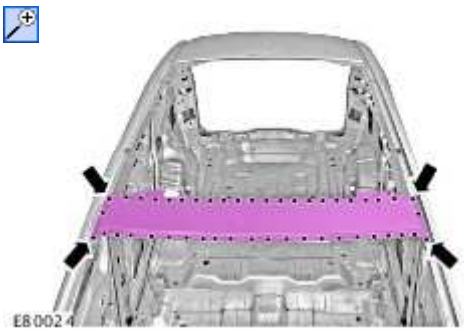


E80023



E80024

3. Fit the roof and weld it in place (front partial section)
    - Resistance spot welding.

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Removal and Installation

1. **Replacement parts**
   - Roof panel

Removal

1. General Notes
   - Necessary removal work: Tailgate, doors, windshield, side windows, headliner, interior trim panels and rear lights.
   - Move the wiring harness away from the working area.
2. Roof panel
   - Mill out the spot welds.

3. Rear roof panel
   - Grind out the spot welds starting from the front side of the vehicle..
4. Roof panel
   - Heat the bonded areas from the outside (approx. 170° C).

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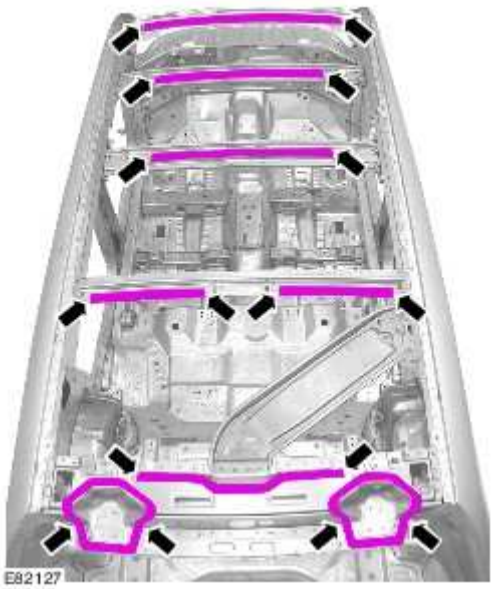
Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: In order to achieve a complete seal in the area of the tailgate mountings, a sufficient quantity of PU glass adhesive needs to be applied.
   Prepare the bonded areas
   - Apply PU glass adhesive to the roof crossmembers and the tailgate mountings.

2. Offer up the roof panel and weld in place.
   - Resistance spot welding.

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3. Rear roof panel
    - Resistance spot welding.

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Lubricants, sealants and adhesives

	Part number	Specification
PU glass adhesive (150 ml)	1 102 109	WSK-M11 P57-A1

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Removal and Installation

General Equipment

Measurement or alignment angle system

1. **Replacement parts**
   - A-pillar outer panel
   - A-pillar inner panel
   - A-pillar reinforcement
   - Rocker panel reinforcement
   - NVH elements

Removal

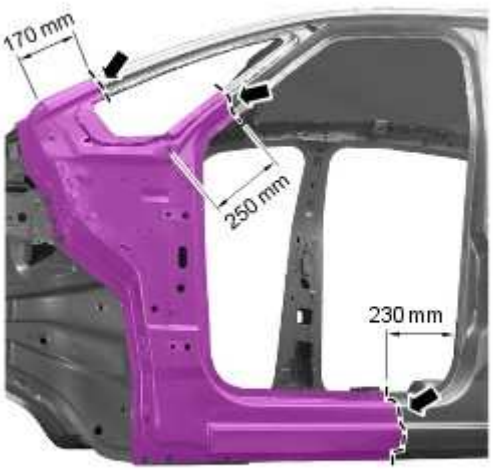
1. General Notes
   - The apron panel reinforcement needs to be removed before the repairs can be started.
   - Required removal operations: A-pillar trim panel, rocker panel trim and driver or passenger seat.
   - Reposition the carpeting and the wiring harness away from the working area.

NOTE: Due to the locations of inner reinforcements and NVH elements, it is very important that the dimensions quoted for the separating cuts on the outer A-pillar and on the rocker panel are accurately met.

2. A-Pillar outer

   NOTE: Take care not to damage the inner A-pillar reinforcement when making the separating cut on the front of the A-pillar.

   - Cut points.



E77637

3. A-Pillar outer
   - Mill out the spot welds.

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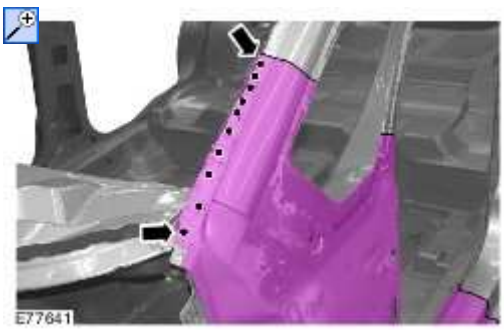
E77638

4. A-Pillar outer
   - Mill out the spot welds (two panel thicknesses).

E77639



E77641

5. A-Pillar outer
   - Mill out the spot welds.

6. A-Pillar outer
   1. Grind out the MIG brazed joints.
   2. Heat the areas (approx. 170° C) and detach the NVH elements.

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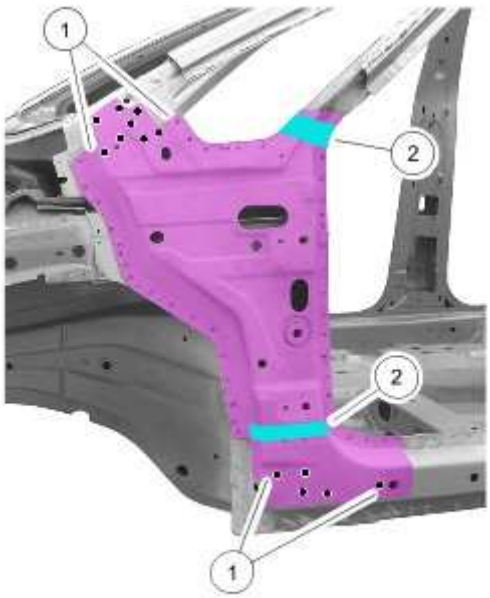
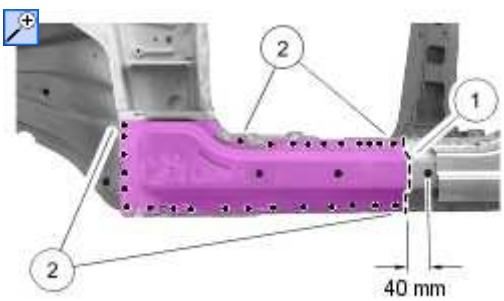
E77640



E77642

7. A-pillar reinforcement
    1. Mill out the spot welds.
    2. Heat the areas (approx. 170° C) and detach the NVH elements.



E77643

8. Rocker panel reinforcement
    1. Cut location.
    2. Mill out the spot welds.

9. A-pillar inner panel
    1. Cut location.
    2. Mill out the spot welds (two panel thicknesses).

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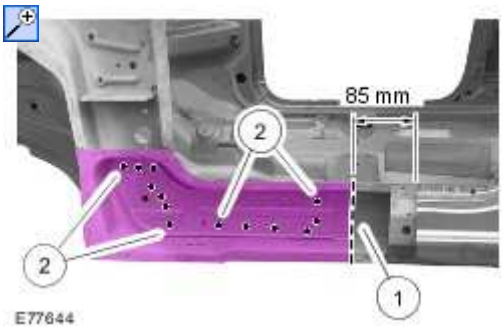
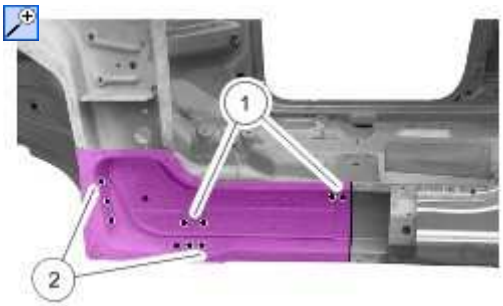
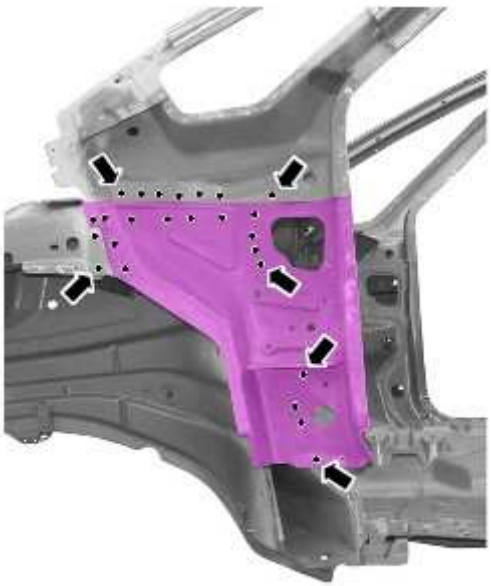


E77644



E77645

10. A-pillar inner panel
    1. Mill out the spot welds.
    2. Grind out the spot welds.


E77646

11. A-pillar inner panel
    - Mill out the spot welds.

12. A-pillar inner panel
    1. Mill out the spot welds (two panel thicknesses).
    2. Grind out the spot welds.

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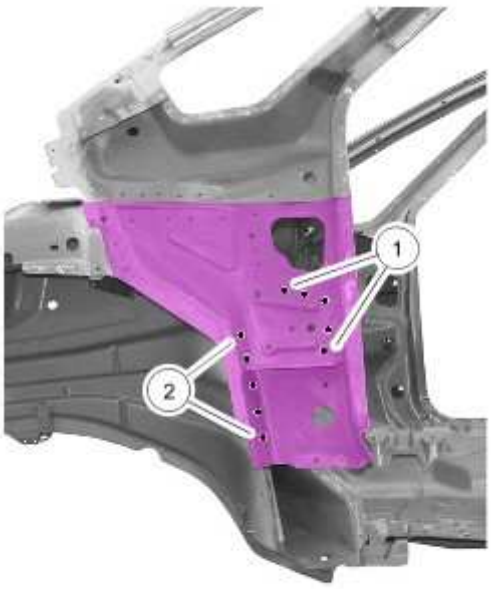
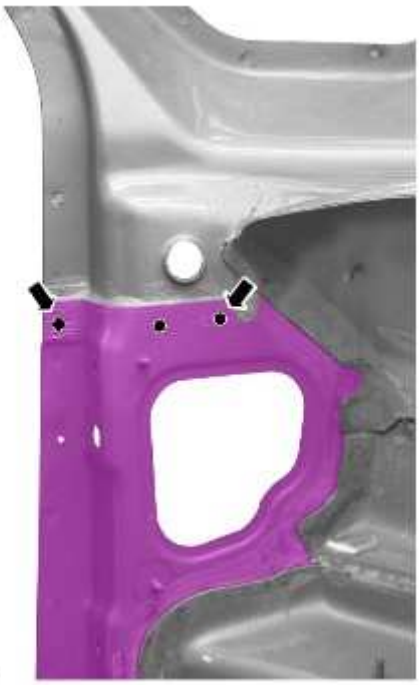


E77647



E77648

13. A-pillar, inner panel (inside view)
    - Mill out the spot welds.

E81917

14. A-pillar, inner panel (inside view)
    - Heat the area (approx. 170° C) and release the NVH element.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be

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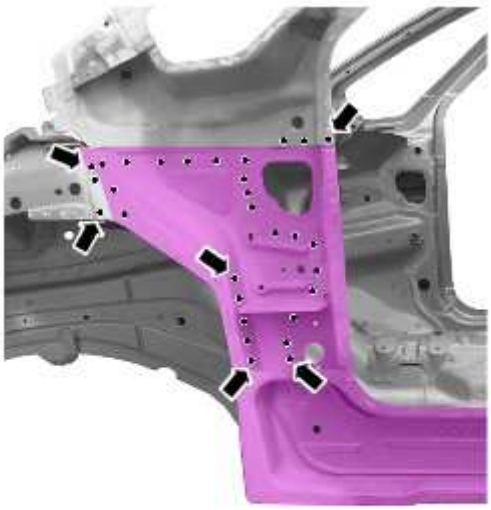
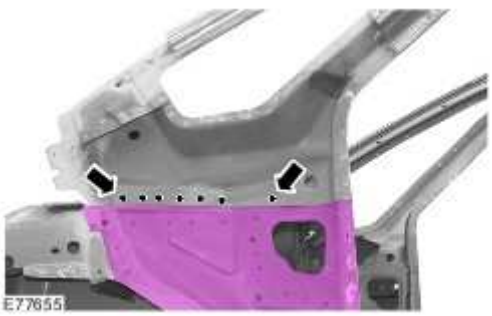
followed.

1. A-pillar inner panel
   - Drill out the holes for puddle welding (10 mm diameter).

2. A-pillar inner panel
   - Drill a hole for puddle welding (10 mm diameter).



3. A-pillar inner panel
   - Resistance spot weld.



4. A-pillar inner panel
   - Puddle weld.

5. A-pillar inner panel

   NOTE: Once the A-pillar reinforcement and the A-pillar outer panel have been

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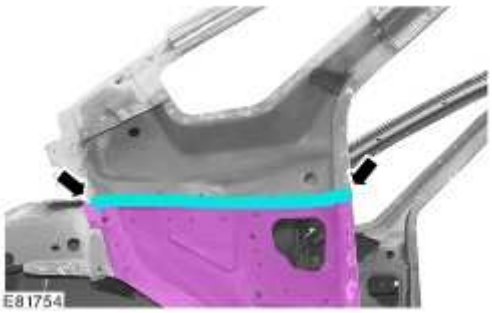

E81754

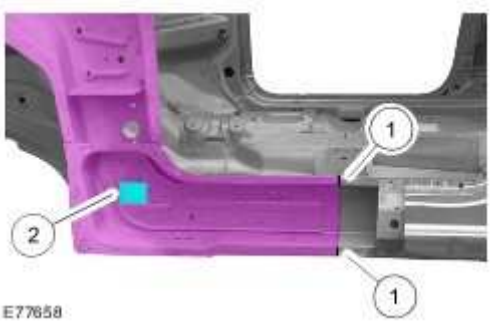
installed this area is no longer accessible.
- Applu PU sealant to the outside and inside.

E77656

6. A-pillar inner panel
   1. Puddle weld.
   2. Continuous MIG weld seam.

E77657

7. A-pillar inner panel
   - Resistance spot weld.



E77658

8. A-pillar inner panel
   1. Surface grind the MIG weld seams in the area of the welded flange.
      NOTE: Once the A-pillar reinforcement and the A-pillar outer panel have been installed this area is no longer accessible.
   2. Apply self-adhesive sealing strip.

E77659

9. NOTE: Only tack-weld the rocker panel reinforcement at the top and bottom. The final welded joint is made when the rocker panel is installed.
   Rocker panel reinforcement
   1. Continuous MIG weld seam.
   2. Resistance spot welding (tack-weld).

10. WARNING: The A-pillar reinforcement is covered with a hot-dip aluminized coating on its entire surface. This coating needs to be fully ground off on the MIG welding flanges

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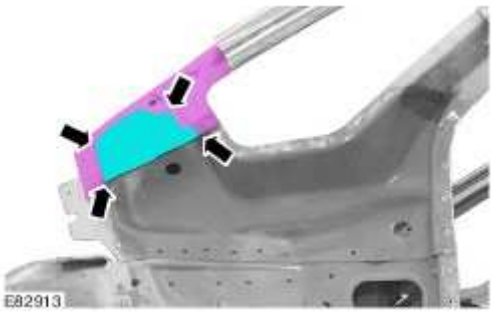

on the front using a fibre grinding disc. Any contamination due to parts of the coating in the welding bath will weaken the welded joint.

A-pillar reinforcement

- Clean the contact area.

11. A-pillar reinforcement
    - Drill holes for puddle welding (10 mm diameter).

12. NOTE: Working from the inside, insert the NVH element at the A-pillar reinforcement into the mounting tube for the instrument panel bracket.

    A-pillar, inner panel (inside view)
    - Apply PU glass adhesive to the NVH element.

13. NOTE: The PU window adhesive acts as noise insulation in the area of position 1.

    A-pillar reinforcement
    1. Apply PU window adhesive to the inside of the A-pillar.
    2. Apply PU glass adhesive to the NVH element.
    3. Puddle weld.

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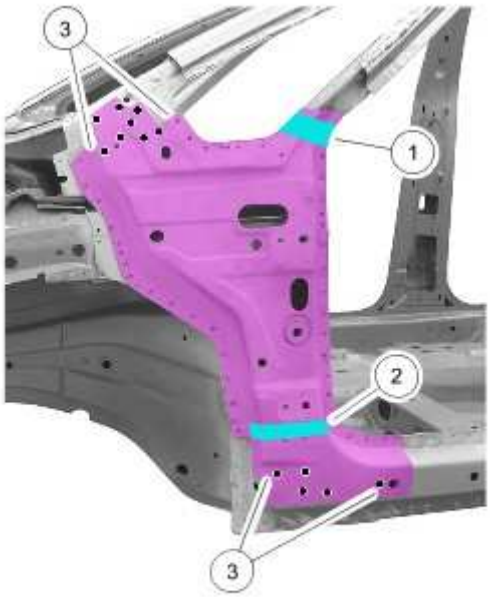

E77660

E77661

14. NOTE: Only tack-weld A-pillar reinforcement. The final welded joint is made when the outer A-pillar is installed.
A-pillar reinforcement
    - Resistance spot welding (tack-weld).

15. NOTE: The MIG spot welds need to be surface ground so that the outer A-pillar fits correctly.
A-pillar reinforcement
    - Surface grind the MIG spot welds.

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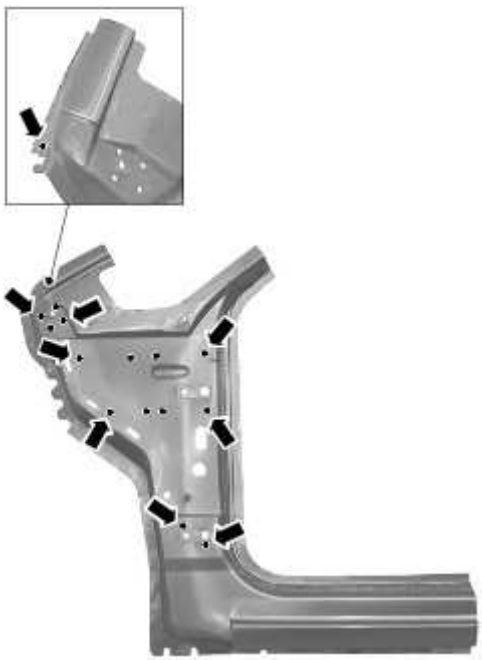
E77662



E77652

16. A-Pillar outer
    - Drill holes for puddle welding (10 mm diameter).

NOTE:

- The factory-installed MIG brazed joints must be replaced by MIG welds in a different position if a repair is performed.
- These MIG welds must not be carried out on or in the immediate vicinity of existing MIG brazed seams as even the smallest amount of brazing solder can result in a reduction in the strength of the weld seam.

17. NOTE: For the reasons described above, when preparing the outer A-panel the existing openings need to be enlarged by 10 mm (see illustration E77653).
    A-Pillar outer
    - Mill out the openings with a spherical

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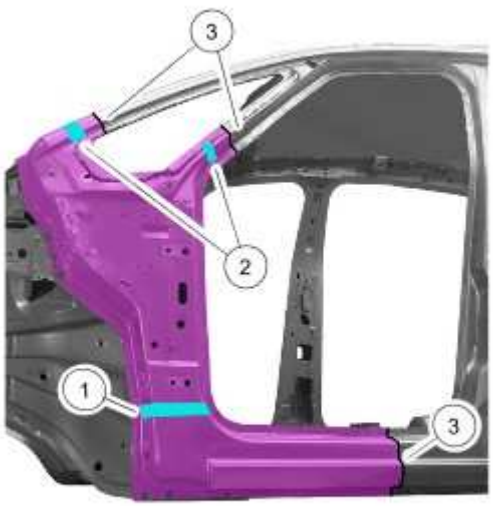
cutter.

E77653

18. NOTE: The PU window adhesive acts as noise insulation in the area of positions 2.
A-Pillar outer
    1. Apply PU glass adhesive to the NVH element.
    2. Apply PU window adhesive to the inside of the A-pillar.
    3. Continuous MIG weld seam.



E77663

19. A-Pillar outer
    - Resistance spot weld.

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E77664

20. A-Pillar outer
    - Puddle weld.

E77665

21. A-Pillar outer
    - Intermittent MIG weld.

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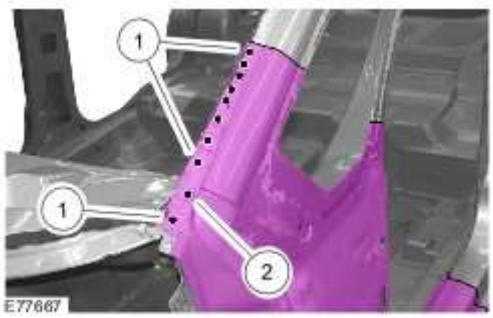
E77666



E77667

22. A-Pillar outer
    1. Resistance spot weld.
    2. Puddle weld.

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Removal and Installation

1. **Replacement Parts**
   - Rocker panel

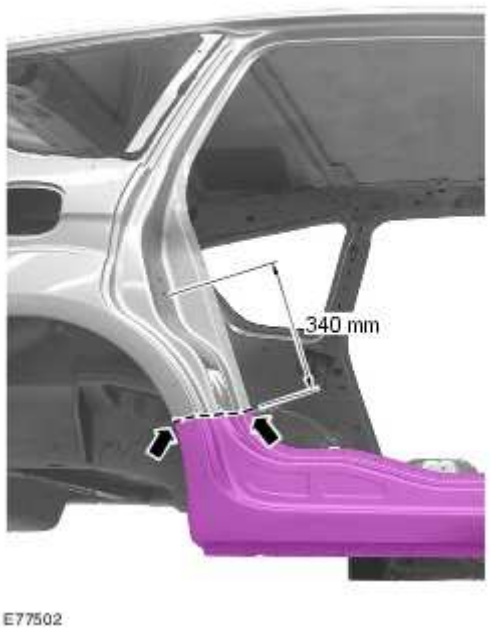
Removal

1. General notes
   - Required removal operations: Doors, door hinges, front and rear seats, door sill inner trim, A- B- and C- pillar inner trim.
   - Reposition the carpeting and the wiring harness away from the working area.

NOTE: The location of the separating cut may be changed depending on the extent of the damage. The repair shown only describes a complete replacement in full.

2. Rocker panel
   - Overview of cutting options

3. Rocker panel
   - Separating cut.



4. Rocker panel
   - Separating cut.

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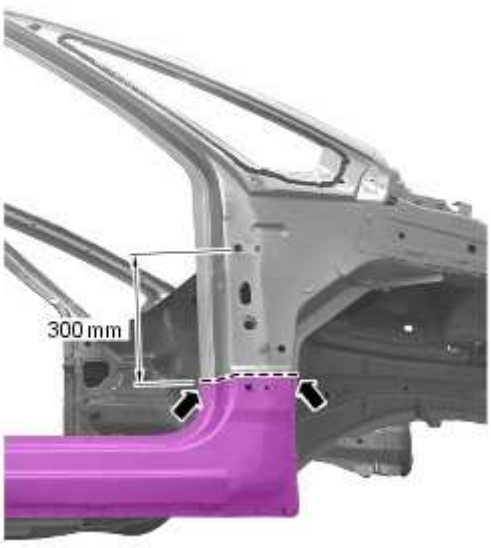
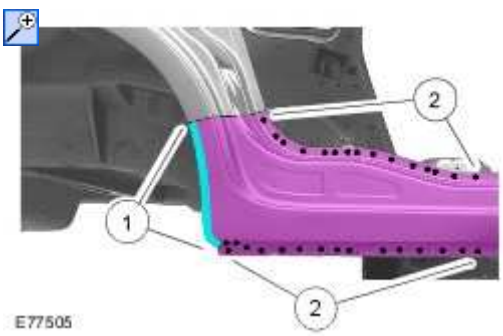
E77503

5. Rocker panel
   - Separating cut.



E77504



E77505

6. Rocker panel
   1. Heat the bonded area at the edge of the wheel arch (approx. 170° C).
   2. Mill out the spot welds.

7. Rocker panel
   1. Mill out the spot welds.
   2. Heat the area (approx. 170° C) and release the NVH element.

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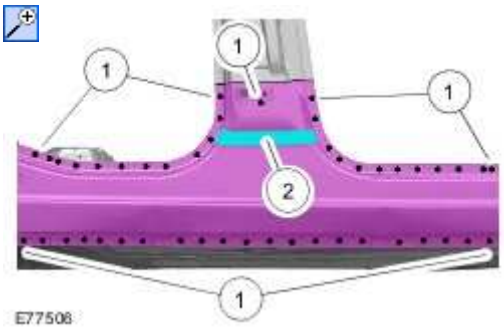
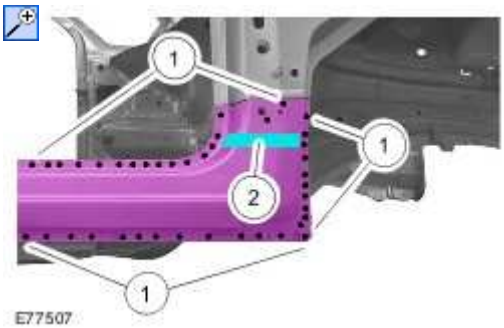


E77508



E77507

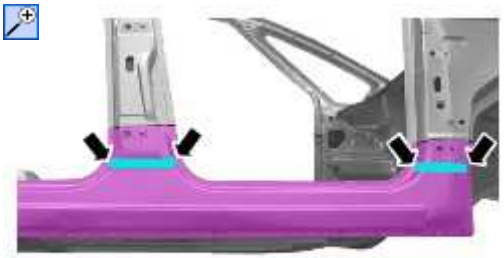
8. Rocker panel
    1. Mill out the spot welds.
    2. Heat the area (approx. 170° C) and release the NVH element.

Installation

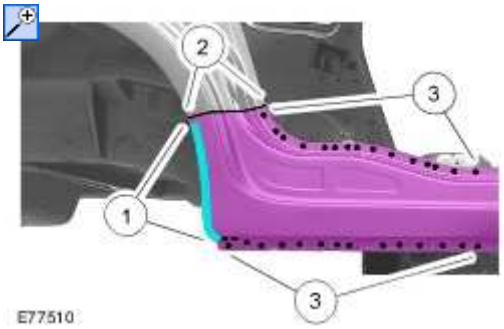
NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

E77508

1. Rocker panel
    - Drill holes for puddle welding.


E77509

2. Rocker panel
    - Apply PU glass adhesive to the NVH elements.



E77510

3. Rocker panel
    1. Apply PU glass adhesive to the edge of the wheel arch.
    2. Continuous MIG weld seam.
    3. Resistance spot weld.

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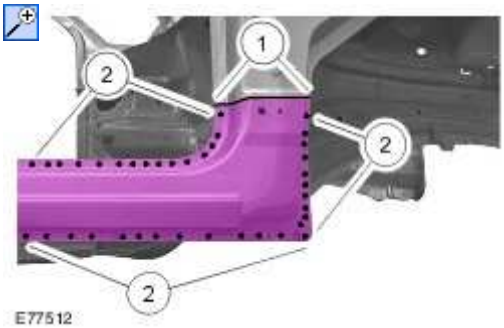
E77511

4. Rocker panel
    1. Continuous MIG weld seam.
    2. Resistance spot weld.



E77512

5. Rocker panel
    1. Continuous MIG weld seam.
    2. Resistance spot weld.

E77513

6. Rocker panel
    - Puddle weld.

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Removal and Installation

General Equipment

Measurement or alignment angle system

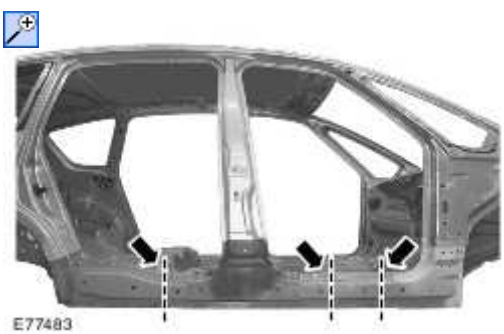
1. **Replacement Parts**
   - Rocker panel reinforcement

Removal

NOTE:

- In order to prevent body distortion while performing repairs, the body must be fixed on an alignment angle system.
- The location of the separating cut may be changed depending on the extent of the damage.
- The joints are butted up and joined using a continuous MIG weld seam.
- Depending on the level of damage, it is not always necessary to remove the A-pillar or B-pillar for partial replacements.
- The repair shown only describes a complete replacement in full.

1. General notes
   - The rocker panel, A-pillar outer panel with reinforcement and B-pillar with reinforcement need to be removed before commencing the repair.
   - Reposition the carpeting and the wiring harness away from the working area.
2. Rocker panel reinforcement
   - Overview of cutting options


E77483

E77484

3. Rocker panel reinforcement, front
   - Mill out the spot welds.
4. Rocker panel reinforcement, rear
   - Mill out the spot welds.

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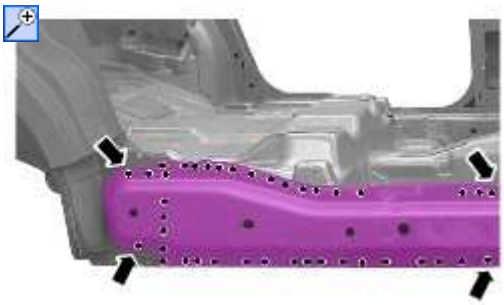


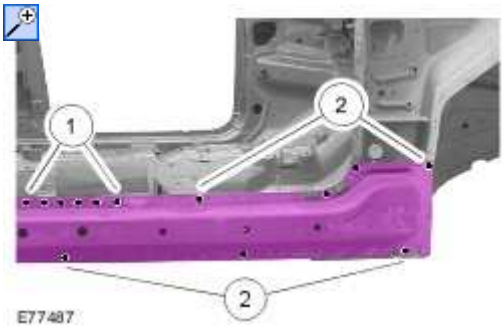
E77485

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

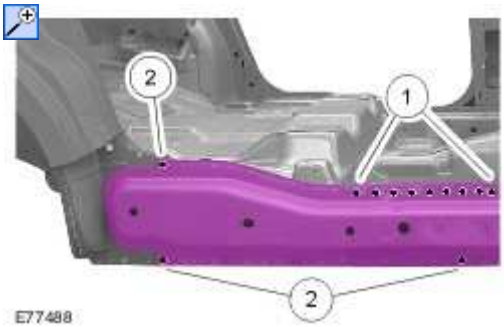
E77486

1. Rocker panel reinforcement, rear
   - Drill holes for puddle welding (10 mm diameter).



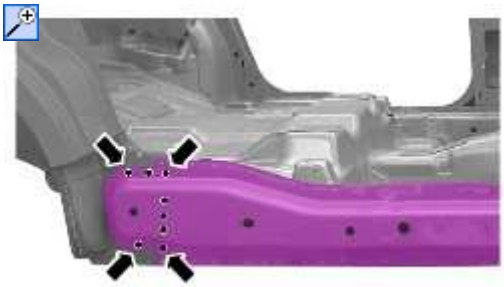
E77487

2. NOTE: Only tack-weld the rocker panel reinforcement at the top and bottom. The final welded joint is made with the rocker panel installed.
   Rocker panel reinforcement, front
   1. Resistance spot weld.
   2. Resistance spot welding (tack-weld).



E77488

3. NOTE: Only tack-weld the rocker panel reinforcement at the top and bottom. The final welded joint is made with the rocker panel installed.
   Rocker panel reinforcement, rear
   1. Resistance spot weld.
   2. Resistance spot welding (tack-weld).



E77489

4. Rocker panel reinforcement, rear
   - Puddle weld.

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Removal and Installation

General Equipment

Measurement or alignment angle system

1. **Replacement Parts**
   - B-pillar outer panel
   - B-pillar inner panel
   - B-Pillar reinforcement
   - NVH element

Removal

WARNING:

- A suitably powerful resistance spot welding device with inverter technology should be used for this repair. Observe the welding equipment instructions in sub-section 501-25.
- The welded joints at the front and rear door apertures must only be made by resistance spot welding. MIG puddle welding is not a permissible alternative.

1. General notes
   - Necessary removal work: Doors, B-pillar trim panel, rocker panel trim and driver or passenger seat.
   - Reposition the carpeting and the wiring harness away from the working area.

WARNING:

- The B-pillar reinforcement is made of high-strength steel plate (Usibor 1500).
- A partial replacement in the area of the B-pillar reinforcement is not permissible. The required continuous MIG weld seam in the area of the cut causes structural changes which result in significant loss of strength in the B-pillar reinforcement.
- Due to its strength, the B-pillar reinforcement cannot always be worked on with conventional body tools.
- Additional preparations are required for MIG puddle welding.

2. NOTE: Due to the inner reinforcements and NVH elements, the specified dimensions for the cuts to be made in the rocker panel area must be complied with.
   Outer B-pillar
   NOTE: Only cut through the outer panels of the B-pillar - do not damage the inner reinforcement of the rocker panel.
   1. Rocker panel cut locations
   2. B-Pillar cut location.

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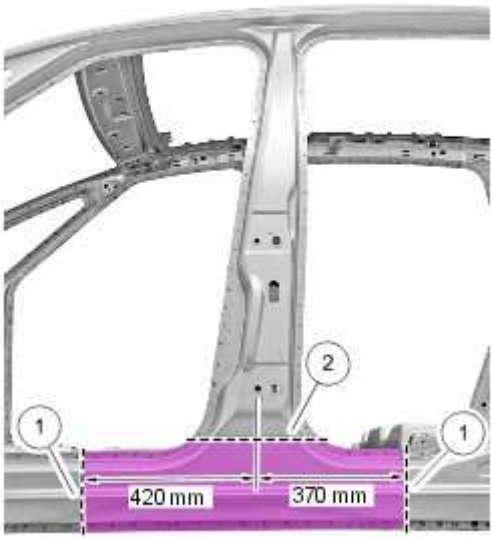
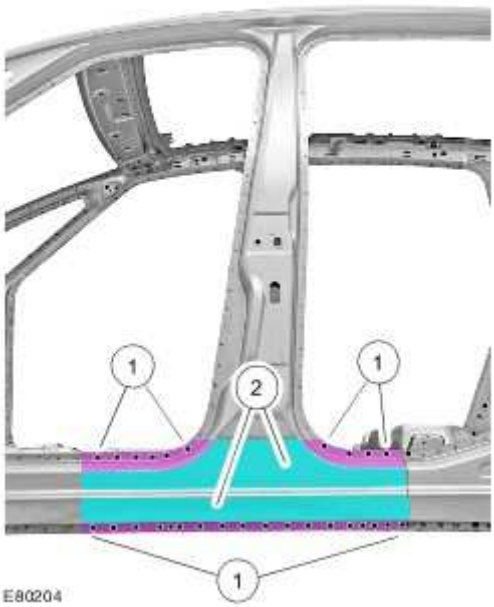
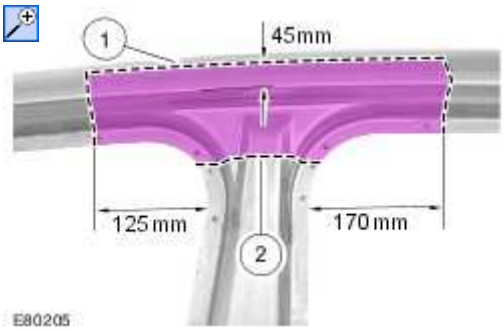


E80203

3. Outer B-pillar
    1. Mill out the spot welds.
    2. Heat the bonded areas at the bottom of the B-pillar (approx. 170° C).



E80204



E80205

4. NOTE: Only cut through the outer panels. When making the cut at the roof rail, do not damage the inner reinforcement of the A-pillar.
   Outer B-pillar
    1. Roof rail cut location
    2. B-Pillar cut location.

5. Outer B-pillar
    - Mill out the spot welds.

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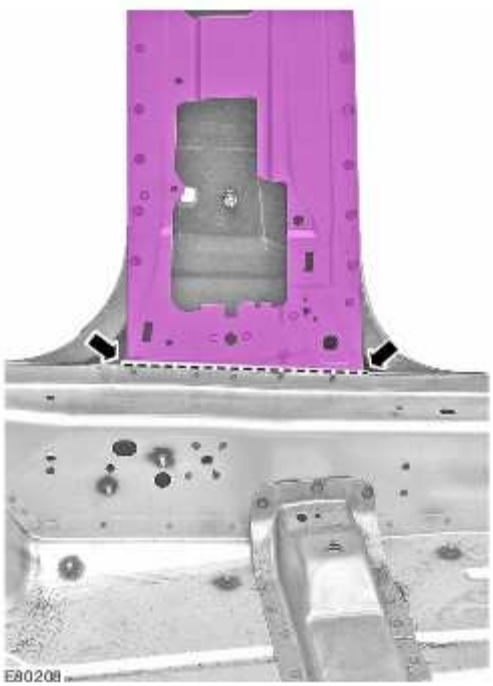
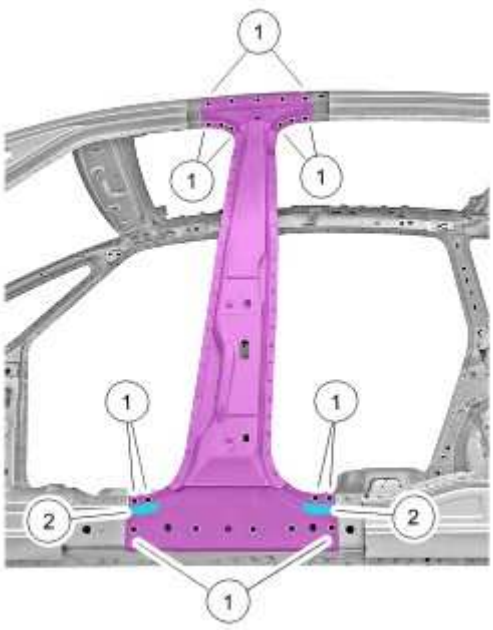


6. Inner B-pillar
   - Rough cut location.



7. B-Pillar reinforcement
   1. Grind out the spot welds.
   2. Heat the bonded areas at the bottom of the B-pillar (approx. 170° C).

8. Residual part on the inside of the B-pillar
   1. Mill out the spot welds (all panel thicknesses).
   2. Mill out the spot welds.

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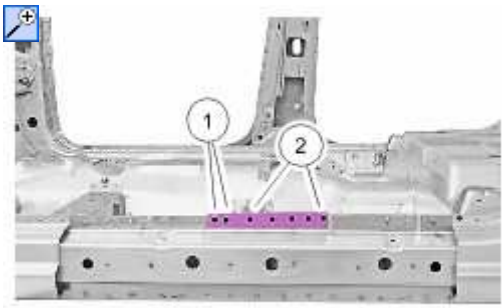

E80217

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

E80210

1. NOTE: To start with the holes need to be pre-milled with a spherical cutter with a small diameter. Afterwards these holes are then milled out to the required diameter with a spindle milling cutter. This method is essential in order to ensure that the material in the edge area of the milled holes is not weakened.
   B-Pillar reinforcement
   - Mill out the holes for puddle welding (10 mm diameter).

2. WARNING: The B-pillar reinforcement is covered with a hot-dip aluminized coating on its entire surface. This coating needs to be fully ground off on the MIG welding flanges on the front and rear using a fibre grinding disc. Any contamination due to parts of the coating in the welding bath will weaken the welded joint.
   B-Pillar reinforcement
   - Clean the contact areas.

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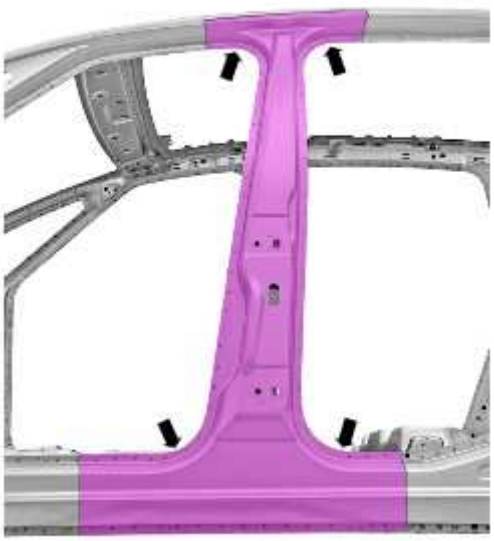
E80209

E80216



E80218

3. WARNING: The A-pillar reinforcement is covered with a hot-dip aluminized coating on its entire surface. This coating needs to be fully ground off on the MIG welding flanges on the front using a fibre grinding disc. Any contamination due to parts of the coating in the welding bath will weaken the welded joint.
   A-pillar reinforcement
   - Clean the contact area.
4. NOTE: Fit the B-pillar inner panel, B-pillar reinforcement and B-pillar outer panel in the vehicle and secure. Tack-weld the B-pillar inner panel and the the B-pillar reinforcement on the inside with MIG spot welds on the inside of the rocker panel and on the inner part of the roof frame. Take the B-pillar outer panel back off again.
   B-pillar
   - MIG welding from the inside (tack-welding)
5. B-Pillar reinforcement
   1. Apply PU glass adhesive to the rocker panel reinforcement.

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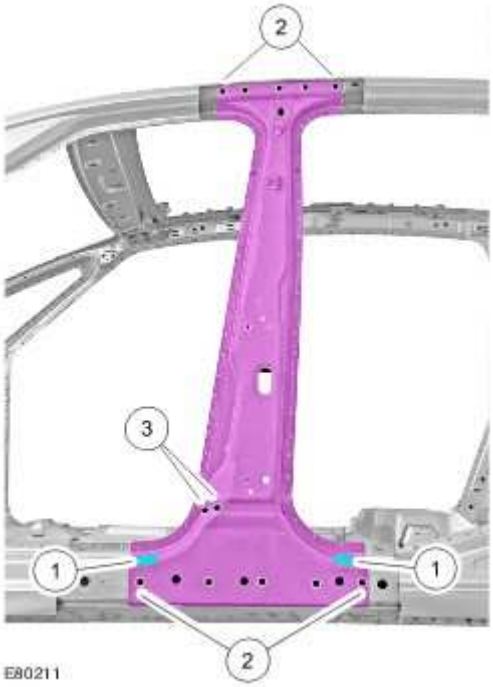
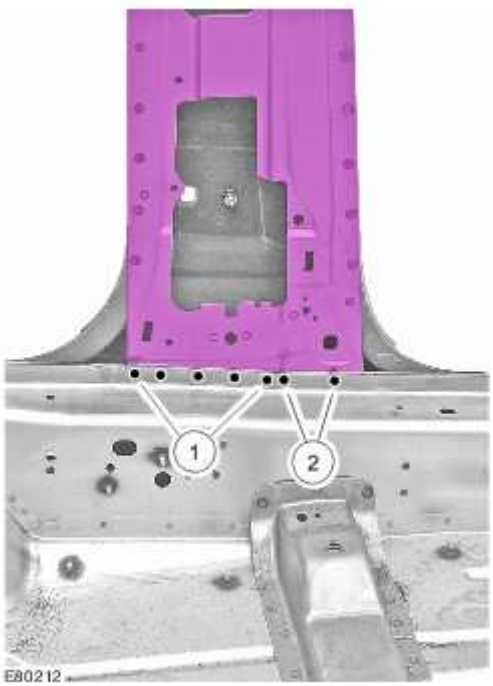


2. Puddle weld.
3. Resistance spot weld.



6. Inner B-pillar
    1. Resistance spot weld.
    2. Puddle weld.

7. Outer B-pillar
    1. Apply PU glass adhesive to the NVH element and insert the NVH element.
    2. Apply PU glass adhesive to the inside of the B-pillar outer panel.

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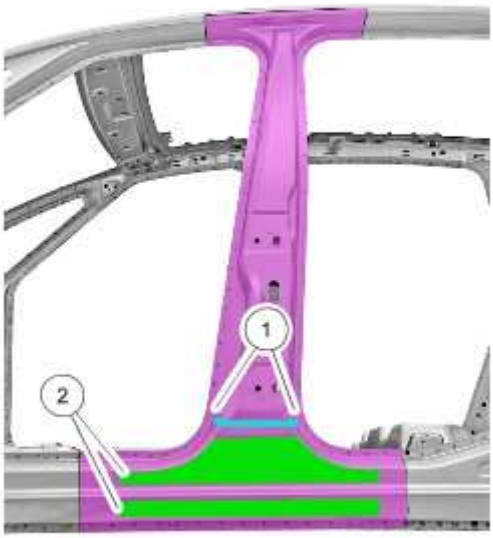
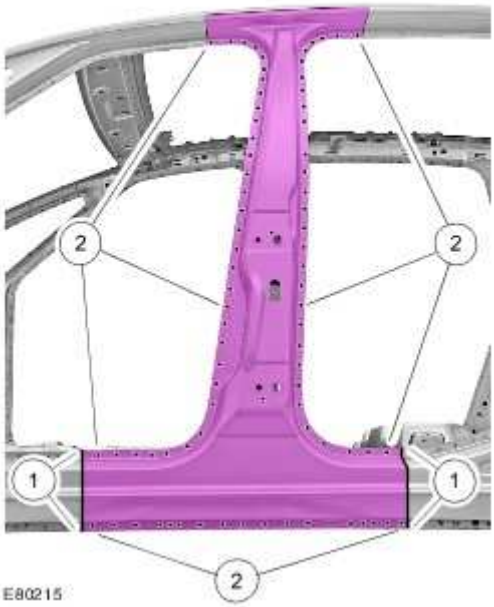


E80214

E80213

8. Outer B-pillar
    - Continuous MIG weld seam.



E80215

9. Outer B-pillar
    1. Continuous MIG weld seam.

       WARNING: The welded joints at the front and rear door apertures must only be made by resistance spot welding. MIG puddle welding is not a permissible alternative.
    2. Resistance spot weld.

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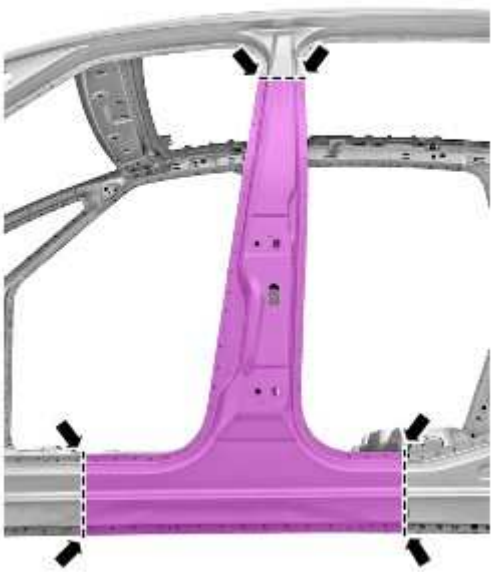
Removal and Installation

1. **Replacement Parts**
   - B-pillar outer panel

Removal

1. General:
   - Necessary removal work: Doors, B-pillar trim panel, rocker panel trim and driver or passenger seat.
   - Reposition the carpeting and the wiring harness away from the working area.
2. NOTE: The cut locations may vary depending upon the extent of the damage.
   B-pillar outer
   NOTE: Only cut through the outer part of the B-pillar, but do not damage the inner rocker panel reinforcement or B-pillar reinforcement..
   - Cut points.


E80149

3. B-pillar outer
   - Mill out the spot welds.

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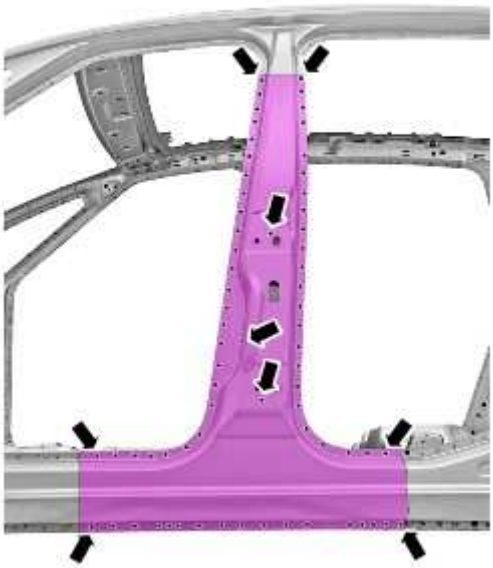
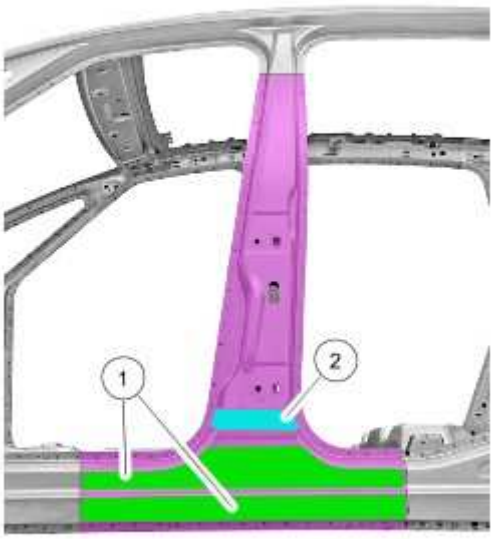


E80150

4. B-pillar outer
    1. Heat the bonded areas at the bottom of the B-pillar (approx. 170° C).
    2. Warm the area (to about 170° C) and release the NVH elements.



E80151

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. B-pillar outer
    1. Apply PU glass adhesive to the rocker panel reinforcement and to the B-pillar reinforcement.
    2. Apply PU glass adhesive to the NVH element.

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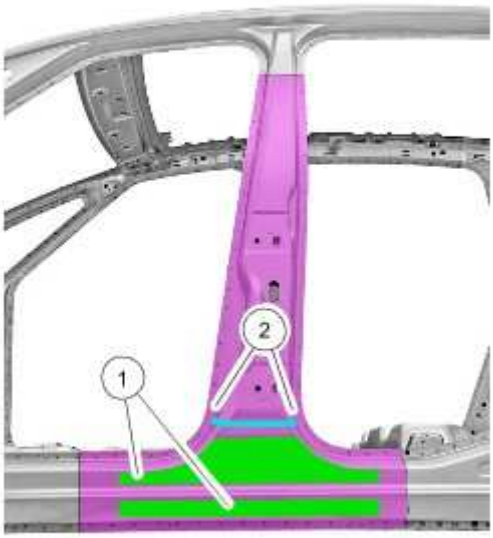
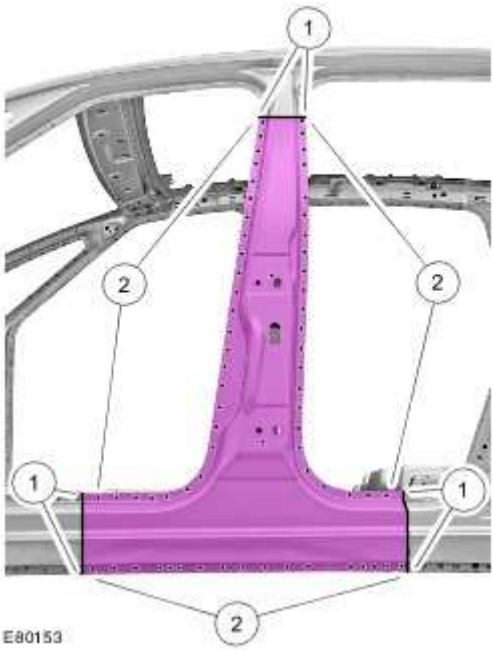


E80152

2. B-pillar outer
    1. Continuous MIG weld seam.
    2. Resistance spot weld.



E80153

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Lubricants, Sealers and Adhesives

	Part number	Specification
PU glass adhesive (150 ml)	1 102 109	WSK-M11 P57-A1

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Removal and Installation

1. **Replacement Parts**
   - Repair panel, rear quarter panel

Removal

1. General notes
   - Necessary removal work: wheelhouse trim panel, rear lamp, rear bumper, quarter panel trim.
   - Reposition the carpeting and the wiring harness away from the working area.
   - Depending on the extent of the damage, the forced air extraction gusset should also be replaced.
2. Quarter panel section
   - Separating cut.

E77445

3. Quarter panel section
   - Mill out the spot welds.

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4. Quarter panel section
    - Mill out the spot welds.

Installation

1. Quarter panel section
    - Punch holes for puddle welding.

2. Quarter panel section
    1. Continuous MIG weld seam.
    2. Puddle weld.

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3. Quarter panel section
    - Puddle weld.

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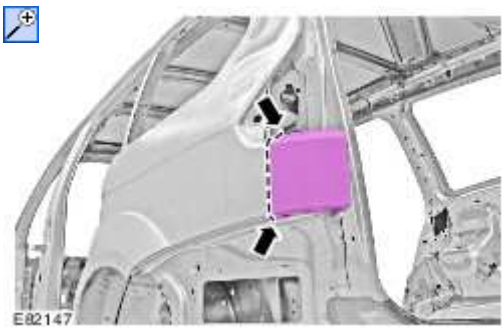
Removal and Installation

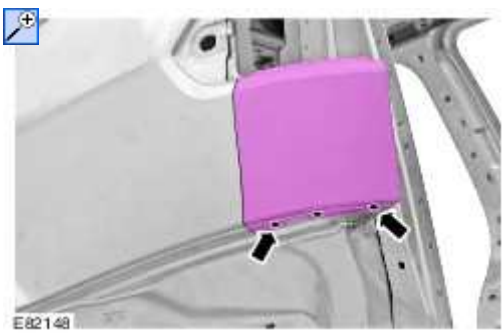
1. **Replacement Parts**
   - Repair panel, rear quarter panel

Removal

1. General notes
   - Necessary removal work: wheelhouse trim panel, rear lamp, rear bumper, quarter panel trim.
   - Reposition the carpeting and the wiring harness away from the working area.
   - Depending on the extent of the damage, the forced air extraction gusset should also be replaced.



2. Quarter panel section
   - Separating cut.



3. Quarter panel section
   - Mill out the spot welds.

4. Quarter panel section
   - Mill out the spot welds.

Installation

1. Quarter panel section
   - Punch holes for puddle welding.

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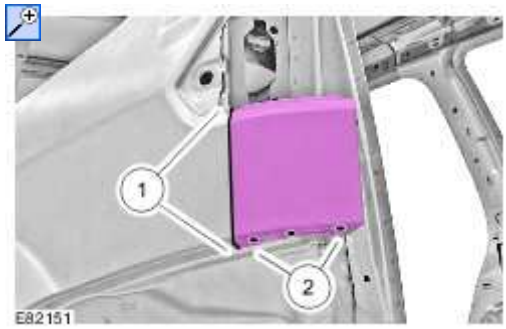
E82150



E82151

2. Quarter panel section
    1. Continuous MIG weld seam.
    2. Puddle weld.

E82149

3. Quarter panel section
    - Puddle weld.

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Removal and Installation

1. **Replacement Parts**
   - Quarter panel

Removal

1. General notes
   - Necessary removal work: Rear door, weatherstrip, side window, rear seat, wheelhouse trim panel, rear lamp, rear bumper, quarter panel trim.
   - Reposition the carpeting and the wiring harness away from the working area.
   - Depending on the extent of the damage, the forced air extraction gusset should also be replaced.
2. NOTE: If it is also necessary to install a new inner quarter panel with wheelhouse during the repairs, then the separating cuts need to be made as shown in the diagram (E79835).
   Separating cuts on the quarter panel
   1. Upper C-pillar separating cut.
   2. Rear rocker panel separating cut.

E79835

3. NOTE: The specified dimensions must be met when making the separating cuts.
   Quarter panel
   1. Cut points.
   2. Mill out the spot welds.

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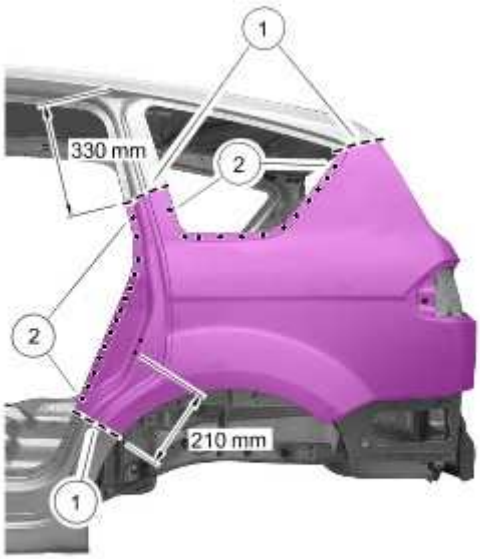


E77466

E77467

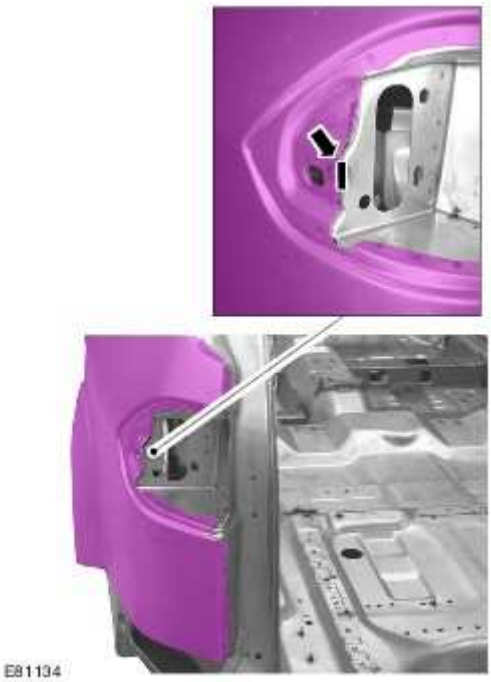
4. Quarter panel
   - Mill out the spot welds.

E77468

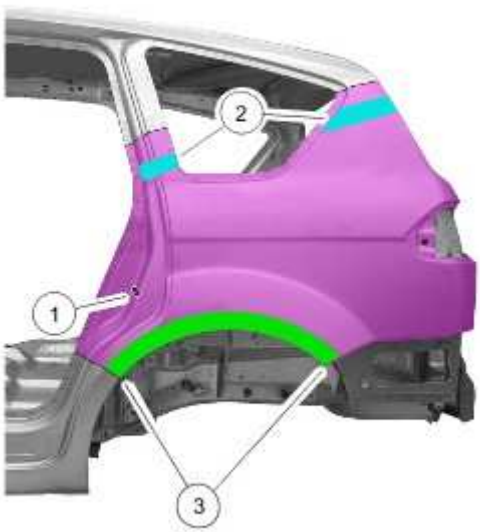
5. Quarter panel
   - Mill out the spot welds.

6. Quarter panel
   - Grind out the MIG brazed joint.

http://vnx.su


E81134

7. Quarter panel
    1. Mill out the spot welds.
    2. Heat the areas (approx. 170° C) and detach the NVH elements.
    3. Heat the bonded area at the edge of the wheel arch (approx. 170° C).



E77469

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. Quarter panel
    - Drill holes for puddle welding.

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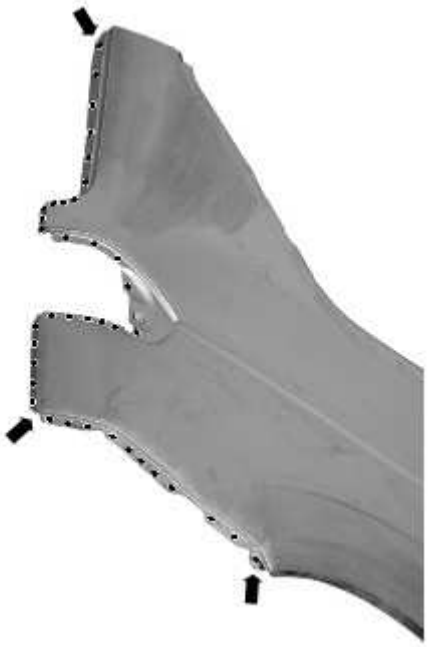
E77470

2. Quarter panel (inside view)
   - Punch holes for puddle welding.



E77471

3. NOTE: If the forced air extraction gusset is being replaced, it must be welded onto the quarter panel before installation of the quarter panel.
   Forced air extraction gusset
   - Resistance spot weld.

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E77472

E77473

4. Quarter panel
    1. Apply PU glass adhesive to the NVH element.
       NOTE:
        - The PU glass adhesive on the edge of the wheel arch must not be applied as far as the cutting point on the rocker panel. A distance of around 20 mm should be maintained here. The continuous MIG welding at the cut on the rocker panel would burn the adhesive.
        - As there is no adhesive in this area, it needs to be thoroughly sealed afterwards.
    2. Apply PU glass adhesive to the edge of the wheel arch and to the C-pillar reinforcement.
    3. Continuous MIG weld seam.

5. Quarter panel
    1. Resistance spot weld.
    2. Puddle weld.

http://vnx.su

E77474

E77467

6. Quarter panel
    - Puddle weld.

E77468

7. Quarter panel
    - Puddle weld.

8. NOTE:
    - The factory-installed MIG brazed joint must be replaced by MIG welds in a different position if a repair is performed.

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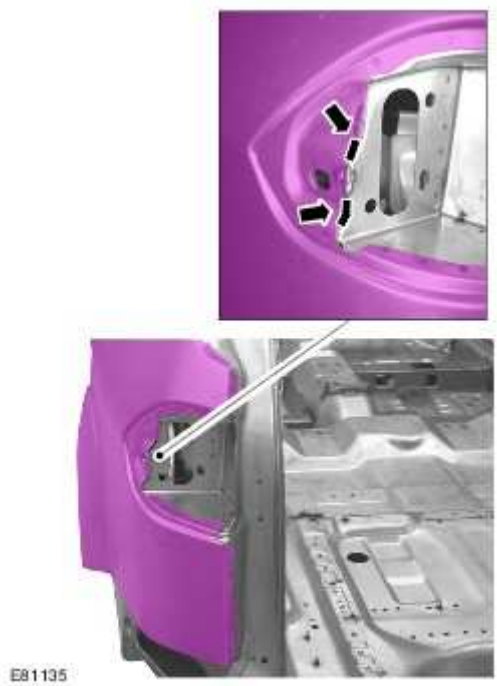

- These MIG welds must not be carried out on or in the immediate vicinity of an existing MIG brazed seam, as even the smallest amount of brazing solder can result in a reduction in the strength of the weld seam.

Quarter panel

- Intermittent MIG weld.

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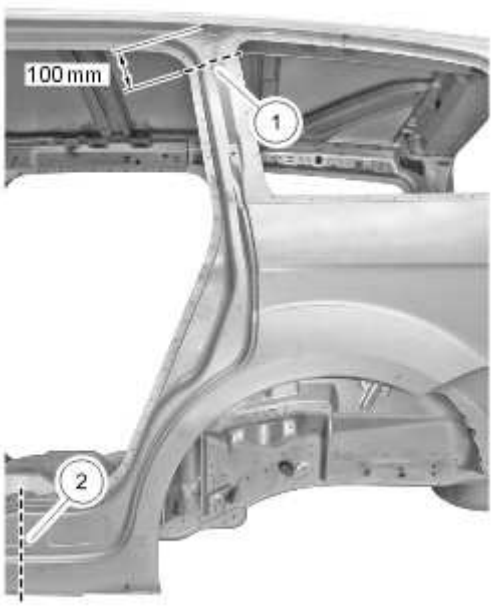
Removal and Installation

1. **Replacement Parts**
   - Quarter panel

Removal

1. General notes
   - Necessary removal work: Rear door, weatherstrip, side window, rear seat, wheelhouse trim panel, rear lamp, rear bumper, quarter panel trim.
   - Reposition the carpeting and the wiring harness away from the working area.
   - Depending on the extent of the damage, the forced air extraction gusset should also be replaced.
2. NOTE: If it is also necessary to install a new inner quarter panel with wheelhouse during the repairs, then the separating cuts need to be made as shown in the diagram (E82137).



E82137

Separating cuts on the quarter panel
1. Upper C-pillar separating cut.
2. Rear rocker panel separating cut.

3. NOTE: The specified dimensions must be met when making the separating cuts.

Quarter panel
- Cut points.

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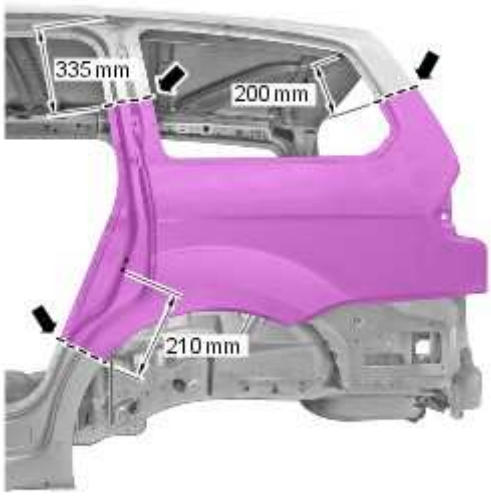
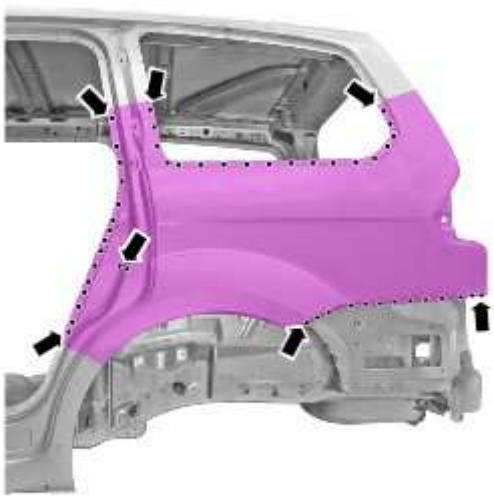


E82138

4. Quarter panel
    - Mill out the spot welds.



E82139

5. Quarter panel
    1. Mill out the spot welds.
    2. Grind out the MIG brazed joint.

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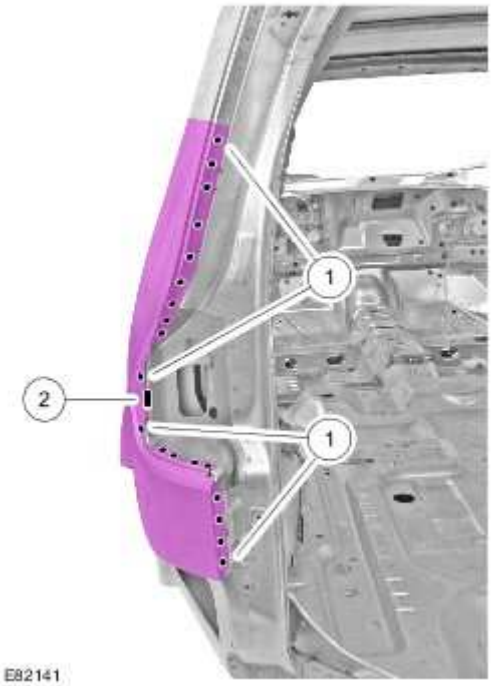
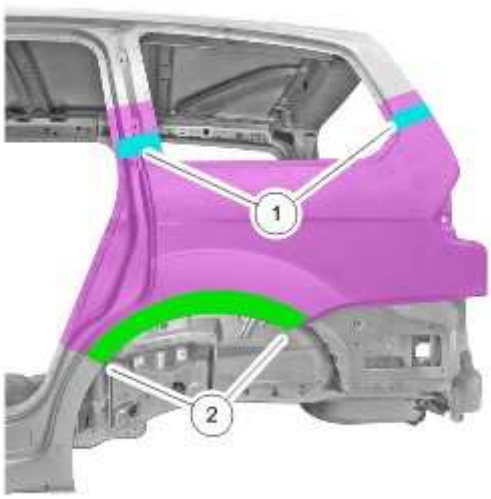


E82141

6. Quarter panel
    1. Heat the areas (approx. 170° C) and detach the NVH elements.
    2. Heat the bonded area at the edge of the wheel arch (approx. 170° C).



E82140

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. Quarter panel
    - Drill holes for puddle welding.

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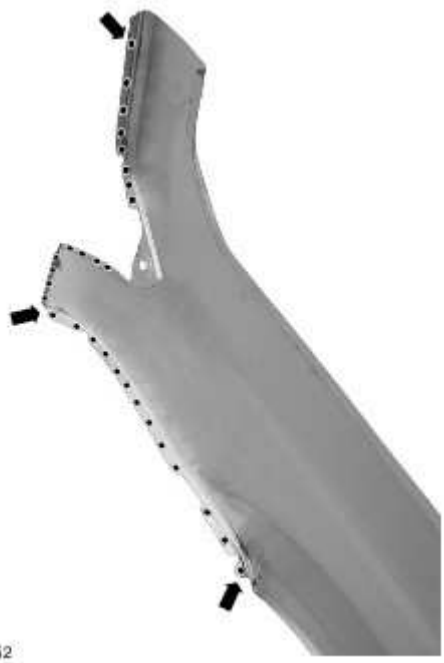
E82143

2. Quarter panel (inside view)
    - Punch holes for puddle welding.



E82152

3. NOTE: If the forced air extraction gusset is being replaced, it must be welded onto the quarter panel before installation of the quarter panel.
   Forced air extraction gusset
    - Resistance spot weld.

E82142

4. Quarter panel
    1. Apply PU glass adhesive to the NVH element.
       NOTE:

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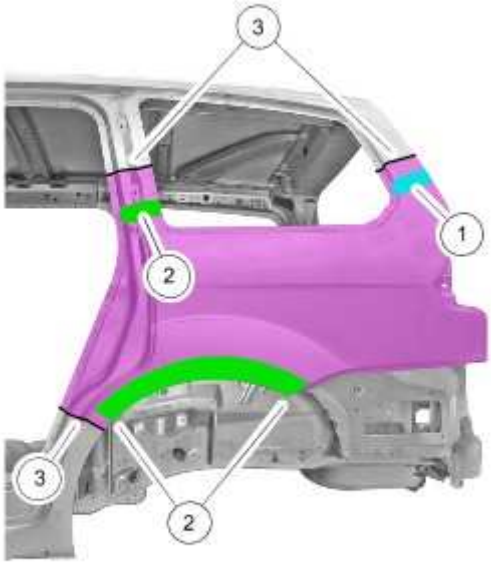
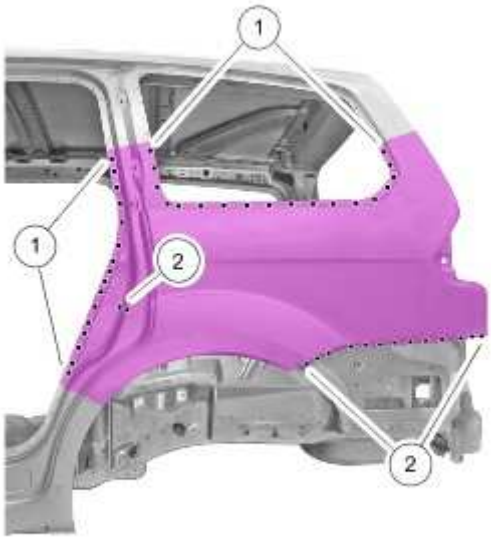
- The PU glass adhesive on the edge of the wheel arch must not be applied as far as the cutting point on the rocker panel. A distance of around 20 mm should be maintained here. The continuous MIG welding at the cut would burn the adhesive.
- As there is no adhesive in this area, it needs to be thoroughly sealed afterwards.

2. Apply PU glass adhesive to the edge of the wheel arch and to the C-pillar reinforcement.
3. Continuous MIG weld seam.



E82144

5. Quarter panel
   1. Resistance spot weld.
   2. Puddle weld.



E82145

6. NOTE:
   - The factory-installed MIG brazed joint must be replaced by MIG welds in a different position if a repair is performed.
   - These MIG welds must not be carried out on or in the immediate vicinity of an existing MIG brazed seam, as even the smallest amount of brazing solder can result in a reduction in the strength of the weld seam.

   Quarter panel
   1. Intermittent MIG weld.
   2. Puddle weld.

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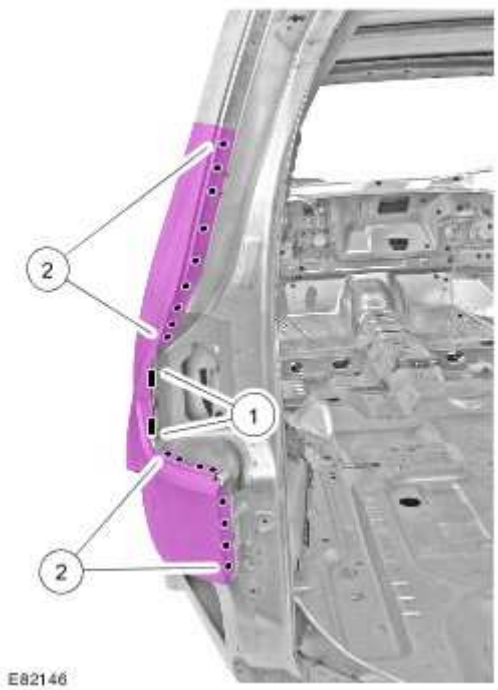

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Removal and Installation

General Equipment

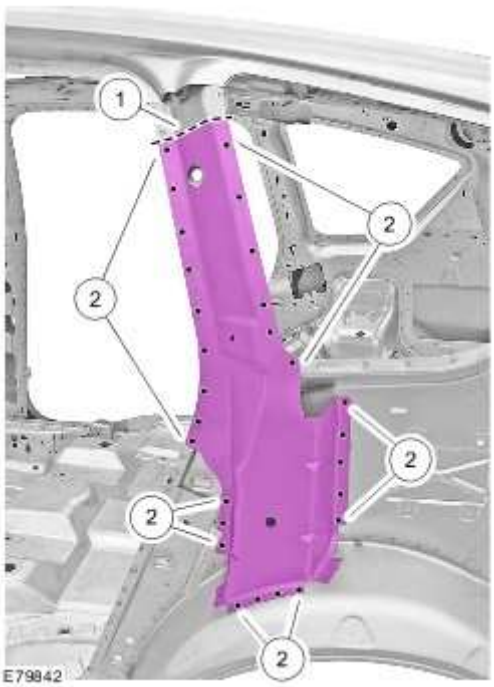
Measurement or alignment angle system

1. **Replacement Parts**
   - Inner quarter panel with wheelhouse
   - C-pillar reinforcement
   - Closing panel reinforcement
   - NVH elements

Removal

NOTE: NVH elements which are attached to the inner quarter panel with wheelhouse must always be replaced with new NVH elements.

1. General notes
   - Remove the following components before starting the repairs: quarter panel, rear panel with reinforcement, water drain panel and water drain panel reinforcement.
   - Reposition the carpeting and the wiring harness away from the working area.



2. C-pillar reinforcement
   1. Separating cut.
   2. Mill out the spot welds.

3. C-pillar reinforcement
   1. Grind out the spot welds.
   2. Heat the area (approx. 170° C) and release the NVH element.

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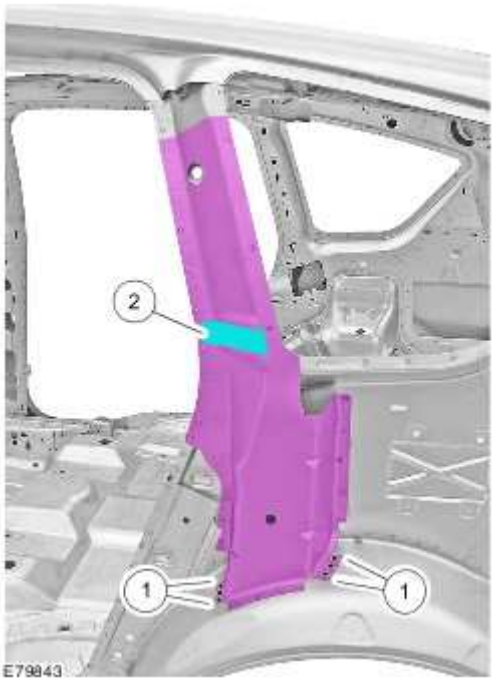
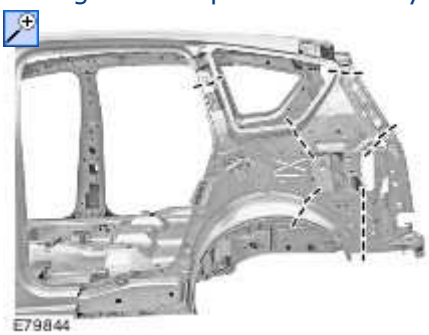
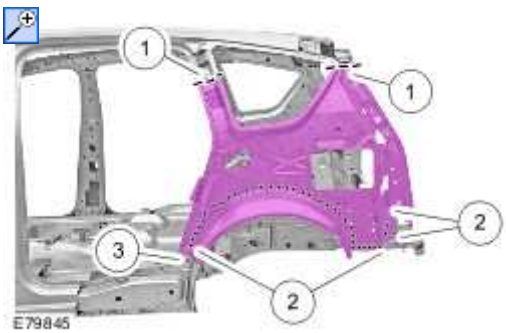


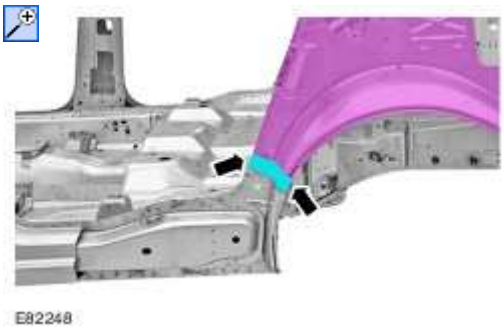
NOTE: The location of the separating cut may be changed depending on the extent of the damage. The repair shown only describes a complete replacement in full.



4. Inner quarter panel with wheelhouse
   - Overview of cutting options



5. Inner quarter panel with wheelhouse
   1. Cut points.
   2. Mill out the spot welds.
   3. Mill out the spot weld (two panel thicknesses).



6. Inner quarter panel with wheelhouse
   - Heat the area (approx. 170° C) and release the NVH element.

7. Inner quarter panel with wheelhouse (inside view)

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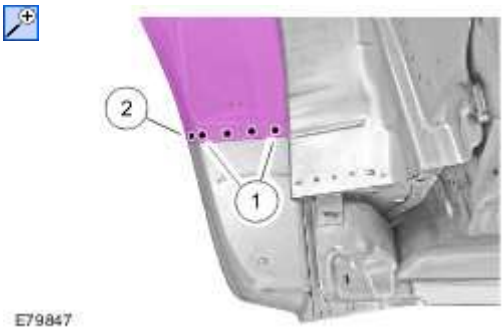
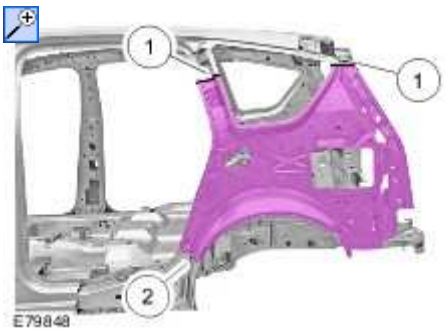
- Mill out the spot welds.



8. Wheelhouse (inside view)
    1. Mill out the spot welds.
    2. Grind out the spot welds.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
   Inner quarter panel with wheelhouse
    1. Continuous MIG weld seam.
    2. Drill out by one panel thickness and puddle weld.

2. Inner quarter panel with wheelhouse
    - Resistance spot weld.

3. Wheelhouse (inside view)
    - Resistance spot weld.

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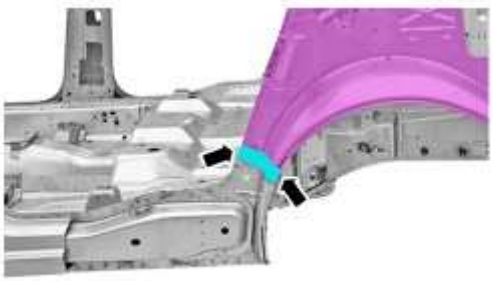
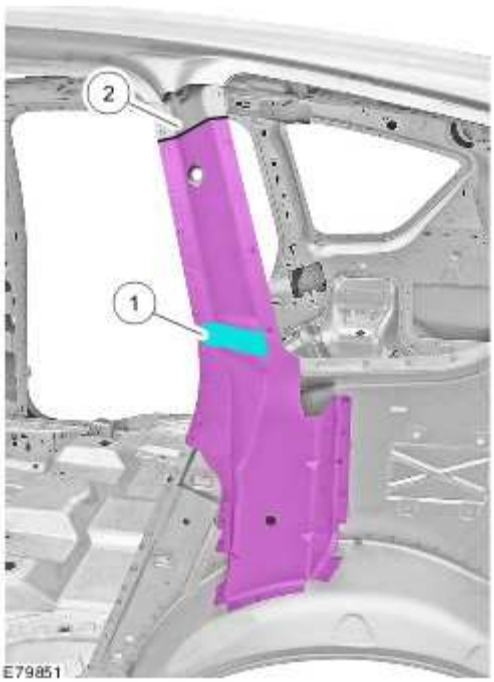


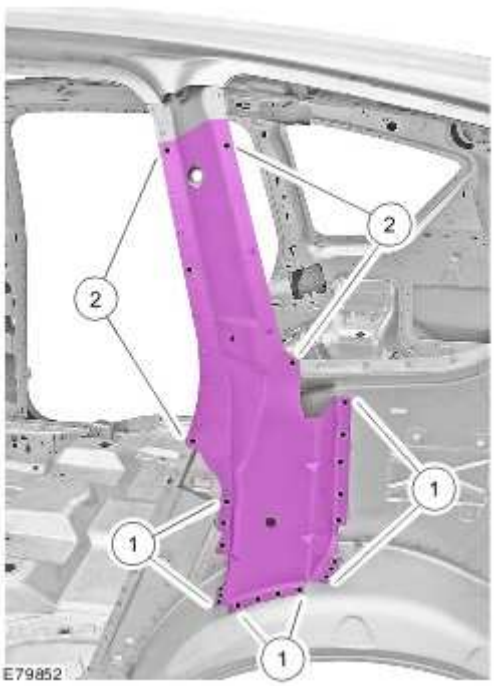
E82248

4. Inner quarter panel with wheelhouse
   - Apply PU glass adhesive to the NVH element and insert the NVH element.



E79851

5. C-pillar reinforcement
   1. Apply PU glass adhesive to the NVH element and insert the NVH element.
   2. Continuous MIG weld seam.



E79852

6. NOTE: Only tack-weld the C-pillar reinforcement at the door and side window cutout. The final welded joint is made when the quarter panel is installed.
   C-pillar reinforcement
   1. Resistance spot weld.
   2. Resistance spot welding (tack-weld).

7. NOTE: Fit the closing panel reinforcement - to do this, determine the correct installation position on the quarter panel.
   Closing panel reinforcement

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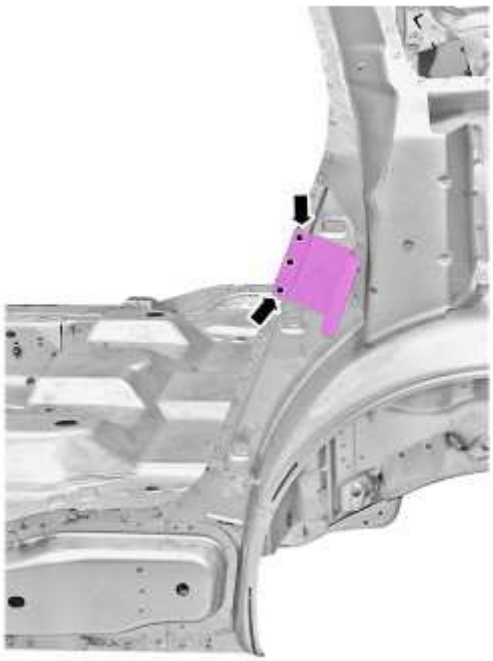

E79853

- Resistance spot weld.

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Removal and Installation

General Equipment

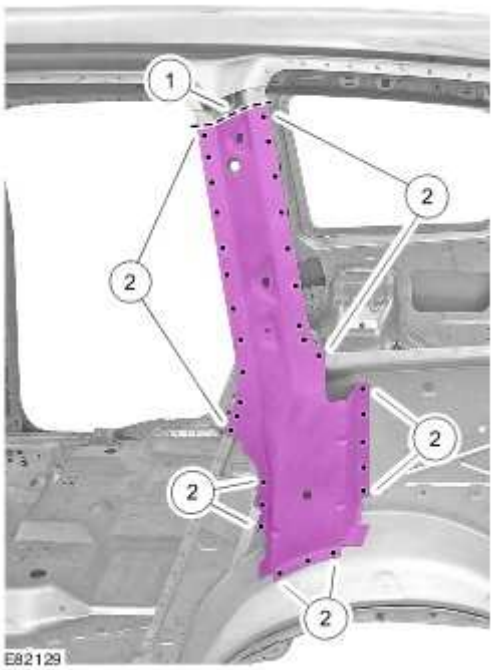
Measurement or alignment angle system

1. **Replacement Parts**
   - Inner quarter panel with wheelhouse
   - C-pillar reinforcement
   - Closing panel reinforcement
   - NVH elements

Removal

NOTE: NVH elements which are attached to the inner quarter panel with wheelhouse must always be replaced with new NVH elements.

1. General notes
   - Remove the following components before starting the repairs: quarter panel, rear panel with reinforcement, water drain panel and water drain panel reinforcement.
   - Reposition the carpeting and the wiring harness away from the working area.



2. C-pillar reinforcement
   1. Separating cut.
   2. Mill out the spot welds.

3. C-pillar reinforcement
   1. Grind out the spot welds.
   2. Heat the area (approx. 170° C) and release the NVH element.

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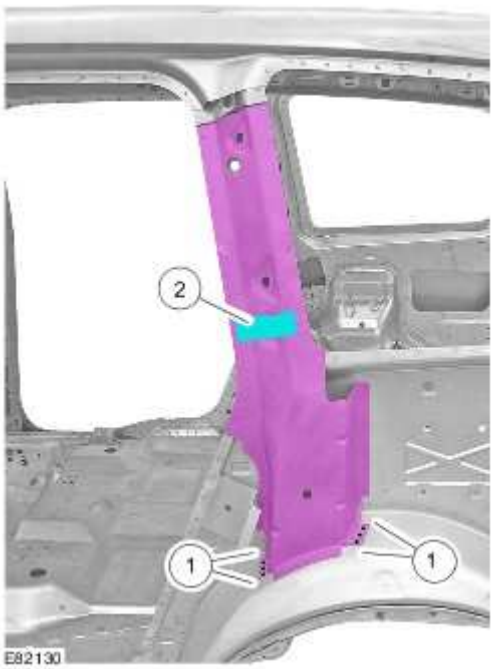
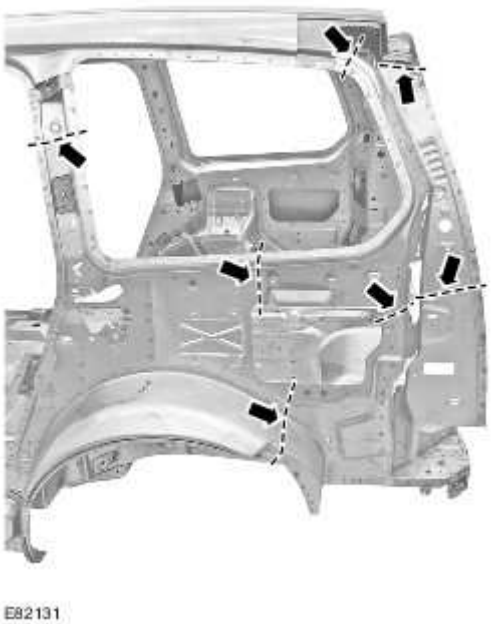


NOTE: The location of the separating cut may be changed depending on the extent of the damage. The repair shown only describes a complete replacement in full.

4. Inner quarter panel with wheelhouse
   - Overview of cutting options



5. Inner quarter panel with wheelhouse
   1. Cut points.
   2. Mill out the spot welds.
   3. Mill out the spot weld (two panel thicknesses).

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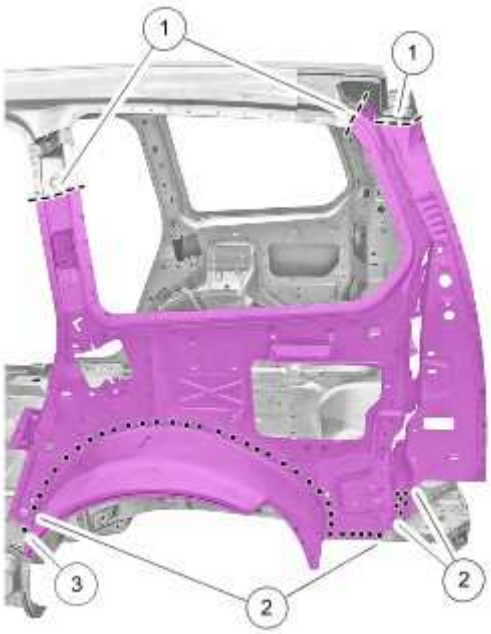
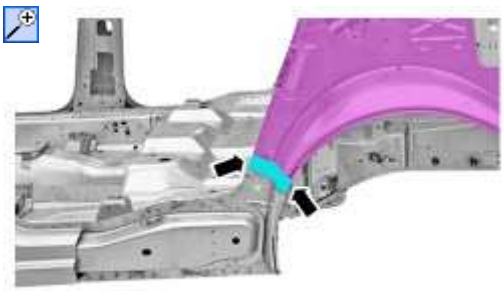


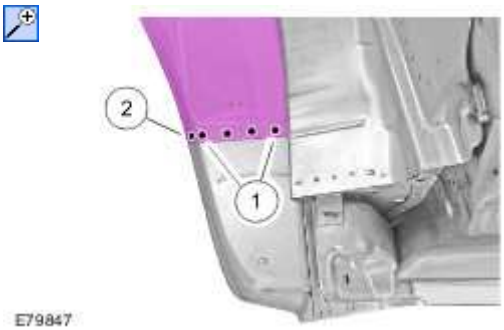
E82132


E82248

6. Inner quarter panel with wheelhouse
   - Heat the area (approx. 170° C) and release the NVH element.

E79846

7. Inner quarter panel with wheelhouse (inside view)
   - Mill out the spot welds.



E79847

8. Wheelhouse (inside view)
   1. Mill out the spot welds.
   2. Grind out the spot welds.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be

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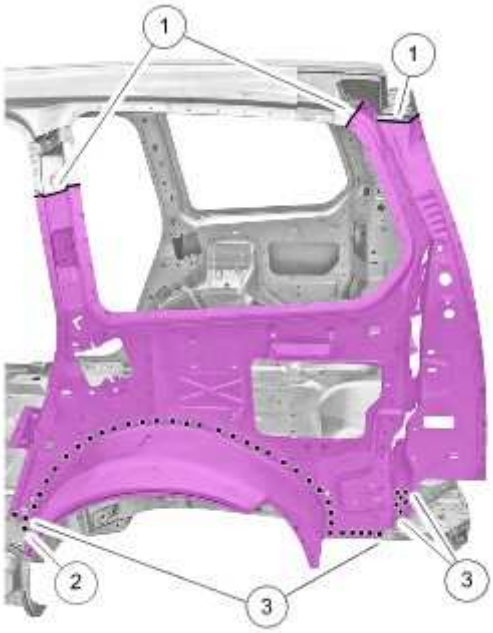
followed.

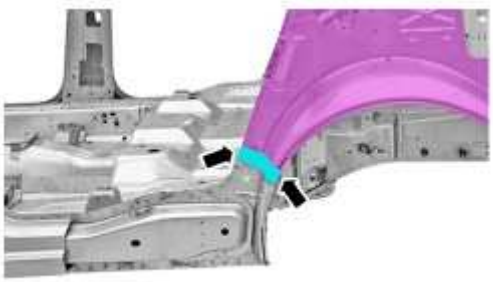


E82133

1. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
   Inner quarter panel with wheelhouse
   1. Continuous MIG weld seam.
   2. Drill out by one panel thickness and puddle weld.
   3. Resistance spot weld.

E79850

2. Wheelhouse (inside view)
   - Resistance spot weld.



E82248

3. Inner quarter panel with wheelhouse
   - Apply PU glass adhesive to the NVH element and insert the NVH element.

4. C-pillar reinforcement
   1. Apply PU glass adhesive to the NVH element and insert the NVH element.
   2. Continuous MIG weld seam.

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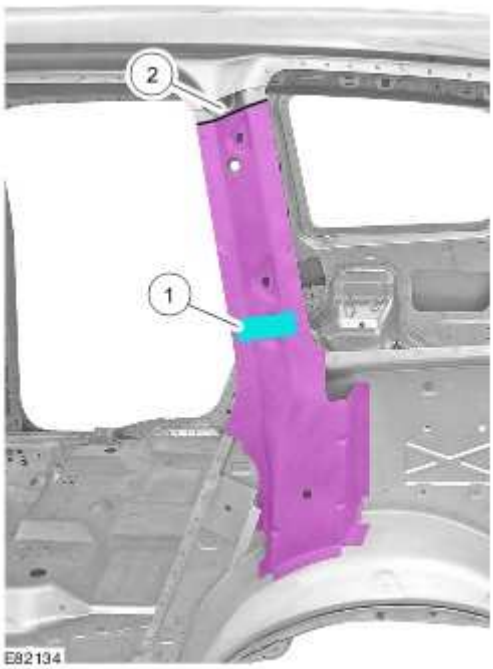

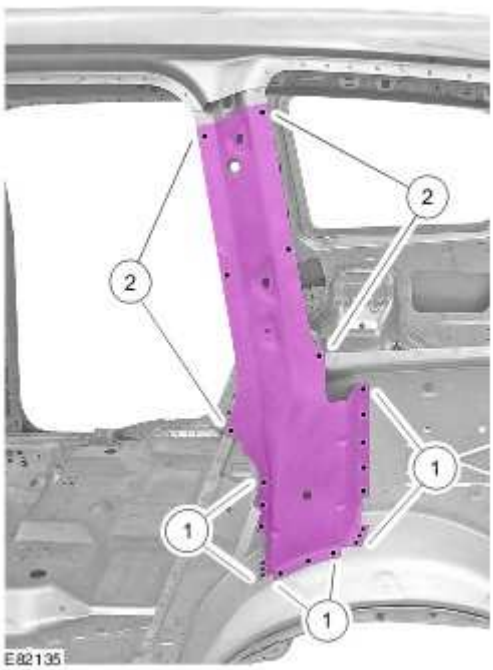

5. NOTE: Only tack-weld the C-pillar reinforcement at the door and side window cutout. The final welded joint is made when the quarter panel is installed.
   C-pillar reinforcement
   1. Resistance spot weld.
   2. Resistance spot welding (tack-weld).

6. NOTE: Fit the closing panel reinforcement - to do this, determine the correct installation position on the quarter panel.
   Closing panel reinforcement
   - Resistance spot weld.

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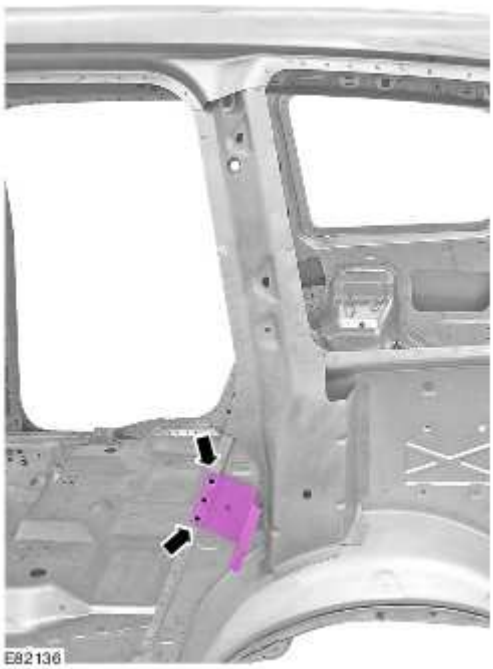

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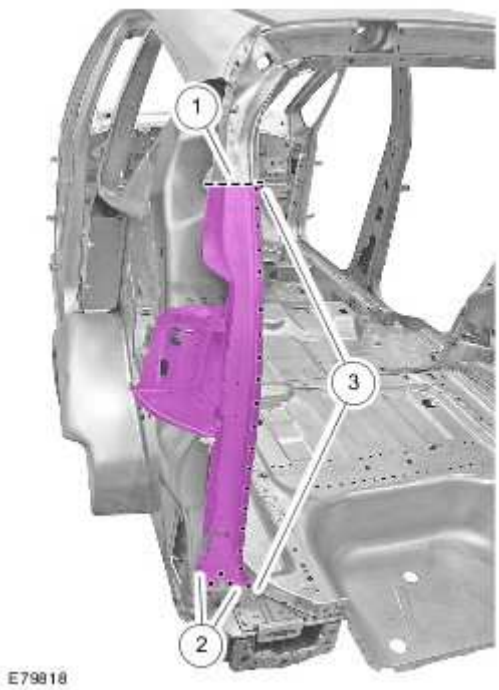
Removal and Installation

1. **Replacement parts**
   - Water drain panel
   - Rear lamp retaining plate

Removal

1. General Notes
   - The quarter panel and back panel with reinforcements need to be removed before the start of repairs.
   - Reposition the carpeting and the wiring harness away from the working area.



2. NOTE: The exact location of the cut can be varied according to the damage.
   Water drain panel
   1. Cut location.
   2. Mill out the spot welds.
   3. Grind out the spot welds.

Installation

1. Water drain panel
   1. Continuous MIG weld seam.
   2. Resistance spot weld.

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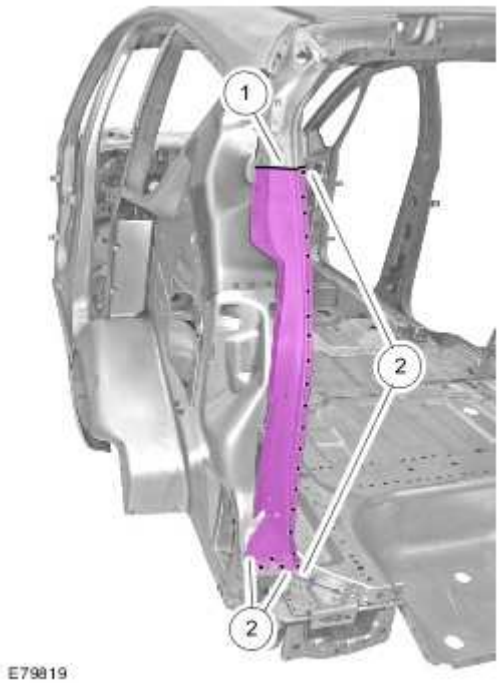

E79819

E79820

2. Rear lamp retaining plate
    - Resistance spot weld.

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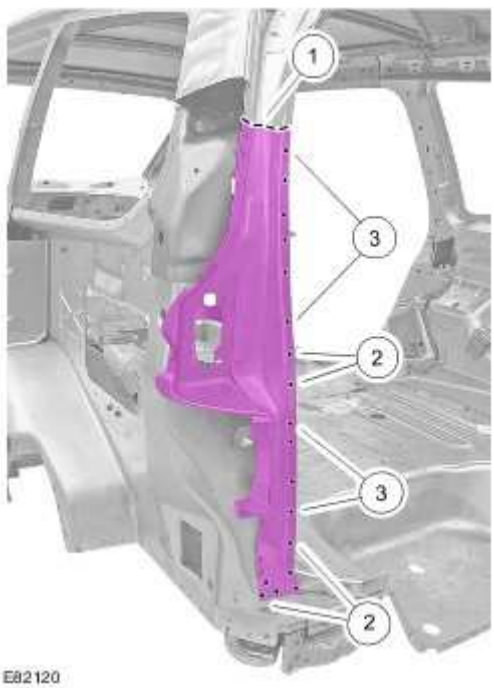
Removal and Installation

1. **Replacement parts**
   - Water drain panel
   - Rear lamp retaining plate

Removal

1. General Notes
   - The quarter panel and back panel with reinforcements need to be removed before the start of repairs.
   - Reposition the carpeting and the wiring harness away from the working area.



2. NOTE: The exact location of the cut can be varied according to the damage.
   Water drain panel
   1. Cut location.
   2. Mill out the spot welds.
   3. Grind out the spot welds.

Installation

1. Water drain panel
   - Punch holes for puddle welding.

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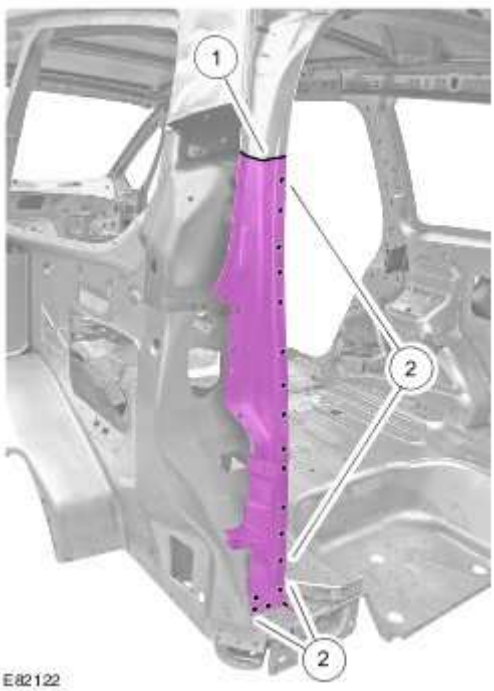
E82121



E82122

2. Water drain panel
    1. Continuous MIG weld seam.
    2. Resistance spot weld.

3. Rear lamp retaining plate
    1. Puddle welding.
    2. Resistance spot weld.

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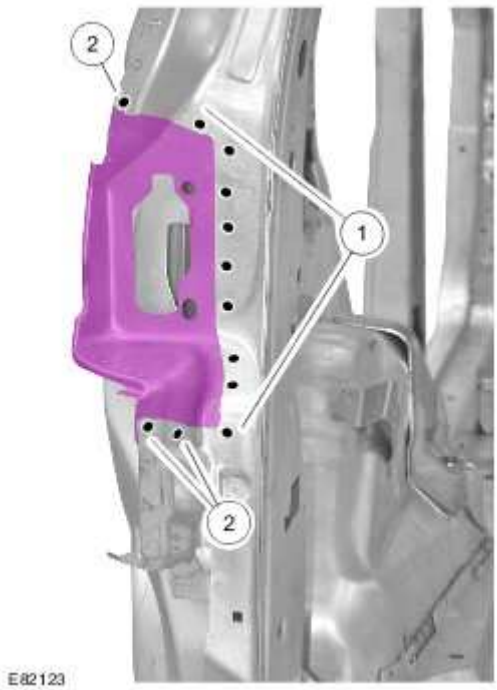

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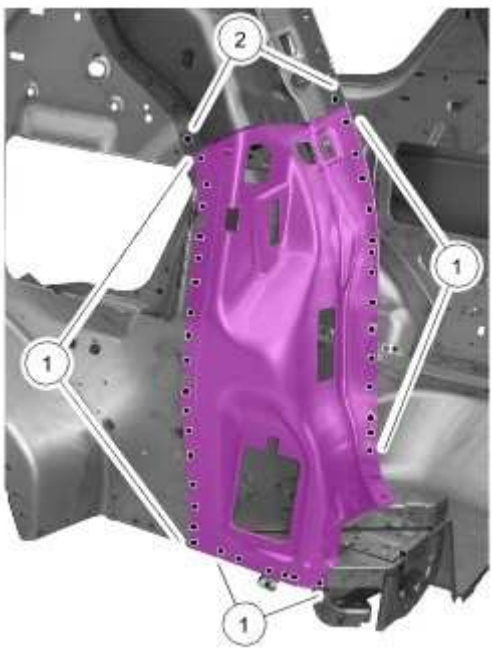
Removal and Installation

1. **Replacement parts**
   - Upper water drain panel reinforcement
   - Lower water drain panel reinforcement

Removal

1. General Notes
   - Remove the following components before starting the repairs: quarter panel, rear panel with reinforcement and luggage compartment water drain panel.
   - Reposition the carpeting and the wiring harness away from the working area.

NOTE: The revised cut locations in the upper area need to be taken into account when installing the water drain panel and the quarter panel.



E79941

2. Lower water drain panel reinforcement
   1. Mill out the spot welds.
   2. Mill out the spot welds (two panel thicknesses).

E79942

3. Lower water drain panel reinforcement (inside view)
   - Mill out the spot welds.

NOTE: The upper quarter panel only needs to be cut out if it is necessary to fully expose the upper water drain panel reinforcement.

4. NOTE: The cutting dimensions for the quarter panel cut must be accurately met in order to obtain access to the upper water

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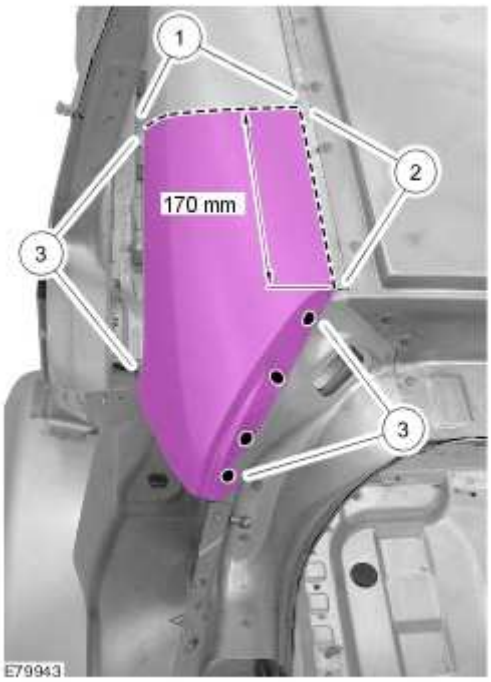
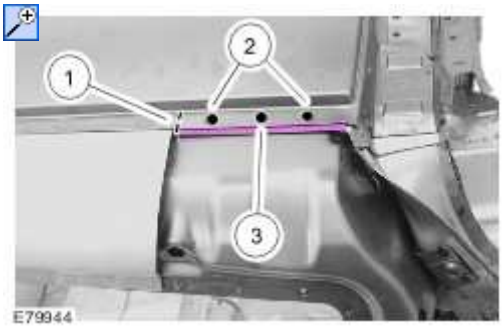


drain panel reinforcement.

Upper quarter panel

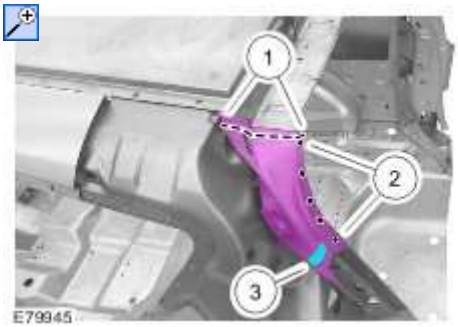
1. Cut location.
2. Rough cut location.
3. Mill out the spot welds.



5. NOTE:
   - When making the cut at position 1 it is also necessary to cut through the outer area of the roof.
   - The spot weld in position 3 is covered by the roof. In order to accurately locate it, you need to slightly lift up the roof sealing flange.

   Residual part of the upper quarter panel
   1. Cut location (through two panel thicknesses).
   2. Mill out the spot welds (two panel thicknesses).
   3. Mill out the spot weld (two panel thicknesses).

NOTE: The upper water drain panel only needs to be cut out if it is necessary to fully expose the upper water drain panel reinforcement.



6. Residual part of the upper water drain panel
   1. Cut location.
   2. Grind out the spot welds.
   3. Warm the area (to about 170° C) and release the NVH elements.

7. Upper water drain panel reinforcement
   1. Cut location.
   2. Mill out the spot welds.

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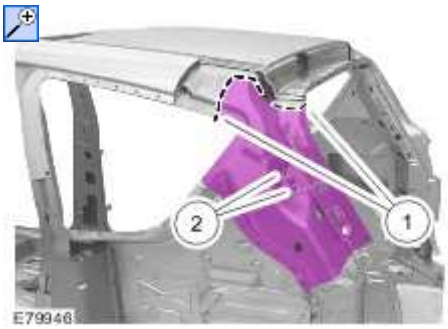
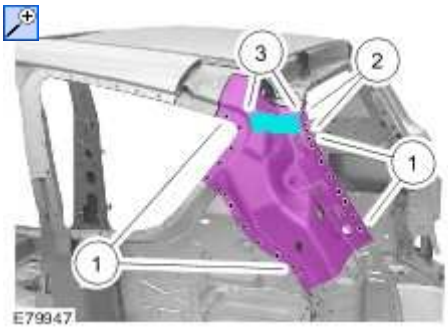
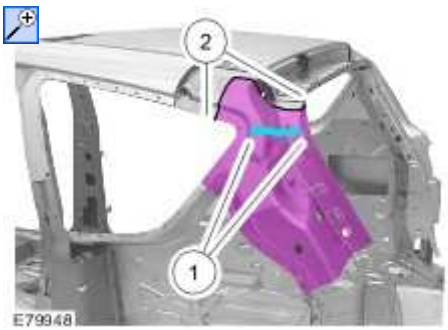




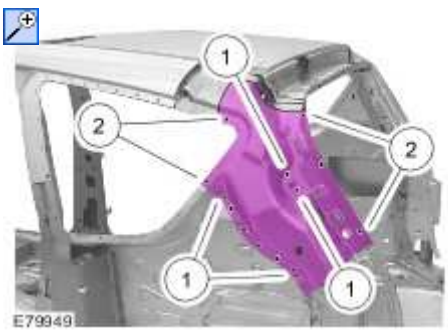
8. NOTE: Working from the passenger compartment, heat up the NVH element and detach it. The NVH element is also secured to the water drain panel reinforcement from the inside by means of plastic clips.
   Upper water drain panel reinforcement
   1. Mill out the spot welds.
   2. Grind out the spot welds.
   3. Heat the area (approx. 170° C) and detach the NVH element from the inner quarter panel.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: Working from the inside, insert the NVH element at the water drain panel reinforcement using PU window adhesive and secure it with the two plastic clips.
   Upper water drain panel reinforcement
   1. Apply PU glass adhesive to the NVH element.
   2. Continuous MIG weld seam.



2. NOTE: Only tack-weld the water drain panel reinforcement to the tailgate aperture and the side window aperture. The final welded joint is made when the quarter panel is installed.
   Upper water drain panel reinforcement
   1. Resistance spot weld.
   2. Resistance spot welding (tack-weld).

3. NOTE:
   - By drilling out the holes it is possible to weld all three layers of metal together.
   - Only tack-weld the water drain panel reinforcement at the tailgate aperture and at the inner quarter panel. The final welded joint is made when the water drain panel and the quarter panel are installed.

   Lower water drain panel reinforcement
   1. Drill out by one panel thickness and

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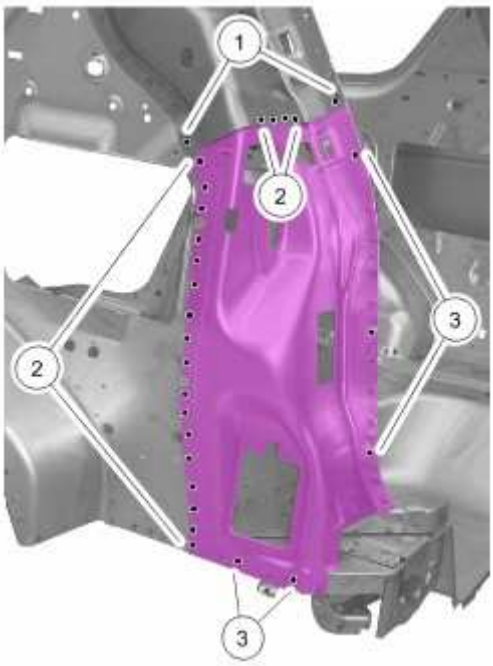
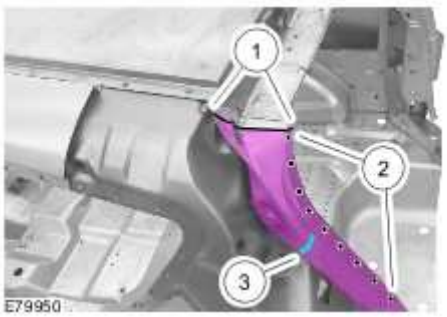


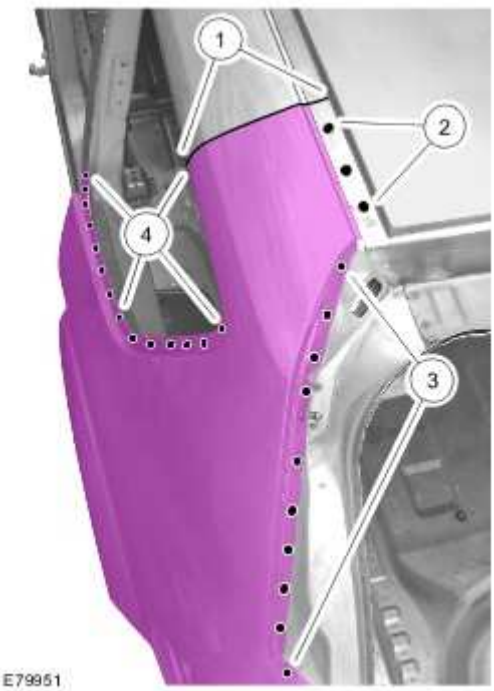
E79952

puddle weld.
2. Resistance spot weld.
3. Resistance spot welding (tack-weld).



E79950

4. Water drain panel, upper
    1. Continuous MIG weld seam.
    2. Resistance spot weld.
    3. Apply PU glass adhesive to the NVH element and insert the NVH element from the inside into the water drain panel.



E79951

5. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
Upper quarter panel
    1. Continuous MIG weld seam.
    2. Drill out by one panel thickness and puddle weld.
    3. Puddle welding.
    4. Resistance spot weld.

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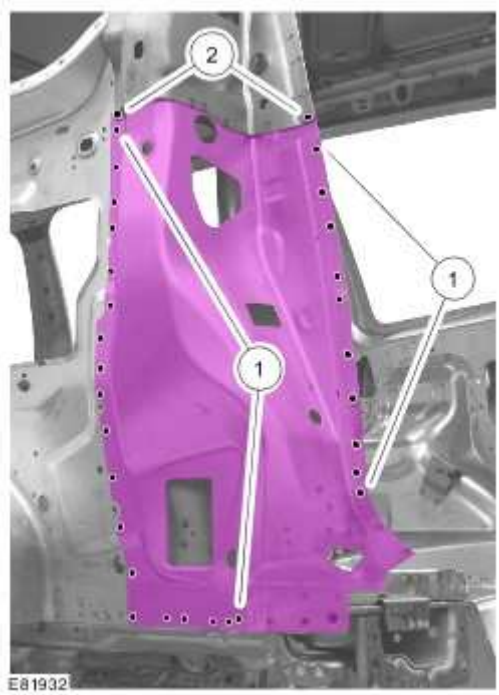
Removal and Installation

1. **Replacement parts**
   - Upper water drain panel reinforcement
   - Lower water drain panel reinforcement

Removal

1. General Notes
   - Remove the following components before starting the repairs: quarter panel, rear panel with reinforcement and luggage compartment water drain panel.
   - Reposition the carpeting and the wiring harness away from the working area.

NOTE: The revised cut locations in the upper area need to be taken into account when installing the water drain panel and the quarter panel.



2. Lower water drain panel reinforcement
   1. Mill out the spot welds.
   2. Mill out the spot welds (two panel thicknesses).

3. Lower water drain panel reinforcement (inside view)
   1. Mill out the spot weld.
   2. Grind out the spot welds.

NOTE: The upper quarter panel only needs to be cut out if it is necessary to fully expose the upper water drain panel reinforcement.

4. NOTE: The cutting dimensions for the quarter panel cut must be accurately met in order to obtain access to the upper water

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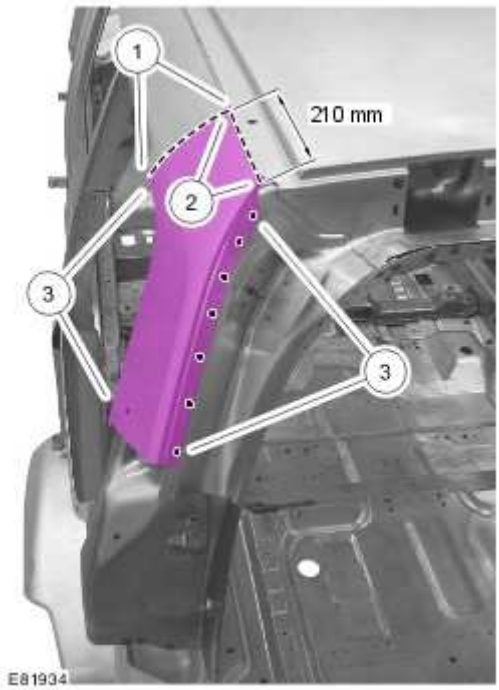
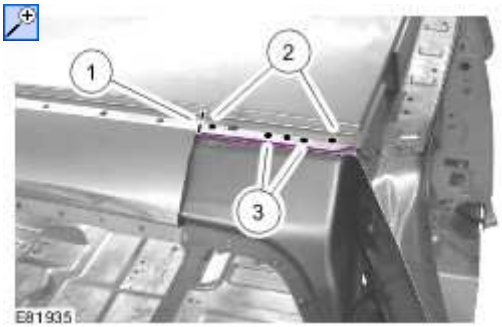


drain panel reinforcement.

Upper quarter panel

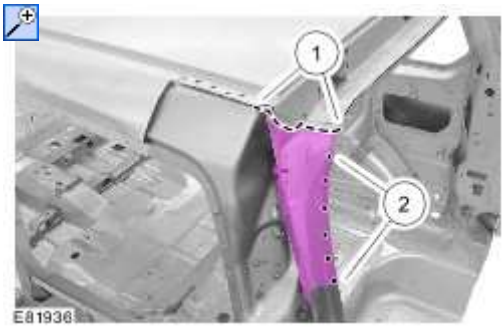
1. Cut location.
2. Rough cut location.
3. Mill out the spot welds.



5. NOTE:
   - When making the cut at position 1 it is also necessary to cut through the outer area of the roof.
   - The spot welds at position 3 are covered by the roof. In order to accurately locate it, you need to slightly lift up the roof sealing flange.

   Residual part of the upper quarter panel
   1. Cut location (through two panel thicknesses).
   2. Mill out the spot welds (two panel thicknesses).
   3. Mill out the spot welds (two panel thicknesses).

NOTE: The upper water drain panel only needs to be cut out if it is necessary to fully expose the reinforcement of the upper water drain panel.



6. Residual part of the upper water drain panel
   1. Cut location.
   2. Grind out the spot welds.

7. Upper water drain panel reinforcement
   - Cut location.

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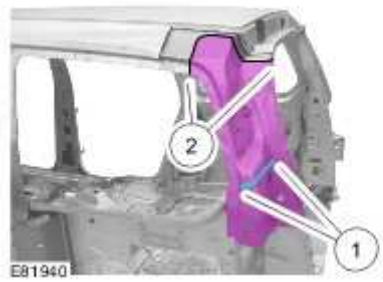
8. Upper water drain panel reinforcement
   - Mill out the spot welds.

9. NOTE: Working from the passenger compartment, heat up the NVH element and detach it. The NVH element is also secured to the water drain panel reinforcement from the inside by means of plastic clips.
   Upper water drain panel reinforcement
   - Heat the area (approx. 170° C) and detach the NVH element from the inner quarter panel.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: Working from the inside, insert the NVH element at the water drain panel reinforcement using PU window adhesive and secure it with the two plastic clips.
   Upper water drain panel reinforcement
   1. Apply PU glass adhesive to the NVH element.
   2. Continuous MIG weld seam.

2. Upper water drain panel reinforcement
   - Resistance spot weld.

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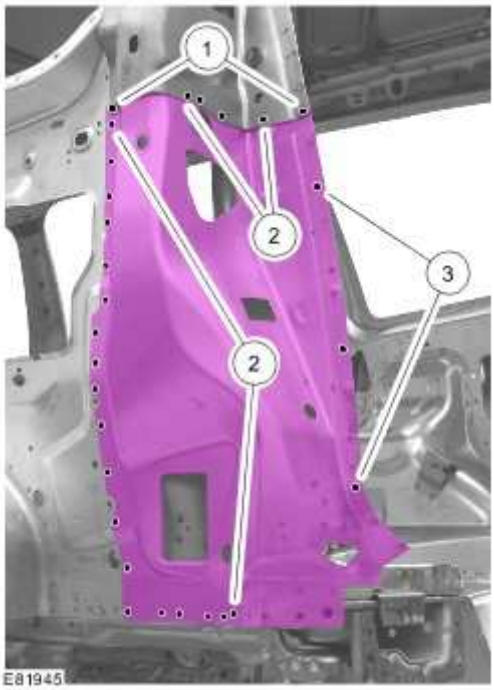
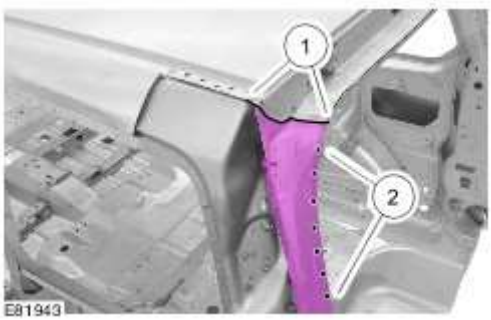
3. NOTE: Only tack-weld the water drain panel reinforcement to the tailgate aperture and the side window aperture. The final welded joint is made when the quarter panel is installed.
   Upper water drain panel reinforcement
   - Resistance spot welding (tack-weld).



4. NOTE:
   - By drilling out the holes it is possible to weld all three layers of metal together.
   - Only tack-weld the reinforcement of the water drain panel to the tailgate aperture. The final welded joint is made when the water drain panel and the quarter panel are installed.

   Lower water drain panel reinforcement
   1. Drill out by one panel thickness and puddle weld.
   2. Resistance spot weld.
   3. Resistance spot welding (tack-weld).



5. Water drain panel, upper
   1. Continuous MIG weld seam.
   2. Resistance spot weld.

6. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
   Upper quarter panel
   1. Continuous MIG weld seam.
   2. Drill out by one panel thickness and puddle weld.
   3. Puddle welding.
   4. Resistance spot weld.

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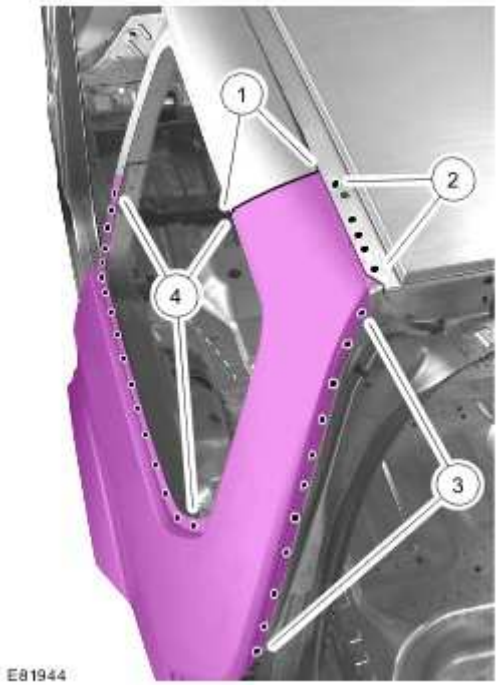

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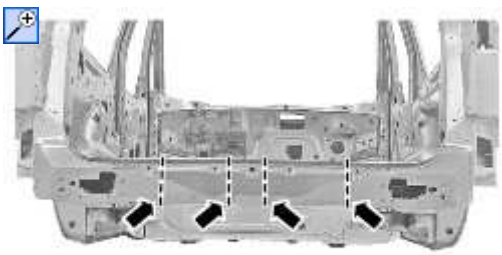
Print

Removal and Installation

1. **Replacement parts**
   - Back Panel
   - Back panel reinforcement

Removal

1. General Notes
   - Necessary removal work: Tailgate, rear bumper, back panel inner trims and quarter panel trims.
   - Reposition the carpeting and the wiring harness away from the working area.

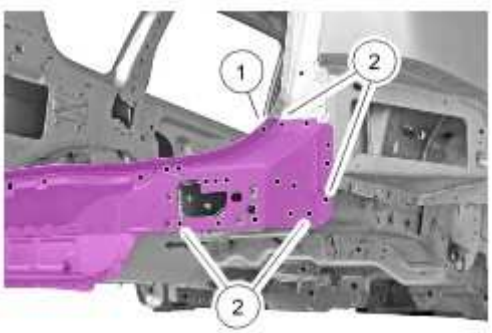


E80105

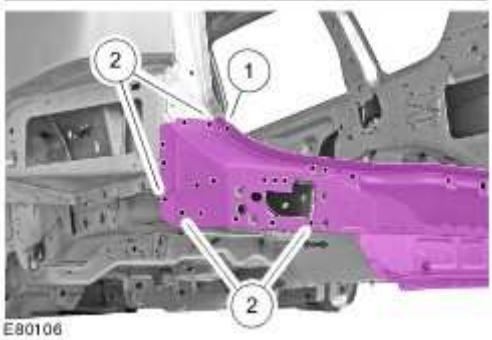
2. NOTE:
   - The cut location on the back panel reinforcement may varied depending upon the extent of the damage.
   - The repair shown only describes a complete replacement in full.
   - The back panel must always be replaced as a complete unit.

Back panel reinforcement

- Overview of cutting options



3. Back panel with reinforcement
   1. Mill out the spot welds from below.
   2. Mill out the spot welds.



E80106

4. Back panel with reinforcement
   1. Mill out the spot welds.
   2. Mill out the spot welds (two panel thicknesses).

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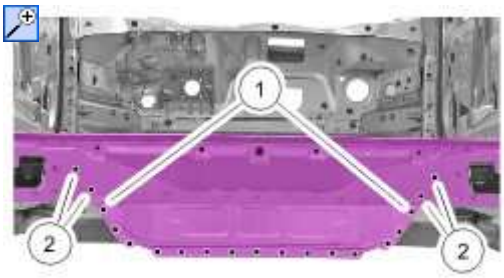


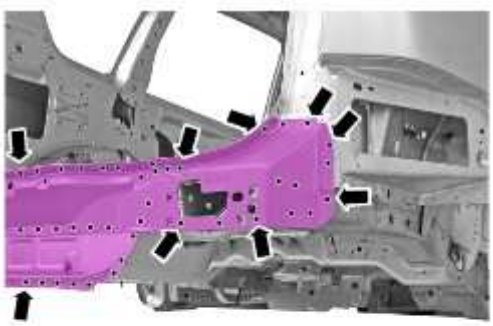
E80107

Installation

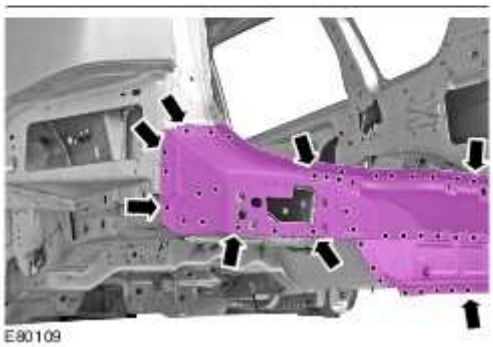
NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. Back panel reinforcement
   - Drill holes for puddle welding.

E80108



2. NOTE: First install the back panel and then the back panel reinforcement. The two body parts are welded in together.
   Back panel with reinforcement
   - Resistance spot weld.



E80109

3. Back panel with reinforcement
   - Puddle welding.

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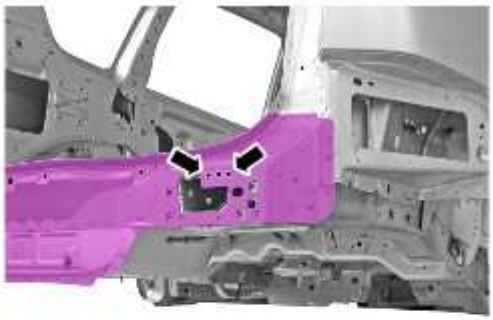

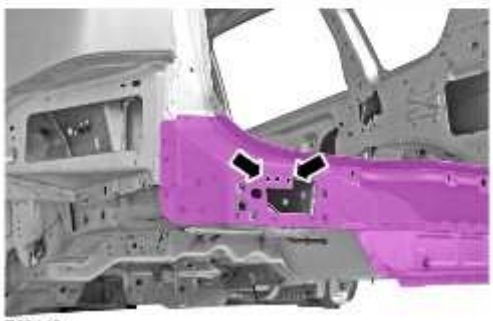

E80110

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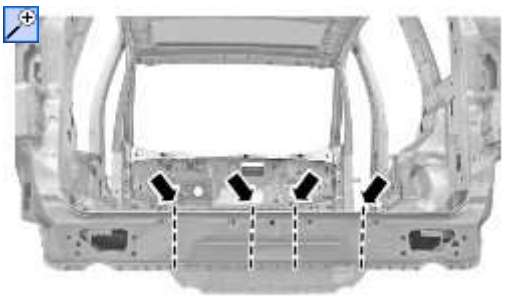
Removal and Installation

1. **Replacement parts**
   - Back Panel
   - Back panel reinforcement
   - Rear side member extension panel (left and right-hand side)

Removal

1. General Notes
   - Necessary removal work: Tailgate, rear bumper, back panel inner trims and quarter panel trims.
   - Reposition the carpeting and the wiring harness away from the working area.



E82036

2. NOTE:
   - The cut location on the rear panel may vary depending upon the extent of the damage.
   - The repair shown only describes a complete replacement in full.
   - The reinforcement of the rear panel must always be replaced in full.

   Back Panel
   - Overview of cutting options

E82037

3. Back Panel
   - Mill out the spot welds.

4. Back Panel
   1. Mill out the spot welds.
   2. Mill out the spot welds from below.

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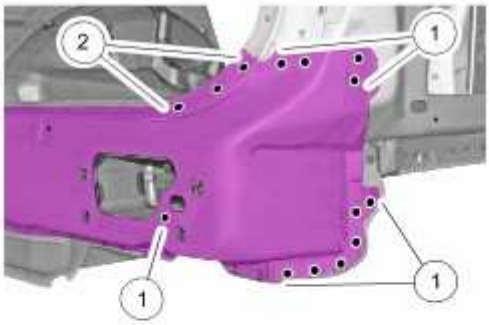
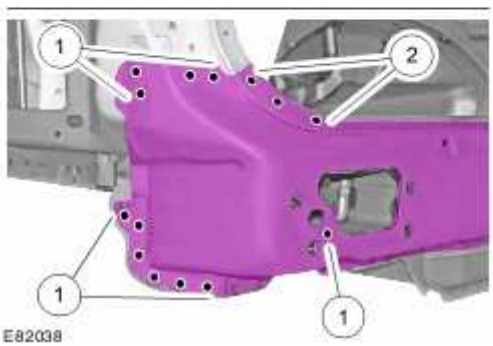
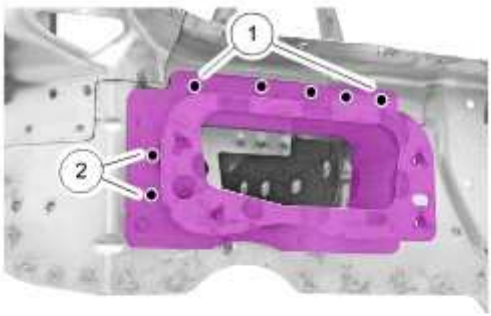
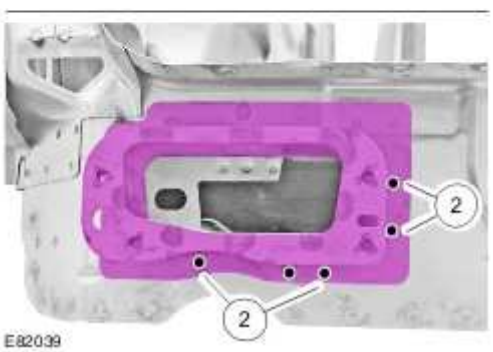




5. Rear left-hand side member extension panel
    1. Mill out the spot welds with a spherical cutter.
    2. Grind out the spot welds.





6. Rear right-hand side member extension panel
    1. Mill out the spot welds with a spherical cutter.
    2. Grind out the spot welds.

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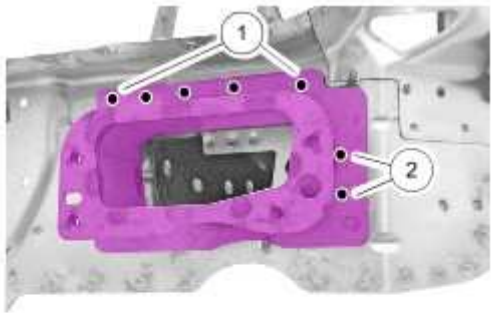
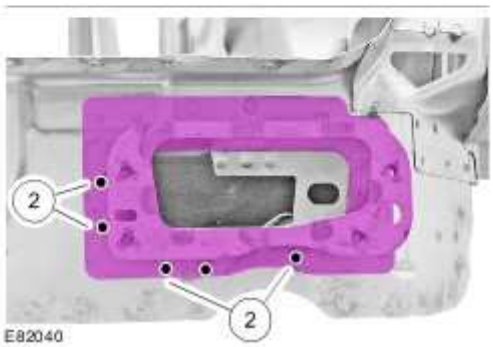
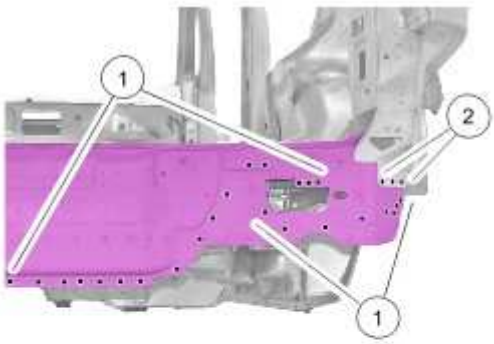
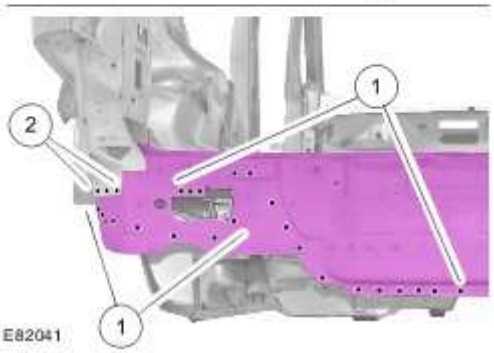




E82040





E82041

7. Back panel reinforcement
    1. Mill out the spot welds.
    2. Mill out the spot welds (two panel thicknesses).

8. Back panel reinforcement
    1. Mill out the spot welds with a spherical cutter.
    2. Mill out the spot welds.

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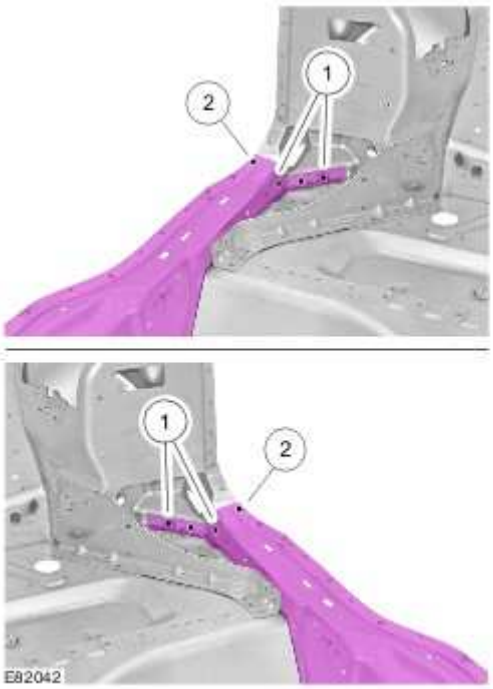
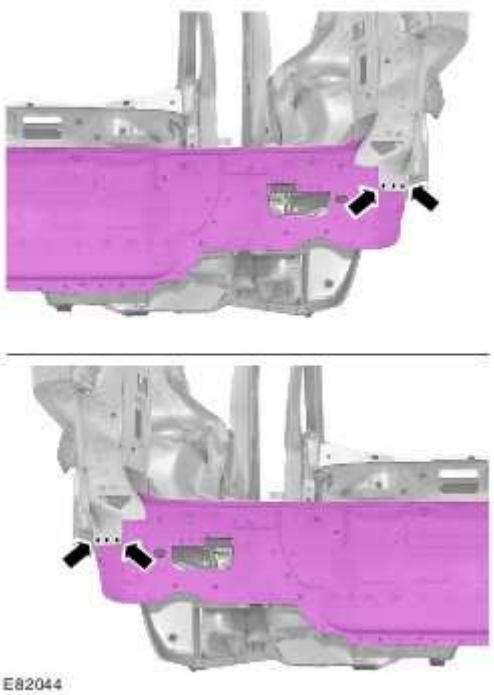


Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.



1. NOTE: By drilling out the holes it is possible to weld all three layers of metal together.
   Back panel reinforcement
   - Drill out by one panel thickness.

2. Back panel reinforcement
   1. Resistance spot weld.
   2. Puddle welding.

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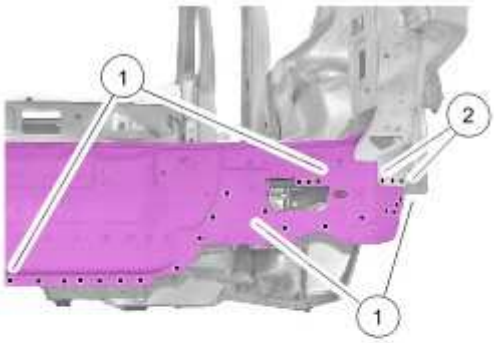
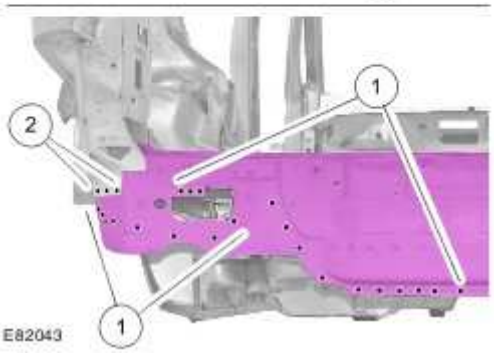
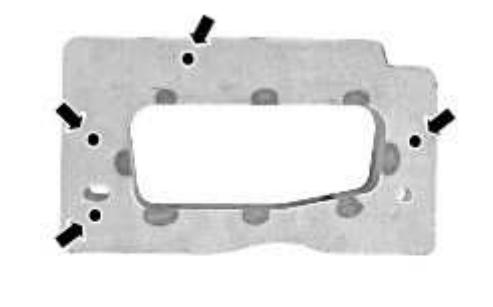
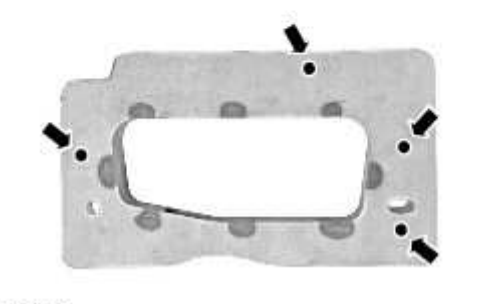




E82043

3. Rear side member extension panel (left and right-hand side)
    - Drill holes for puddle welding (10 mm diameter).





E82047

4. Rear left-hand side member extension panel
    1. Puddle welding.
    2. Resistance spot weld.

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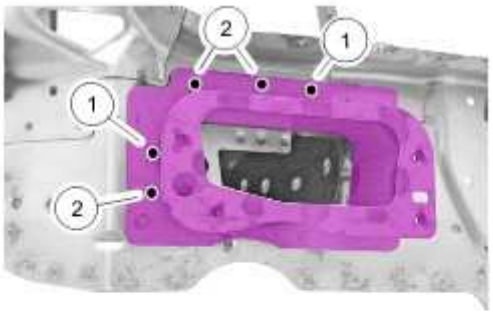
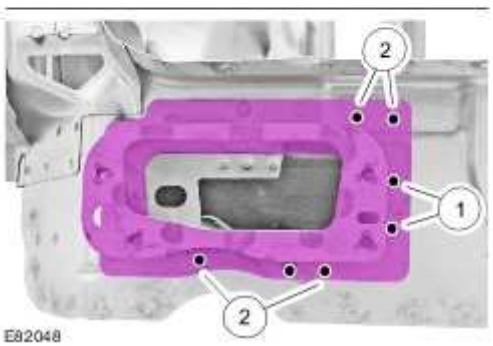
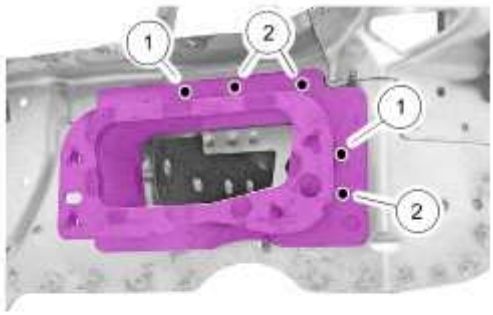
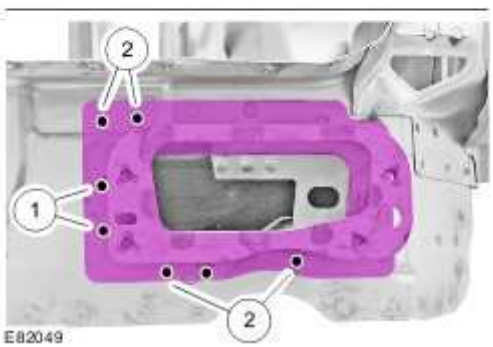




E82048





E82049

5. Rear right-hand side member extension panel
    1. Puddle welding.
    2. Resistance spot weld.

6. Back Panel
    - Drill holes for puddle welding (10 mm diameter).

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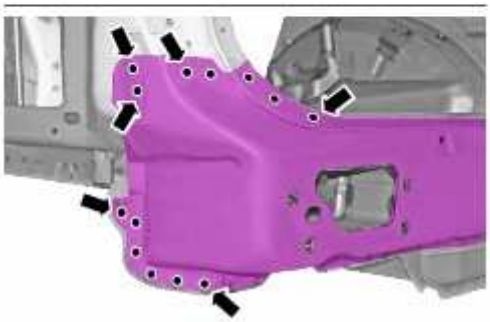
E82046

E82037

7. Back Panel
    - Resistance spot weld.



E82045

8. Back Panel
    - Resistance spot weld.

9. Back Panel
    - Puddle welding.

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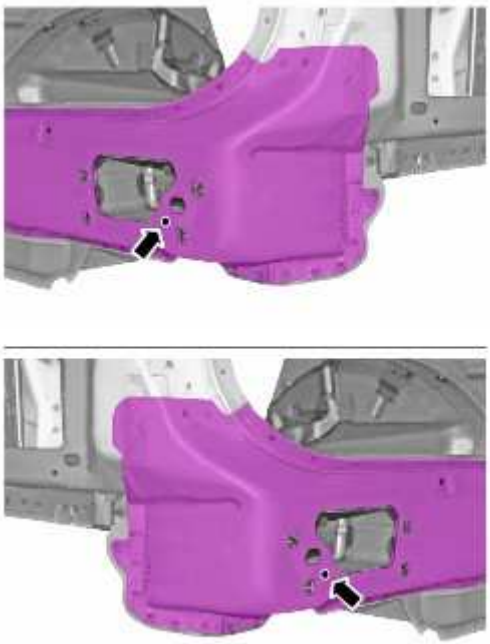

E83067

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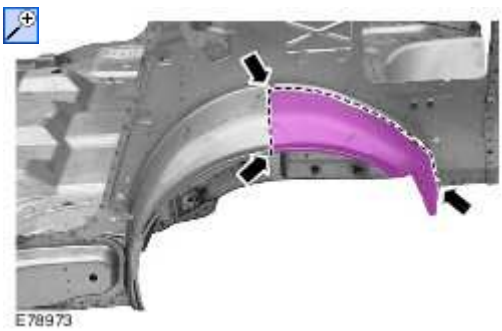
Removal and Installation

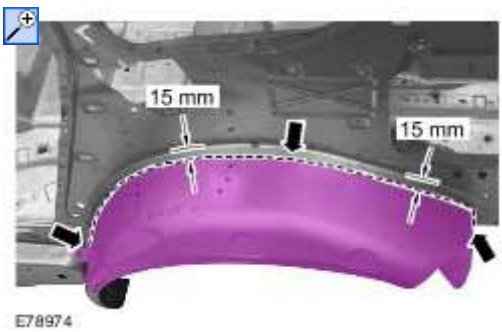
1. **Replacement parts**
   NOTE: For a partial replacement the required replacement part needs to be cut out from the complete inner quarter panel with wheelhouse.
   - Inner quarter panel with wheel housing

Removal

1. General Notes
   - Before starting the repair work, remove the quarter panel, C-pillar reinforcement and the rocker panel.

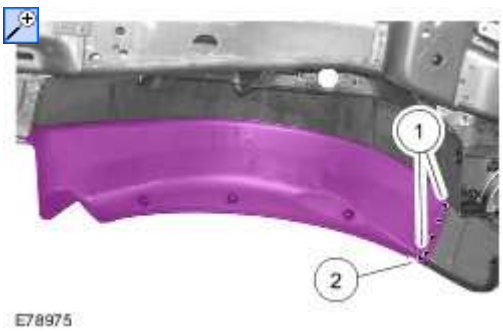

E78973

2. NOTE: When replacing the rear part only (partial replacement) the C-pillar reinforcement does not need to be removed.
   Outer wheelhouse
   - Separating cut for rear partial replacement.



E78974

3. NOTE: The residual flange (15 mm) is needed for welding in the components with an overlap.
   Outer wheelhouse
   - Cut location.



E78975

4. Outer wheelhouse (inside view)
   1. Mill out the spot welds.
   2. Grind out the spot welds.

Installation

1. Outer wheelhouse
   - Resistance spot weld.

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E78976

E78977

2. Outer wheelhouse (inside view)
    - Resistance spot weld.

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Removal and Installation

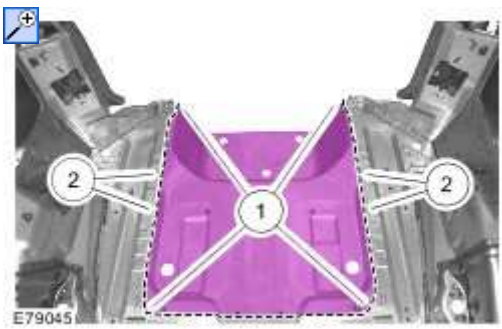
General Equipment

Measurement or alignment angle system

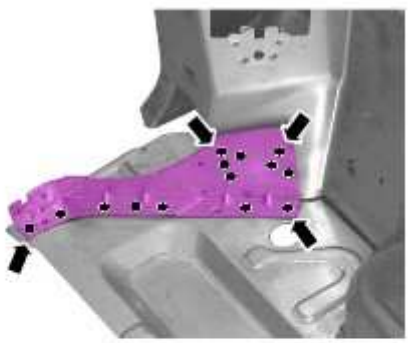
1. **Replacement parts**
   - Repair panel, rear floor panel
   - Rear reinforcement panel (left and right)
   - Rear gusset plate (left and right)
   - Rear floor panel crossmember

Removal

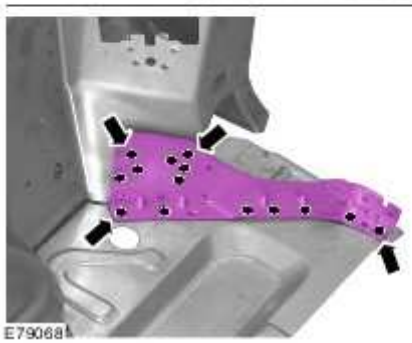
1. General Notes
   - Before starting the repair work, remove the back panel with reinforcement.
   - Reposition the carpeting and the wiring harness away from the working area.



2. NOTE: Use a rough separating cut to cut out the luggage compartment floor panel with the crossmember which is underneath.
   Rear floor panel
   1. Rough separating cut (luggage compartment floor panel).
   2. Rough separating cut (luggage compartment floor panel and crossmember).



3. Rear gusset plates
   - Mill out the spot welds.



4. Rear gusset plates
   - Mill out the spot welds (two panel thicknesses).

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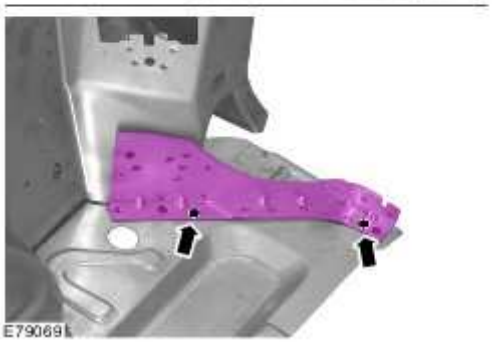

5. Residual part of the luggage compartment floor panel
   - Front separating cuts.

6. Residual part of the luggage compartment floor panel
   - Mill out the spot welds.

7. Residual part of the luggage compartment floor panel
   1. Grind out the spot welds.
   2. Grind out the spot welds (two panel thicknesses).

8. Residual part of the luggage compartment floor panel
   1. Grind out the spot welds.
   2. Grind out the spot welds (two panel

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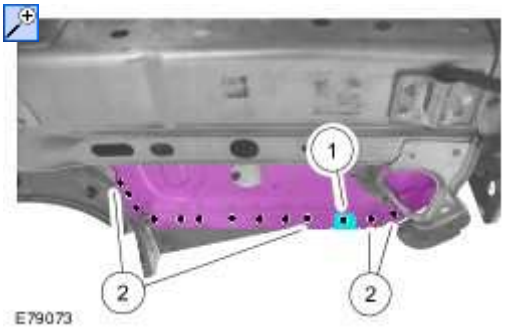
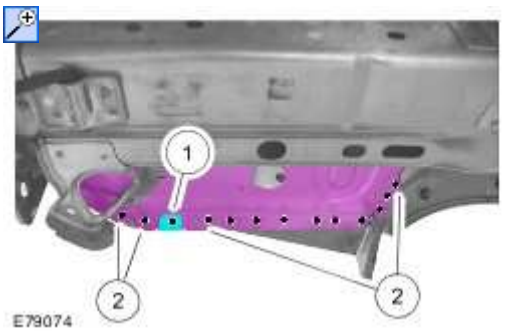
thicknesses).

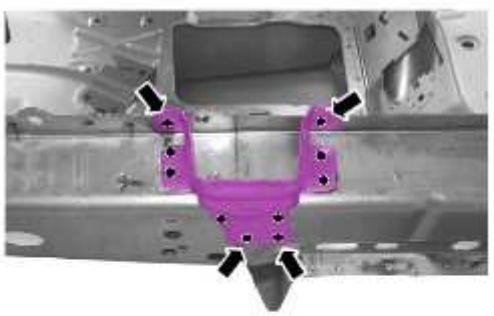
9. Rear floor panel (shown from below)
    1. Grind out the spot weld on the inside and outside and bend open the metal tab.
    2. Grind out the spot welds.

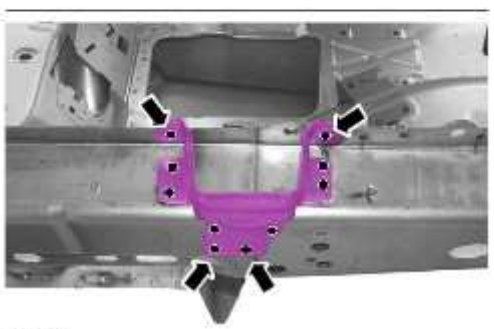


10. Rear floor panel (shown from below)
    1. Grind out the spot weld on the inside and outside and bend open the metal tab.
    2. Grind out the spot welds.



11. Residual parts of the luggage compartment floor panel crossmember
    - Mill out the spot welds.





Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be

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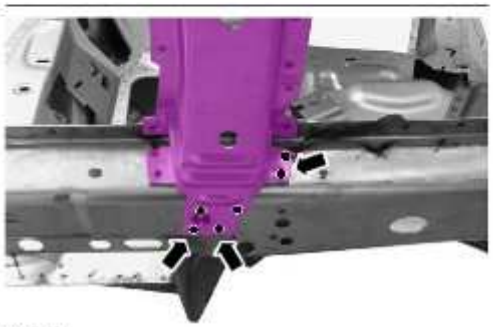
followed.

1. Rear floor panel crossmember
   - Drill holes for puddle welding.

E79049

2. NOTE: The luggage compartment floor panel crossmember is supplied in two parts as a replacement part. In order to allow for compensation in terms of length, the parts must be first welded to the longitudinal members.
   Rear floor panel crossmember
   - Puddle welding.



E79050

3. Rear floor panel crossmember
   - Resistance spot weld.

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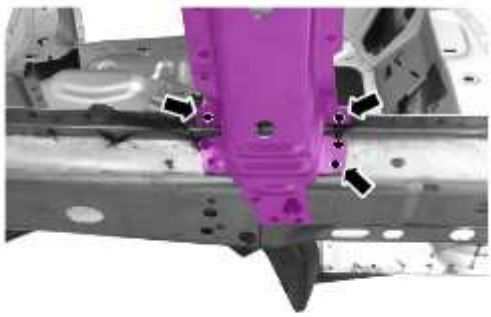
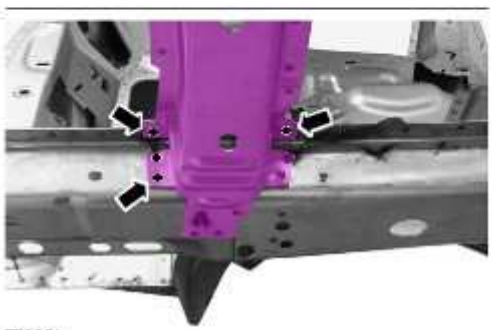
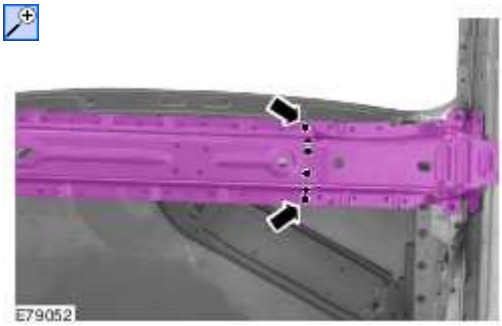




E79051



E79052

4. Rear floor panel crossmember
   - Resistance spot weld.

E79054

5. NOTE: Fit the reinforcement panels and make sure they form a closed form.
   Rear reinforcement panels
   - Resistance spot weld.

E79053

6. Rear floor panel
   - Drill holes for puddle welding.

7. NOTE: The inserted new part must overlap by approx. 30 mm in the front joining area (position 1). In the flange areas in position 2 (longitudinal member and belt

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reinforcement) the new part is fitted so that it abuts with the existing part.

Rear floor panel

1. Intermittent MIG weld.
2. Continuous MIG weld (butt weld).

8. Rear floor panel
   - Puddle welding.

9. Rear floor panel
   - Resistance spot weld.

10. Rear floor panel
    - Resistance spot weld.

11. Rear floor panel
    - Resistance spot weld.

12. Rear gusset plates
    - Punch holes for puddle welding.

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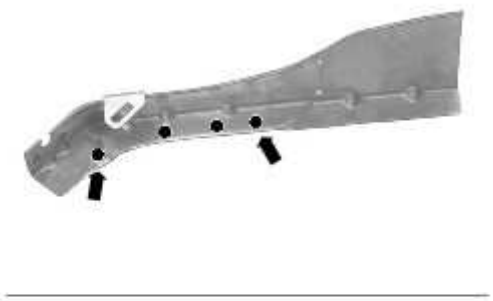
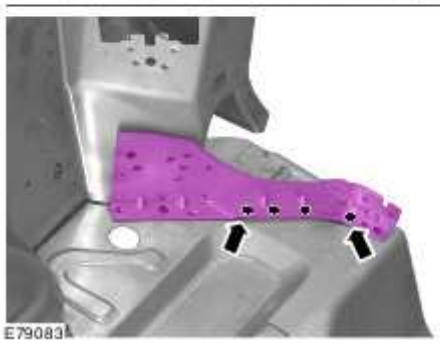


E79082

13. Rear gusset plates
    - Puddle welding.



E79083

14. Rear gusset plates
    - Resistance spot weld.

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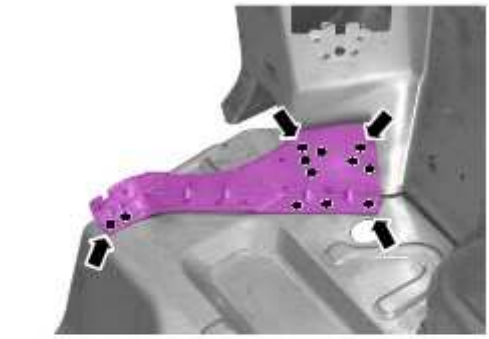
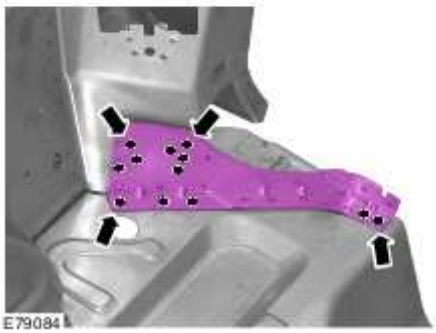
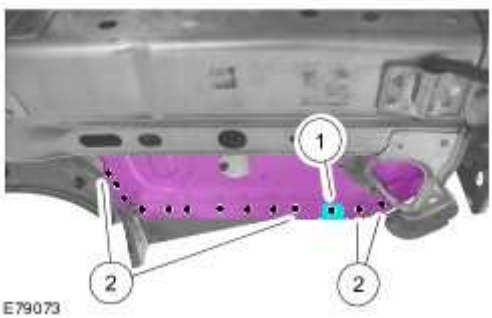
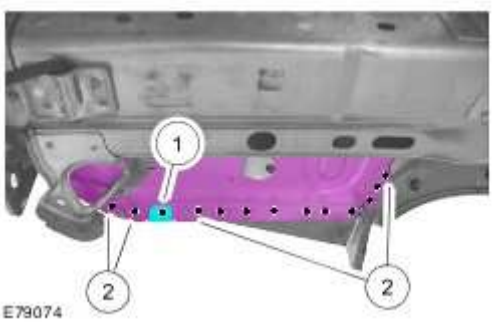






15. Rear floor panel (shown from below)
    1. Bend over the metal tab and resistance spot weld.
    2. Resistance spot weld.



16. Rear floor panel (shown from below)
    1. Bend over the metal tab and resistance spot weld.
    2. Resistance spot weld.

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Removal and Installation

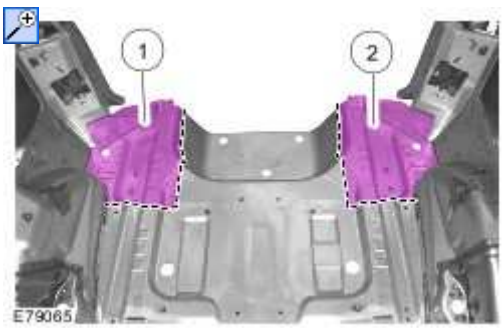
General Equipment

Measurement or alignment angle system

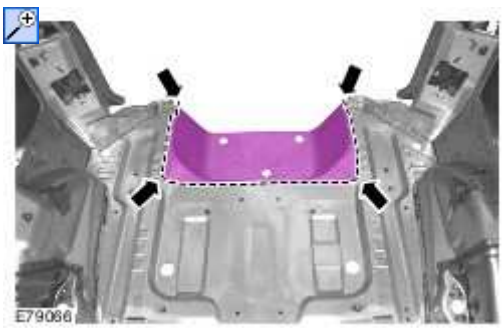
1. **Replacement parts**
   - Repair panel, rear floor panel
   - Rear reinforcement panel (left and right)
   - Rear gusset plate (left and right)

Removal

1. General Notes
   - Before starting the repair work, remove the back panel with reinforcement.
   - Reposition the carpeting and the wiring harness away from the working area.



2. NOTE: Depending on the extent of the damage, two side partial replacements are also possible.
   Possible partial replacements with separating cuts
   1. Right-hand side.
   2. Left-hand side.



3. NOTE: Cut out the luggage compartment floor panel with a rough separating cut.
   Rear floor panel
   - Rough cut location.

4. Rear floor panel
   - Cut location.

5. Rear gusset plates
   - Mill out the spot welds.

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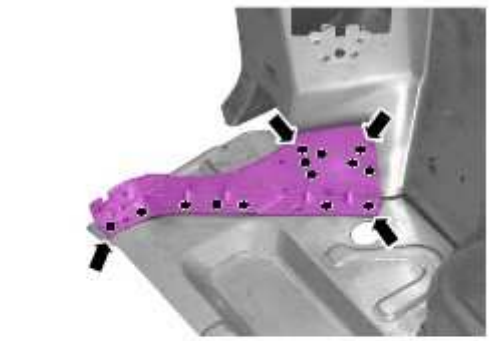

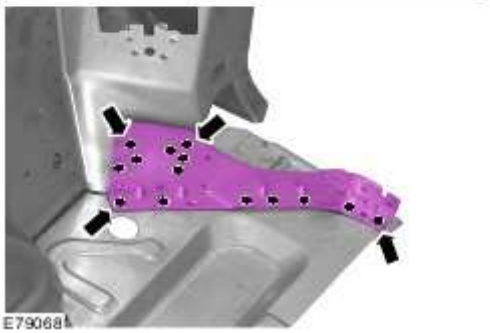

6. Rear gusset plates
   - Mill out the spot welds (two panel thicknesses).

7. Residual part of the luggage compartment floor panel
   - Mill out the spot welds.

8. Residual part of the luggage compartment floor panel
   1. Grind out the spot welds.
   2. Grind out the spot welds (two panel

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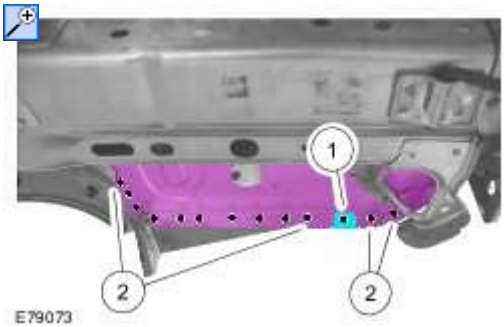
E79071

thicknesses).

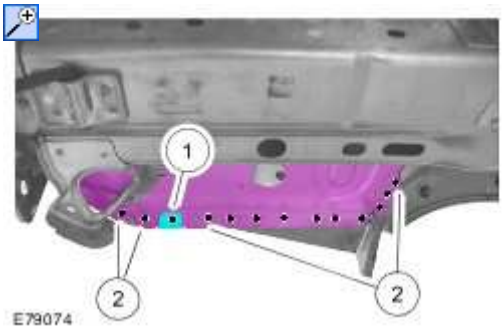
E79072

9. Residual part of the luggage compartment floor panel
   1. Grind out the spot welds.
   2. Grind out the spot welds (two panel thicknesses).



E79073

10. Rear floor panel (shown from below)
    1. Grind out the spot weld on the inside and outside and bend open the metal tab.
    2. Grind out the spot weld.



E79074

11. Rear floor panel (shown from below)
    1. Grind out the spot weld on the inside and outside and bend open the metal tab.
    2. Grind out the spot weld.

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

E79075

1. NOTE: Fit the reinforcement panels and make sure they form a closed form.
   Rear reinforcement panels
   - Resistance spot weld.

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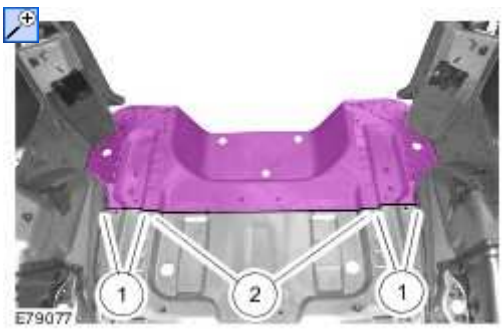
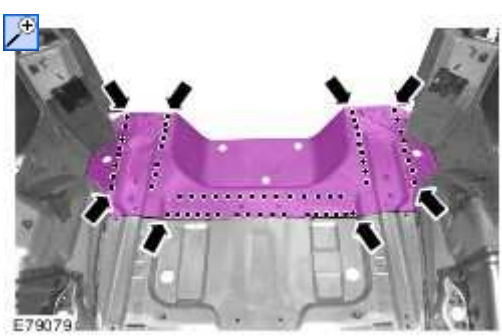
2. Rear floor panel
   - Drill holes for puddle welding.



3. Rear floor panel
   1. Continuous MIG weld (butt weld).
   2. Intermittent MIG weld.

4. Rear floor panel
   - Puddle welding.



5. Rear floor panel
   - Resistance spot weld.

6. Rear floor panel
   - Resistance spot weld.

7. Rear floor panel
   - Resistance spot weld.

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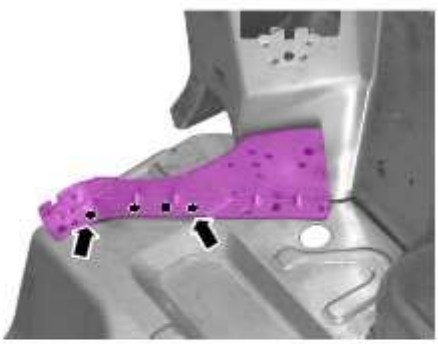
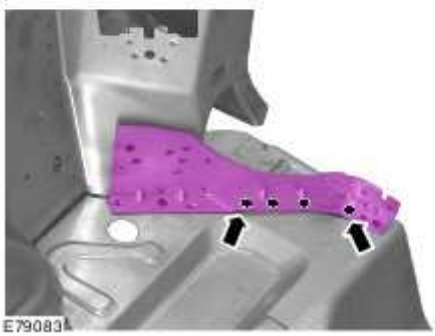
E79081

8. Rear gusset plates
    - Punch holes for puddle welding.

E79082



9. Rear gusset plates
    - Puddle welding.



E79083

10. Rear gusset plates
    - Resistance spot weld.

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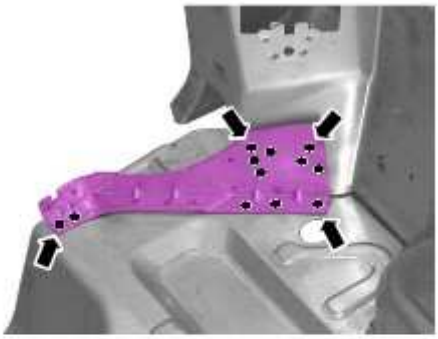
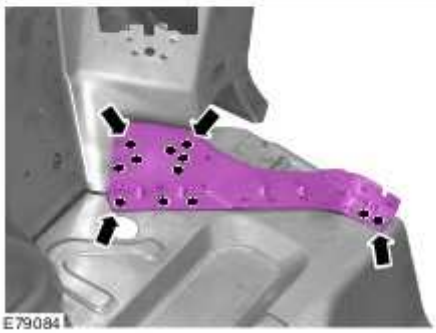
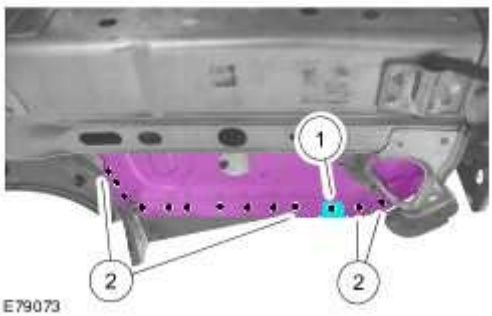
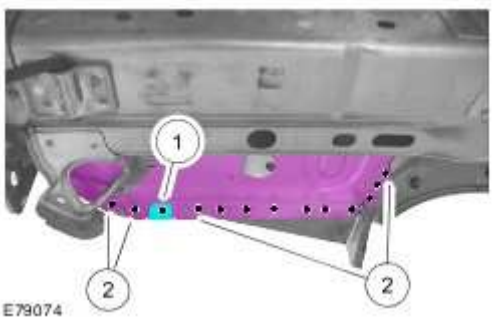






11. Rear floor panel (shown from below)
    1. Bend over the metal tab and resistance spot weld.
    2. Resistance spot weld.



12. Rear floor panel (shown from below)
    1. Bend over the metal tab and resistance spot weld.
    2. Resistance spot weld.

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Removal and Installation

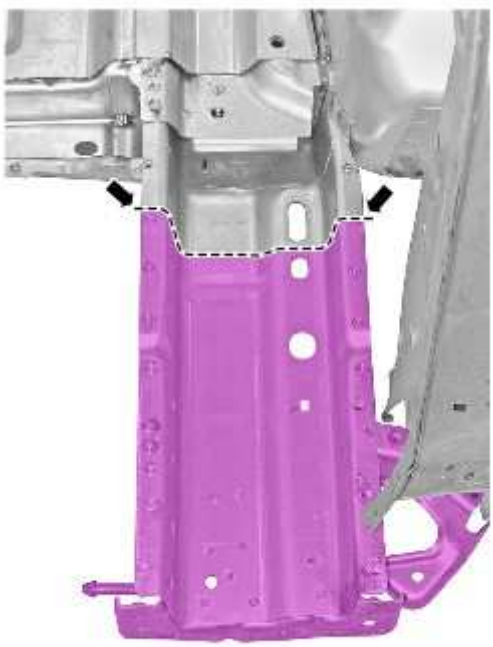
General Equipment

Measurement or alignment angle system

1. **Replacement parts**
   - Side member sectional part
   - Longitudinal member flange plate
   - Exhaust bracket
   - D-pillar gusset plate

Removal

1. General Notes
   - Remove the following components before starting the repairs: rear panel with reinforcement and luggage compartment floor panel (partial replacement).
2. NOTE: The cut location may vary depending upon the extent of the damage.
   Rear side member
   - Cut location.


E80112

Installation

NOTE: Before resistance spot welding of body panels with a total panel thickness of 3 mm and greater, the welding equipment instructions contained in sub-section 501-25 must be followed.

1. NOTE: Fit the longitudinal member flange plate using the straightening angle. Insert and fit the side member.
   Rear side member
   1. Continuous MIG weld seam.
   2. Resistance spot weld.

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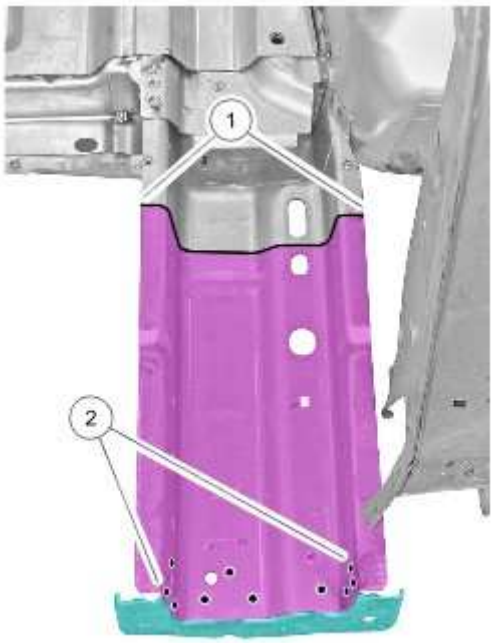
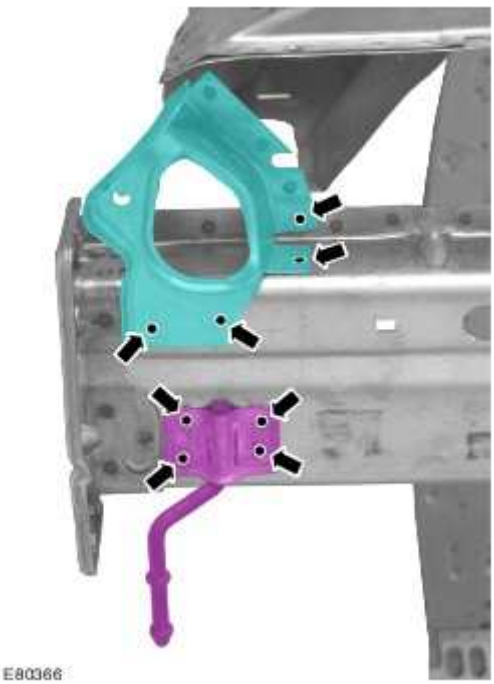


E80113



E80366

2. NOTE: Position the exhaust bracket and the D-pillar gusset plate on the longitudinal member and secure.
   Exhaust bracket and D-pillar gusset plate
   - Resistance spot weld.

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Paint - General Information - Specifications

Description	
Underbody protection	
Anti-corrosion wax	
Cavity wax	
Profiled butyl seal	
Weld primer	
Clinched flange protection	
Seam sealing compound	
Body sealing compound	

Because the supply of paint materials to the dealer workshops has been handed over

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Description and Operation

Vehicle paints are subject to severe demands caused by external influences. Moisture, air-borne deposits in the form of various chemicals and UV light constantly affect a paint surface. Furthermore, mechanical damage occurs through grit, stones and sand. Bird droppings, insect residues, pollen and tree sap also attack the paint surface.

The present literature not only informs the specialist about current repair painting techniques, but also provides tips and instructions on modern and economical repair processes.

High quality bodywork paints require the use of the most modern technologies and regular updating of the technician's knowledge of painting techniques, because of the constantly new developments in paint technology.

Information about different materials is listed under Specification.

Furthermore, information on the fundamental principles of repair painting and paint materials is provided in several chapters. The safety instructions indicate the possible health hazards and other sources of danger. There are also notes about tools and materials as well as on basic painting methods.

In the model specific repair instructions, only the most important repair steps or special features are referred to. Detailed information on the generally applicable painting procedures is given in this paint manual.

Direct supply of repair paints by Ford has been discontinued. There is however an agreement with many paint manufacturers, which ensures fast and problem-free supply to the dealer undertakings.

Paint suppliers:

- DuPont
- Glasurit
- PPG
- Sikkens
- Spies Hecker
- Standox

When using painting materials, it should be taken into account that the manufacturers have exactly matched their products between each other. In order to avoid quality defects, difficulties in working and losses in corrosion protection, these may not be substituted with other products.

NOTE: The Ford Service Organization organizes basic and more in-depth training on much of the content of this paint manual. As well as the practical part of the training, a further component is the Student Information document, which offers supplementary information in the form of a brochure.
During all work it must always be ensured that personal safety and the operational capability of the vehicle are not threatened by the choice of methods, tools and components.

The information given in the diagrams in the chapter "Paint Damage" is provided by the repair paint manufacturer.

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Description and Operation

General

Various symbols, signs, instructions and illustrations are used in this literature. Warnings and cautions have different meanings and require different ways of proceeding. Diagrammatic representations are provided with instructional signs for improved clarity. These are briefly explained below:

WARNING: This caption is used when failure to follow instructions exactly or failure to follow them at all may result in a hazard to persons or in persons being injured.

CAUTION: This caption is used when incorrectly following the test procedures or instructions or failure to follow them at all could lead to damage to the vehicle or components.
NOTE: This caption is used when attention needs to be drawn to special or extra information.
When reading this handbook, you will come across the points WARNING, CAUTION AND NOTE. These instructions are always given immediately before the corresponding job steps.

Hazardous materials designations

Many accidents occur because of ignorance. In the area of personal health protection, it is particularly important to clearly emphasize sources of danger and their effects on human organs.

Only with knowledge of hazardous material designations can it be certain that the necessary precautions are taken when handling substances which are harmful to health.

NOTE: Pay attention to the manufacturer's data on the containers and given in the Safety Data Sheet.
Hazardous material symbols

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E59393

Item	Part Number	Description
1	-	Very poisonous, T+ (extremely toxic), small quantities can be fatal.
2	-	Poisonous, T (toxic), causes serious damage to health
3	-	Corrosive, C (corrosive), destroys living tissue.
4	-	Harmful to health, Xn (noxious).
5	-	Irritant, Xi (irritant), can cause inflammation.
6	-	Explosive
7	-	Highly flammable, F+ (extremely flammable), already flammable at temperatures below 0° C.
8	-	Flammable, F (flammable), forms a flammable mixture with air.
9	-	Oxidizing, O (oxidizing), reacts with combustible substances.

As well as the danger symbols, there is more comprehensive manufacturer's information to be found on the containers and in the Safety Data Sheets, and you must pay attention to this information.

Instructions on measures to be taken for personal protection.

As well as the information about sources of danger, there are mandatory instructions which draw your attention to the personal protection measures to be taken.

Mandatory symbol

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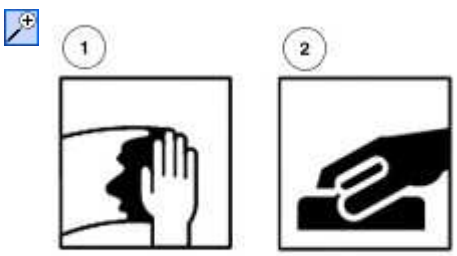
E59394

Item	Part Number	Description
1	-	Breathing protection must be worn
2	-	Eye protection must be worn
3	-	Ear protection must be worn
4	-	Protective gloves must be worn
5	-	Protective footwear must be worn

Icons

So that the necessary information for optimal handling is clear, unambiguous and can be quickly understood, the leading paint manufacturers have agreed a standard symbolic language. Language independent representations in the form of icons provide handling instructions which are supplemented with quantity or time information.

Pretreatment



E59395

Item	Part Number	Description
1	-	Clean
2	-	Sand

Mix

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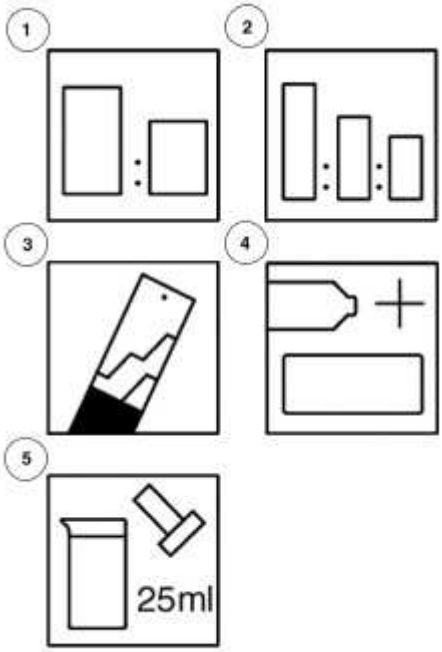
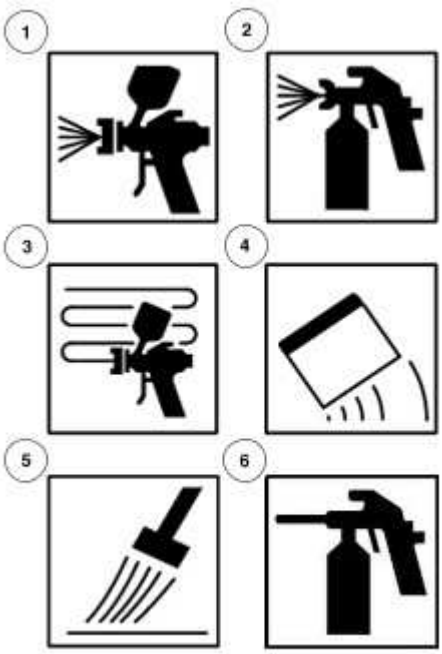


E59396

Item	Part Number	Description
1	-	2 component mixture
2	-	3 component mixture
3	-	Use a measuring rod
4	-	Addition of hardener
5	-	Addition of additives

Process



E59397

Item	Part Number	Description
1	-	Flow-beaker spray gun
2	-	Suction-beaker spray gun

-

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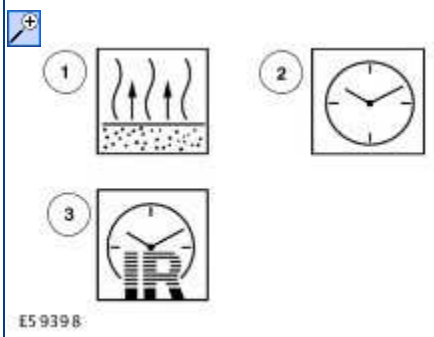
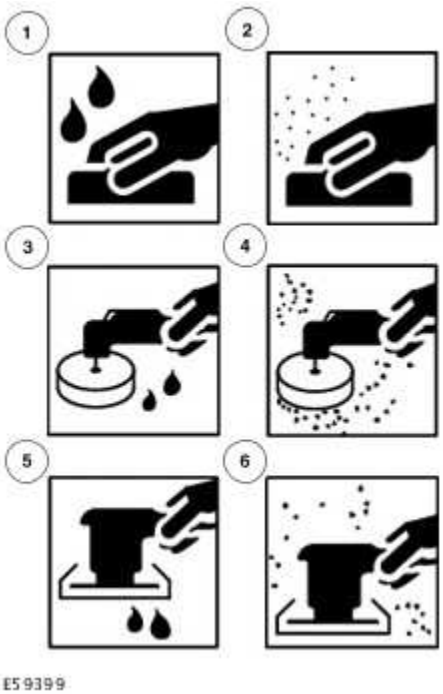
3		Spray passes
	4 -	Filler
5	-	Coat
6	-	Underbody protection spray gun

Dry



Item	Part Number	Description
1	-	Ventilate
2	-	Drying time
3	-	Drying time with infra-red dryer

Further processing



Item	Part Number	Description
1	-	Hand abrade (wet)
2	-	Hand abrade (dry)
3	-	Eccentric sander (wet)
4	-	Eccentric sander (dry)
5	-	Oscillating sander (wet)
6	-	Oscillating sander (dry)

Store

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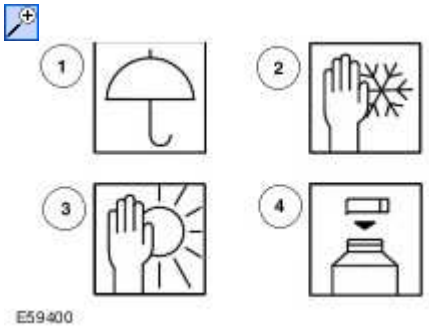
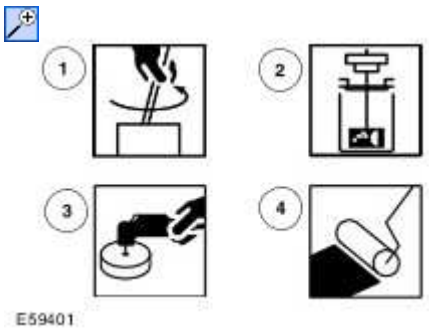


Item	Part Number	Description
1	-	Protect from moisture
2	-	Store in a frost-free environment
3	-	Store in a cool place
4	-	Close the container

Other



Item	Part Number	Description
1	-	Stir by hand
2	-	Stir using a mixing machine
3	-	Polish
4	-	Roll

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Description and Operation

General instructions for the paint shop and handling paint materials

Hazardous areas in repair paint shops:

- Danger from fires, explosions and hot surfaces.
- Dangers to health and safety from the effects of harmful substances because of their absorption through the skin and/or inhalation.
- Dangers caused by electricity, compressed air, power tools and noise.

WARNING: During painting work there is an increased danger of fire or explosion. Prevent any sparks being created. Fire, naked lights and smoking are forbidden.
Measures:

- Wear protective footwear made from anti-static material.
- Only use tools made of wood, brass or copper to clean stands and extraction ducts. Do not use tools made of steel.

Only fill or decant paint materials in a specially marked area.

As well as these general instructions on the dangers in repair paint shops, all national and international regulations must be observed:

- Health and Safety at Work Act
- Ordinance on Hazardous Substances
- Technical Rules for Hazardous Substances
- Regulations for the Prevention of Industrial Accidents
- EU Directive on Hazardous Substances, 98/24/EU
- EU Directive on Noise, 2003/10/EU
- EU Directive on Volatile Organic Compounds (VOC), 1999/13/EU, 2001/81/EU, 2004/42/EU
- Safety instructions of equipment and tool manufacturers

Personal protection

Besides the body and limbs, several organs vital to life are in very particular danger. Because damage is mostly irreparable, special attention and comprehensive protection are necessary.

WARNING: Solvents cause damage to the health through inhalation. Splashes in the eyes or on the skin can cause bodily harm. When working with solvents, always use suitable means of protection.

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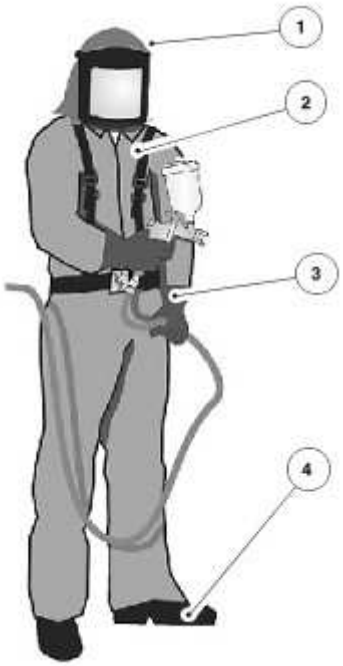

E59518

Item	Part Number	Description
1	-	Protective hood with fresh air supply
2	-	Protective clothing
3	-	Protective gloves
4	-	Protective footwear

Breathing protection

During painting work and in the preparations for painting, gases, vapors, mists or dusts can appear in dangerous concentrations in the areas where fellow employees breath.

For short periods of work or minimal concentrations of hazardous substances, breathing protection devices with a combination filter are suitable as breathing protection equipment.

E59517

Item	Part Number	Description
1	-	Activated charcoal filter
2	-	Coarse filter

For higher concentrations of harmful substances, breathing protection devices which are independent of the local atmosphere are suitable.

In these types of isolation systems, a compressed air hose carries natural air from the compressor line into the protective mask. During supply, the air undergoes pressure reduction, water removal, fine filtration and usually warming to natural breath temperature.

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WARNING: Vapor or spray mist containing isocyanate as a paint base or hardener can cause toxic respiratory disease (conditions similar to asthma) leading to permanent damage, even when inhaled in the lowest concentrations.
Filter masks with wadding, sponge or colloid filters and also paper masks are all unsuitable for working with coating materials because they do not stop solvent vapors.

The instructions for use provided by the manufacturer must be observed when working with breathing protection equipment.

Skin protection

Spray painters who are subject to considerable exposure to coating materials must wear suitable protective work clothing (flame-proof and anti-static).

NOTE: Also, when working with water based materials, comprehensive skin protection must be worn, because these materials are very easily absorbed through the skin.
The protective clothing must be changed at the proper intervals. Items of clothing which are contaminated with coating materials can easily catch fire.

When selecting protective clothing, it must be taken into account that cloth containing a high proportion of easily melted plastic thread considerably increases the degree of burns injury (melted plastic on the skin!). This must also be taken into account in the choice of underwear.

For areas of skin which are not covered by protective clothing, suitable skin protection, skin cleaning and skin care agents must be used.

Eye protection

Working with portable hand sanding machines on which the tools move unguarded, at speed and with power is fundamentally dangerous.

Goggles must be worn not only when sanding, but also when working with paints and their additives. These contain substances which are harmful to the eyes. Damage ranging from irritation of the cornea to incurable illnesses are possible.

The protective goggles must be inert toward splashes of solvent, and fully enclose the areas at the side of the eyes on both sides. The best protection during spray painting is offered by full mask respirators or helmet respirators with a built-in visor.

Ear protection

Noise disturbance in repair paint shops caused by various sources is particularly high. Sanding and compressed air machines, paint cabin extractor fans (compressors) and extractor ducts in the work rooms are the causes of the high levels of noise.

WARNING: Avoid damage to your hearing! Wear ear protection.
Suitable ear protection is offered by ear plugs or ear defenders.

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Description and Operation

Waste disposal in the repair paint shop

More than ever before, since the introduction of EU directives, rigorous attention is paid to the avoidance of waste materials and to recycling in repair paint shops. In this respect, repair paint shops must take into account and comply with the following requirements:

- Separate waste according to its recycling and disposal methods.
- Produce evidence for the correct transport and disposal of waste.

NOTE: The organization of disposal in the plant must comply with the requirements of the Waste Avoidance and Management Act: The avoidance and recycling of waste must always take priority.
However, despite all measures which may be taken, waste cannot be completely avoided.

NOTE: Waste which is not allowed in household rubbish, and which can no longer be utilized, must be disposed of as special waste.
Paint residues containing solvent, application residues, sanding dust, waste containing peroxides, solvents, soiled cleaning cloths and paint slurry all count as special waste. Each of these must be collected in a separate, sealed and suitably labeled metal container and properly disposed of using a specialist company.

Careful separation allows some waste to be usefully re-used.

- Empty metal containers can be sent for scrap instead of being disposed of as waste.
- Contaminated cleaning thinners can be separated by distillation.
- Packing material and masking paper can be added to the recycled paper collection.

Residues which cannot be used must be correctly disposed of.

All remaining waste must be treated as commercial waste and disposed of according to the local regulations.

The new VOC (Volatile Organic Compounds) solvent regulation

Keeping the air clean protects the environment and the population from the heath-damaging effects of air pollutants.

In certain atmospheric conditions, volatile organic compounds contribute to summer smog.

NOTE: For comprehensive information, please refer to the European VOC Directive, 1999/13/EU. Furthermore, the effective national regulations must be complied with.
The European VOC (Volatile Organic Compounds) Directive has controlled the limits for such compounds since August 2001. It applies to production coating companies and those which undertake repair painting of private and commercial vehicles.

Not least because of the VOC legislation, modern, low solvent and solvent-free lacquers and paints are finding greatly increased distribution across industry and the trade. Up to the year 2007, emissions from painting work will drop by at least 40%.

At the same time, the paint manufacturers guarantee for example that they will produce a ready-to-spray product consisting of base paint + hardener + thinners, with a permitted VOC level.

A company in business today can conform with the stipulated requirements by introducing water-based paints and using the other necessary products from the relevant paint manufacturers.

For more detailed information, please refer to the EU VOC Directive.

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Description and Operation

General fundamentals of paint technology

Paint is a pigment-containing liquid which undergoes chemical and/or physical processes after it has been applied to a surface, so changing into a solid film covering.

Repair paint consists of binder, pigments, filler and solvent.

NOTE: Organic solvent is being replaced by solvent based on water.

Constituents of paint

- Binder
  - Mostly semi-fluid resins which bind together the other components of the paint when it dries.
  - Makes the paint durable.
  - Ensures good surface coverage.
- Pigments
  - Fine, colored powders, which give color to the paint.
  - Cover the components below (covering power).
- Additives
  - Additives give the paint special properties.
  - e.g. flow improver, softener, drying accelerator, thickener.
- Solvent
  - Thins the paint and allows it to flow more freely.
  - Evaporates during drying.

Painting process and corrosion protection.

In production, painting consists of individual steps which are optimally matched to each other.

Bodywork consists almost entirely of steel panels which have been pre-coated with zinc. The zinc layer is between 5-10 µm thick and acts as the first corrosion protection layer of the steel panel.

Production sequence:

- Clean and de-grease
  - In the first step, the bare bodywork is initially dipped in a cleaning bath and cleaned with a degreasing solution.
- Phosphatising
  - The cleaned bodywork is dipped in a bath containing various phosphate salt solutions. This creates a crystalline metal-phosphate layer which offers the optimal prepared surface and also corrosion protection.
- CDP base
  - The cataphoretic dip paint (CDP) base acts as a further corrosion protection layer.
  - In this process the bodywork is completely immersed in a bath consisting of a paint and electrolyte solution.
  - By application of an electric voltage, an electric field is created.
  - Positively charged paint particles settle on the negatively charged bodywork and form a protective layer up to 20 µm thick.
  - Next the bodywork is placed in a dryer, where the CDP base is hardened at 180°C.
- Sealing, stone-chip protection
  - Edges, seams and but joints are sealer with a sealing compound.
  - Vulnerable areas are coated with stone-chip protection.
- Filler
  - Filler protects the body panels from stone impacts. Furthermore, any unevenness of

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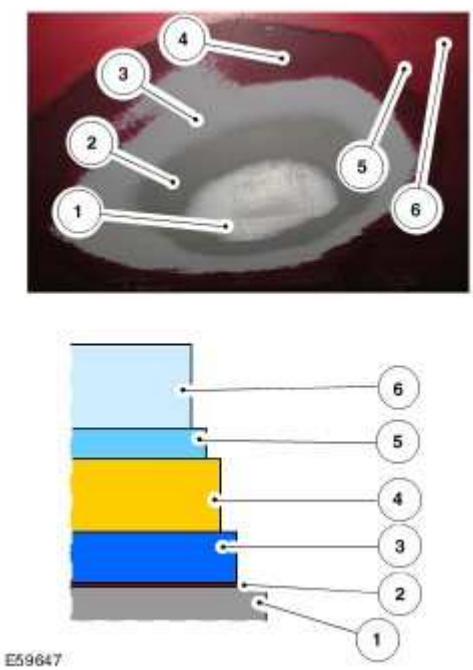
the metal surface is flattened out, in order to create the most homogenous and fault-free undersurface possible.
- Once the filler is dry, it serves as the base on which paint is applied.

- Top coat
  - The top coat is applied as a single layer or two layers of paint.
  - When working with two layer paint, in the first job step the initial colored base paint is applied. In the second job step, a clear lacquer is applied, giving the base paint shine and hardness.

The structure of an original paint finish

During construction of the original paint, a total surface thickness of between 120 and 130 µm is achieved. The thicknesses of the layers may vary however, because they are greater for horizontal surfaces than vertical ones.

Paint layers



Item	Part Number	Description
1	-	Steel panel
2	-	Phosphate layer 2.9 g/m², corresponding to 2 µm.
3	-	Cathodic dip paint 30-35 µm
4	-	Filler 30-35 µm
5	-	Base paint 15-20 µm
6	-	Clear varnish 55 µm

Colored fillers applied in production

Filler which gives color is used in production. Its use makes the base paint and clear varnish unnecessary on certain vehicle interior surfaces (engine, doors).

Not every exterior paint has its own matching filler. It is more that the tones of the filler are color compatible, i.e. they have similar intensity to the top coat.

During repair painting the filler color tones must be used according to the manufacturer's instructions.

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Description and Operation

Diagnosis and Damage Assessment

Paint concerns, regardless of their causes, are part of the everyday work in the paint shop. Correct damage assessment and determination of the cause are preconditions for a professional resolution of a paint concern.

Paint concerns can still occur through a variety of causes, despite improved paint materials and new spray methods.

NOTE: A first appraisal of the paint damage should be done before cleaning. External factors such as rust, droppings, incorrect or insufficient paint care can then be more easily detected.
Diagnosis is best done in daylight but not in direct sunlight. Exact evaluation can also be done under artificial light from special luminescent lamps.

Paint damage guide

The most important paint damage concerns which make a paint repair necessary are:

- Damage from biological paint contamination such as bird or insect droppings, tree resin and aphids.
- Chemical paint damage caused by industrial contaminants such as smoke, fuel, acids, oils.
- Mechanical damage caused by stone impact during operation, scratches in the car wash and parking.
- Damage caused by faults in treatment. Application defects such as paint runs or orange peel.
- Dirt inclusions in the paint layer, e.g. caused by dust in top coat or textile lint.
- Damage due to corrosion.

Before repair of such paint concerns, exact diagnosis must be performed to determine the cause exactly. On the spot diagnoses using simple aids and processes are often enough.

Diagnosis without disturbing the paint is done by:

- Optical inspection without visual aids, under suitable light conditions from a suitable angle and correct distance.
- Optical inspection with the help of a magnifying glass.
- pH paper.
- Measurement of the thickness using FE / NFE coating thickness meters for ferrous (FE) and non-ferrous metals and non-magnetic steel (NFE) - magnetic process on steel panels, eddy current process on non-metals.

A test method where the traces of testing can be easily removed again is the finger nail test. With suitable experience the existing hardness of the paint can be determined.

Test methods where the paint is partially destroyed are:

- Pencil hardness test.
- Adhesion test using adhesive tape.
- Lattice cut test process to check the strength of adhesion.

Under certain circumstances these test methods are not enough for a certain diagnosis. In this case, paint diagnosis under laboratory conditions must be performed.

Measuring and testing equipment for painted surfaces

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Coating thickness measuring devices

Magnifying glass

pH paper (together with water)

Suitable photographic equipment with macro lens

Shine measuring equipment

Paint damage caused by environmental factors

- Bee droppings
- Bird droppings
- Insects
- Tree resin and sap
- Aphid secretions
- Tar spots
- Cement, plaster and slaked lime
- Rust film/deposits from industrial fallout
- Battery acid
- Brake fluid

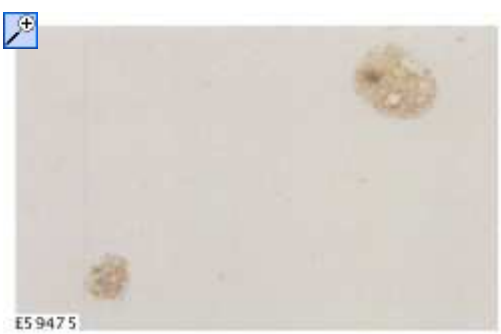
In all the cases of paint damage described below, if the damage is irreversible a new paint finish must be applied.

Paint damage cause by bee droppings

Bee droppings can be recognized on a paint surface through its yellow or brown color and sausage or drop-like shape with a diameter of 3-4 mm.

Cause/damage pattern:

- In combination with heat and high air humidity, bee droppings leave discolorations and cause paint decomposition.
- The paint can be destroyed down to the filler.



Repair of damage:

- If the damage is light, perform a polishing repair.

Paint damage caused by bird droppings

Bird dropping damage appears most often as matt, etched topcoat areas of various sizes. If left on the vehicle for a long time, crack formation and etching down to the filler will occur.

Cause/damage pattern:

- Bird droppings are particularly harmful in combination with heat and moisture. The urea (white part) has a very high salt content and is very aggressive.
- The intensity of the damage varies depending on the type, quantity, contact time and

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extent.
- Cracks, etching, marks up to dissolution of the top coat are the results.

Repair of damage:

- If the damage is light, perform a polishing repair.

Paint damage caused by insects

At insect impact locations on the hood, roof and bumper, small etched or etched through paint marks with partially visible spots of filler.

Cause/damage pattern:

- The top coat layer is destroyed in a short time by surface swelling and etching.
- Colliding insects stick to the paint surface. In combination with moisture and heat, because of the resulting acids the insect bodies sink into the paint top coat.
- The corrosion is G, C, U or O shaped and is only a few millimeters thick.

Repair of damage:

- Wash the vehicle, treat the affected area with insect remover. Clean the paint surface several times.
- Protect with hard wax.

Paint damage caused by tree resin or sap

Small yellow-brown marks or drops on the horizontal parts of the vehicle. The drops melt in sunlight. Resin damage only occurs in the warm summer months.

Cause/damage pattern:

- Because of their chemical composition, tree resins combine with or adhere very well to paint top coats and cause them to swell. The higher the temperature, the more intensive is the chemical bonding between the resin and the paint topcoat surface.

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Repair of damage:

- Soak several times using a cloth saturated with a petrol & paraffin mixture.

NOTE: After successful cleaning the top coat must be preserved.

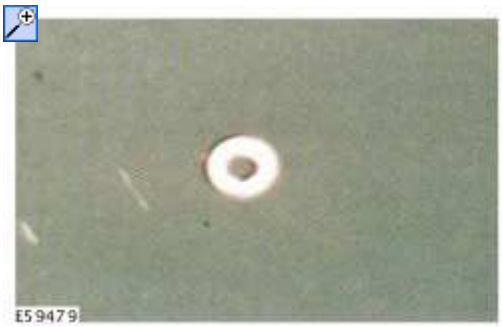
- Swellings can be removed by warming.

Paint damage from aphid secretions

Small, round, matt marks about 1 mm diameter and etching with small islands down to the filler. Fresh aphid excrement looks like small drops of honey.

Cause/damage pattern:

- Aphids produce a mixture of starch, leaf acid and sugar from sap in leaves. Under the effects of warming and moisture this can turn into alcohol.
- The round shape of the damage and the island of intact paint are typical.



Repair of damage:

- Remove the excrement as soon as possible.
- Small single matt locations without etching can be repaired using a polishing repair.

Paint damage caused by tar spots

Yellow or dark marks.

Cause/damage pattern:

- Firmly stuck spots of tar which lead to discoloration of the surface. In some cases penetration through the clear lacquer into the top coat.

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Repair of damage:

- Clean the paint surface with tar remover and polish.

Paint damage caused by cement, plaster and slaked lime

Damage appears as whitish matt marks on the top coat.

Cause/damage pattern:

- Corrosive alkaline compounds interacting with moisture.

Repair of damage:

- Wash immediately if the contamination is fresh.
- If the contamination has dried on, dissolve and neutralise it with vinegar, then thoroughly wash off with water and rinse.
- Rectify mild damage using a polishing repair.

Rust film/deposits from industrial fallout

Small round marks, about 1 mm in size, in all shades from black, grey, blue to reddish, on the horizontal surfaces of the vehicle.

Cause/damage pattern:

- Deposits from oil fired systems and industrial plant, especially at high humidities and inversion weather conditions, cause damage to the paint top coat.
- As the activity time increases so called rust halos form. They spread as long as the deposits corrode.
- Industrial fallout containing iron will no longer be removable after a few days!

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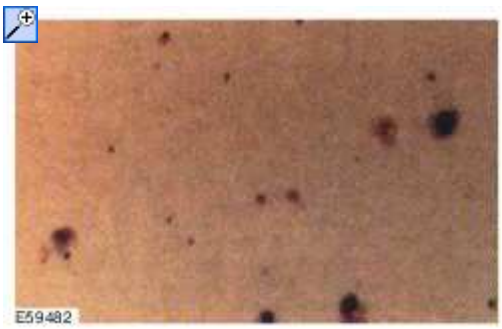

Repair of damage:

- Remove the dust using an industrial fallout remover and thoroughly wash.
- Polish the paint surface.

NOTE: Never try to remove the particles of industrial fallout by polishing or rubbing!

- Use cleaning dough.

Damage caused by battery acid.

Splashes of battery acid caused by carelessly topping up the battery.

WARNING: Batteries contain sulphuric acid. When working near the battery, or where there is battery acid on the vehicle body, protect the skin and eyes from contact with the acid. If battery acid contacts the skin or enters the eyes, flush the affected area immediately with water (flush for at least 15 minutes) and call a doctor without delay. If acid is swallowed, call a doctor immediately. Failure to follow these instructions may result in personal injury.
NOTE: High temperatures accelerate the attack on the top coat. At 50°C the top coat layer breaks down after about 15 minutes!

Cause/damage pattern:

- Etching of the paint layer to decomposition of the paint finish.

Repair of damage:

- Flush the acid splashes with plenty of water and neutralize with car washing liquid.
- If the contact time of the acid was short, perform a polishing repair.

Paint damage caused by brake fluid.

Careless handling of brake fluid. The glycols contained in the fluid cause swellings.

Cause/damage pattern:

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- The temperature and contact time are critical. Splashes lead to loss of shine and lightening of color.

Repair of damage:

- Flush immediately with plenty of water.
- The swellings can often be made to recede completely by treatment with the radiant heater or in the paint drying oven at max. 60°C for about 1 hour.

Mechanical damage

Stone impact damage or mechanical damage

Mechanical damage caused by impact of stones or other hard objects and extending down to the metal panel lead very quickly to corrosion and rusting under the paint on the adjoining surface.

Cause/damage pattern:

- Paint damage caused from the outside, down to filler, primer or metal panel.

Repair of damage:

- Sand or blast out.
- Use anti-corrosion primer.
- Apply top coat.

Damage due to corrosion

Blistering/rusting below

Air or water filled blister-shaped raised areas in the paint film.

Cause/damage pattern:

- Overpainting corroded steel panel.
- Condensation in the spray air.
- Sanding water not dried out or salt crystal residues.
- Road chippings and road winter grit containing salt.

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Repair of damage:

- Sand the affected area of damage or the body component and re-create the paint finish.
- More severe and larger areas of rusting below must be repaired using the corresponding repair painting, Repair Level III or IV.

Damage caused by faults in treatment

- Craters
- Paint boils
- Adhesion defects
- Adhesion defects - clear lacquer
- Sanding scores
- Formation of stripes
- Peeling/blistering on plastic parts
- Blistering on polyester material
- Peroxide marks in metallic paints
- Crack formation
- Shrinking back/zone edge marks
- Blistering
- Etching
- Paint wrinkles/puckering
- Cloud formation
- Spots/metallics
- Metamerism/color deviations
- Washing out
- Loss of gloss
- Covering ability/areas of thin paint
- Flow problems/orange peel
- Dirt embedded in metallic base paint
- Dirt embedded in top coat
- Water marks
- Paint runs
- Swirl marks

Craters

Crater-like single or extensively occurring depressions with raised edges, in top coat or the intermediate layers.

Cause/damage pattern:

- Substrate not adequately cleaned with silicone remover.
- Spray air contaminated by oil residues and water accumulations.
- Filter ceiling not adequate for requirements.
- Use of polishes, cleaning agents or sprays (e.g. interior sprays) containing silicone.
- Oil, wax, grease, silicone containing residues.
- Working clothes contaminated by materials containing silicone.

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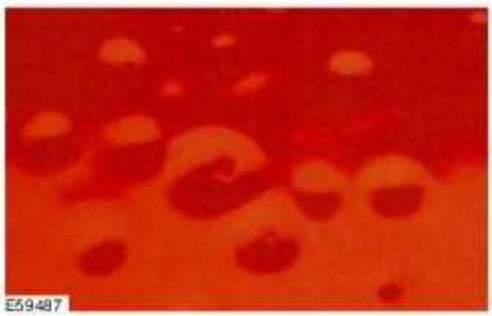

Repair of damage:

- Sand paint surface, clean with silicone remover and apply one thin spray pass. Let it begin to dry well, then apply several thin and dry sprayed passes.

Paint boils

Small, hard, closed or burst blisters in the paint top coat. They appear locally in groups or spread individually across the whole surface. Sanding opens up a larger cavity, under which the primer can often be seen.

Cause/damage pattern:

- Paint applied in layers which were too thick.
- Specified flash-off and drying times between coats were not adhered to.
- Specified working viscosity and spray pressure were not adhered to.
- Use of unsuitable hardener and thinner materials. (Solvent combinations in paint system not optimally matched).
- Poor booth conditions.

Repair of damage:

- Single boil blisters can be removed using polishing.
- After thorough drying, sand the top coat at the affected areas, clean with silicone remover and re-paint. Fill any fine pores still present with 2-component acrylic filler.
- On larger areas of damaged topcoat, sand completely away and apply new paint finish.

Adhesion defects

Whole coating detached from substrate or individual layers one from another. Sometimes adhesion defects can only be noticed after an external influence such as stone impact.

Cause/damage pattern:

- Substrate not adequately prepared (rust, grease, moisture, sanding, cleaning).
- Unsuitable material used.
- Drying times, flash-off times too short.
- Base paint not sprayed wet-in-wet, instead the intermediate drying times were too long.

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- Failure to intermediate sand.
- Condensation formed because of temperature fluctuations.
- Unprofessional preparation (especially on plastics).
- Overheated CDP/intermediate filler.

Repair of damage:

- Sand out the damage and recreate the paint finish. Create the paint finish strictly in accordance with the general technical information.

Adhesion defects in clear lacquer.

Clear lacquer detched from base paint.

Cause/damage pattern:

- Base paint layer too thick.
- Intermediate and final flash-off times of base paint too long.
- Incorrect mixture ratio clear lacquer/hardner.

Repair of damage:

- Refinish sanding and recreate the paint finish.

Sanding scores

Single or wide area clusters of scoring or sanding marks, often with raised edges. Noticeable on metallic paints as light-dark stripes.

Cause/damage pattern:

- Stopper sanded too coarsely.
- Filler sanded too coarsely.
- Filler not thoroughly dried bfore sanding.
- Old paint sanded too coarsely.
- Soft elastic substrates, e.g. TPA base, treated with thinners which was too aggressive and therefore etched.
- Top coat applied too thinly.

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Repair of damage:

- If the damage pattern is minimal, after the top coat has dried fine sand the paint surface and refurbish by polishing.
- If the damage is great or on metallic paints, sand the paint surface or substrates and if necessary remove them, then cover the bare metal and re-paint.

Formation of stripes

Differing, stripe shaped color/effect formations in dark/light areas of a metallic paint finish.

Cause/damage pattern:

- Spray gun (nozzle) not perfect.
- Incorrect spray pressure.
- Thinners not suitable.
- Incorrect spray viscosity.
- Flash-off time too short.
- Unsuitable working temperature.

Repair of damage:

- Apply base paint evenly.
- Repair spray gun.
- After clear lacquer has thoroughly dried, sand surface and paint again.

Peeling/blistering on plastic parts

Paint adhesion insufficient between top coat and filler and/or primer layer. It often happens that the whole of the paint finish detaches from the plastic.

Cause/damage pattern:

- Plastic item not cleaned sufficiently, not or inadequately tempered.
- Unsuitable cleaning agent used.
- Unsuitable materials used.
- Moisture.
- Paint finish underbaked or overbaked.

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- Poor or lack of intermediate sanding.

Repair of damage:

- Sand away faulty paint coats and re-apply paint finish.
- In extreme cases use a new part.

Blistering on polyester material

Color shade differences or marks in paintwork subsequently applied to previously unpainted plastic material.

Cause/damage pattern:

- Plastic material is not suitable for painting.
- Incorrect bonding agent.
- Paint used not solvent resistant.

Repair of damage:

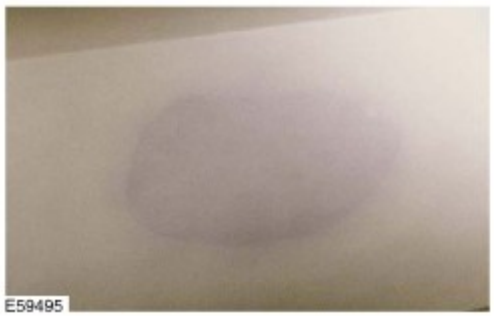
- Repaint using suitable materials.
- Install unpainted new part (after consulting customer).

Peroxide marks in metallic paints

After longer period of drying, abnormal marks where the color shade varies.

Cause/damage pattern:

- Too much hardener added to polyester stopper (over 3% can cause this damage pattern).
- Polyester stopper not well enough mixed.



Repair of damage:

- Sand, fill with polyester or epoxide filler and re-paint.

Crack formation

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Cracks of different lengths and depths running in all directions.

Cause/damage pattern:

- Layers too thick.
- Painted several times.
- Temperature fluctuations.
- Mechanical effects e.g. distortions.
- Substrate not thoroughly hardened.
- Old paint not completely dried out.
- No or insufficient hardener added.
- 2-component materials used on nitro or TPA.

Repair of damage:

- Sand away layers until sound substrate is reached and create new paint finish (prime, fill, apply topcoat).

Shrinking back/zone edge marks

Lifting or dropping in of edge zones (edges which accentuate themselves in the top coat), flow problems and loss of shine in top coat.

Cause/damage pattern:

- Old paintwork not rubbed down to a seamless transition.
- Stopper and filler on a viscoplastic base primer.
- Filler sanded and overpainted when not thoroughly hard.
- Previous materials overworked too early, substrate not sufficiently hardened.
- Primer applied in layers which were too thick, and not dried for long enough.
- Sanding paper too coarse.
- Top coat thinned too much.

Repair of damage:

- After hardening off the top coat, fine sand the surface and polish up, apply filler if necessary and paint once more.

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Blistering

Small, spot-like, air-filled or water-filled blister shaped high-spots in the paint construction. Their dimensions can range from pin-head to pin-point size in a closed paint film. Arrangement and accumulation very variable. In the advanced stages, circular flaking of the paint from the substrate. These are neither boils nor corrosion.

Cause/damage pattern:

- Moisture absorption by substrate.
- Insufficient drying of the substrate after wet sanding (especially on polyester material).
- Humidity too high before painting; condensation formation because of temperature fluctuations.
- Pores/sink holes in substrate not sanded out.
- Polyester material not covered.
- Sweat from hands.
- Salts and minerals in sanding water.
- Spray air contaminated.

Repair of damage:

- Sand away damage, matt sand remainder of surface, clean with silicone remover, fill and re-paint.

Etching

The base paint is etched by the clear lacquer. This causes the aluminum pigments to change their alignments. The color of the etched base paint seems more grey than that of normal base paint. Result is that the surface structure of the clear lacquer becomes increasingly more matt.

Cause/damage pattern:

- Base painted too wet.
- No intermediate flash-off time.
- Layers too thick.

Repair of damage:

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- Sand and re-paint.

Paint wrinkles/puckering

Lifting/puckering of the paint surface.

Cause/damage pattern:

- First paint not hardened through or can be etched.
- Areas of clear lacquer which were sanded through to base paint have not been not isolated with filler, or with unsuitable filler.
- Unsuitable substrate (e.g. spray can painting with TPA or nitro).
- Use of unsuitable primer, paint and thinner materials.
- Paint systems not matched to each other.
- In wet-in-wet process, specified flash-off times not adhered to.
- Synthetic resin top coat (alkyd resin) worked over too soon.

Repair of damage:

- After thorough drying, completely remove the top coat together with the attacked substrate at the affected areas and re-create a new paint finish.
- Before applying top coat, rub down the complete surface.

Cloud formation

Differing, blotchy color/effect formations in dark/light areas of a metallic paint finish.

Cause/damage pattern:

- Spray gun, spray nozzle, spray pressure not perfect.
- Varying spray viscosity, spraying method, flash-off times, spray booth temperature.
- Thinners not suitable.

Repair of damage:

- Droplet method before clear lacquer application.
- After clear lacquer has thoroughly dried, sand surface and re-paint.

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Spots

Points rising up from the paint film.

Cause/damage pattern:

- Metallic base paint sprayed too dry, so that the metal particles could not incorporate into the paint. The clear lacquer could not cover these vertical standing particles because the spray air was too hot or the booth temperature was too high.

Repair of damage:

- After the paint surface has dried, lightly sand it with grade P800 sanding paper, clean with silicone remover and re-apply clear lacquer.

Metamerism/color deviations

Noticeable when identical color shades undergo a change of hue as the light source changes (daylight/artificial light). Different pigment composition between original and repair paint.

Cause/damage pattern:

- Use of paints with pigmentation which was not compatible with the standard, e.g. a green can be formulated from yellow and blue, or directly from green.
- Use of an unsuitable mixed or ready made paint to re-tone.

Repair of damage:

- Repaint using the correct paint.

Washing out

On paint which has been newly applied but not yet dried, the interaction of surface tension and very different specific gravities of the different pigments can lead to swirl-like turbulence which results in separation of the pigments.

Cause/damage pattern:

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- Layer too thick, paint not stirred enough.

Repair of damage:

- Sand and re-paint.

Loss of gloss

Milky, dreary tarnishing of the paint with more or less even loss of gloss.

Cause/damage pattern:

- Cold with low air humidity.
- Heat with high air humidity.
- Substrate can be etched.
- Hardener fault or wrong hardener used.
- Paint thinned too much.
- Proportion of pigment too high because of poor stirring.
- Not optimum drying.

Repair of damage:

- After drying, remove the matt effect by polishing. If unsuccessful, rub down complete area and paint again.

Covering ability/areas of thin paint

Different color shades in the surface. The minimum layer thickness is not achieved here. The effects range from local minor shade variations through mottled spray zones to completely missing top coat.

Cause/damage pattern:

- No correct, uniform substrate (effect paint).
- On three-layer systems, wrong filler.
- Insufficient top coat application.

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Repair of damage:

- Sand surface and recreate the paint finish.

Flow problems/orange peel

Surface structure bumpy, grained. The surface is similar to the peel of an orange.

Cause/damage pattern:

- Paint viscosity too high.
- Use of fast evaporating, highly volatile thinners.
- Booth temperature too high.
- Spray gun distance too great, too little material applied.
- Nozzle too large.
- Incorrect spray pressure.

Repair of damage:

- Small surfaces: fine sand and polish.
- Sand out the surface and recreate the paint finish.

Dirt embedded in metallic base paint.

Inclusions of contamination in metallic base paint, of different sizes and shapes (grains or lint).

Cause/damage pattern:

- Dust was not properly removed from the surface to be painted.
- Paint material not sieved.
- Function of the painting facilities not optimum.
- Filter contaminated.
- Wearing unsuitable clothing.

Repair of damage:

- Sand and repaint.

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Dirt embedded in top coat

Inclusions of contamination in top coat or under paint layers, of different sizes and shapes (grains or lint). Optical adverse effect.

Cause/damage pattern:

- Dust was not properly removed from the surface to be painted.
- Paint material not sieved.
- Function of the painting facilities not optimum.
- Filter contaminated.
- Wearing unsuitable clothing.

Repair of damage:

- Single inclusions: after thorough hardening, sand out using 1200 - 1500 grade paper and repolish using a suitable silicone-free sanding or painting paste.
- Large area contamination: sand and repaint.

Water marks

Ring shaped marks appearing on the paint surface.

Cause/damage pattern:

- Evaporation of water droplets on freshly painted and not yet fully hardened paint finishes (mostly only found on horizontal surfaces).
- Layer too thick.
- Drying time too short.
- Hardening faults or hardener no longer useable.
- Use of unsuitable thinners.

Repair of damage:

- Rub down only slight marks with sanding paper grade P1000 - P1200 and then polish.
- For heavy marking, sand the surface matt, clean with silicone remover and repaint.

Paint runs

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Wave-like paint run tracks in top coat or in an intermediate layer on vertical surfaces. Mostly in the area of swage lines, seams or openings (there they are paint runs, otherwise curtains).

Cause/damage pattern:

- Uneven paint application.
- The specified viscosity was not complied with.
- Use of unsuitable thinner materials.
- Air, material or room temperature too low.
- Layers too thick.
- Spray gun (nozzle) not perfect.

Repair of damage:

- After thorough drying, sand unevenness flat, if necessary leave to dry afterwards.
- Small areas of damage can be equalised using the paint plane, then sand, polish or repaint.

Swirl marks

Three dimensional appearance in the paint surface in the form of smears or blotches. This effect is intensified in direct sunlight.

Cause/damage pattern:

- Polishing using polishing machine on paint which has not yet hardened throughout.
- Polishing intervals too long or none at all.
- Pressure too high while polishing.
- Incorrect polishing material or polishing tool.

Repair of damage:

- Allow the paint to harden completely and then polish.
- If the damage is irreversible, rub down and apply new clear lacquer.

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Description and Operation

General work equipment

In the repair paint shop there is a range of painting tools which make the work of the painter easier and improve the quality of the repair paintwork.

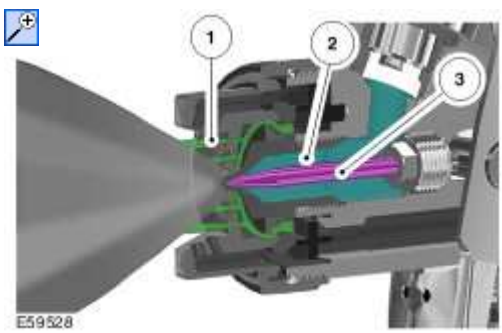
Among these are small tools which are used for the following work:

- **Measuring beakers** to measure and mix various paint materials.
- **Measuring rods** with which the required combination amounts of paint and primer filler are gauged and mixed.
- **Viscosity measuring beaker** with a calibrated opening of 4mm, used to set the correct paint viscosity.
- **Paint filter/paint sieve** for filtering foreign bodies out of mixed paint or primer. Care must be taken that the correct filter is used for each paint.
- **Color sample plates** onto which the mixed paint is applied, and the shade is then compared to that of the vehicle. Other aids which should help the painter to find the correct shade are **color sample cards** and **color panels**, which are offered by many paint manufacturers.
- **Dust bonding cloths** which are impregnated with a tacky resin and which pick up dust particles particularly well. A surface to be painted must be cleaned with a dust binding cloth immediately before paint is applied.
- **Compressed air guns** are used to remove sanding residues and to dry sanded surfaces.

Filler and spray guns

NOTE: Regular maintenance, cleaning after use and careful handling of all individual parts of the spray gun are essential for a high-quality paint finish.
The spray gun is the most important implement in the paint shop. Application of paint using the spray gun can produce a layer with absolutely constant thickness and a smooth paint surface.

Principle of operation



Item	Part Number	Description
1	-	Air supply
2	-	Paint supply
3	-	Nozzle needle

Because of the construction design and with the aid of compressed air, a spray-ready paint mixture is dragged out of the container to the nozzle by the venturi effect, and is applied to the surface being worked.

When the trigger of the spray gun is pressed to the first pressure point, only the compressed air passage opens. If the trigger is pressed further, the nozzle needle displaces and the air stream drags paint with it at high speed. This produces a spray mist consisting

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of micro-droplets of paint.

Types of spray gun

Item	Part Number	Description
1	-	Suction-beaker spray gun
2	-	Flow-beaker spray gun

In the flow-beaker spray gun, the paint container is mounted above the spray gun. On the suction-beaker spray gun, it is below.

Furthermore, spray guns are categorized by their air pressure requirement into high and low pressure guns.

High pressure guns have the disadvantage that they exhibit high consumption of energy and materials. The spray pressure they require is between 1 - 6 bar.

Because of the high air pressure and the large amount of air needed, the result is a powerful paint mist formation (paint transfer rate approx. 35%).

Current practice is mainly to work with reduced mist spray systems (RP and HVLP systems).

Reduced pressure (RP) guns are optimized high pressure guns which have an input pressure at the gun of approx. 2.5 bar and an atomization pressure at the air cap of 1 - 2 bar. In practice this spray technology is preferred for spraying clear lacquer because of the finer atomization.

Low pressure guns have the advantage that they exhibit minimal paint mist formation and because of this the paint transfer rate rises to approx. 65%. The spray pressure required in this case is between 1 - 5 bar. Nozzle sizes from 1 - 2.2 mm can be used.

HVLP spray guns

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Item	Part Number	Description
1	-	Quantity control
2	-	Working pressure control
3	-	Spray pattern control

The high volume low pressure (HVLP) spray gun is a high performance spray gun which forms a soft, fine and homogenous spray pattern. The atomization pressure at the air cap is 0.7 bar when the input pressure at the gun is 2.0 bar.

The low atomization pressure of 0.7 bar together with greatly reduced spray mist provide high material ejection. The low nozzle internal pressure minimizes rebound of the paint droplets from the object and thus the proportion of overspray.

This spray technology has a very high application efficiency. By matching the size of the nozzle, the HVLP spray gun can be used for all repair painting materials.

HVLP spray guns are often used in practice for the application of water based paints.

Mini spray guns are often used for small, localized touching-up work. Use of HVLP spray technology and nozzle sizes of 0.3 - 1.2 mm permits very fine work, so that the area of the repair can be kept as small as possible.

In order to ensure that a spray gun operates efficiently for a long time, careful cleaning is absolutely vital after use.

NOTE: During cleaning you must distinguish between water based and solvent based materials.
Cleaning by hand:

- Empty the paint beaker immediately after use.
- Flush the gun with cleaner.
- Clean it inside and outside with a brush.
- Dismantle the gun to clean it thoroughly.
- Clean the air cap using a suitable brush.
- Use nozzle cleaning needles to clean bores and nozzles.

A spray gun washing machine is recommended if the painting work is highly intensive.

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New types of paint processing systems are replacing the conventional mixing beaker, filter and spray gun flow beaker. This reduces the amount of solvent required for cleaning and the amount of routine waste which remains.

Paint preparation system (PPS)

Item	Part Number	Description
1	-	Beaker
2	-	Color bag

With this system, which is suitable for both suction and flow beaker spray guns, only one beaker is required for mixing and painting.

A bag is inserted in the beaker, in which paint can be mixed, processed and stored after use or completely disposed of.

The small quantity of paint remaining in the gun is removed using a minimum quantity of solvent from the pipette bottle.

The amount of cleaner used is reduced because only the spray gun needs to be cleaned.

Hand and machine sanding tools

Sanding is used to prepare a surface for application of a paint layer, enabling it to adhere well. Sanding materials have a great influence on the quality of a repair paint finish. The correct sanding medium must therefore be chosen for every material.

During sanding, material is mechanically removed from a surface.

In the paint shop, carborundum or silicon carbide abrasive on a substrate of paper or cloth are the most common sanding materials used.

Carborundum is a very hard mineral consisting mostly of aluminum oxide. During use carborundum becomes blunt and wears away.

Silicon carbide has a very high degree of hardness, but is more brittle than carborundum. When silicon carbide is used, the mineral grains break. New long and pointed profiles are formed.

Use of the correct sanding paper depends on the application, the substrates and the tools used. The following table can be used as a guideline, but the recommendations of the

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supplier of the auxiliary materials and additive materials must be followed.

Application	Working area	Grade	Sanding system
Body work, corrosion damage	Equalizing paint system transition	to P150	Orbital sander, dry
			Hand sanding, dry
Stopper	Rough sand	P80 - P150	Orbital sander, dry
	Fine sand	P240 - P320	Orbital sander, dry
			Hand sanding, dry
Spray stopper	Rough sand	P120 - P180	Orbital sander, dry
	Fine sand	P240 - P320	Orbital sander, dry
			Hand sanding, dry
Filler sanding work	Filler fine sand	P400 - P500	Orbital sander, dry
		P800 - P1200	Hand sand, wet
Top coat	Old paint	P400 - P500	Orbital sand, dry
		P800 - P1200	Hand sand, wet
	Touch-up paint surfaces	P1000 - P2000	Hand sand, wet
Paint damage	Sanding out faults	P2000 - P3000	Hand sand, wet

Soft Pads are recommended for manual refinishing of contours, curves and difficult to reach areas. On a Soft Pad the abrasive is found on a coarse structured fleece. Because of this, it is very flexible, does not kink and does not slip in the hand. This enables a fine and even finish to be achieved.

Item	Part Number	Description
1	-	Extraction bores
2	-	Connection for extraction equipment

Notes on working with sanding tools:

- Tools with a rigid backing pad do not adjust to fit the surface. They are used for flat surfaces.
- Tools with a flexible backing pad are used for fine sanding of a surface because they adjust to the shape of the surface.
- Build up an even working pressure over the sanding surface.
- Keep the sanding paper tight on the tool (use self-gripping systems).
- Align the extraction holes in the sanding paper with the holes in the tool.
- Guide the tool flat over the surface to be worked. Do not tilt it.

Hand sanding can be carried out dry but also wet. Wet and dry paper with particle size P 80 to P 1200 is used for this in the paint field.

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Ways of sanding

Sanding tools are driven either by electricity or compressed air.

Item	Part Number	Description
1	-	Sanding machine
2	-	Polishing machine
3	-	Orbital sander

The disadvantage of electrically driven machines is that their own weight is high compared with pneumatic systems. They also become warm during work. They do not however need any special operating equipment for their energy supply.

Sanding machines are categorized by their type of sanding movement.

Rotational sanders

On these machines the sanding paper turns.

- Advantage:
  - Ideal for heavy sanding work.
  - Fast and aggressive sanding possible.
- Disadvantage:
  - Large amount of heat developed.
  - Difficulty sanding flat surfaces.
- Application:
  - Removal of old paint layers.
  - Preparation of panel for stopper.
  - Removal of rust.

Oscillating sander

On these machines the sanding paper oscillates. The backing pad is rectangular.

- Advantage:
  - Large sanding surface.
  - Ideal for large and flat surfaces.
- Disadvantage:
  - Hardly useable on rounded surfaces.
  - Flexible backing pad not possible.
  - Vibrations because of the poor support of the backing pad.
- Application:
  - Sanding of polyester stopper.
  - Sanding processes on flat surfaces.

Orbital sander

On these machines the sanding paper turns and oscillates.

- Advantage:

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- Easy to handle and good sanding power.
- Minimal heat development.

- Disadvantage:
  - Not suitable for sanding stopper on flat surfaces.
  - Smooth guidance important, otherwise sanding marks will occur.
- Application:
  - Sanding of paint layers.
  - Well suited for final preparation of a primer.

NOTE: Comply with the manufacturer's recommendations when setting the orbital sander.
On the orbital sander, stroke settings of approx. 3 mm for fine sanding work and approx. 5 - 7 mm for coarse sanding work have been established.

Polishing and finishing tools

The term polishing in the context of paint repairs means the elimination of paint flaws and high shine polishing of neighboring parts.

During polishing the fine sanded surface is returned to a high shine using a special abrasive polish.

Before the actual polishing, all flaws in the paint surface must be removed and the following working procedures must be adhered to:

- Thoroughly clean the vehicle.
- Remove spray mist from all surfaces.
- Sand out and polish particle inclusions.
- Sand down paint runs and polish them out.
- Examine the exactness of the color match in daylight.
- Remove masking edges.
- Remove sanding water, sanding dust and polish residues.

After the polishing process the results must be tested using a special test spray.

Infrared drying technology

The drying process in a painting/drying cabin occurs through heat conductance (convection). When an infrared dryer is used, the drying process is through heat radiation.

The infrared rays penetrate the air and the paint layer without warming them. Because the infrared rays are reflected from the steel panel, the paint coat is warmed from the inside outwards.

Advantages of infrared drying:

- The drying process occurs from the inside to the outside.
- The drying time is shorter than for warm air systems.
- Because the infrared dryer consists of several cassettes which can be switched on independently, the drying area can be optimally controlled.

Independent of the manufacturer's instructions, pay attention to the following:

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- Flash-off time of the paint before switching on the infrared dryer.
- Distance between the infrared dryer and the surface.
- Duration of the irradiation.

The most common use of the infrared dryer is to dry stopper and primers. The wait time between the job steps is shortened without having to use the painting/drying cabin.

The painting/drying cabin can then be used exclusively for application and drying of topcoat.

There are two types of infrared dryer:

- Infrared dryer with short wavelength radiation.
- Infrared dryer with medium wavelength radiation.

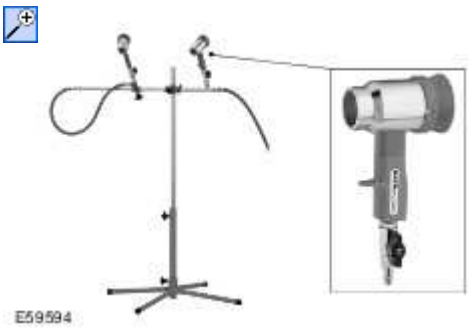
As an indication, the following drying times are listed for some materials (at 80 cm distance):

NOTE: Observe the material manufacturer's and supplier's specifications.

- Polyester stopper 2 minutes.
- Spray stopper 2 to 7 minutes.
- Water based primer-filler 7 to 9 minutes.
- Primer 3 to 8 minutes.
- Top coat 7 to 10 minutes.

Air dryers

The air dryer is suitable in places where drying needs to be done, but without great outlay (painting/drying cabin or infrared dryer).



NOTE: Air from the compressor is often too cold for effective drying.
Air dryers use the venturi effect to blow the warm ambient air over the paint surface in a gentle air flow.

Paint mixing system

Because of the many different color variants, it is now seldom possible to store all color shades as ready-made mixtures.

For this reason, vehicle manufacturers make the mixture proportions of their paints available as color codes. The required color shade can be obtained from the paint mixing system using this color code.

All the color components are combined according to their proportions by weight using a precise computer scales to produce a finished color shade.

Painting cabin

The air requirement in a painting cabin is large. The outside air which is drawn in must be passed through filtering and warming equipment. This particularly applies during colder times of the year and especially for combined types of building where the painting cabin is

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also used as a drying cabin.

It is primarily used to keep the air free of dust. At the same time, explosive solvent-air mixture concentrations are prevented

NOTE: Vacuum will lead to contamination of the newly applied paint. The outside air flows through door gaps, wall joints and other openings and as it does so, brings dust deposits with it.
The air supply quantity depends on the size of the painting space and the quantity of extracted air. Enough air must be supplied to cause positive pressure in the painting space. An air extraction : air supply ratio of about 1 : 1.05 is sufficient.

The filters should have a dust-removal grade of not less than 99.8% and must always be kept clean.

It is especially important that the air supply does not cause strong air currents in the painting cabin. If not, the following problems could occur:

- Paint contamination cause by paint mist, which persists in air eddies and gradually falls on the fresh paintwork.
- Flow problems in the paint because of the high speed of the air, causing the paint to thicken very quickly on the surface.
- Loss of gloss and wrinkle formation because the surface dries too fast.
- Painter disturbance while working.

In modern paint cabins the air supply is provided from the complete surface of the ceiling. The air speed should be 0.3 m/sec (measured in the unrestricted cross-section of the spray cabin). At the same time, the air in the cabin should change about 350 times per hour.

Air extraction is best achieved through extraction channels in the floor of the painting cabin.

NOTE: Refer to the manufacturer's specifications for the operating instructions, safety instructions and notes on the maintenance of a paint cabin.
Smooth walls in the paint cabin should prevent dust deposits. Regular cleaning is necessary however.

Special easily washed adhesive-bonding paint can be applied to the walls to protect the cabin from paint mist.

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Description and Operation

The manufacturer's instructions must always be followed when dealing with all materials! The information given in the following text is data which is independent of the manufacturer, and it should only be used as an indication.

Stopper materials

- 1-component nitro-combination stopper
- 2-component polyester stopper
- 2-component plastic stopper

Use suitable primer to protect from corrosion areas which have been sanded bare before applying stopper.

1-component nitro-combination stopper

Nitro-combination stopper has mostly been superseded by 2-component polyester stopper.

Fast drying fine stopper for the smoothing of irregularities.

The working properties of 1-component nitro-combination stopper can be improved by the addition of nitro thinners.

Drying time increases with thickness of the layer.

Application	1-component nitro-combination stopper
Layer thickness	Max. 80 µm
Drying time	up to 2 hours at 20°C
Sand	P240 - P400

2-component polyester general stopper

CAUTIONS:

Do not exceed the quantity of hardener specified by the manufacturer, excess peroxide can cause staining of the paint top coat.

Mix the stopper base and the hardener well to avoid a marble-like effect.
Check that the manufacturer permits use on the substrate to which it will be applied.

2-component polyester stopper is available in coarse and fine grades. The coarse stopper can be used for very uneven areas and surfaces and fine stopper or spray stopper should be applied afterwards.

Application	2-component polyester coarse stopper
Use	Rough equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes
Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150
Application	**2-component polyester fine stopper**
Use	Equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes

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Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P240

Application	2-component polyester glass fiber stopper
Use	Equalization of unevenness; blending in of vehicle extensions; repair of GRP components
Hardener quantity	approx. 3 - 5%
Working time	approx. 4 - 6 minutes
Drying	20°C approx. 12 minutes
	Short wavelength infrared approx. 4 minutes
	Medium wavelength infrared approx. 5 - 10 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150

2-component polyester fine stopper should always be applied after 2-component polyester glass fiber stopper.

Application	2-component polyester spray stopper
Use	Equalization of unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 25 - 30 minutes
Layer thickness	200 µm or 4 - 8 spray passes
Drying	20°C approx. 3 hours
	Short wavelength infrared approx. 10 minutes
	Medium wavelength infrared approx. 15 - 20 minutes
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150; fine sand - P280

Application	2-component plastic stopper for flexible thermoplastic
Use	Equalization of scratches or unevenness
Hardener quantity	approx. 3 - 5%
Working time	approx. 25 - 30 minutes
Drying	20°C approx. 15 - 30 minutes
	60°C approx. 15 min
	(Short wavelength infrared approx. 8 minutes)*
	(Medium wavelength infrared approx. 8-10 minutes)*
Sanding tool	Eccentric, sanding disk by hand
Grade	P80 - P150; fine sand - P280

***Infrared drying may adversely affect adhesion, therefore check the manufacturer's instructions.**

Plastic stopper has a very great tendency to shrink back, so that the edge of the stopper repair becomes visible.

Plastic stoppers are flexible and universally applicable on all types of plastic (except for pure PE and PP, these are plastics which cannot be painted). The manufacturer's instructions must be very exactly followed in order that no adhesion problems occur. A special plastic etch primer is specified for some materials.

Primers

Application	1-component primer
Use	Isolation of bare sanded areas.
Spray gun	HVLP 1.3 mm
Spray pressure	2.0 bar
Drying	20°C approx. 15 - 20 minutes

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	60°C approx. 10 min
Coat application	Wet on wet, no intermediate sanding

Application	2-component primer
Use	Corrosion protection and bonding agent (steel sheet, zinc coated steel sheet, aluminum)
Spray gun	HVLP 1.3 mm
Spray pressure	2.0 bar
Drying	20°C approx. 15 - 20 minutes
	60°C approx. 10 min
Coat application	Wet on wet, no intermediate sanding

HS primer filler and HS tinted filler

Note:

- Primer filler is available as 1-component and 2-component water based and solvent based forms.
- 1-component products are only suitable for isolation of sanded through bare areas and new painting.
- Water based products are also used for the skinning of thermoplastics and substrates which are sensitive to solvents.
- Tinted fillers can be individually matched to the top coat color and therefore find uses in effect paints and paints with poor covering power.
- Use dry sand or wet sand filler according to application in order to avoid unnecessary sanding work.
- On critical substrates the use of epoxy resin base filler is recommended in order to avoid adhesion problems.

Application	HS primer filler and HS tinted filler
Use	Equalization of unevenness, edge zones, sanding scores
Spray gun	HVLP 1.6 - 1.9 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm to 150 µm possible
Drying	20°C approx. 2.5 hours
	(60°C approx. 25 min)*
	(Short wavelength infrared approx. 8 minutes)*
	(Medium wavelength infrared approx. 10-15 minutes)*
Coat application	Wet on wet, no intermediate sanding

***In order to avoid boiling out, drying should be performed slowly.**

Paint

The base and the clear lacquer must be matched to one another.

Application	Water based paint
Use	Two layer metallic effect paint and Uni-paint finishes
Spray viscosity	At 20°C 18 - 20 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	15 - 20 µm
Drying	20°C approx. 2.5 hours
	60°C approx. 25 min
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes
Coat application	Wet on wet
Ventilation time	approx. 5 minutes

The base paint must be dried matt before the clear lacquer is applied.

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Application	2-component HS clear lacquer
Use	Gloss providing protective coat for base coat substrate
Spray viscosity	At 20°C 18 - 20 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm
Drying	20°C approx. 10 hours
	60°C approx. 30 min
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	2K HS Uni top coat
Use	Color and gloss providing paint layer
Spray viscosity	At 20°C 20 - 22 s
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar - 3.0 bar
Layer thickness	50 - 70 µm
Drying	20°C approx. 8 hours
	60°C approx. 30 min
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 -15 minutes

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Description and Operation

The manufacturer's instructions must always be followed when dealing with any materials! The information given in the following text is data which is independent of the manufacturer, and it should only used as an indication.

Adhesive sealants

Adhesive sealants are permanently elastic, long-lived, can be painted and accept filler.

Application: Sealing of visible and normal seams.

Can be over-painted with 2-component paint, primer and fillers after having dried throughout.

Contamination can be removed using cleaner and thinner.

1-component PUR adhesive sealant

Note:

- Hardens using oxygen from the air. For that reason, it must only be stripped after it has completely dried through.

2-component MS polymer adhesive sealant

2-component MS polymer adhesive sealant is free of isocyanate, solvent and silicones and can be spot-welded.

MS polymer adhesive sealant

Can be over painted with water-based paints.

Suitable for spraying and brushing to obtain a composition true to the original.

MS polymer adhesive sealant is free of isocyanate, solvent and silicones and can be spot-welded.

Underbody protection

Underbody protection products are immune to abrasion, permanently elastic, adhere well and are suitable for a true to original texture.

Underbody protection based on solvent

Application:

- Underbody protection for visible areas.

Properties:

- Can be over-painted, also with 2-component paint.
- Can be colored with a proportion of up to 40% paint.

Note:

- Contamination can be removed using cleaner and thinner.

Water based underbody protection

Can be over-painted with water based paint.

Can be colored with water based paint.

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Contamination can be removed using water.

Application	Water based underbody protection
Use	**Underbody protection** for visible areas
Spray viscosity	ready to use
Spray gun	Suction beaker HVLP gun 3 - 4 mm
Spray pressure	4 - 6 bar
Layer thickness	500 - 1000 µm
Drying	approx. 6 hours at 20°C
	approx. 45 - 60 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Water based underbody protection
Use	**Isolation primer** for peroxide marks, bloomed old paintwork and thermoplastics.
Spray viscosity	Thin as necessary with distilled water
Spray gun	HVLP gun 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	40 - 50 µm
Drying	approx. 2 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Paint additives

Application	Sanding test color
Use	To test sanding results
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 bar
Layer thickness	Spray drifted

Application	Fixer additive
Use	Converts solid top coat into two layer solid; multicolor painting
Spray viscosity	18 - 20 secs at 20°C
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	max. 30 µm
Coat application	Wet on wet
Ventilation time	approx. 15 - 30 minutes

Maintain maximum layer thickness without fail.

Must always next be overpainted with clear lacquer.

Application	Drying accelerator
Use	Accelerates drying with only minimal reduction in working life
Working life	approx. 5 hours at 20°C
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 6 hours at 20°C
	approx. 25 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Cannot be used in all paints, read the manufacturer's instructions.

Particularly suitable for partial painting.

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Application	Elastifier additive in primer material
Use	Elastifies the complete paint structure on plastics.
Addition	Up to 25%
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 µm
Drying	approx. 4 hours at 20°C
	approx. 40 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Elastifier additive in top coat
Use	Elastifies the complete paint structure on plastics.
Addition	Up to 25%
Spray gun	HVLP 1.7 - 1.9 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 60 µm
Drying	approx. 16 hours at 20°C
	approx. 45 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Application	Matting additive in solid paint
Use	Elastifies the complete paint structure on plastics.
Semi-gloss addition	Up to 25% in the paint without hardener and thinner
Silk gloss addition	Up to 35% in the paint without hardener and thinner
Silk matt addition	Up to 45% in the paint without hardener and thinner
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 8 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

CAUTION: Do not dry using infrared.

Application	Matting additive in clear lacquer
Use	Elastifies the complete paint structure on plastics.
Semi-gloss addition	Up to 25% in the paint without hardener and thinner
Silk gloss addition	Up to 35% in the paint without hardener and thinner
Silk matt addition	Up to 45% in the paint without hardener and thinner
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 8 hours at 20°C
	approx. 30 minutes at 60°C

Note:

- When mixing, first put in the matting additive, then the hardener and thinners.
- Stir immediately after adding the matting additive.
- Do not store after addition of the matting additive, storage will change the degree of gloss.
- Also suitable for use on plastics without addition of elastifier additive.

Application	Matting paste

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Use	Matts, elasticizes and gives structure to solid paint and clear lacquer during painting of bumpers or hard plastic.
Addition	1:1 or 2:1 depending on manufacturer in solid paint without hardener or thinners.
Spray gun	HVLP 1.2 - 1.3 mm
Spray pressure	2.0 - 3.0 bar
Layer thickness	50 - 70 µm
Drying	approx. 6 - 10 hours at 20°C
	approx. 30 minutes at 60°C
	Short wavelength infrared approx. 8 minutes
	Medium wavelength infrared approx. 10 - 15 minutes

Note:

- **The paint must not be filtered.**

Application	Anti-silicone additive
Use	Prevents silicone craters
Addition	2% to maximum 5%

Note:

- Only add away from the paint cabin and immediately remove contaminated cloths.
- If anti-silicone additive is used in the first coat, then it must be used in the following coats, and in at least the same proportions.

Additive materials

Variety of adhesive tapes

For profile, fine and large area masking work.

Properties:

- Withstands heat.
- Withstands water-based paint.
- Accepts paint.
- Easily removed without leaving adhesive residues.

Masking film.

For masking of large areas on vehicles.

Properties:

- Accepts 2-component and water-based paints.
- Withstands heat.
- Withstands water spray and condensation.
- Withstands solvent.
- Easily cut.
- Environmentally friendly and can be recycled.

Polishing materials.

Polishing means microfine sanding. For this reason, polishes must only contain abrasives, and no silicones.

During polishing repair, a good shine is achieved through the step-by-step use of polishes, starting with a highly abrasive polish and ending with a polish having very slight abrasive

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action.

Polishes are available in graduations from coarse to fine.

Abrasives

Please refer to the "Tools" chapter for information on abrasives.

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Description and Operation

General information

There is a great difference between painting in production and repair painting.

In production, only the bodyshell is painted, it has no trim, upholstery or assemblies. Because of this, other paints, tools and processing techniques can be used.

In contrast to that used in production, paint used in the workshop must dry at low temperatures. Plastics and the vehicle electronics must not be subjected to temperatures greater than 70°C.

The painting process in the case of repair work consists of two phases:

- Pre-treatment of the surface for corrosion protection and the smoothing of irregularities.
- Top coat application.

The precondition for a professional paint finish on a vehicle is the permanently maintained cleanliness of work spaces, tools and equipment,

Original materials must be worked according to the manufacturer's instructions, so that no problems arise in the processing nor during drying.

The room temperature must be 20 - 25°C and the humidity must be low. Temperatures which are too low or too high can lead to porosity, poor flow and boiling. High humidity leads to paint damage such as tarnishing of the paint film (matt film), adhesion problems and craters.

Pre-treatment of the surface

Perfect preparation of the subsurface is the precondition for a brilliant paintwork result. Faults in the preliminary stages delay completion and cause unnecessary extra work. The working steps described here demonstrate how important it is to follow these instructions step by step.

NOTE: Thorough cleaning of the vehicle and especially of the area being repaired is particularly important because of the danger of contamination of the paint.
Clean the area of the damage

Clean the damaged surface thoroughly, to allow the extent of the damage to be seen. Use silicone remover to produce a grease-free surface.

NOTE: The treated surface must be rubbed with a clean dry cloth before the solvent evaporates, otherwise there will be no cleaning effect.
Effective de-greasing is important not only before the application of paint, but also before all sanding stages, for two reasons:

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- During sanding of grease contaminated surfaces, globules may form with the sanding dust. Sanding marks will occur and the sanding medium quickly becomes unuseable.
- Oil and grease are embedded by the action of the abrasive particles, and are then very difficult to remove.

Establish the area of damage and the repair stages. In doing so, establish how much disassembly work must be undertaken. Perform a color test at this stage.

Mask off the area of the repair ready for preparatory work.

Sand out the damage location

When sanding, produce smooth transitions from the painted area to the bare metal.

Use an eccentric sander and P80 or P120 abrasive sheets. Finish off sanding with P150 or P180. The remaining adhering sanding dust must be completely removed.

Cleaning, de-greasing

Use silicone remover to thoroughly clean the surface in order to remove grease residues, sweat from the hands and other contamination.

NOTE: Use a solvent test to establish whether the old paint can be etched. Apply 2-component thinners to the damaged area using a clean cloth and rub lightly for about 1 minute. If the subsurfaces can be etched away, special pre-treatment is necessary. See "Tips and Tricks"
Apply primer filler

Before applying stopper, apply primer to the sanded and bare surface.

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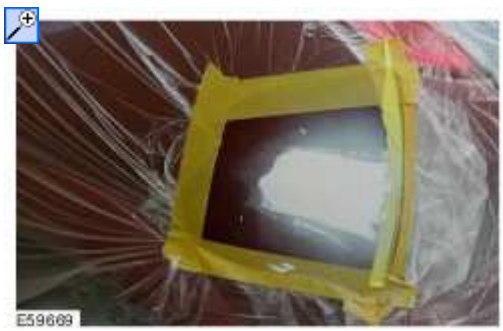
Allow the primer to dry and then lightly sand by hand using P220 - P400 dry.

NOTE: Most stopper can be applied directly to bare metal. But application of a primer filler provides better corrosion protection.
NOTE: Avoid sanding through to the bare metal. Points which are sanded through must be retreated with primer filler.
Stopper application



Pre-sand the hardened stopper using an eccentric sander and P80 dry, then final-sand using P120 - P140 dry. Clean the sanded surface using silicone remover.

Apply 2-component stopper to the filled surface. The stopper compound must only be applied thinly.

NOTE: Use of a testing powder is recommended so that the sanding process can be more easily checked.
Apply filler

Filler can now be applied to the dried repair area. Choose the correctly toned filler according to the manufacturer's instructions.

NOTE: Alternatively, filler with the correct tone can be mixed with the aid of colour matching cards.
Sand the filler.

The working area is expanded by applying new masking. This makes it possible to even out the transition from the damage area to the vehicle paintwork.

NOTE: The primer filler must be carefully sanded. Faults in the primer filler layer will be

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visible in the top coat.
The sanding process consists of two stages. Coarse sanding levels out the surface of the filler primer. Fine sanding ensures the necessary surface structure which allows the top coat to adhere well and cover sanding marks.

Sand the filler using the eccentric sander and P400 - P500 used dry. Clean the sanded filler finished surface using silicone remover.

The painted area is matted using a fine matting sponge, and then thoroughly cleaned.

Surface ready for paint

The surface which has been repaired and then prepared according to the manufacturer's instructions is now ready for basic paint application.

Top coat application

It is important for a good paint result that the recommended process data is adhered to, i.e. mixture proportions, layer thickness, viscosity, drying time etc.

First of all the work area is carefully masked ready for paint application. The correct adhesive materials and techniques must be used so that no hard transitions and edges are created during painting.

NOTE: The chapter "Tips and Tricks" gives in-depth information on masking work.
Thoroughly check the surface once more and rub-off with a dust-bonding cloth.

NOTE: Once more check the paint material and that the spray gun is correctly adjusted before applying the paint.
Paint application

The base paint is applied in two or three steps. First of all only the repair area is painted with the first paint application.

Flash off

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Allow the paint application to flash off until the surface has a matt appearance. So that the transition to the original paint is optimally created, the next paint application is applied to a wider area.

After the base paint has dried for the specified time, the clear lacquer is applied. Next the transitions to the original paintwork are treated with fade-out remover. This removes the spray mist and forms an ideal paint surface.

Repair stages for repair painting

The required time and material data is divided into four painting levels for calculations concerning repair painting. Proceed according to these divisions for every calculation.

Level 1 - Painting of new components

On new components, all inner surfaces, seams and edges which will no longer be seen after assembly must be primed and pre-painted.

NOTE: The cathodic dip primer must not be sanded away. Cleaning with silicone remover or light sanding of the primer is all that is required.

Job steps:

- Wash off, prime and pre-paint inner surfaces, seams and edges which cannot be reached at all or only partly after the component is installed.
- Sand new component with P280 - P320 or a fine sanding pad.
- Clean subsurface with silicone remover.
- Carry out masking work (when painting an installed component).
- Apply one spray run of filler, dry.
- Sand the filler. P1200 wet or P500 dry.
- Clean filler application with silicone remover.

Then the prepared surface can be painted with solid or 2-component paint.

If the new part has mild transport damage, this must be rectified beforehand.

To do so, add the following steps:

- Grind out the scratch.
- Finely sand the surrounding surfaces.
- Use a steel cleaning agent to thoroughly clean and then rub dry.
- Apply corrosion protection primer to the bare areas.

Level II - Top surface painting (color tone matching)

Complete bodywork surfaces which are to be painted without the need to apply stopper belong to this group. In addition, surfaces with faults in the top coat surface which cannot be removed by polishing.

The following faults are included:

- Loss of gloss.

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- Sanding scores.
- Heavy paint runs.
- Large dust and dirt inclusions.

The scope of the work is as follows:

- Sand the surface.
- Sand out paint damage and faults.
- Treatment of small areas which have been sanded through.
- Masking work (when painting an installed component).
- Apply top coat according to the painting process (one or several coat process).
- Dry the top coat and perform finishing work.

Level III - Repair painting with stopper applied to up to 50% of the surface.

If in addition to painting, work with stopper application must be performed, then the repair levels III or IV must be used.

In repair level III, apart from painting the complete bodywork surface, partial stopper work is carried out on up to 50% of the surface to be painted. The necessary primer and filler work are also included.

The following damage must be rectified in this level:

- Slight panel unevenness.
- Damage due to corrosion.
- Dented body surfaces.
- Weld locations.
- Deep scores or scratches.

The scope of the work is as follows:

- Fine sand pre-treated bodywork surfaces (e.g. lead-loaded areas).
- Sand out existing damage.
- Perform all necessary masking operations on the vehicle.
- Apply primer.
- Partial stopper application on up to 50% of the surface to be painted (two to a maximum of three stopper applications).
- Fill the repair area.
- Apply stone chip protection (when present in production).
- Apply top coat according to the painting process (one or several coat process).
- Dry the top coat and perform finishing work.

Level IV - Repair painting with stopper applied to more than 50% of the surface.

In repair level IV, apart from painting the complete bodywork surface, partial stopper work is carried out on more than 50% of the surface to be painted. The necessary primer and filler work are also included.

The following damage must be rectified in this level:

- Damage due to hail.
- More extensive stone chip damage.
- Extensively dented body panels.
- Sectional repairs with large weld seams.
- Surfaces with severe corrosion damage.

The scope of the work is different to level III because of the partial application of stopper to more than 50% of the area to be painted. In addition, more extensive sanding work is usually required.

Polish

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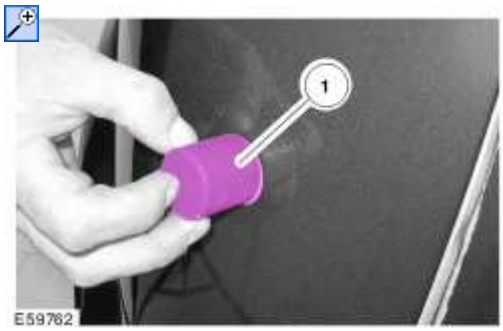
In order to achieve faultless quality, it is sometimes necessary afterwards to polish a newly painted surface.

Even after the most careful painting, it sometimes happens that dirt inclusions and paint runs occur in work with top coat or clear lacquer. Before polishing, such paint faults must be removed with the sanding cylinder ("Finiball") and hand sanding or eccentric sander in a wet sanding process.

Sanding cylinder



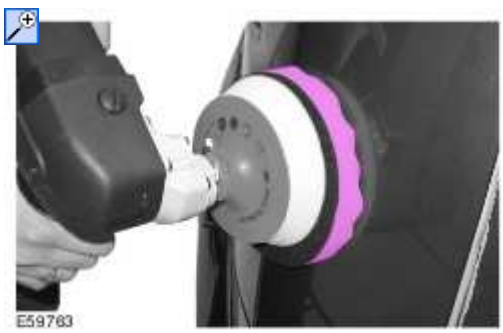
The special sanding compound **-1-** (sanding bloom) for the sanding cylinder is self-adhering and available in grades from P1000 to P2500.

- P1000 - P1500 for pre-sanding of runs and large imperfections in the paint.
- P1500 - P3000 for subsequent sanding of runs and sanding out of dust inclusions.

A small eccentric sander can be used for more extensive working areas. When doing so, first of all put the eccentric sander in place and then switch it on, so that the danger of sanding through on edge is reduced.

Finally polish the sanded area to a high gloss with suitable polish. To this end the various manufacturers recommend materials and process techniques which are specially suited to their products.

NOTE: The polishing is to be done in the same way as that used to remove swirl marks.
Polish



NOTE: Before using the nap sponge for the first time and after any long pauses in working, dampen the nap sponge with polish.

Job steps:

- Clean and degrease the area to be polished using silicone remover.
- Apply the polish to the polishing disc and spread it.
- Place the polishing machine down flat on the area to be polished and before switching it on, gently distribute the polish over the underlying surface.
- Polish out the location for 10 - 15 seconds with the edge, working with a criss-cross motion.
- Subsequently polish the location for about 10 seconds with the machine laid down flat.

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- Wash off and clean the polished location using the professional polishing cloth and then clean the polished surface.
- It is absolutely vital to carry out a visual check after finishing the polishing procedure. If any swirl marks are not completely removed by the first polishing procedure, then process must be repeated.

Aids

Cleaning putty

Cleaning putty allows deposits on the paint surface to be removed easily and gently. The following paint faults can be removed using cleaning putty:

- Metal deposits and iron dust.
- Paint or color mist.
- Tree resin and tar.
- Insect residues.

The surface to be worked must be thoroughly cleaned before the cleaning putty can be applied. Then the surface is sprayed with soapy water. Now the cleaning putty can be slid over the surface until all unevenness is removed.

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Print

Description and Operation

General

Although these days plastics can be produced in all colors and with a matt or gloss surface, painting is often necessary.

NOTE: Manufacturer's limitations concerning the feasibility of painting certain components must always be observed.
Reasons in favor of applying paint to plastic are:

- Individual coloring, matching the body paint.
- More gloss and color brilliance through painting.
- Removal of production imperfections.
- Protection from atmospheric exposure.

Nowadays painting plastic presents no problems because the materials are known and matched to the paint. In order that the painter can use the correct painting materials, the type of plastic must first be correctly determined.

To allow this, plastics are marked on the rear in accordance with the recommendations of the Association of Vehicle Manufacturers.

Once the type of plastic is determined it is an easy matter to assign special paint recommendations, matched to that particular plastic. Unmarked plastics require knowledge of materials so that a correct choice of paint materials can be made and the component can be reliably painted.

Plastic groups

Thermoplastics

When warmed these undergo a reversible transformation into a plastic deformable state and once cooled they maintain their shape. They consist of string-like (linear) or only slightly branched molecular chains.

Thermosets

Thermosets are hard and have the form of a close-meshed network in all directions. They do not undergo plastic deformation, are especially resistant to chemicals, are difficult to swell and are insoluble. At normal temperatures they are hard to brittle. At first the material does not undergo any change when heated, but when it reaches a critical point, the thermoset is totally destroyed.

Elastomers

Elastomers are characterized by high elasticity over a wide temperature range. They have properties like rubber or a sponge and after compression or distension they return to their original state.

Types of plastic

The plastics used in the automotive area:

- ABS - Acrylonitrile butadiene styrene (polymer)
- PA - Polyamide
- PC - Polycarbonate
- PE - Polyethylene
- PP - Polypropylene
- PP/EPDM - Polypropylene/ethylene propylene diene copolymer
- PC/PBT - Polycarbonate/Polybutylene terephthalate

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- PBT/PC - Polybutylene terephthalate/Polycarbonate
- PUR - Polyurethane
- GRP - Glass reinforced plastic

NOTE: PE and PP are plastics which cannot be painted, or can only be painted using special techniques.
As well as the pure plastics, so-called 'blends' are also used. This means combinations of different plastics. If we were dealing with metals they would be called alloys.

Plastic identification

Normally the identifier is marked on the plastic components used in vehicle construction.

One method to determine the plastic group is the sanding test. In this a place is chosen which will not be visible later, and the finger belt sander is used to sand the plastic.

The plastic group can be determined using the pattern left by the sanding and the dust:

- Thermosets produce a white dust.
- Thermoplastics smear and do not produce dust.

The plastic group can be determined by a sound test:

- Degree of hardness - the higher-pitched the sound, the harder the plastic.
- Elasticity - the more muffled the sound, the higher the elasticity of the plastic.

Cleaning plastic

Plastic components are manufactured using complicated moulds and presses or other highly engineered tools, mostly using an injection moulding process or reactive injection moulding process.

In order to be able to remove the component from a particular tool, a separating agent is used, which in some cases adheres very strongly to the plastic.

This separating agent on the plastic components must be completely removed before any surface coating is applied.

Warm storage (tempering) before actual cleaning brings the following advantages:

- The separating agent sweats out of the plastic.
- Tensions in the plastic are released.
- Air inclusions can be recognized and removed.

Intensively clean the item several times using a pad and fresh cleaning agent.

NOTE: A single wipe, even with cleaning agent, is not usually sufficient in most cases. Clean textured components with the aid of a soft brush.
After cleaning, it is absolutely vital that cleaning agent absorbed by the plastic should be expelled by tempering again. If the ventilation is good and the room temperature is about 20°C the solvent can be evaporated away by overnight storage.

Painting new components

It is absolutely vital that the substrate of an unpainted new component is free of separating agent. Paint can only be applied directly to very few plastics. The plastic must first be identified exactly and then worked with a repair system which is matched to the type of plastic. In most cases a plastic etch primer must be applied as adhesion base to all plastics which can be painted.

NOTE: Plastics have a tendency to become electrostatically charged. This can easily cause contamination during painting. Special antistatic cleaning cloths prevent electrostatic charging.

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Work process for thermoplastics:

- Thoroughly clean the surface.
- Temper the plastic.
- Afterwards clean with antistatic cleaner or antistatic cloths.
- Apply the bonding agent.
- Apply elastic filler. After it has dried, sand and clean.
- Apply one coat Uni-paint with elasticizer additive. For two layer painting the elasticizer additive is in the clear lacquer.

NOTE: Follow the paint manufacturer's guidelines during all work.

Work process for thermosets:

- As a rule, thermosets can be handled in the same way as normal body components.

Work process for PUR soft foam:

- The work process is the same as for thermoplastic.
- Instead of using bonding agent, a filler wash is applied to close the pores of the PUR soft foam.

The primer which has been applied to a primed new component can vary greatly. If no manufacturer's data is available, the composition and suitability for further working must be tested.

Painted components with an already ascertained and intact paint coat present no problems for possible repainting. After sanding and careful cleaning with plastic cleaner or thinners, painting can be done directly.

Unknown primer

When dealing with unknown substrates it is important to carry out an adhesion test on the existing paint before any repainting is attempted. First of all a mechanical test must be carried out, for instance using a lattice cut and tear-off band. If the adhesion of the old paint is not acceptable, it must be mechanically removed and new paint finish applied.

If the adhesion is acceptable, then an etch test is performed using 2-component thinners. If no etching can be detected in this test, application of the the paint finish can be started directly. Otherwise the old paint must be removed and a new paint finish created.

With the help of universal or special plastic primers and with only a few materials complementary to those previously present anyway, the painter can now apply a long-lasting paint finish to all popular vehicle attachments made of plastic.

Paint faults on plastic substrates

NOTE: Paint faults are fully described in the chapter Paint Defects and Damage.
The most common paint faults which can occur when painting plastic components and the methods of repair are briefly described.

Discoloration

Cause/damage pattern:

- Plastic material is not suitable for painting.
- Incorrect bonding agent.
- Paint used not solvent resistant.

Repair of damage:

- Repaint using suitable materials.
- Install a new unpainted component.

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Softening

Cause/damage pattern:

- Substrate not carefully cleaned.
- Air humidity too high or working temperature too low.
- Drying time incorrect (too short).
- Materials for substrate not correctly matched to each other or not mixed correctly.

Repair of damage:

- Dry out, sand, re-isolate and paint.
- Sand away faulty paint coats and re-apply paint finish.

Paint damage caused by detachment, poor adhesion

Cause/damage pattern:

- Insufficient paint adhesion between top coat and filler. The whole of the paint finish detaches from the plastic.
- Plastic not cleaned sufficiently, not or inadequately tempered.
- Unsuitable cleaning agent or materials used.
- Poor or lack of intermediate sanding.
- Paint finish underbaked or overbaked.

Repair of damage:

- Sand away faulty paint coats and re-apply paint finish.

Paint damage caused by blisters, craters, sink holes

Cause/damage pattern:

- Painting on PUR plastic which was not painted in production.
- Surface of the plastic material too porous.
- Flash-off time not adhered to.
- Drying temperature too high.
- Moisture in plastic material.
- Layers too thick.

Repair of damage:

- Clean the damaged area, sand, re-isolate and paint.
- Remove the paint layers and re-paint.

Crack formation

Cause/damage pattern:

- Overexpansion of painted PUR plastic components.
- Use of unsuitable paint materials.
- Paint materials not suited to each other or incorrect mixture ratio.

Repair of damage:

- It is not possible to repair overexpanded PUR plastic components.
- On other plastics, sand away damaged layers, isolate and repaint.

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Description and Operation

General

In general, partial surface painting at a point is called a spot repair. Using this technique, minor paint damage can be resolved economically and to time.

Advantage of this method

Because this application remains confined to the area of the damage, it is often unnecessary to remove components or color match against neighboring components. The material used is very much reduced because only a part of the repair area is coated.

Practical application areas

Only occasionally can satisfactory results be achieved in the centre of larger surfaces and/or on difficult colors. In addition, unprofessional application may cause tear-off edges to appear in clear lacquer. Only certain application areas are recommended.

NOTE: The final decision on whether to spot repair or paint the component must be made by an expert.

Application areas:

- 2-layer paint.
- Depending on the damage zone, paint damage up to a diameter of 3.5 cm or a length of 10 cm.
- Scratches.
- Clear lacquer application up to an area of DIN A4 max.
- Smaller areas which are optically broken up by other components such as trim strip, tail lights, swage lines and edges.
- Boundary zones and edge areas of larger components.

The best application areas have proven to be optical break lines such as corners, narrow surfaces, fenders and wheel arches.

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Because of their locations, the violet colored areas are the most suitable for spot repair painting. The turquoise areas are only marginally suitable and the rest of the areas are not

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suitable for spot repairs.

Repair process

Perfect preparation of the subsurface is the precondition for a brilliant paintwork result. Faults in the preliminary stages delay completion and cause unnecessary extra work. The working steps described here demonstrate how important it is to follow these instructions step by step.

Illustration of damage

A typical case for spot repair is a small stone chip on the fender.

Cleaning

First of all the component is thoroughly cleaned using silicone remover and refurbished using abrading and polishing paste. This re-creates the original degree of shine and ensures exact color matching on the touch-up surface.

Sand out

Sand out the damaged location using P180 - P320. Only small sanding blocks and small sanding machines must be used, so that the area of the repair remains as small as possible.

Sanding is completed by rubbing down the surrounding surface with a fine sanding pad or P1000 paper. Remove sanding residues and clean the repair area with silicone remover. The peripheral zone must then be masked for application of the filler.

NOTE: The size of the repair area must be kept as small as possible (maximum size DIN

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A4).
Filling

The filler layer is applied in stages. First of all, filler is only applied to the location which has been sanded away. After a wait time for flashing off, the second coat is applied so that it spreads over onto the existing paintwork.

The filler must be dried according to the instructions of the material supplier.

Rubbing down

The repair location is now rubbed down with P400 - P500 and the bordering surface with P2000 - P4000. Remove sanding residues and clean the repair area with silicone remover.

Paint

Before painting, clean the area for the final time using a dust-bonding cloth. Then apply the basic paint in thin layers using a spray gun until enough coverage is achieved.

After drying, apply clear lacquer in 1 or 2 coats (depending on product). In doing so, spray so that only the newly applied basic paint is completely covered. Finally a touch-up thinners is sprayed over the edge of the clear lacquer to dissolve the clear lacquer spray mist.

Dry

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Now dry the clear lacquer according to the manufacturer's instructions using an infrared gun.

Polish

Polish the component using a polisher and polish and check the polished area for any swirl marks which may be present. Polish away any swirl marks which are present.

Dirt inclusions

Sand out

Minor damage can be removed with a small sanding machine or preferably with an eccentric sander with P1500 - P2000. Very fine spray mist can be removed using P2000 - P4000 paper and a larger eccentric sander.

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Print

Description and Operation

General

Although corrosion protection measures and painting processes in production have reached a very high technical standard and will be continuously developed further, in the long term corrosion on a vehicle cannot be totally avoided. Further demands are therefore made of the paint specialist besides his knowledge of normal repainting of vehicles which have been repaired after an accident, in addition specialist knowledge is required for assessing and rectifying damage due to corrosion.

During repair painting, take care over the maintenance and re-creation of the corrosion protection applied in production, in view of the long-term warranty on Ford vehicles. Only those repair materials which are approved by Ford may be used for body repair work and repair painting.

For detailed information on corrosion protection measures during body repairs, please refer to chapter 501-25.

Furthermore, information on corrosion protection measures is repeated in individual chapters of the paint manual.

In particular, pay attention that the layer thicknesses specified in production are maintained. The complete system of solid one-layer on galvanized steel panels must equal at least 90 µm and the total system of two-layer on galvanized steel panels must equal at least 105 µm.

It is important that sealing operations, as far as they are necessary, should be undertaken after the application of the paint to specification, in order to ensure the best corrosion protection. All components which form hollow cavities such as pillars, rails, side components etc. must be provided with a coating of cavity protection wax.

Causes of corrosion

Corrosion of steel is an electrochemical process during which the steel combines with oxygen. The following factors lead to corrosion:

- Acidic compounds contained in the air, such as carbonic acid and sulphur dioxide, combined with oxygen from the air and/or water. Salts such as sodium chloride used as road salt accelerate the corrosion process.
- Mechanical damage such as stone chips and scratches which penetrate through to the steel panel.
- Lack of care by the vehicle owner of the painted and corrosion proofed surfaces or areas on the vehicle.
- Unfavorable weather or environmental conditions, as may occur in areas with high humidity, high salt content in the air or serious air pollution due to aggressive gases and dusts.

In the case of mechanical damage, formation of rust can often be seen, beginning to spread into the painted surface from a point (stone chip) or from a line (scratch). If these faults are not professionally rectified in good time, the result is rusting through from the outside to the inside. Rusting penetration from the inside to the outside occurs when for instance the cavity protection was inadequate.

Operations after painting

NOTE: The manufacturer's instructions must be followed when working with the various corrosion protection materials.

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- After painting, treat all cavities in the repair area with cavity protection wax. In doing so, pay particular attention to the weld seams. In dead-end applications with a panel insert, the cavity protection wax must be applied so that it also reaches the area of the panel insert.
- Seals which were applied in production and not over painted must be reapplied. Seals protect vulnerable parts of the bodywork, keep moisture away, reduce wind and road noise and dampen vibrations.
- Apply transparent wax.

Definition of the degree of rust

In workshop practice, in order to be able to carry out a consistent and objective evaluation of the scope of the damage, a degree of rust on the scale of 1 to 5 is determined by the DIN 53 210 standard. The main criterion here is the extent to which rust exists under the paint structure. It is determined in millimeters (mm).

Underlying rust grade: R1 < 1 mm

Corrosion starting with up to 1 mm of rust underlying (in the form of a spot or a line).

The damage can be rectified by cleaning the defective location and mechanically removing the underlying rust. For a small extent, apply a primer using a brush and allow it to dry. Touch-up the location with a paint pen or provide a new paint coating.

Underlying rust grade R2 < 1 - 2 mm

Advanced corrosion with up to 2 mm underlying rust.

Rectifying the damage:

- Clean the defective location.
- Remove the underlying rust mechanically down to the paintwork carrier.
- Apply 1-component filler and then 2-component "Vario" filler.
- Provide the damage location with new paint coat on visible outer surfaces. Only locally touch-up areas which are not optically conspicuous.

Underlying rust grade R3 < 2 - 4 mm

More advanced corrosion with up to 4 mm underlying rust. The damage must be rectified in the same way as for R2. A permanent cure of this type of damage pattern is still just possible

Underlying rust grade R4 < 4 - 5 mm

Notably advanced corrosion with up to 5 mm underlying rust. The damage must be rectified in the same way as for R2. If it is found that for whole areas this is only possible with a great deal of work, or is not possible at all, then a new component must be used.

Underlying rust grade R5 > 5 mm

Extreme corrosion, with more than 5mm underlying rust (panels, flanges or load-bearing components partially rusted or rusted through).

Such damage can no longer be repaired because in many cases the constructional strength of the component can no longer be produced. The risk in making a repair is too great. Install a new component and paint it.

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Print

Description and Operation

Basic color theory

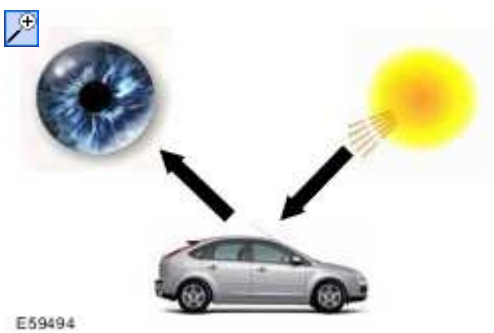
In order to achieve optically perfect painting results it is vital to understand the physical principles of the origin of color impression.

Color

Color itself is a sensory perception.

This perception arises through the combined effect of the following components:

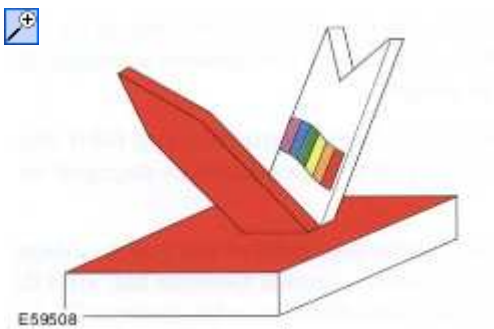
- Light (sunlight or artificial light irradiates the object).
- Surface of the object (reflection from the object of certain constituent parts of the light).
- Eye (perception of the reflections from the object).



Because the sensory impression of color is produced by all three of these components, it is dependent on the type, quality and function of the individual components. Practical examples make this clear:

- If a particular article is subjected to artificial light, then it gives a different impression of color to that which it gives in sunlight.
- An object with uniform color but different surface textures appears to have different colors (grained or ungrained dashboard).
- A person with perception disorder (colorblindness) cannot recognize certain colors or distinguish between them e.g. red-green weakness).

In turn the type of color is determined by the light absorption ability of an object. Light shines with all color components (spectral colors) onto an object, certain components of the light are absorbed (taken in) and other components are reflected (sent on). The components which are reflected produce the specific color impression.



The colors as we see them are the result of a combination of reflected colors from the spectrum. Physically speaking, these are electromagnetic waves with different wavelengths

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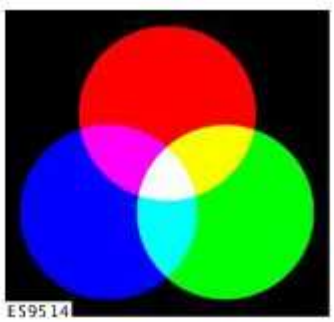
(and frequencies). The healthy human eye can recognize wavelengths between 0.36 µm (violet) and 0.78 µm (red).

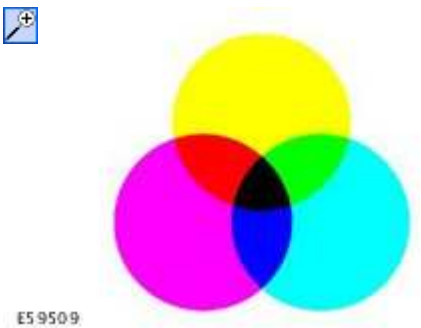
If all the perceptible wavelengths of the spectrum impinge on the human eye at the same time, the impression of white light is produced.

Additive and subtractive color mixing



Additive color mixing is the combination of light from different sources to give white. Different intensities of the additive primary colors red, green and blue allow millions of different colors to be represented (RGB colors).

Additive color mixing is always therefore used when light should enter the eye directly (without reflection off an object). Such as in the case of computer monitors or overhead beamers.



Subtractive color mixing means mixing the primary colors cyan, magenta and yellow to form a desired color (CMY colors).

Subtractive color mixing is used when light should enter the eye of an observer after reflection from an object. Such as happens with painting or in printing.

Oswald color circle

The Oswald color circle is based on subtractive color mixing, and enables the behavior of paints when they are mixed together to be represented.

Colors lying opposite each other are complementary colors and should not be mixed together as this will produce a dull (i.e. grey) shade. If green is added to red, the red

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becomes greyer, not greener.

Color shades which are side by side are partner colors and produce a mixed color shade. For instance, mixing red and blue produces a pure violet.

In addition, black and/or white may be necessary to produce a particular color shade.

- White makes the color shade lighter.
- Black makes the color shade darker.
- With black and white the color shade becomes more dreary or greyer.

Metamerism

Metamerism is the name of the effect which occurs when two colors appear identical in a particular light (e.g. artificial light), but the colors appear different under another light source (e.g. daylight).

The cause is the fact that the human brain, aided by the eyes, does not evaluate the wavelength, instead it evaluates the spectral intensity of the reflected light.

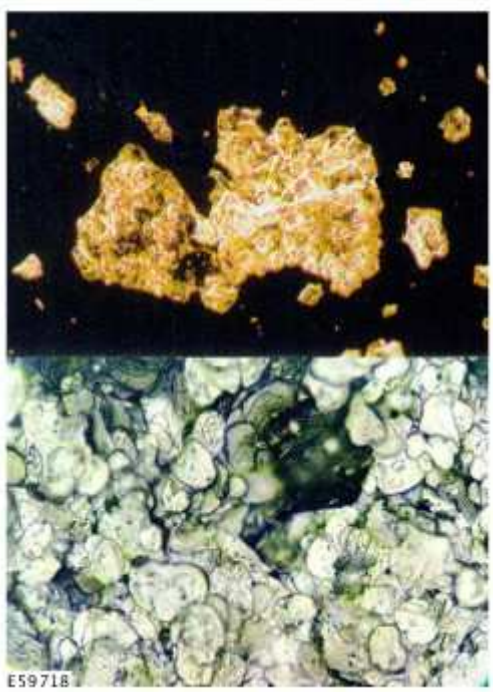
It is for this reason that color matching in practice must only ever be performed in daylight, or under special artificial light which is based on daylight.

Metallic and pearl pigments

Colored paints achieve their color effect by the addition of pigments. Pigments are colored, solid, very fine organic and inorganic particles which are insoluble in the binding material.

Metallic pigments

Aluminum platelets are added as pigment to form metallic paint.



Depending on the size and shape of the aluminum platelets, different metallic effects can be achieved:

- Cornflake aluminum (1) causes very strong dispersion because of rough edges, low brilliance, very low flop and produces grey-silver shades.
- Dollar aluminum (2) causes hardly any dispersion because of the smooth surface, high brilliance, produces very light, almost white silver shades.

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With metallic paints however, only a light-dark light reflection effect occurs.

Colored metallic paints are produced by the extra addition of color pigments to the metallic paint.

Pearl pigments

The basis of pearl pigments is formed by mica, which is metallized with a silver or gold layer.

Depending on the angles of light and observation, the mica platelets reflect different proportions of light. Because of this, the color of the paint appears to the observer to change.

Pearl pigments produce a colored and light-dark reflected light effect.

Color codes and their determination on Ford vehicles

It is necessary to determine the correct color shade of the original paintwork in order to perform a professional and perfect paint repair.

The original paint color shade can be found by:

- Inspection of the vehicle type plate with the color code stamped on it.
  - Later design
  - Earlier design
- Color shade catalog or color shade system of the manufacturer.
- The bare bodyshell plate with color designation.

Type plate

Type plate - location on Ford vehicles:

- Right-hand B-pillar - door rebate
- Left-hand B-pillar - door rebate
- Hood lock panel
- Left-hand vertical edge of inner front wing
- Right-hand vertical edge of inner front wing
- Right-hand engine compartment side member
- Left-hand bulkhead
- Right-hand bulkhead
- Luggage compartment interior
- Inner rear panel - luggage compartment

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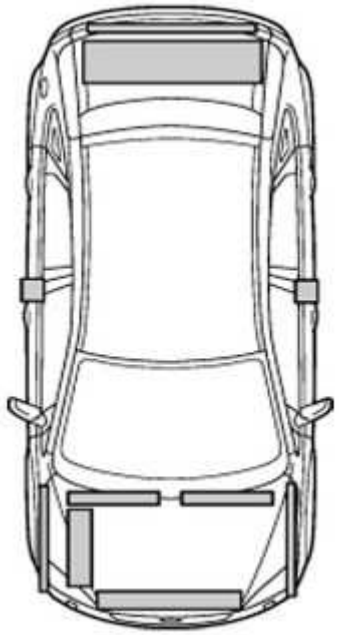

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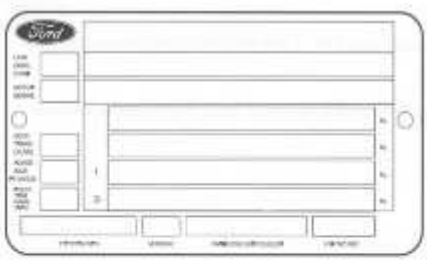
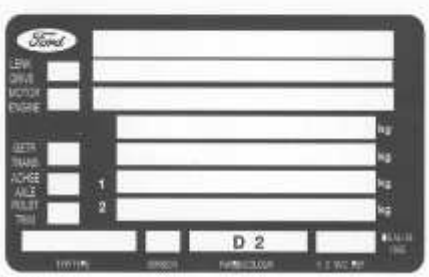
The type plate gives the color code in the last row.





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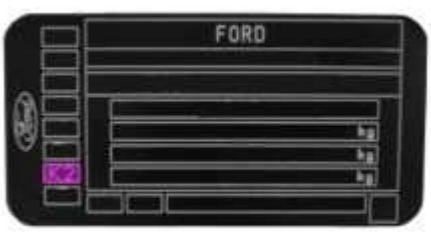
On the newer type plates, the color code is given in the left-hand column, at the penultimate position.



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Color shade catalog or color shade system of the repair paint manufacturer.

The repair paint manufacturers offer a variety of possible systems for the determining the production color shade of motor vehicles. There are electronic systems, color card systems and manuals for the determination of color shades.

Most repair paint manufacturers use the following systems:

- A tabular system based on the following parameters:
  - Color code
  - Make
  - Model
  - Build year
  - Color or color name
  - Ancillary codes
- A system with color cards based on the following parameters:
  - Make
  - Color shade
  - Build year

Because of the many parameters used, in a tabular system the color shade can also be determined by the lack of a parameter.

When using the color cards, emphasis is placed on matching of the original color shade with the color shade samples. For this reason this method is very helpful when the other parameters are not available.

Comparison of the results of both methods increases the certainty of using the correct original color shade and its formulation.

Additional certainty can be achieved during color shade determination by making a color sample plate. Here it is however important to apply the complete paint structure with base paint and clear lacquer onto a sample plate (1) in order to carry out a color shade and color coverage test.

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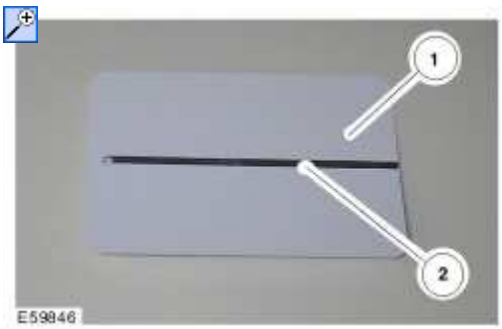

The color shade comparison is done by comparing the vehicle paintwork with the sample plate (1). The color coverage test is possible by using the black test stripe (2): If the test stripe (2) is still visible after test painting of the sample plate (1), the coverage is not good enough.

By using this determination of the original color shade, the formulation and information on any very slight fine adjustments which may be necessary can be established.

Bare bodyshell plate

The bare bodyshell plate is located:

- On the hood lock panel.
- Near the type plate.

The color name is stamped on in the last row.

Matching tinted filler to the color code

NOTE: Color samples must always be made from the same materials as the subsequent repair painting. Perform color shade matching in the fully hardened state, in natural light or under suitable artificial light.
Various tinted fillers are used during factory painting. In order to achieve the exact color shade of the factory applied paint, attention should be paid that the correctly matched fillers are used.

The repair paint manufacturers offer suitable precolored primers. The use of filler color cards allows the matching color shade to be determined.

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Print

Description and Operation

Comparing paint structures

It may happen that an area remains visible, especially when the area of the repair is small. The reason for this is the structural variation in the paint surface at the repair location compared with the original paint finish. The original paint finish has a slight orange peel effect while the repair areas is extremely smooth.

This effect can be reduced by fine sanding using P3000 of the area around the repair location and then polishing.

Etching substrate

If the substrate can be etched during the solvent test, suitable preparation must be done.

Job steps:

NOTE: Follow the manufacturer specific instructions.

- Sand the damaged area extensively using an eccentric sander and P80 or P120 abrasive sheets. Finish off sanding with P150 or P180.
- Remove the sanding dust and clean the area of the damage using silicone remover.
- Apply polyester stopper to the bare panel and to the damaged area.
- Sand the dried polyester stopper to an even surface using P80 - P150. Finish sanding using P180 - P240. If required apply more stopper, again only on the bare panel.
- Wet sand the residual old paint finish using P600 - P800. Transitions with P400 - P600. Clean with silicone remover.
- Prime bare metal areas with acid primer.
- After the acid primer has been left exposed to the air for the correct evaporation time, apply 2-component primer filler in thin layers over the complete repair area, leaving enough air exposure time in between coats.
- After the filler has dried, sand wet with P800 or sand dry with P400. Sanded through areas must be covered again with 2-component Nonstop filler primer.

Another possible method of preventing etching of the substrate is to use waterbased primer and filler materials.

Masking the vehicle

Masking and covering work are among the most important preparations required to achieve a high quality paint finish. Paint application onto neighboring components, paint mist and sharp paint transitions are quality faults. For this reason it is extremely important to take special care and to use suitable masking materials.

NOTE: When water based paints are used, all materials must be stable towards water.
Plan the masking work:

- Determine the sequence of masking work. Sometimes after masking film has been applied, it is difficult or impossible to reach certain areas.
- Prepare the masking material.
- Start with small difficult areas.

Pay special attention to the areas of profiled seals, edges, openings and paint transitions.

Masking tape

Masking tape is available in various widths for special application areas. In practice however, a wide tape has proved best for almost all areas, also taking into account the time required for masking work.

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NOTE: Use of differing masking materials is often much more time-consuming.

Advantages

- Good coverage. Narrower tapes must often be applied in several layers.
- More resistant to tearing.
- Wide tapes can be applied deep into joints and therefore protect from paint mist and contamination.
- Removal is often easier.

Masking film

Transparent plastic film has become accepted as a practical method to mask large areas of a whole vehicle. It can quickly and easily be applied to the vehicle from the roll.

NOTE: Only mask the vehicle when it is dry. Moisture under the film can lead to matt paint in the drying process.

Using masking film

- Clean the vehicle before masking it.
- Pull the film over the vehicle. Because of the static charge, the film lies on the vehicle like a second skin.
- Cut out the repair area using the film knife and then mask it.

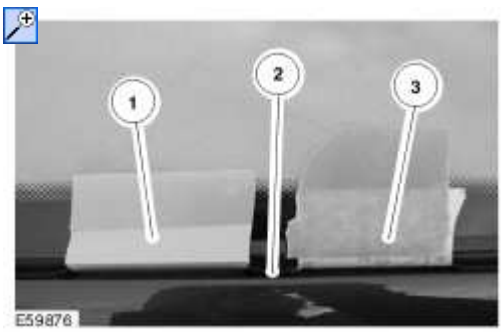
Other ways of masking a vehicle are:

- Masking using masking paper.
- Painting cloth (mostly used during filling work).

Profiled seals

If it is not possible to remove a profiled seal, then it must be masked in such a way that no edges can form due to paint accumulation.

To do this, the seal is lifted slightly and masked. The following techniques are possible:



Item	Part Number	Description
1	-	Masking tape with plastic strips
2	-	Sealing lip
3	-	Sandpaper with masking tape

- Laying a string or cord under the seal. Suitable for soft and elastic seal lips.
- Special masking tape with plastic strips for hard seal lips.
- Instead of using plastic strips, fine sandpaper cut into strips can be inserted and secured using normal masking tape.
- If the seal can be easily displaced, normal masking tape can also be used.

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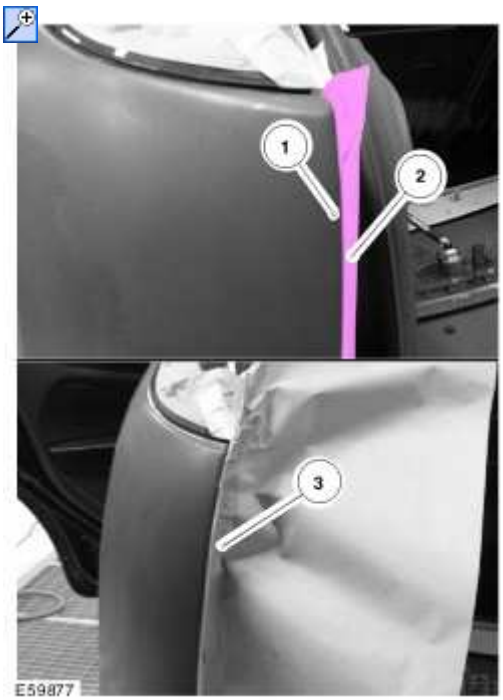
Edges/openings

Smooth paint transitions can be produced by positioning adhesive tapes.

NOTE: Pull the adhesive tapes away immediately after the paint has been applied and check the paint transitions.



Item	Part Number	Description
1	-	Vehicle edge
2	-	Adhesive surface
3	-	Masking paper

Possible variations

- At edges apply one strip of masking tape half on the area not to be painted and mask using a second strip.
- On surfaces, two masking strips can be attached, each affixed by half their adhesive surface. The adhesive strip which arises is then applied with one half on the edge of the area to be painted. The other half is aligned and fixed in addition in the curves.
- Affix masking paper on one side over the area to be painted. Double back the masking paper and secure it.
- Affix round profiled foam at the edge of the area to be painted using masking tape.

Foam strips are suitable for affixing to openings such as door gaps.

NOTE: Choose a suitable profile diameter. A profile which is too thick will protrude from

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the opening, one which is too thin will leave a gap.
Clean the door opening well and affix the matching shape.

Color shade problems

If a vehicle color shade is taken from a vehicle on a hot summer day and the mixed color applied, this may cause color shade problems. Some colors change so much at higher temperatures that it can lead to an incorrect result. Red color shades are particularly prone to this shade behavior.

This means that color determination should always be done on the bodywork when it is at about the same temperature as the later working temperature will be. The best temperature of the item is between 15° and 25° C.

Isopropanol and water

Painted surfaces are very easily cleaned using a mixture of 70% water and 30% isopropanol (can be obtained through a laboratory supplies specialist or a pharmacist).

Temperature reduction spray

If finishing work must be performed on touched-up surfaces and newly painted plastic parts, problems may arise. The paint and the transitions are not yet fully hardened.

NOTE: When working with the polishing machine, make certain that each operating run lasts no longer than about 5 - 10 seconds, in order to prevent the paint becoming warm.
Even so, in order to be able to polish over transitions, temperature reduction spray must be applied to the surface. The transition area is then alternately sprayed and polished until a perfect transition surface is achieved.

Paint faults on soft plastic components where elasticizer additive has been used in painting must be wet sanded using grade P2000 - P2500 paper.

In doing this the sanding location and the surroundings are sprayed with temperature reduction spray and the paint faults sanded out by hand. Afterwards the location is polished as described above.

Paint plane

Dirt inclusions and paint runs can be removed with the sanding cylinder ("Finiball") and hand sanding or eccentric sander in a wet sanding process.

Another practical tool for removal of paint faults which lie proud of the surface is the paint plane.

NOTE: Guide the tool carefully with the minimum of force. It must not tilt, otherwise more serious damage may easily be caused.

This tool allows paint faults to be carefully removed in shavings. Afterwards the surface must be polished using suitable materials.

Shading

Even when all the rules, steps and corresponding instructions have been followed

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concerning possible shades, it may happen that the mixed color shade does not exactly match the vehicle color.

In these cases, shading must be done. Because there is no fixed formula for this, experience and a trained eye are important. Some rules must be followed for shading.

NOTE: Self-made color sample plates of the current colors are very helpful for determining the color shade. Refer to the chapter Color Determination and Color Theory.

- When shading, if possible only use the paint mixture that is also allotted in the color shade formula.
- Observe the rules concerning contrary colors (complementary colors) and partner colors according to the Oswald color circle.
- Complementary colors are not recommended during shading because they mutually inhibit and lead to muddy mixtures.

Sanding marks

In certain circumstances, the recommended sanding methods up to now are no longer suitable for light metallic color shades. Wet sanding with grade P1200 paper or a grey sanding pad can cause sanding scratches which can become very visible under certain lights.

In order to achieve an excellent paint result on difficult color shades, follow these working rules:

- Sand filler as before, rub down area to be painted with 3M ultra fine matting sponge and 3M matting gel.
- Sand filler as before, rub down area to be painted with soaked 3M wet sand paper P1500 - P2000.
- Sand filler as before, rub down area to be painted with 3M 260 L P1000 eccentric (Interface Pad).

Improving touch-up work

During application of special effect base paints, the effect particles align themselves exactly parallel to the surface in the paint layer while it is still liquid. This means a particular thickness of the paint layer is required.

Because during painting the layer thickness in the transition zones reduces from normal to zero, the effect particles can no longer align themselves. This leads to lighter, darker or cloudy zones.

If 1-component clear lacquer is sprayed before the base coat, this effect is prevented. An optically perfect transition will result.

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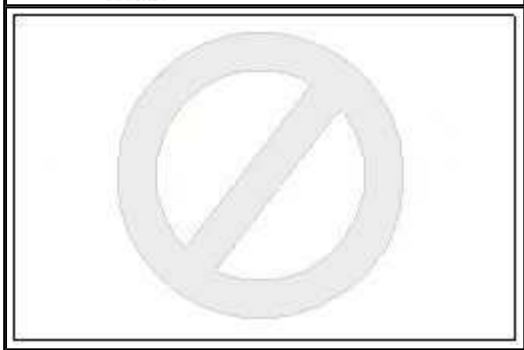
Removal and Installation

Special Tool(s)

E63420	204-607 Remover, Ball joint
	205-316A Alignment Pins, Subframe

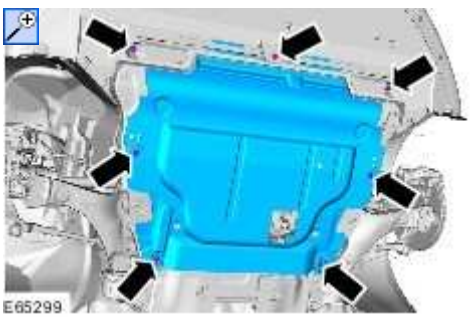
General Equipment

Transmission jack

Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).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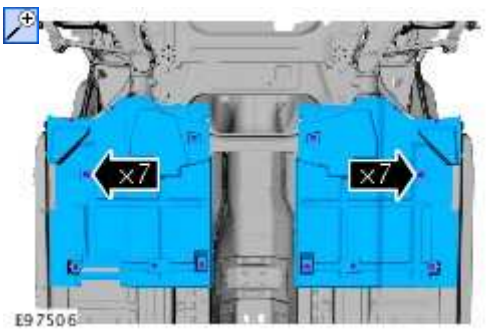
2. If equipped.



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3. If equipped.

4.

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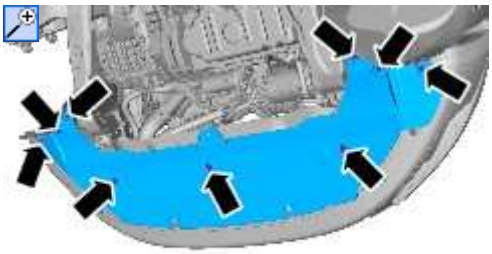
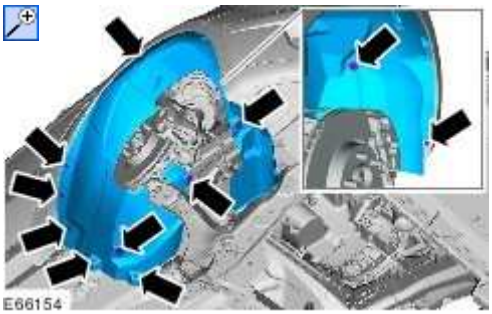


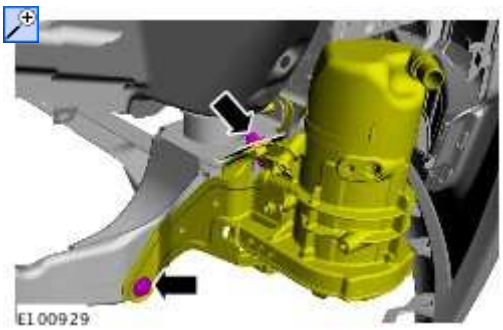
E68962

Vehicles with 2.0L diesel engine



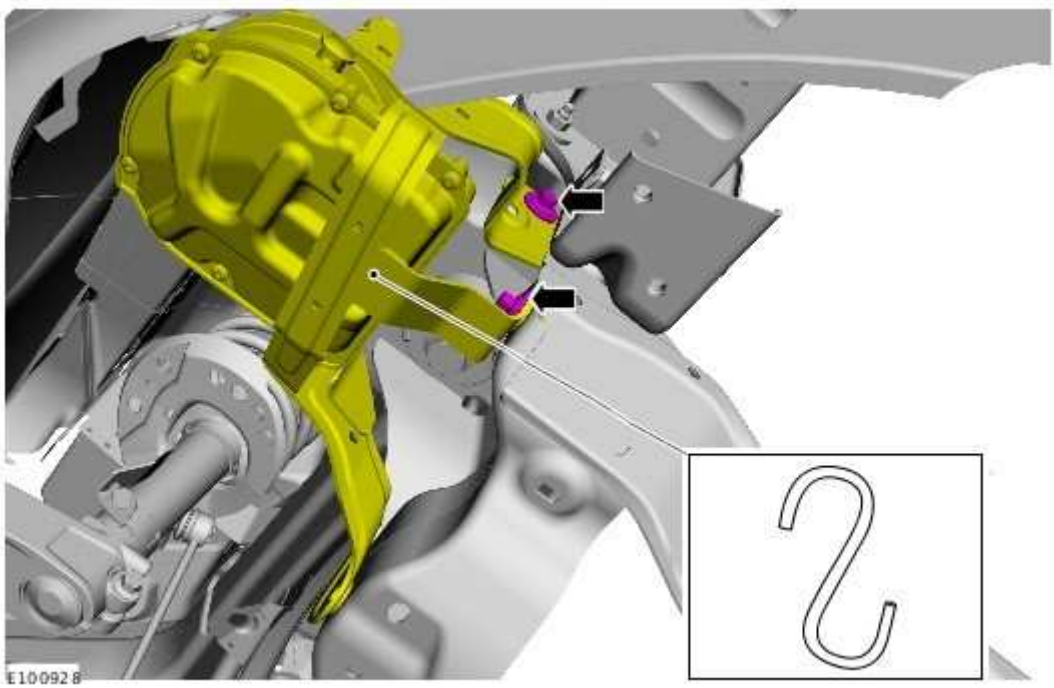
E66154

5.



E100929

6. *Torque:* 25 Nm



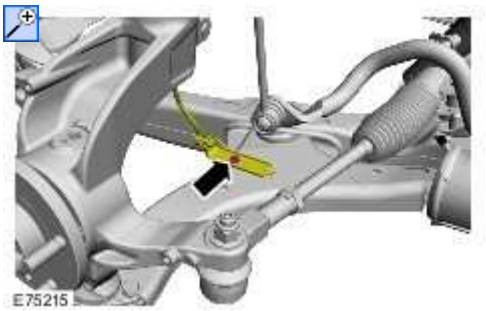
E100928

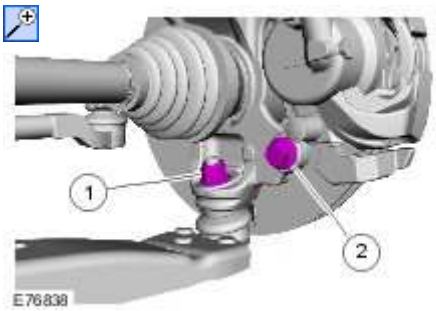
7. *Torque:*

All vehicles

8. If equipped. On both sides.

http://vnx.su



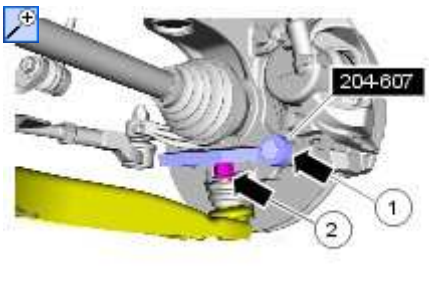


9.

1. CAUTION: Make sure that the ball joint does not rotate.
   On both sides.

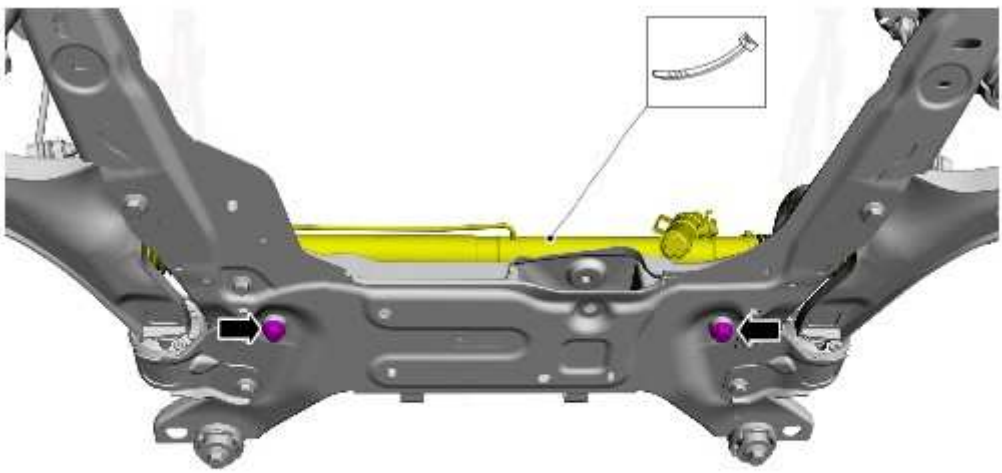
   Loosen: 2 turn(s)
2. On both sides.

   Torque: 200 Nm



10. On both sides.

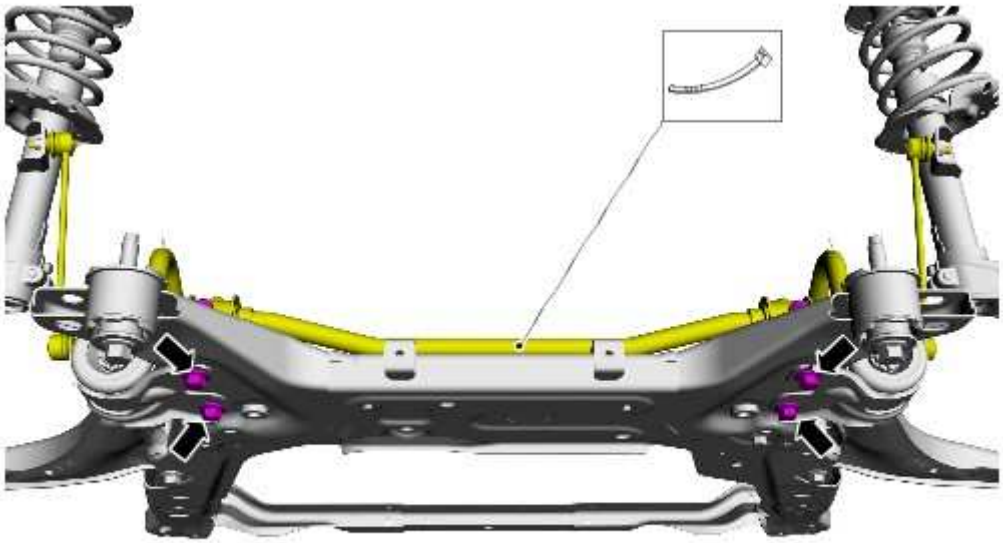
    Special Tool(s): 204-607
    Torque: 100 Nm



11. *Torque:* 120

12. *Torque:*
    Stage
    140 Nm
    Stage
    45°

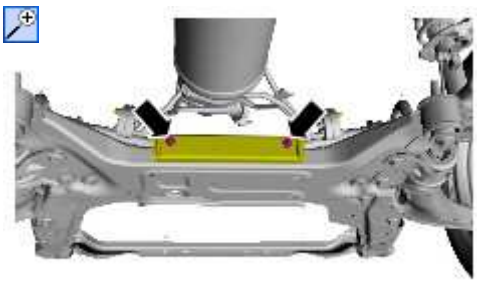
http://vnx.su



E93353

E93355

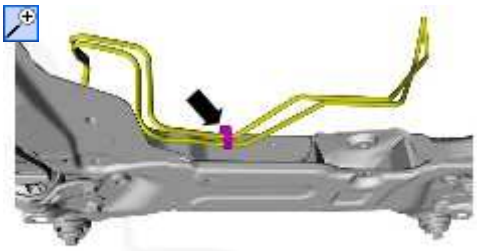
13.



E93370

14. *Torque:* 10 Nm

Vehicles with 2.5L engine



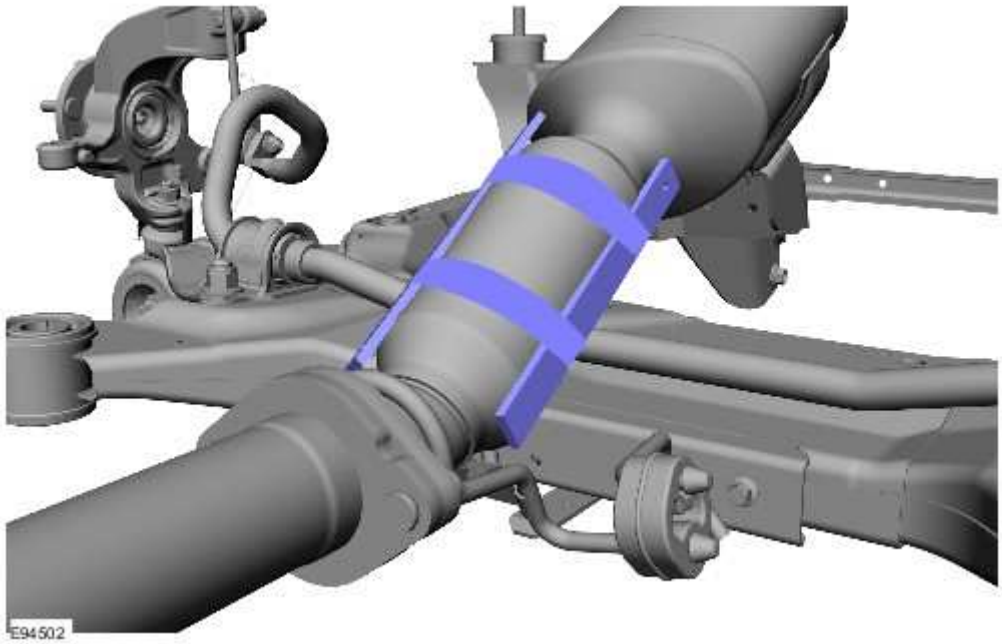
E93356

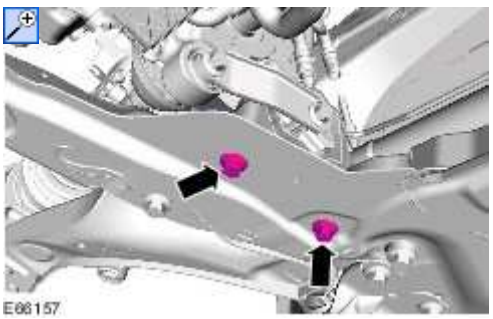
15.

16. CAUTIO
Make sure th
the exhaust
flexible pipe

http://vnx.su

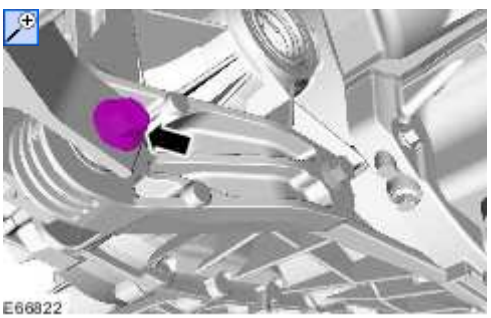
not forcibly t





17. *Torque:* 110 Nm

Vehicles with 2.0L, 2.3L or diesel engine



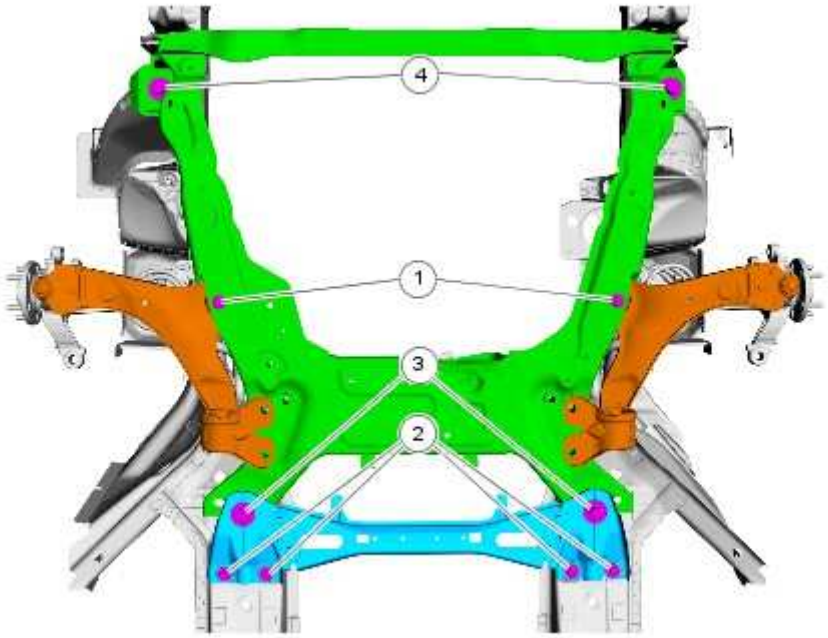
18. *Torque:* 80 Nm

All vehicles

19. *General Equipment:* Transmission jack

20. WARNIN
This step
requires the

http://vnx.su



E93350

of another technician.

CAUTIO
Make sure th
no componer
catch.
NOTE: This s
is only neces
when installi
new compon
Remove the
following iten

1. *Torque*

   140 Nr

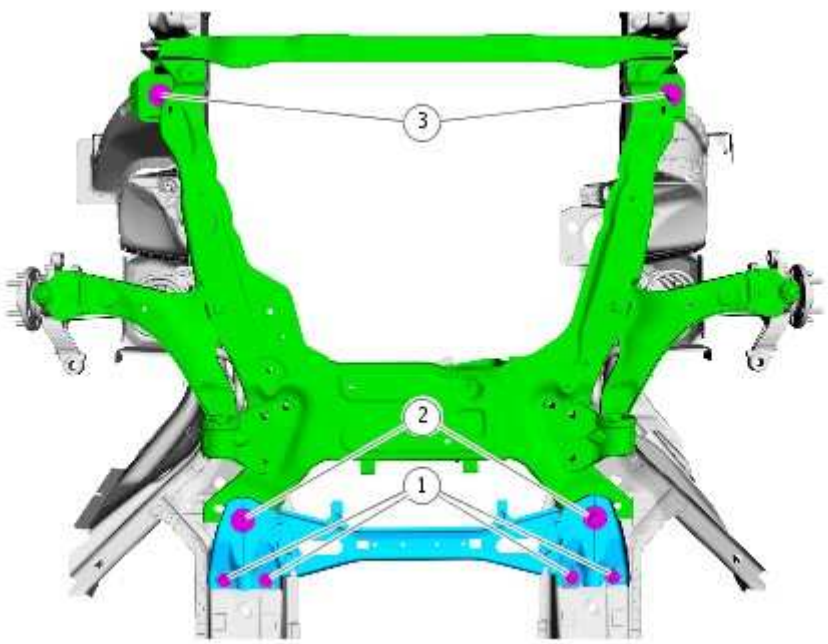
   45°
2. *Torque*
   Nm
3. *Torque*

   150 Nr

   90°
4. *Torque*

   150 Nr

   90°



E93351

21. WARNIN
This step
requires the
of another
technician.

CAUTIO
Make sure th
no componer
catch.
Remove the
following iten

1. *Torque*
   Nm
2. *Torque*

   150 Nr

   90°
3. *Torque*

   150 Nr

   90°

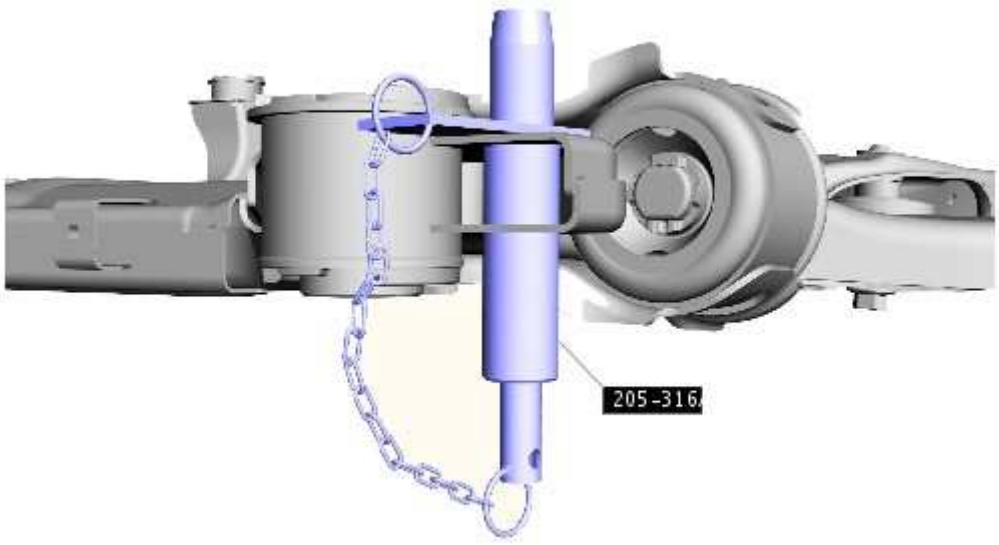
Installation

1. To install reverse the removal procedure.

http://vnx.su

2. On both sides

Special Tool(
205-316A



E93352

3. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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Removal and Installation

Special Tool(s)

E63420	204-607 Remover, Ball joint
	205-316A Alignment Pins, Subframe

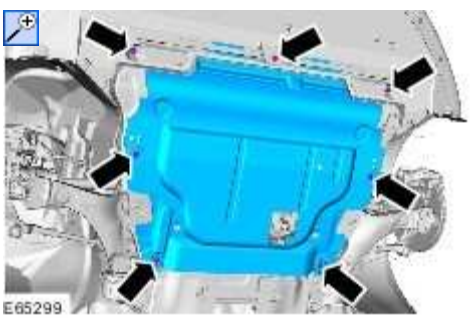
General Equipment

Transmission jack

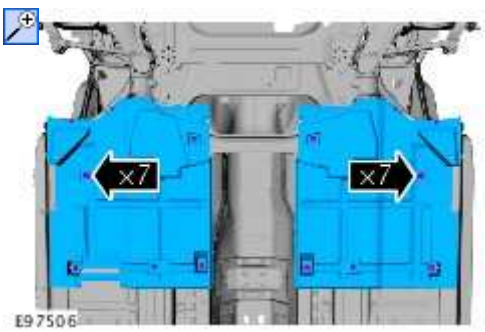
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).
2. If equipped.


E65299

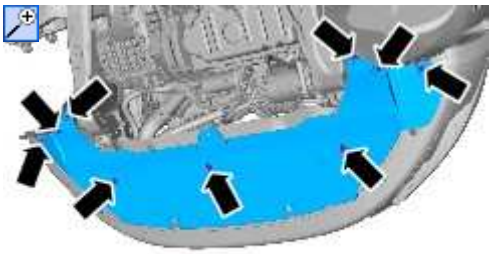
3. If equipped.



E97506

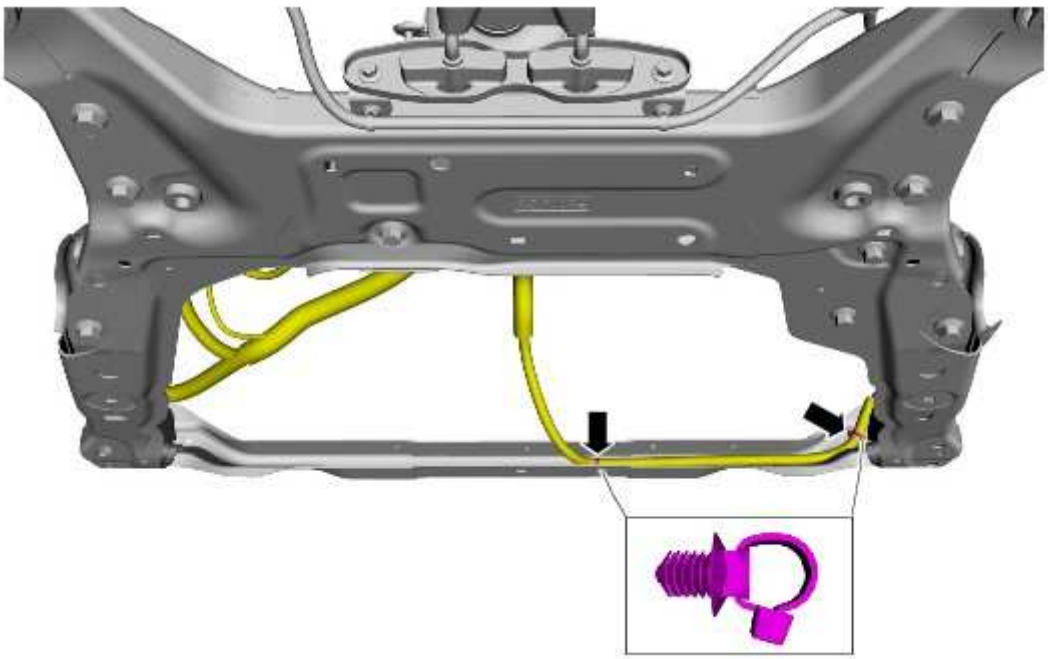
4.

http://vnx.su

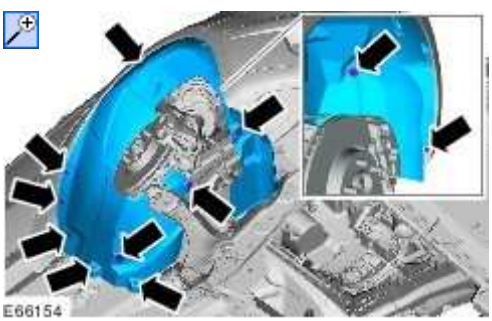


E68962

5.

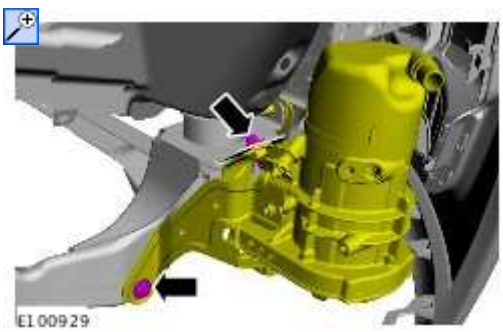


E128177



E66154

6.

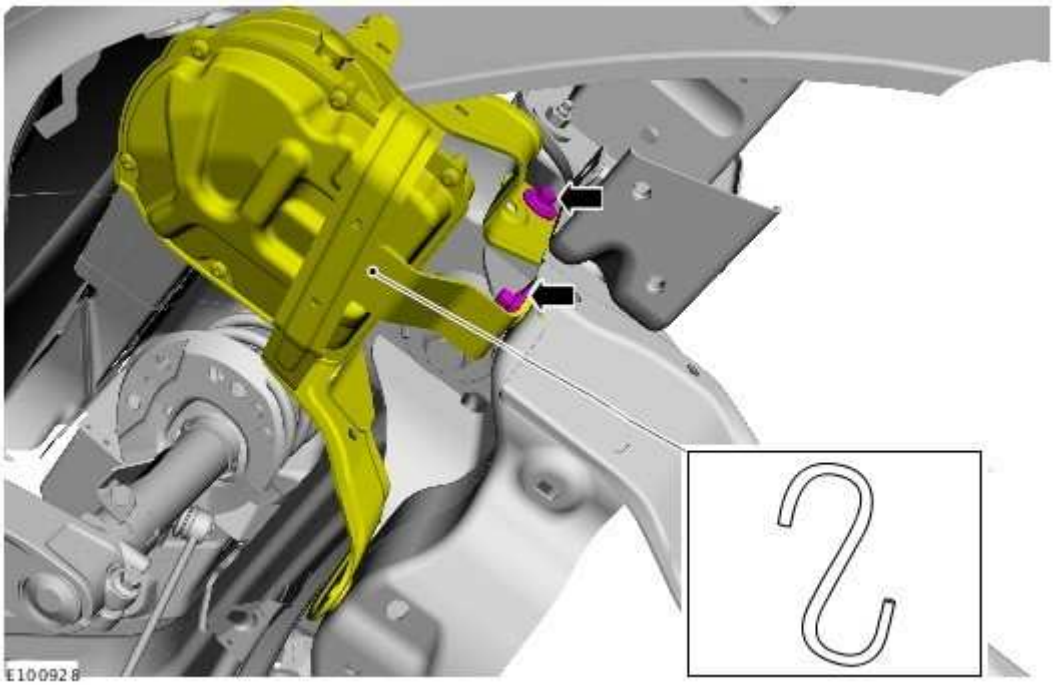


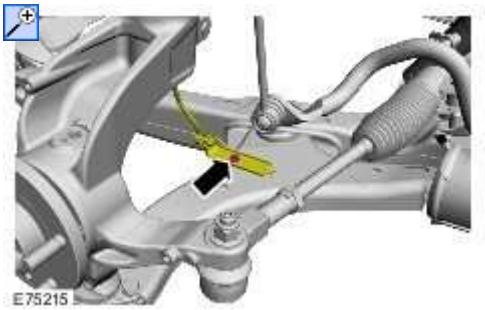
E100929

7. *Torque:* 25 Nm

8. *Torque:*

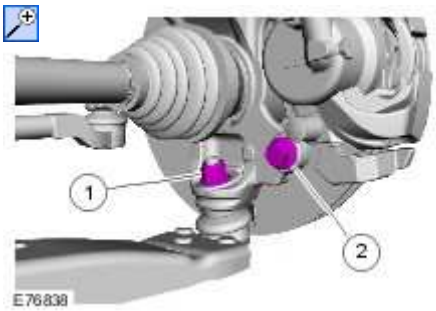
http://vnx.su





9. If equipped. On both sides.

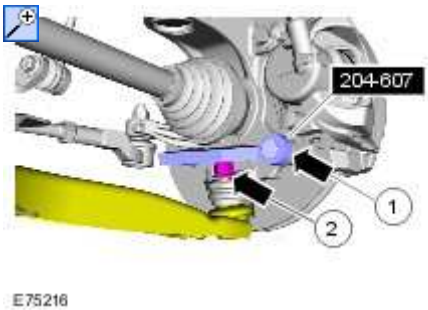
   Torque: 8 Nm



10.
   1. CAUTION: Make sure that the ball joint does not rotate.
      On both sides.

      Loosen: 2 turn(s)
   2. On both sides.

      Torque: 200 Nm

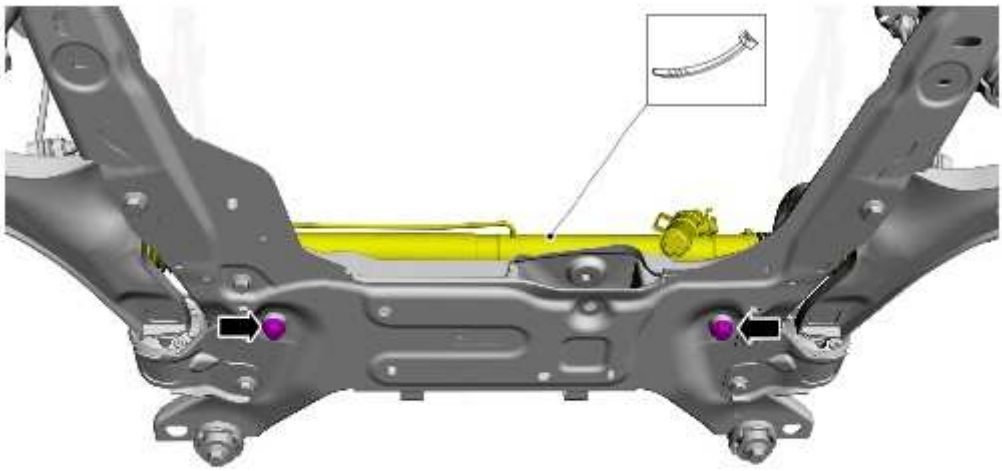


11. On both sides.

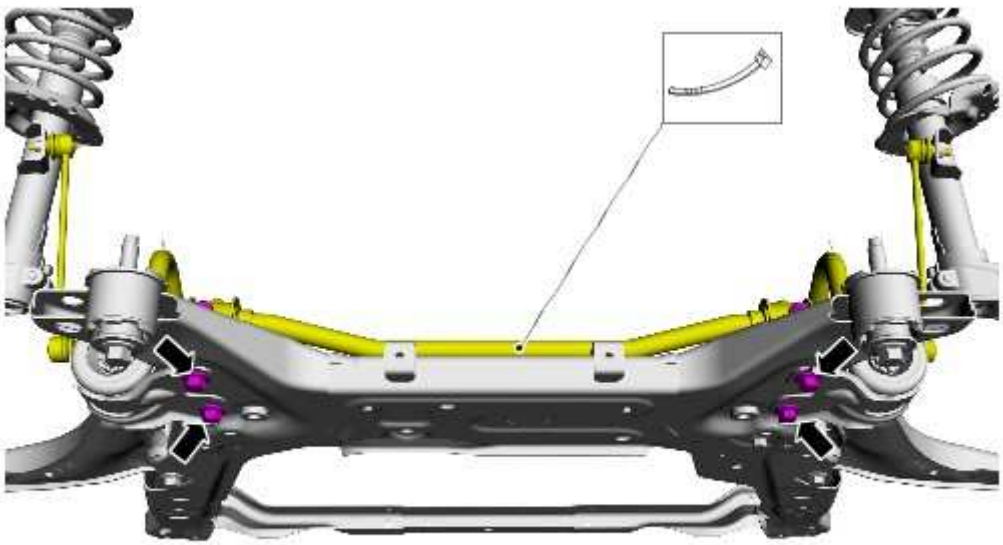
    Special Tool(s): 204-607
    Torque: 100 Nm

12. *Torque:* 120

http://vnx.su

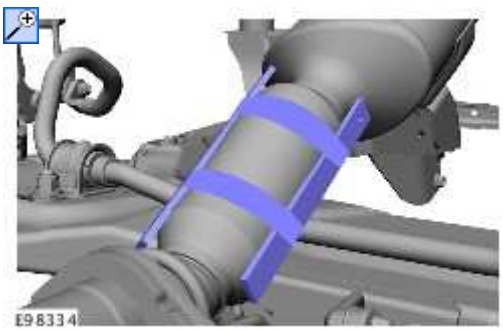


E93354



E93353

13. *Torque:* Stage 140 Nm Stage 45°

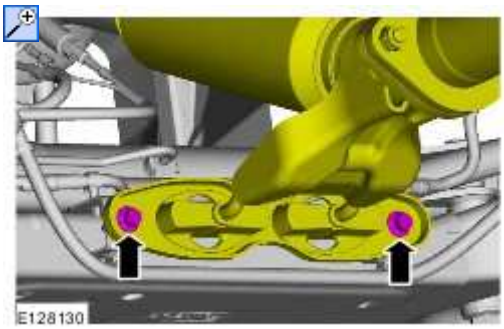


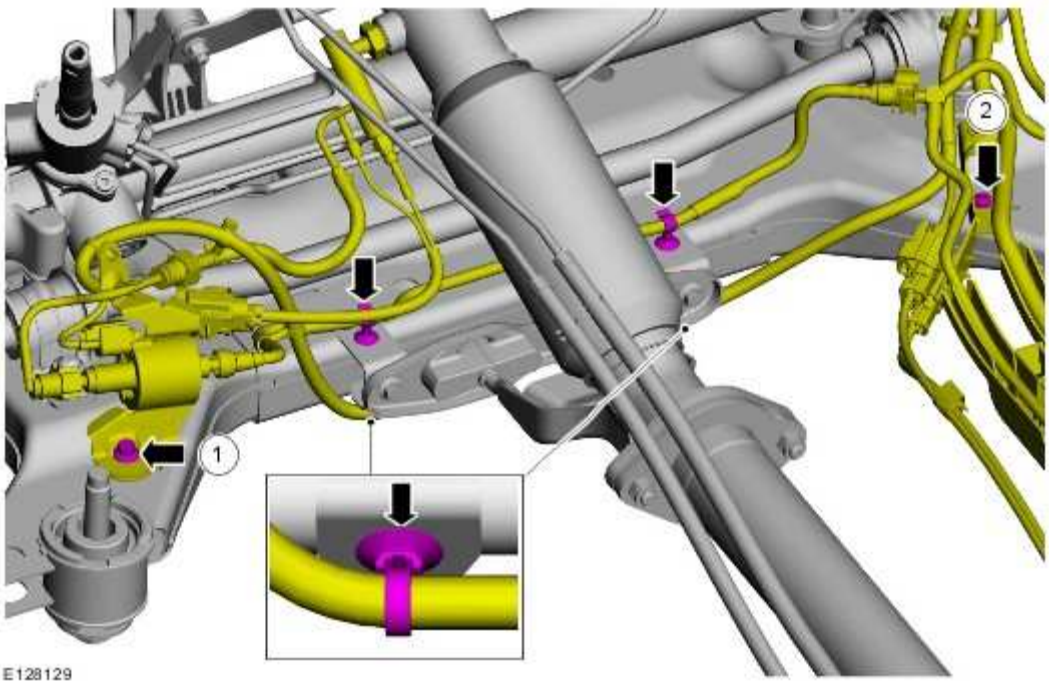
E98334

14. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

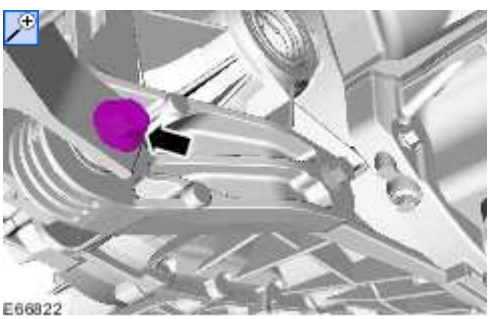
15. *Torque:* 24 Nm

http://vnx.su





16.
1. *To* 25
2. *To* 10

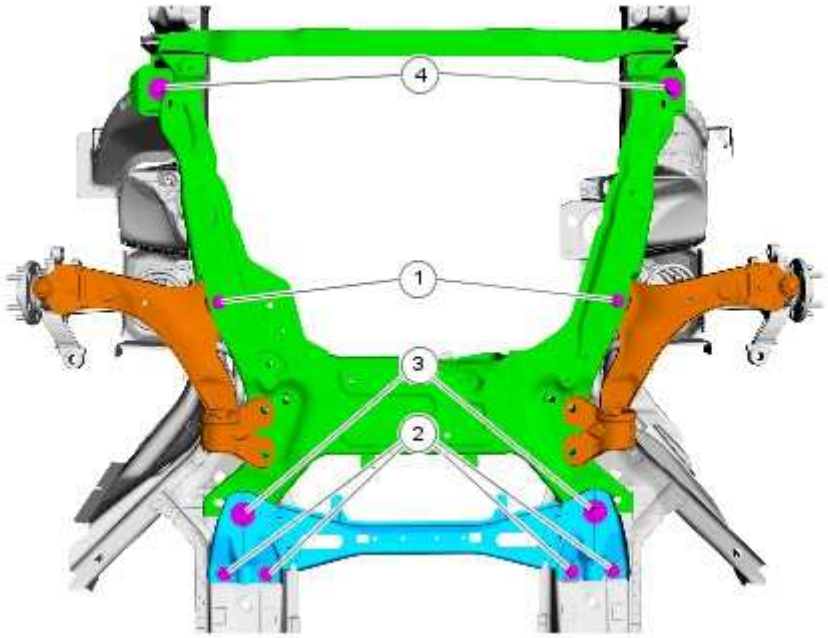


17. *Torque:* 80 Nm

18. *General Equipment:* Transmission jack

19. WARNIN
This step
requires the
of another

http://vnx.su



E93350

technician.

CAUTIO
Make sure th
no componer
catch.
NOTE: This s
is only neces
when installi
new compon
Remove the
following iten

1. *Torque*

   80 Nm

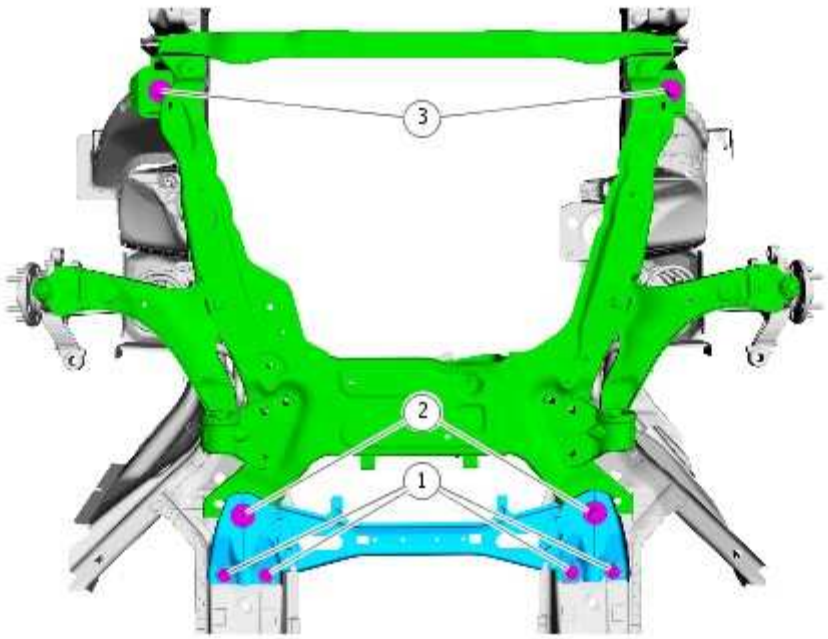
   120°
2. *Torque*
   Nm
3. *Torque*

   150 Nr

   90°
4. *Torque*

   150 Nr

   90°



E93351

20. WARNIN
This step
requires the
of another
technician.

CAUTIO
Make sure th
no componer
catch.
Remove the
following iten

1. *Torque*
   Nm
2. *Torque*

   150 Nr

   90°
3. *Torque*

   150 Nr

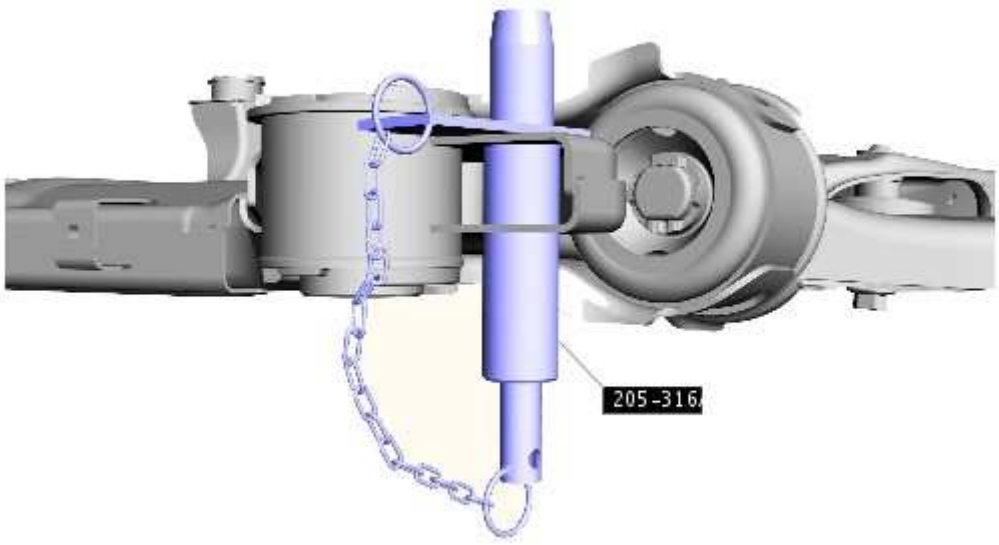
   90°

Installation

1. To install reverse the removal procedure.
2. On both sides

http://vnx.su

Special Tool(s
205-316A



E93352

3. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

http://vnx.su

Removal and Installation

Special Tool(s)

E63420	204-607 Remover, Ball joint
	205-316A Alignment Pins, Subframe

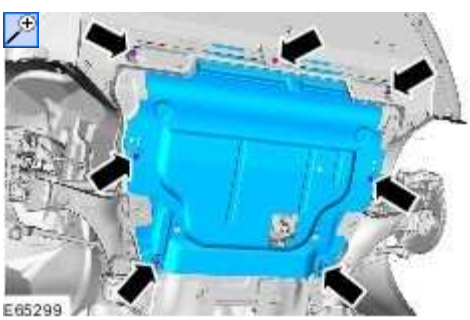
General Equipment

Transmission jack

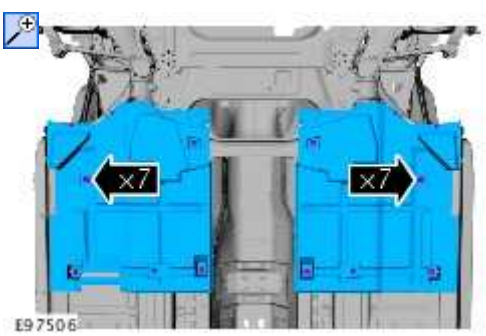
Removal

NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Lifting (100-02 Jacking and Lifting, Descrip and Operation).


E65299

2. If equipped.

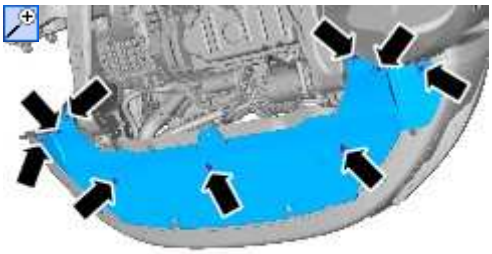


E97506

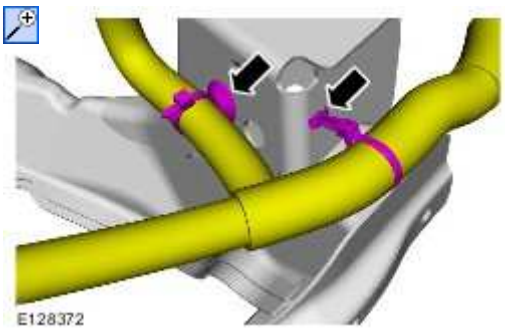
3. If equipped.

4.

http://vnx.su

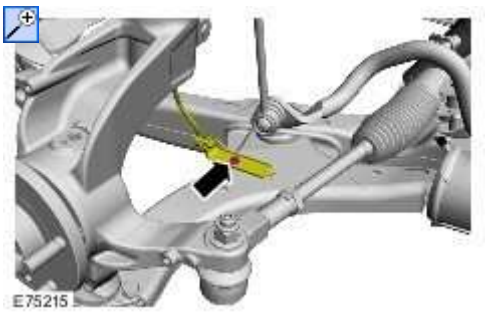


E68962



E128372

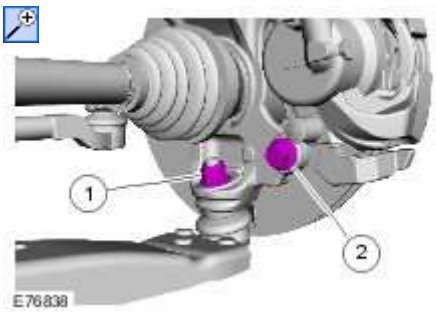
5.



E75215

6. If equipped. On both sides.

   Torque: 8 Nm



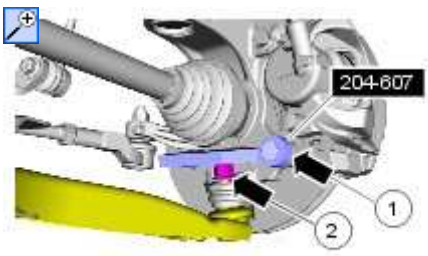
E76838

7.

   1. CAUTION: Make sure that the ball joint does not rotate.
      On both sides.

      Loosen: 2 turn(s)
   2. On both sides.

      Torque: 200 Nm



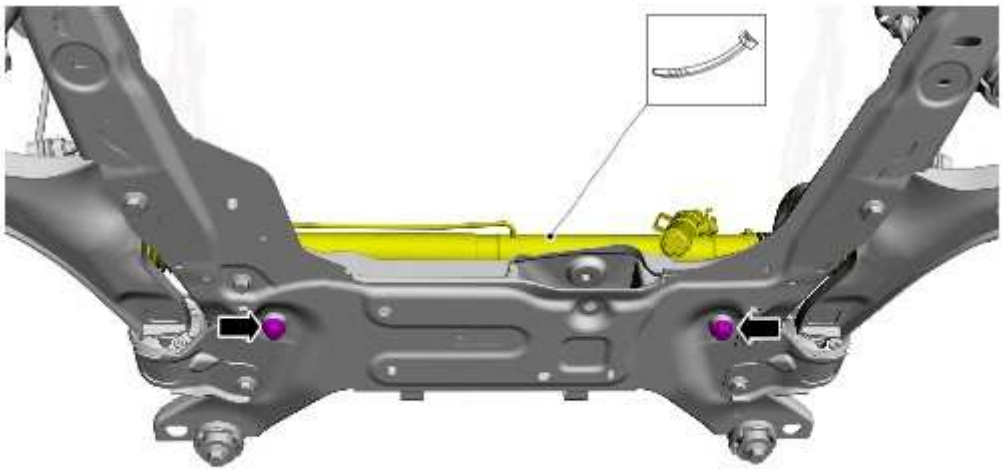
E75216

8. On both sides.

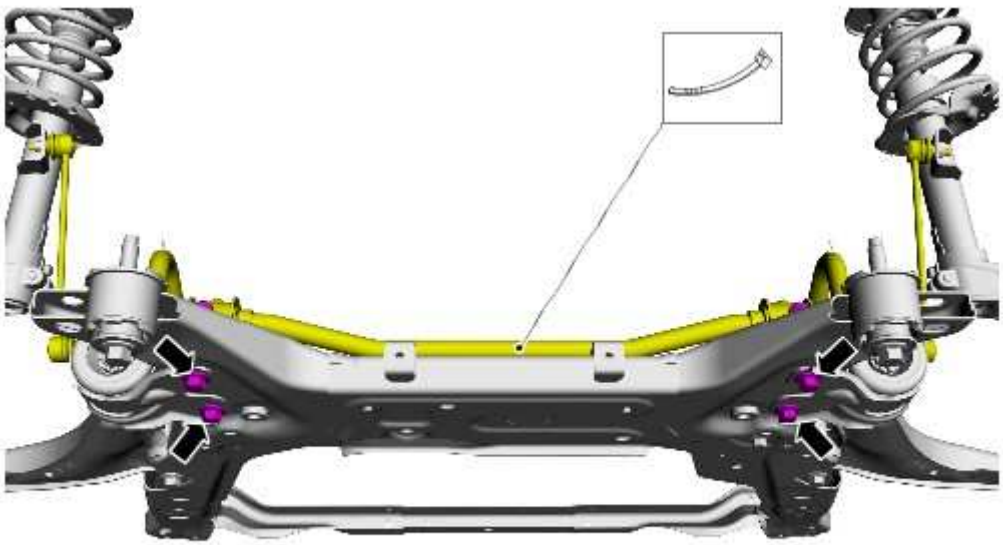
   Special Tool(s): 204-607
   Torque: 100 Nm

9. *Torque:* 120

http://vnx.su

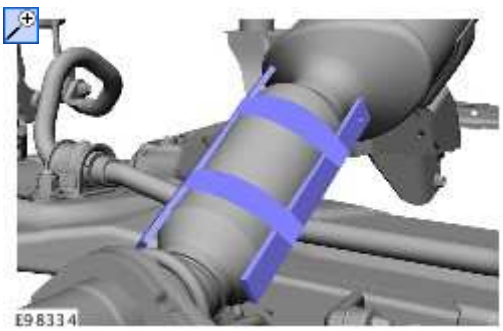


E93354



E93353

10. *Torque:* Stage 140 Nm Stage 45°

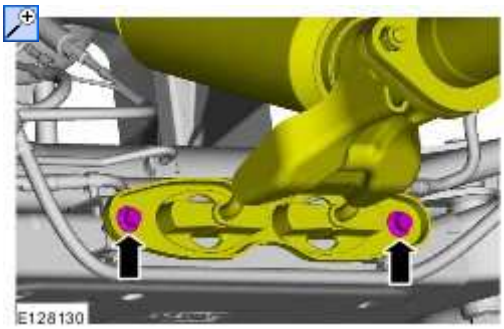


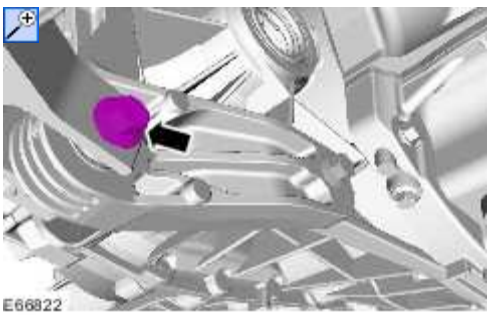
E98334

11. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.

12. *Torque:* 24 Nm

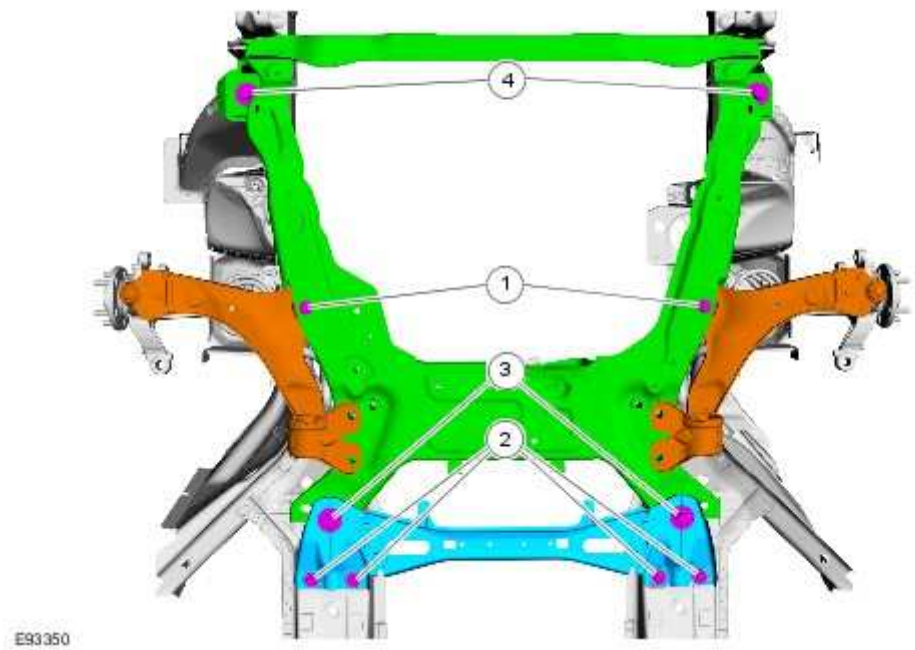
http://vnx.su





13. *Torque:* 80 Nm

14. *General Equipment:* Transmission jack



15. WARNIN
This step rec
the aid of an
technician.

CAUTIO
Make sure th
components
NOTE: This s
only necessa
when installi
new compon
Remove the f
items:

1. *Torque*

   80 Nm

   120°
2. *Torque*
3. *Torque*

   150 Nm

   90°
4. *Torque*

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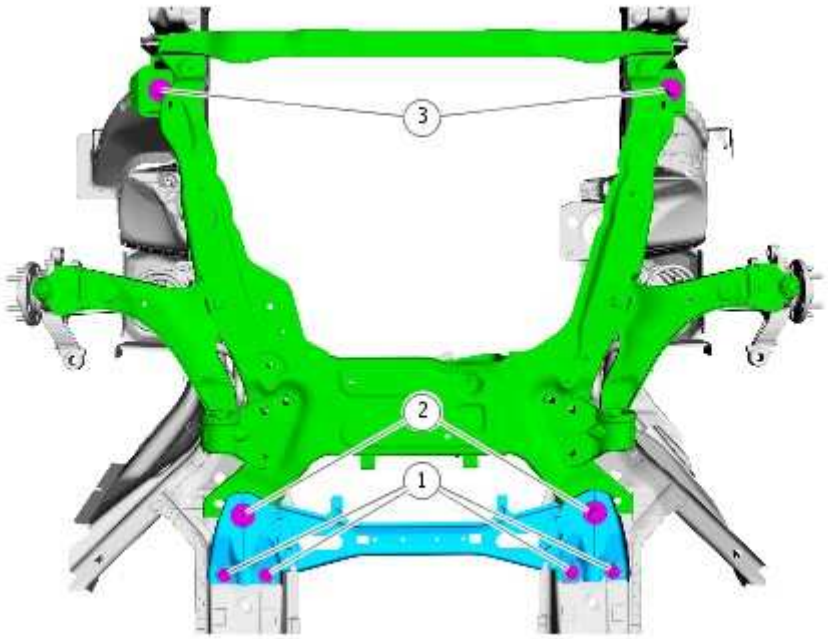
150 Nm

90°



E93351

16. WARNIN
This step
requires the
of another
technician.

CAUTIO
Make sure th
no componer
catch.
Remove the
following iten
1. *Torque*
Nm
2. *Torque*

150 Nm

90°
3. *Torque*

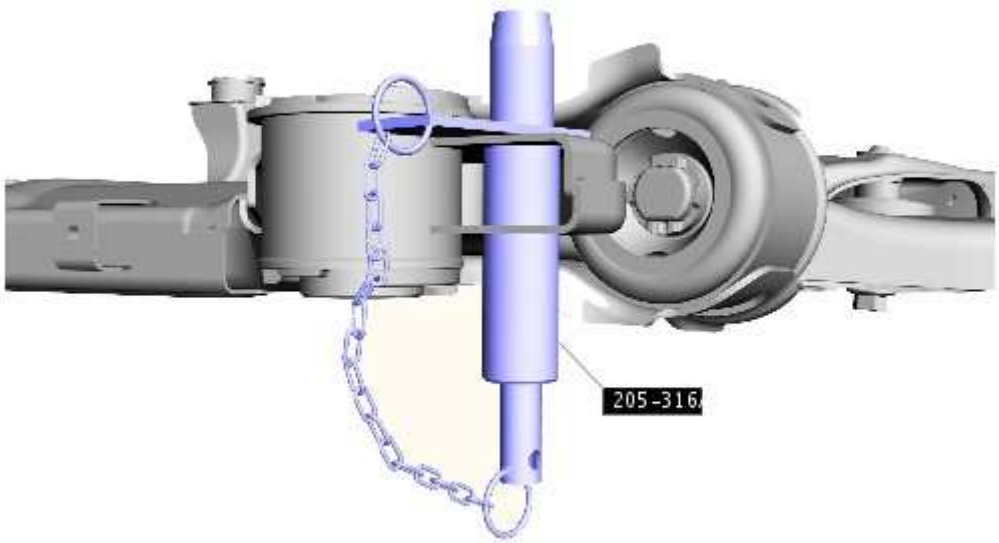
150 Nm

90°

Installation

1. To install reverse the removal procedure.
2. On both sides

Special Tool(
205-316A



E93352

3. Refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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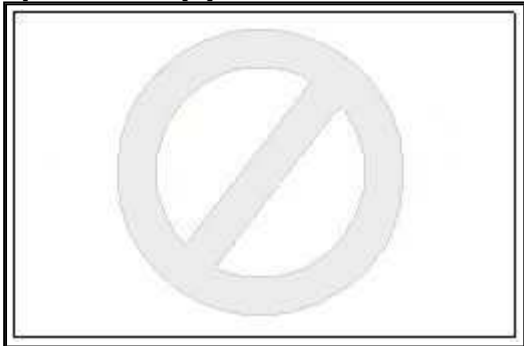
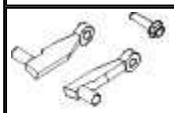
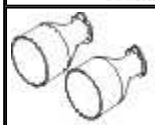
Print

Removal and Installation

Special Tool(s)

	204-598 Hydraulic Cylinder 10t
	204-598-01 Remover/Installer, Subframe Bushing Guide
 E63772	204-605 Separator, Lower Arm Ball Joint
 E63420	204-607 Remover, Ball joint
 E75372	204-609 Protection Cap, Ball Joint Gaiter
	307-242 Remover, Transmission Fluid Cooler
	308-440 Disconnect Tool, Hydraulic Line

General Equipment

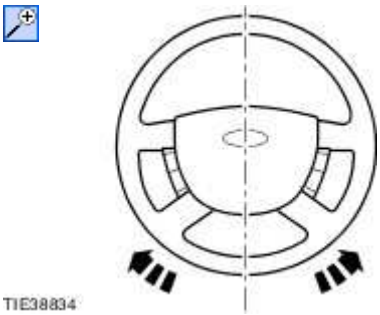
Transmission jack

Removal

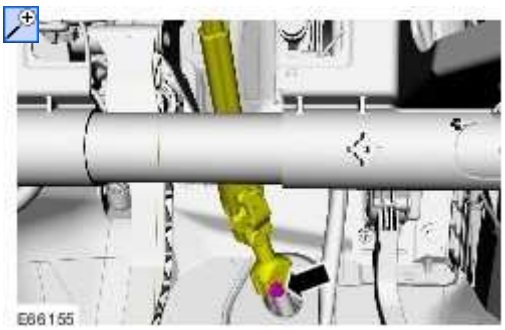
All vehicles

NOTE: Removal steps in this procedure may contain installation details.

http://vnx.su


TIE38834

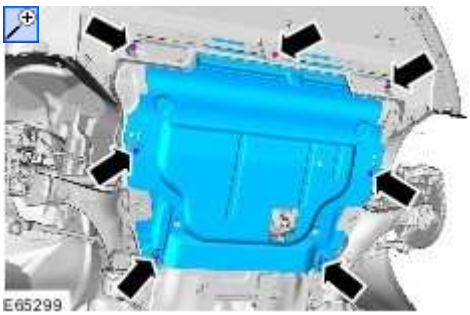
1. CAUTION: Make sure that the steering wheel lock is engaged.
NOTE: Make sure that the road wheels are in the straight ahead position.


E66155

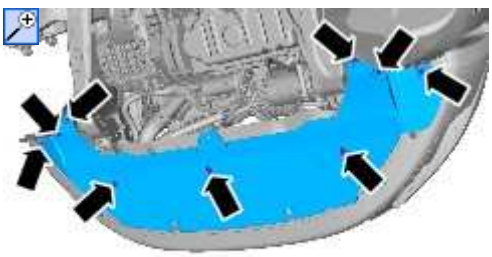
2. *Torque:* 30 Nm

3. Remove the wheel and tire on both sides.

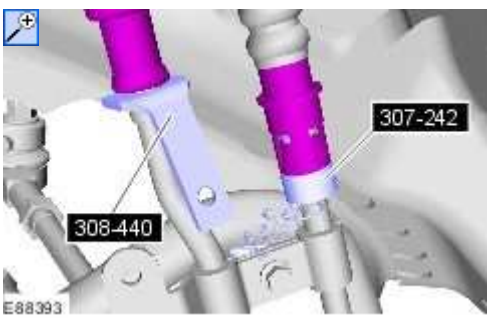
Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E65299

4.


E68962

5.



E88393

6. WARNING: Be prepared to collect escaping fluids.

CAUTION: Make sure that all openings are sealed.
Special Tool(s): 307-242, 308-440

7. CAUTION: Make sure that the ball joint ball does not rotate.

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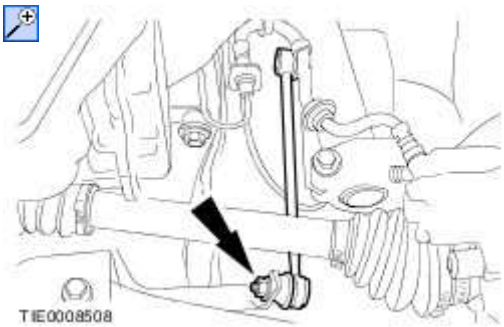
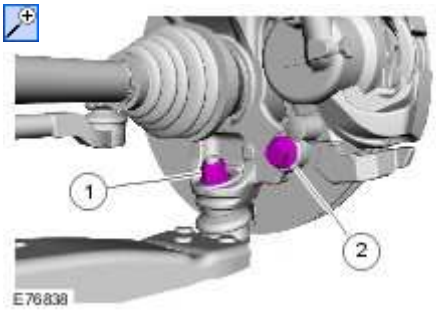


On both sides.

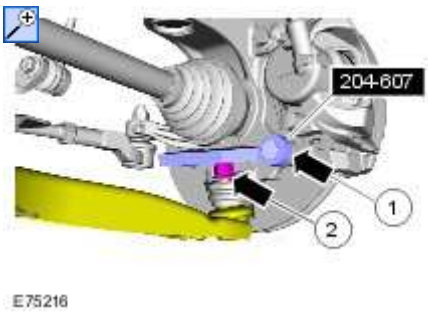
Torque: 75 Nm



8. WARNING: Make sure that no load is placed on the brake hose.
   1. Loosen the nut two turns on both sides.

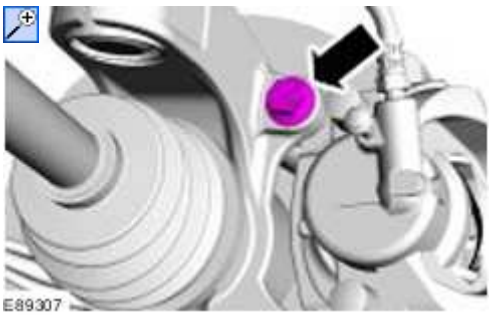
      Torque: 100 Nm
   2. On both sides.

      Torque: 200 Nm



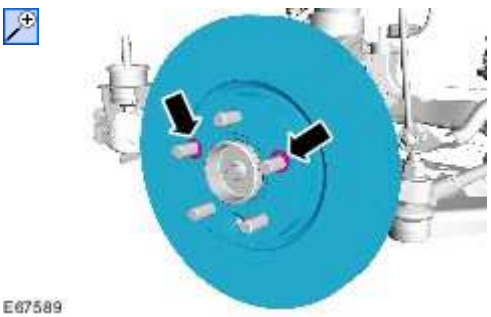
9. On both sides.

   Special Tool(s): 204-607



10. On both sides.

    Torque: 200 Nm



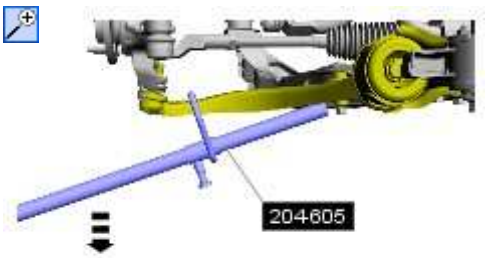
11. On both sides.

12. On both sides.

    Torque: 10 Nm

http://vnx.su

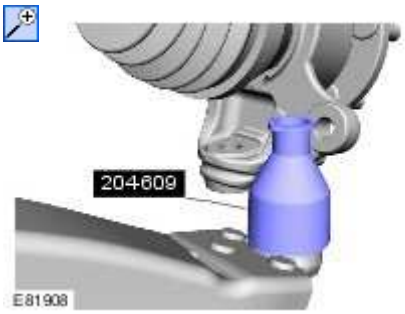
E67359



E81907

13. On both sides.

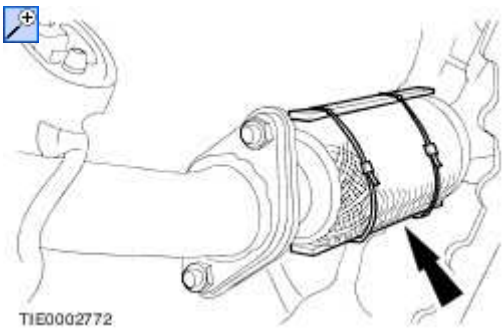
    Special Tool(s): 204-605



E81908

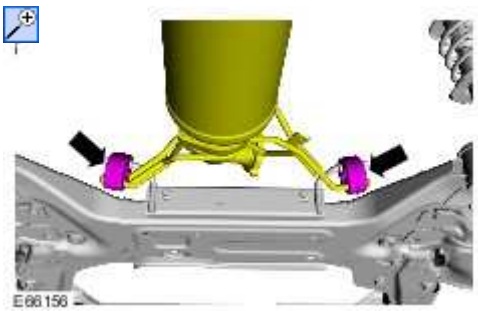
14. On both sides.

    Special Tool(s): 204-609



TIE0002772

15. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



E66156

16.

Vehicles with 2.5L engine

17. *Torque:* 110 Nm

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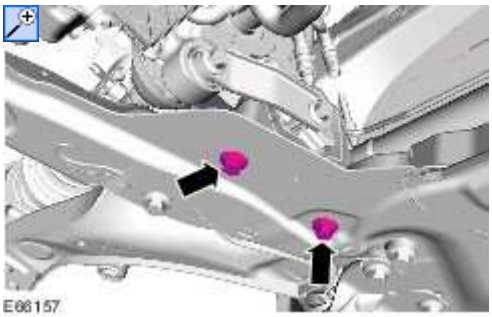
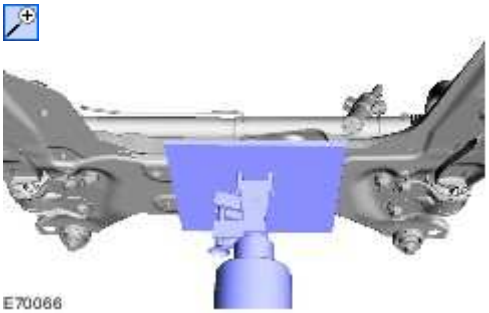

E68157

Vehicles with 2.0L or diesel engine

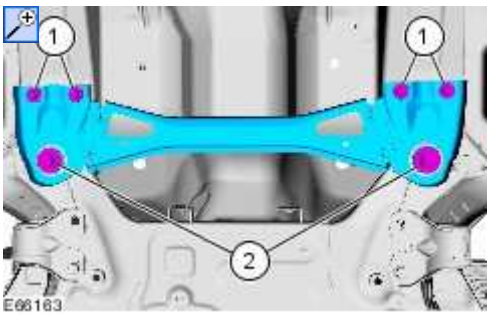
E66822

18. *Torque:* 80 Nm

All vehicles

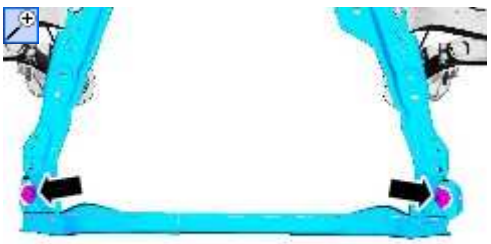

E70066

19. *General Equipment:* Transmission jack



E68163

20.
1. *Torque:* 30 Nm
2. CAUTION: Make sure that new bolts are installed.
   Torque:
   Stage 1: 150 Nm
   Stage 2: 90°


E68164

21. WARNING: This step requires the aid of another technician.
CAUTIONS:

Make sure that no components catch when lowering the subframe.

Make sure that new bolts are installed.
Lower the front subframe to gain access to the front subframe front bushings.

Torque:
Stage 1: 150 Nm

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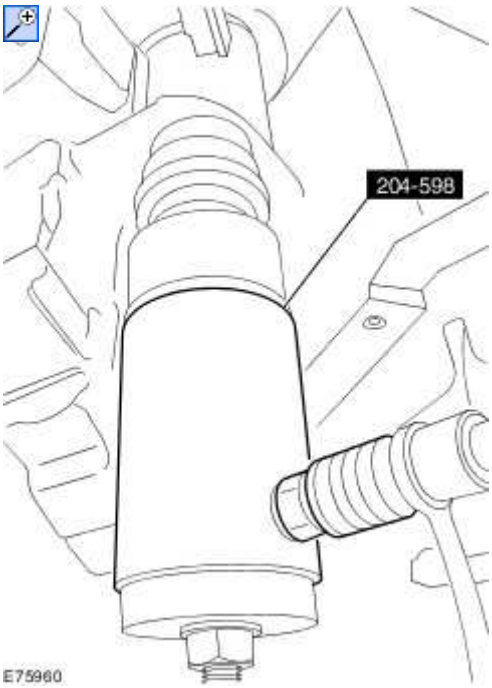
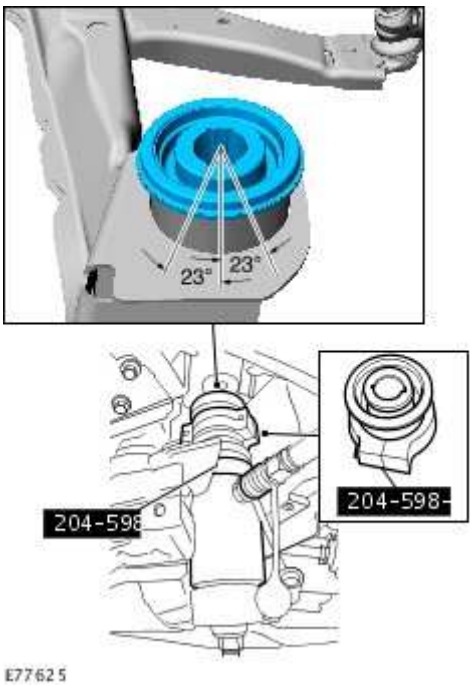
Stage 2: 90°



22. NOTE: Note the position of the component before removal.
Special Tool(s): 204-598

Installation



1. NOTE: Make sure that this component is installed to the noted removal position.
Special Tool(s): 204-598, 204-598-01

2. Install the Front Subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

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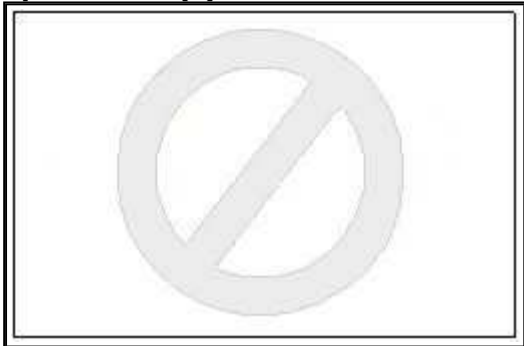
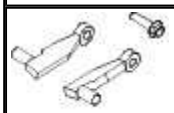
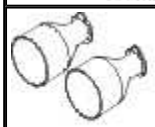
Print

Removal and Installation

Special Tool(s)

	204-598 Hydraulic Cylinder 10t
	204-598-01 Remover/Installer, Subframe Bushing Guide
 E63772	204-605 Separator, Lower Arm Ball Joint
 E63420	204-607 Remover, Ball joint
 E75372	204-609 Protection Cap, Ball Joint Gaiter
	307-242 Remover, Transmission Fluid Cooler
	308-440 Disconnect Tool, Hydraulic Line

General Equipment

Transmission jack

Removal

All vehicles

NOTE: Removal steps in this procedure may contain installation details.

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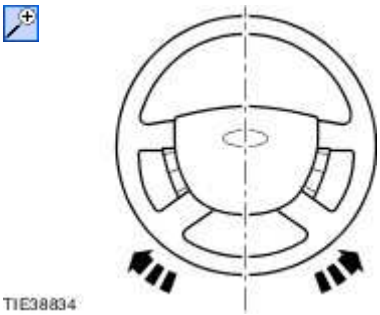
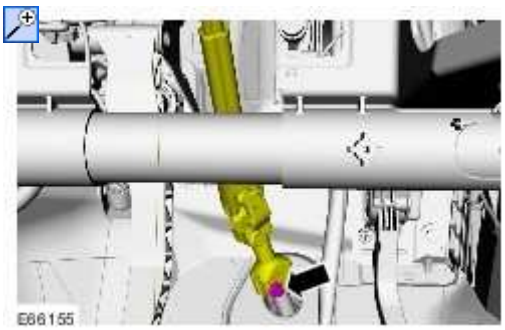

TIE38834

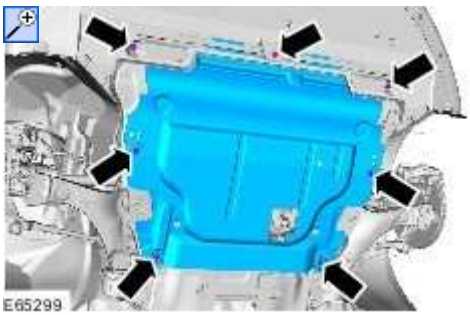
1. CAUTION: Make sure that the steering wheel lock is engaged.
NOTE: Make sure that the road wheels are in the straight ahead position.


E66155

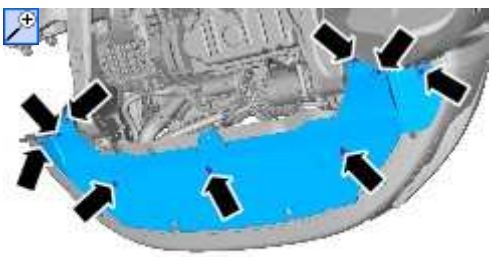
2. *Torque:* 30 Nm

3. Remove the wheel and tire on both sides.

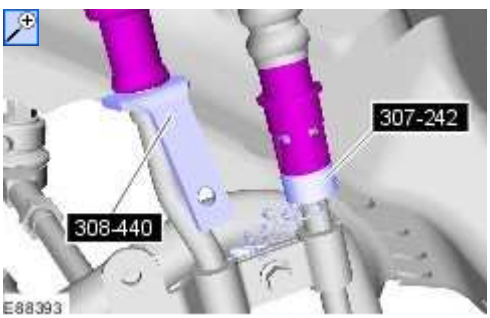
Refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).


E65299

4.


E68962

5.



E88393

6. WARNING: Be prepared to collect escaping fluids.

CAUTION: Make sure that all openings are sealed.
Special Tool(s): 307-242, 308-440

7. CAUTION: Make sure that the ball joint ball does not rotate.

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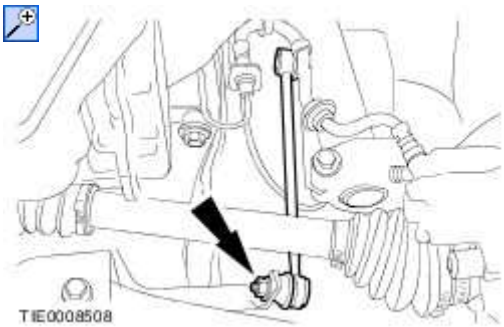
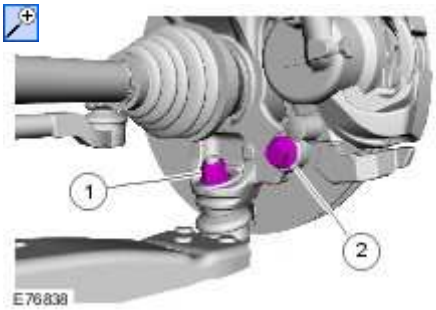


On both sides.

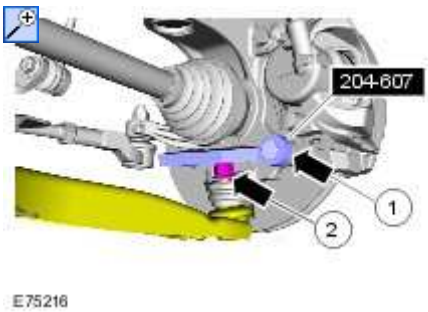
Torque: 75 Nm



8. WARNING: Make sure that no load is placed on the brake hose.
   1. Loosen the nut two turns on both sides.

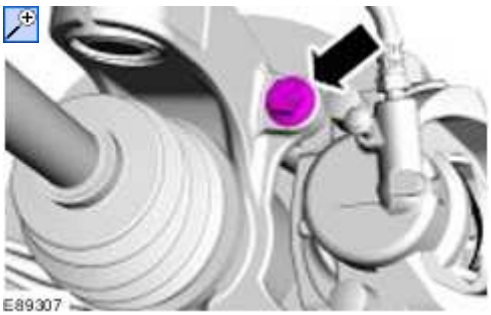
      Torque: 100 Nm
   2. On both sides.

      Torque: 200 Nm



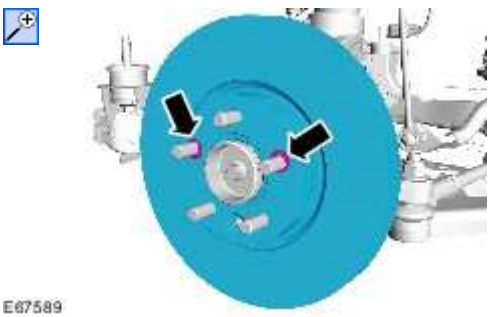
9. On both sides.

   Special Tool(s): 204-607



10. On both sides.

    Torque: 200 Nm

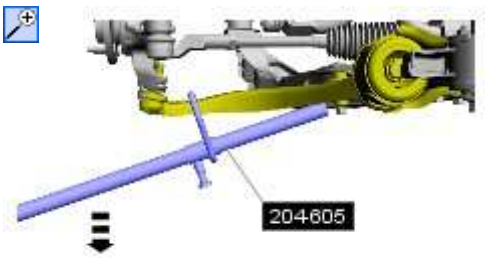


11. On both sides.

12. On both sides.

http://vnx.su

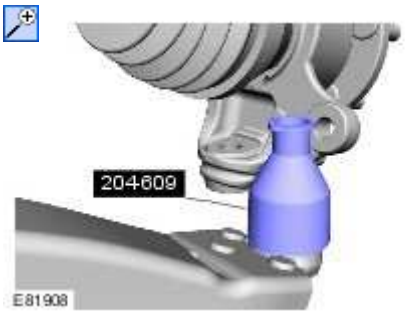
E67359



E81907

13. On both sides.

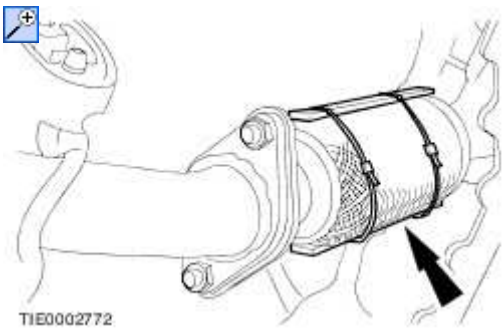
    Special Tool(s): 204-605



E81908

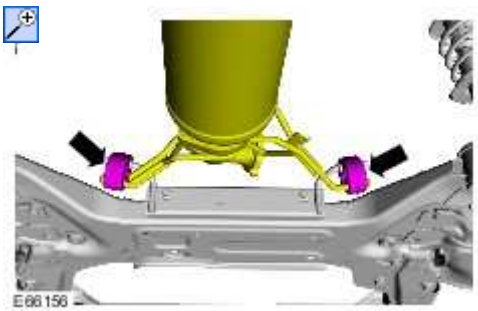
14. On both sides.

    Special Tool(s): 204-609



TIE0002772

15. CAUTION: Make sure that the exhaust flexible pipe is not forcibly bent.



E66156

16.

Vehicles with 2.5L engine

17. *Torque:* 110 Nm

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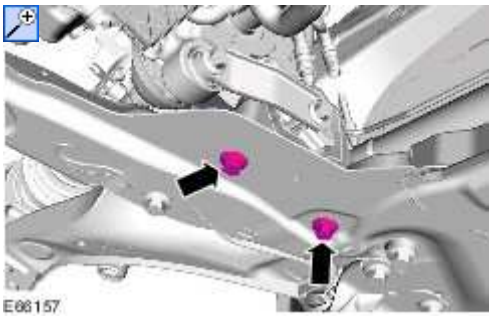
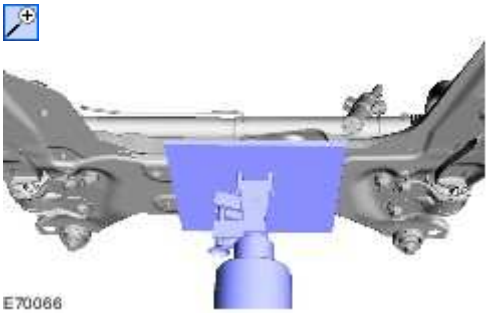

E68157

Vehicles with 2.0L or diesel engine

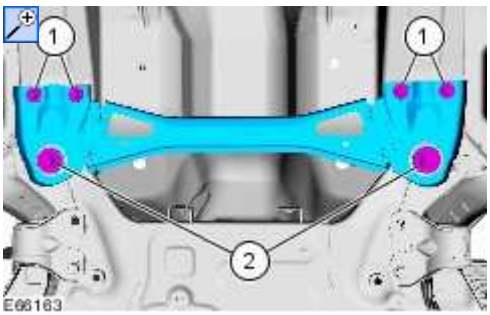
E66822

18. *Torque:* 80 Nm

All vehicles

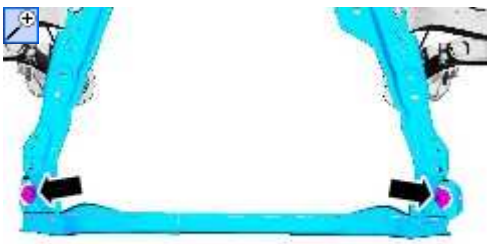

E70066

19. *General Equipment:* Transmission jack



E68163

20.
1. *Torque:* 30 Nm
2. CAUTION: Make sure that new bolts are installed.
   Torque:
   Stage 1: 150 Nm
   Stage 2: 90°


E68164

21. WARNING: This step requires the aid of another technician.
CAUTIONS:

Make sure that no components catch when lowering the subframe.

Make sure that new bolts are installed.
Lower the front subframe to gain access to the front subframe rear bushings.

Torque:
Stage 1: 150 Nm

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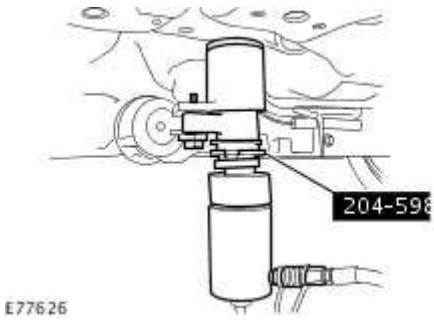
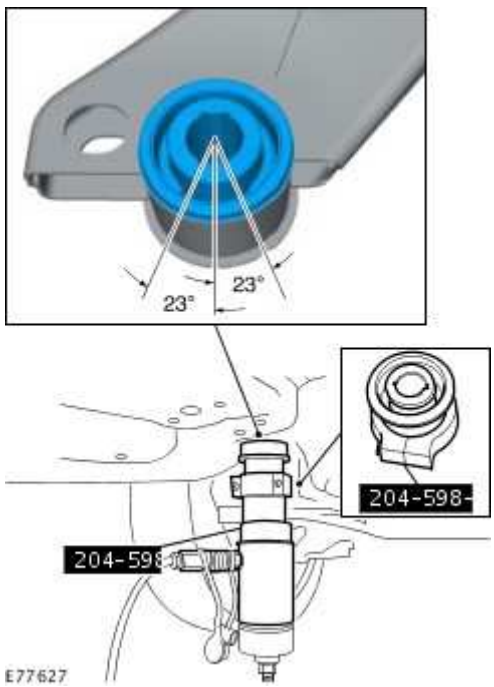
Stage 2: 90°



22. NOTE: Note the position of the component before removal.
Special Tool(s): 204-598

Installation



1. NOTE: Make sure that this component is installed to the noted removal position.
Special Tool(s): 204-598, 204-598-01

2. Install the Front Subframe.

   Refer to: Front Subframe (502-00 Uni-Body, Subframe and Mounting System, Removal and Installation).

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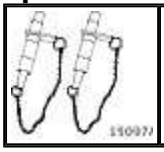
Removal and Installation

Special Tool(s)

	205-316A Alignment Pins, Subframe

General Equipment

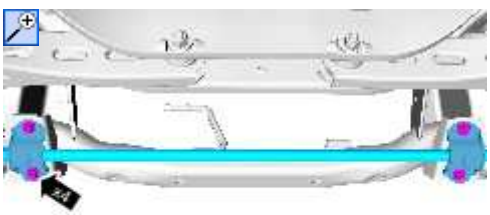
Transmission jack

Removal

1. Remove the following items:
   1. Remove the stabilizer bar link, on both sides.

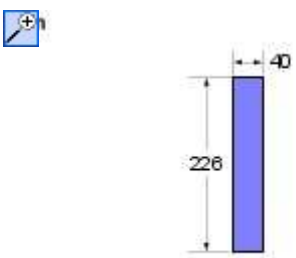
      Refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).
   2. Remove the spring, on both sides.

      Refer to: Spring (204-02 Rear Suspension, Removal and Installation).



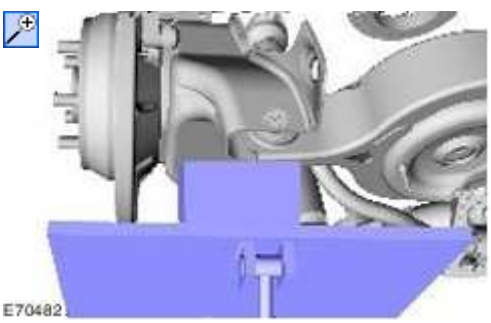
E67812

2.



E69209

3. Fabricate two spacers.



E70482

4. *General Equipment:* Transmission jack

5. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to

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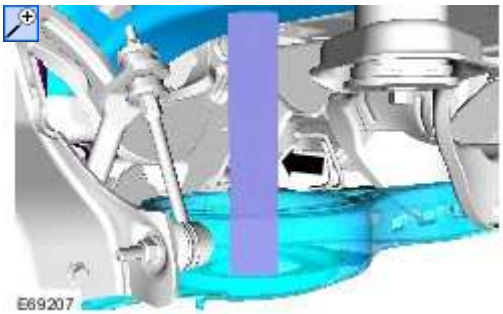
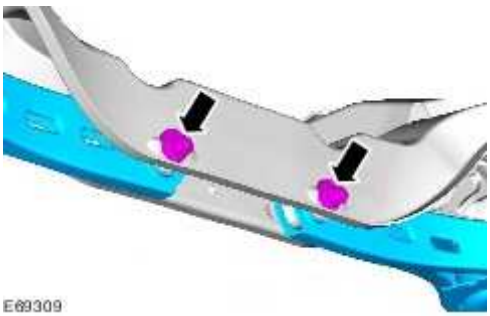
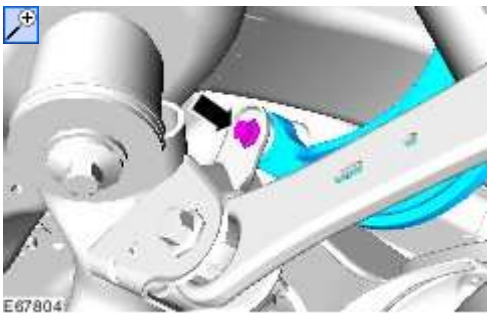


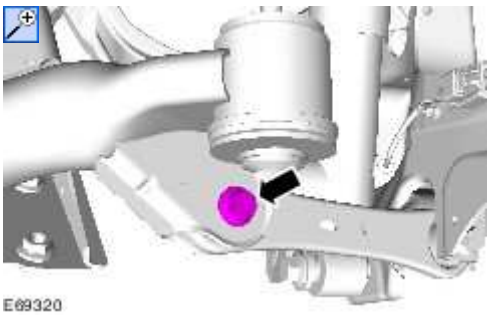
the design height setting on both sides.



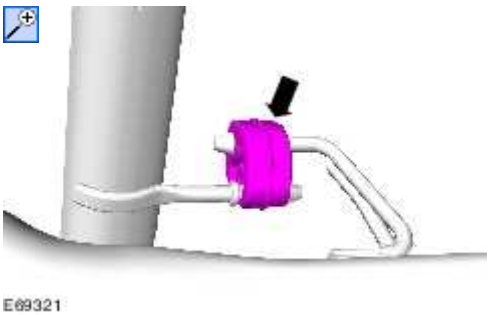
6. NOTE: Note the position of each component before removal.



7. On both sides.



8. On both sides.



9.

10. Support the rear subframe and remove the rear subframe bolts.

General Equipment: Transmission jack

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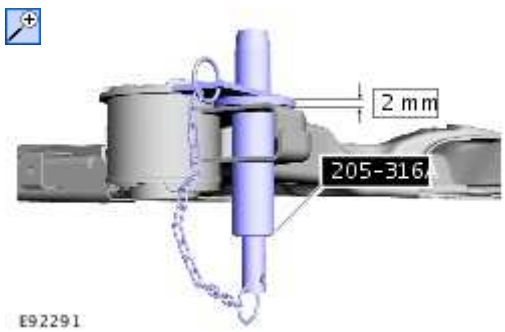
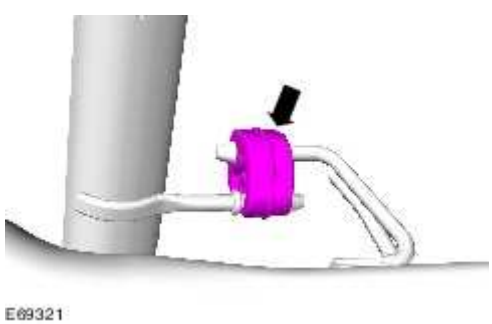
Installation



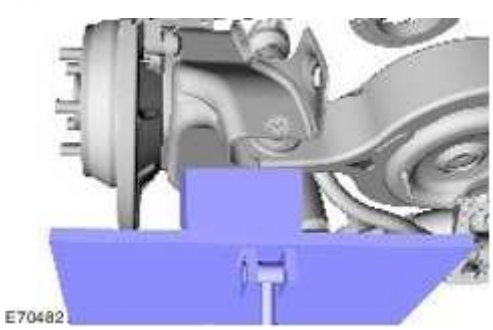
1. *Special Tool(s):* 205-316A

2. Support the rear subframe and install the rear subframe bolts.

   General Equipment: Transmission jack
   Torque: 110 Nm



3.



4. *General Equipment:* Transmission jack

5. Install the spacer. Make sure that the spacer is in a vertical plane and raise the suspension to the design height setting on both sides.

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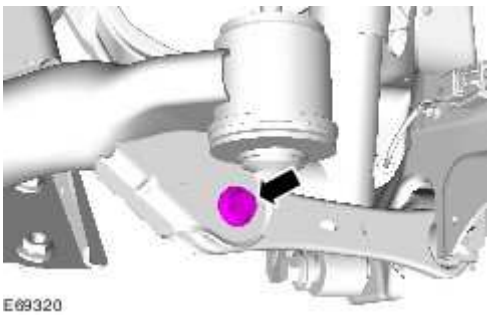
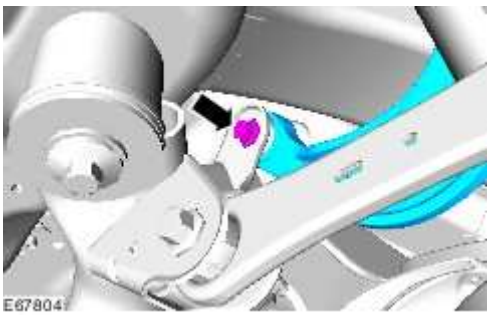
E69207


E69320

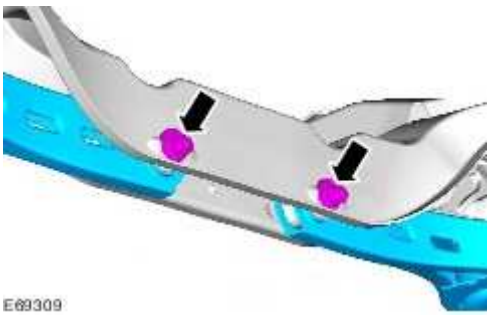
6. On both sides.

   Torque: 130 Nm

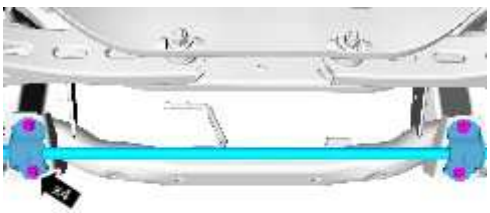

E67804

7. On both sides.

   Torque: 130 Nm


E69309

8. NOTE: Make sure that these components are installed to the noted removal position.
   Torque: 8 Nm


E67812

9. *Torque:* 48 Nm

10. Install the following items:
    1. Install the spring, on both sides.

       Refer to: Spring (204-02 Rear Suspension, Removal and Installation).
    2. Install the stabilzer bar link, on both sides.

       Refer to: Rear Stabilizer Bar Link (204-02

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Rear Suspension, Removal and Installation).

11. Check the toe setting and adjust as necessary.

    Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).
    Refer to: Specifications (204-00 Suspension System - General Information, Specifications).

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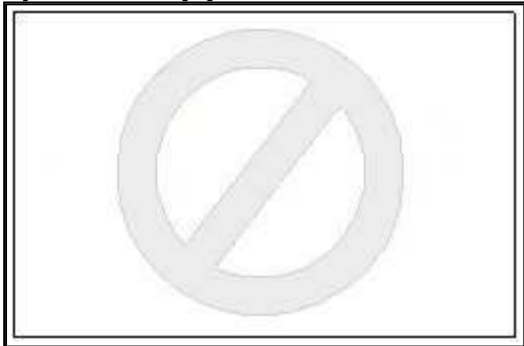
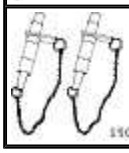
Removal and Installation

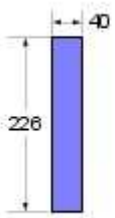
Special Tool(s)

	204-598 Hydraulic Cylinder 10t
	204-598-01 Remover/Installer, Subframe Bushing Guide
	205-316A Alignment Pins, Subframe

General Equipment

Transmission jack

Removal



E69209

1. Fabricate two spacers.
2. Remove the spring, on both sides.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).
3. Install the bolt, on both sides.

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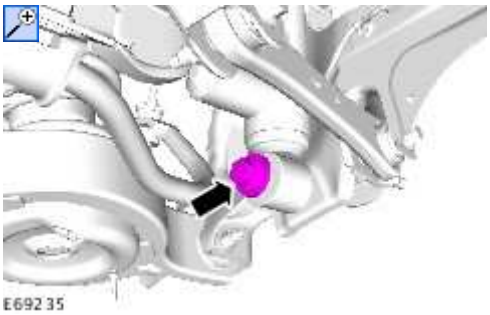
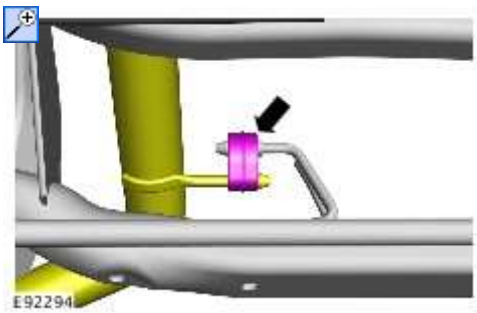
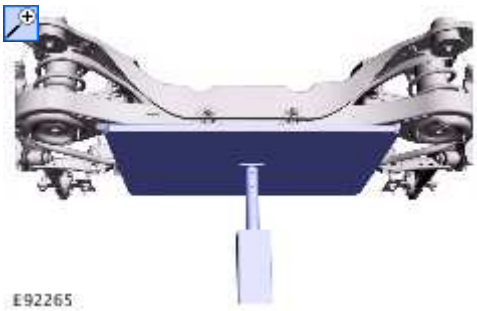


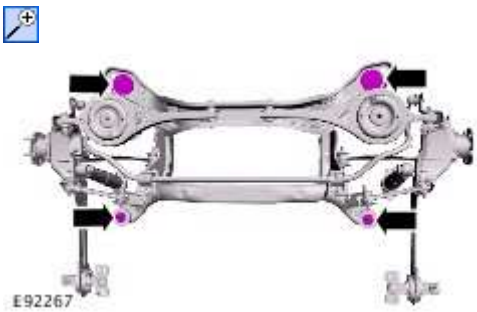
4.



5. *General Equipment:* Transmission jack



6.



7.

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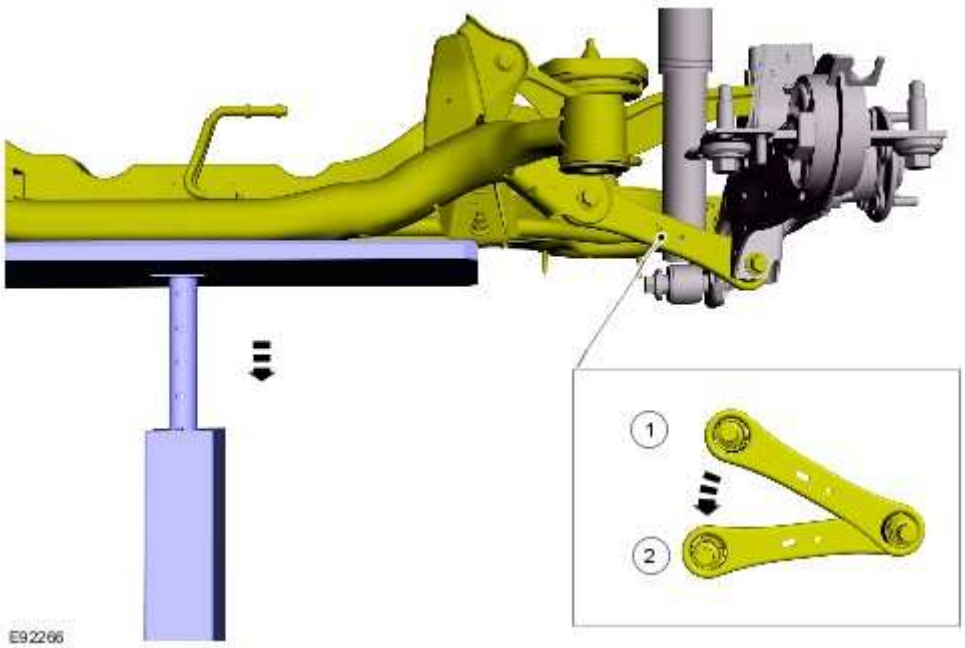
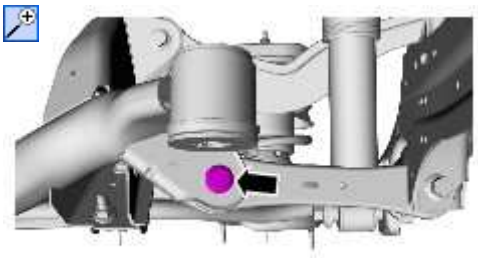
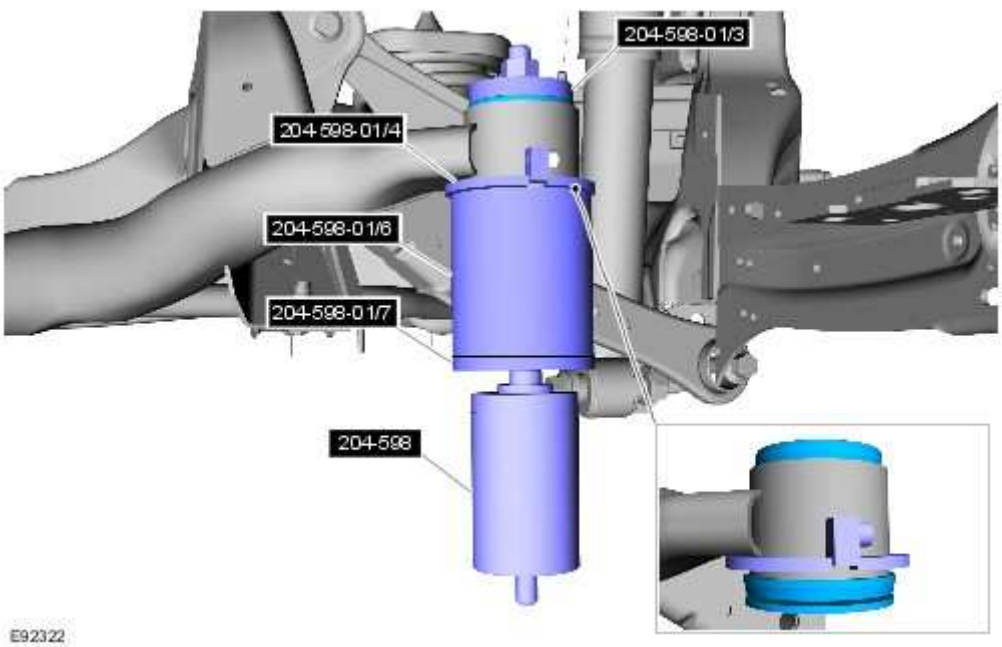




8.



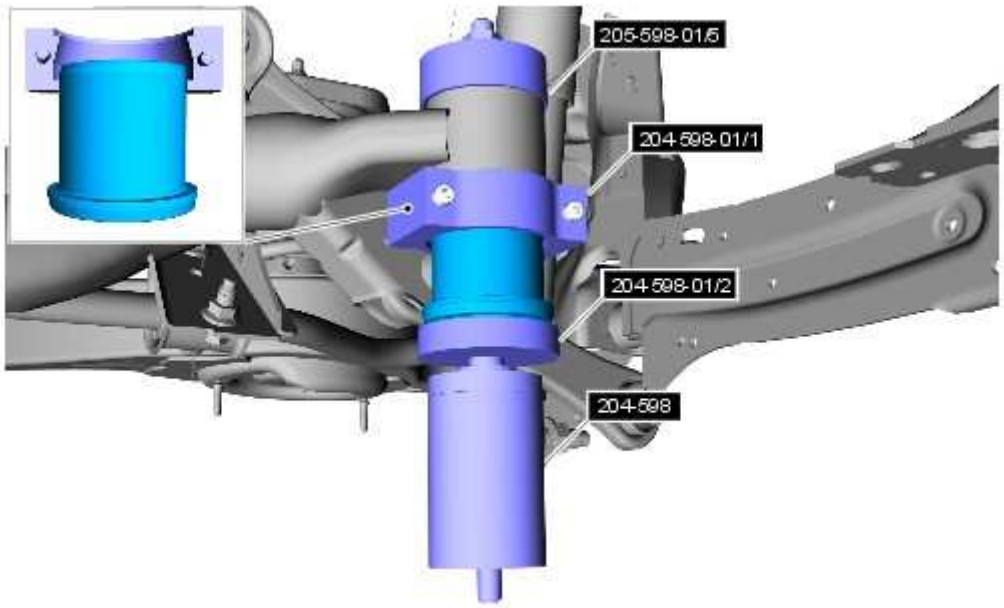
9. *Install the Special Tool(s):* 204-598-01, 204-598

Installation

1. *Install the Special Tool(s):* 204-598, 204-598-

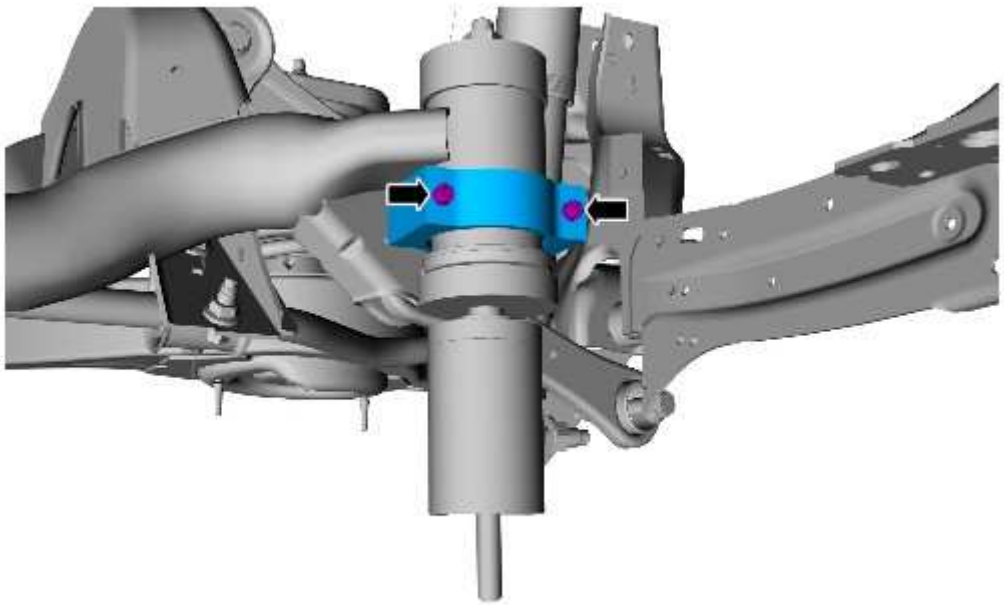
http://vnx.su

01



E92323

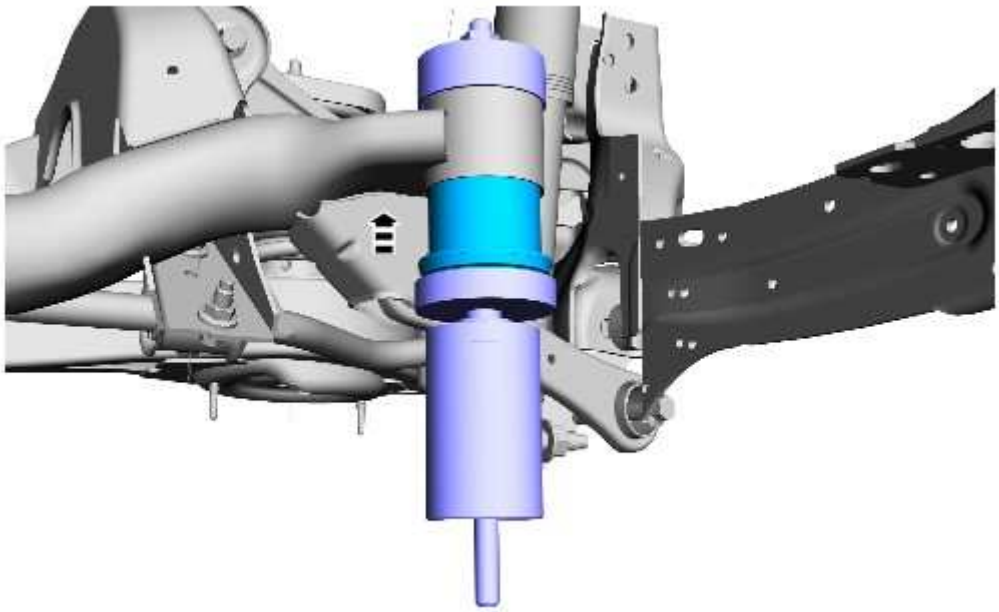
2.



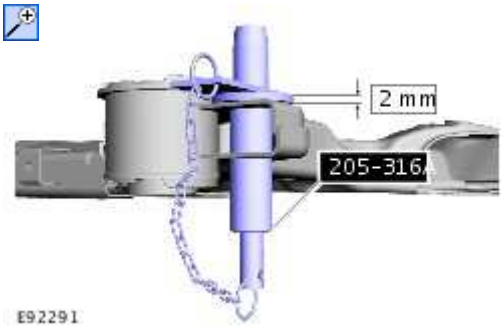
E92324

3.

http://vnx.su


E92325

4. *Install the Special Tool(s):* 205-316A



E92291

5. *General Equipment:* Transmission jack
   Torque: 110 Nm

E92267

6. *Remove the Special Tool(s):* 205-316A

7. On both sides.

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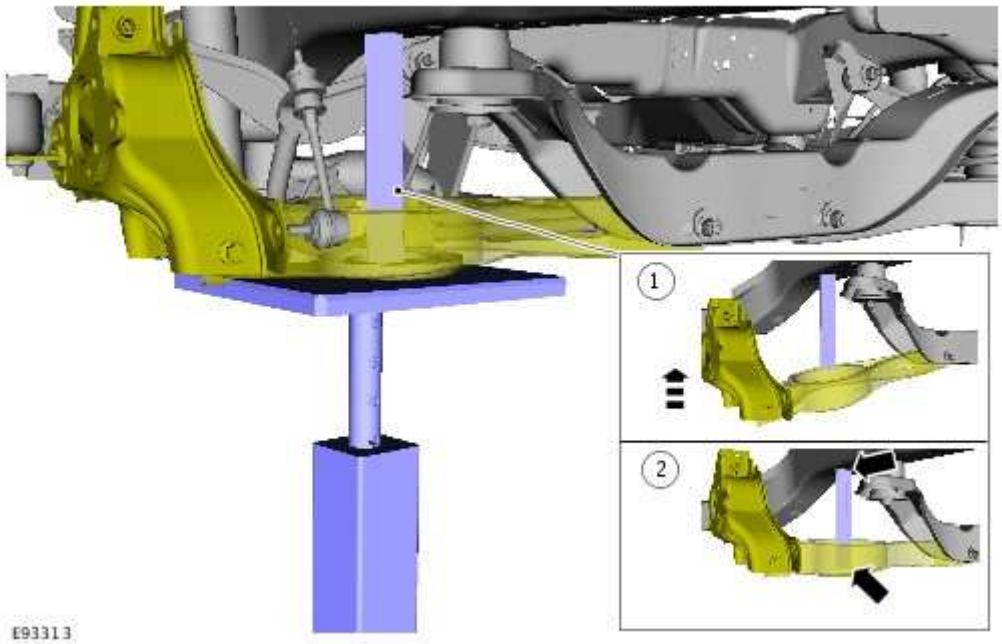
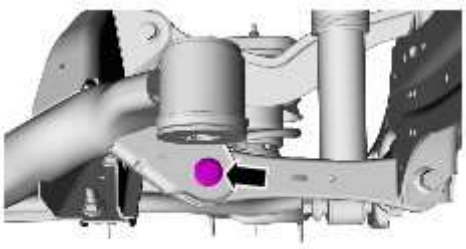
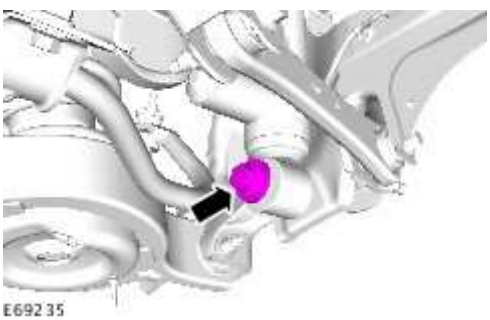




8. *Torque:* 130 Nm



9. Remove the bolt, on both sides.

10. Install the spring, on both sides.

    Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

11. Refer to: Rear Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

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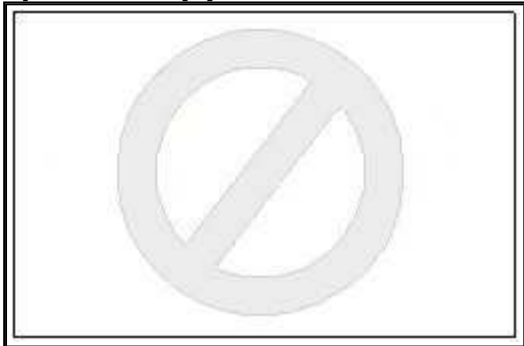
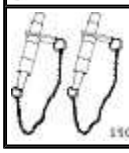
Removal and Installation

Special Tool(s)

	204-598 Hydraulic Cylinder 10t
	204-598-01 Remover/Installer, Subframe Bushing Guide
	205-316A Alignment Pins, Subframe

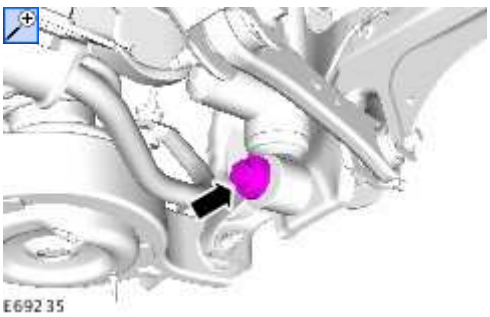
General Equipment

Transmission jack

Removal

1. Remove the spring, on both sides.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).


E69235

2. Install the bolt, on both sides.
3.

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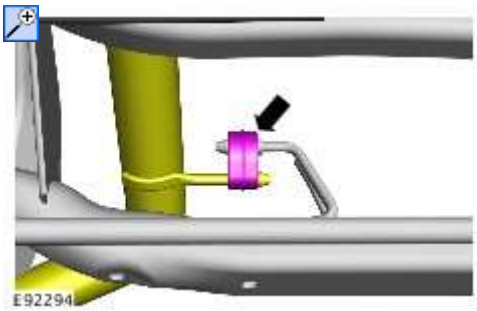
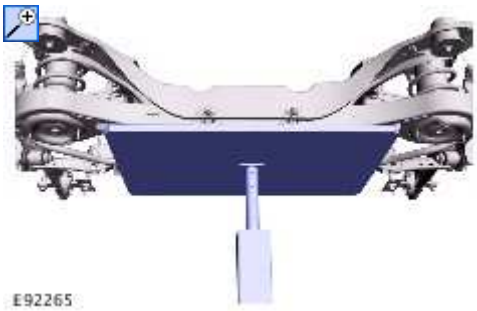
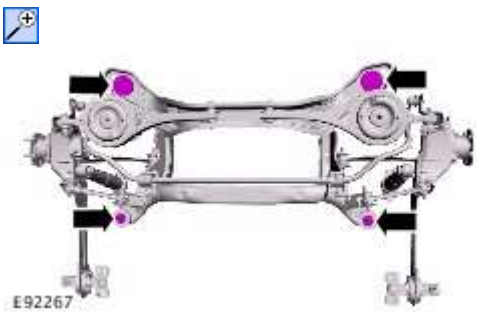
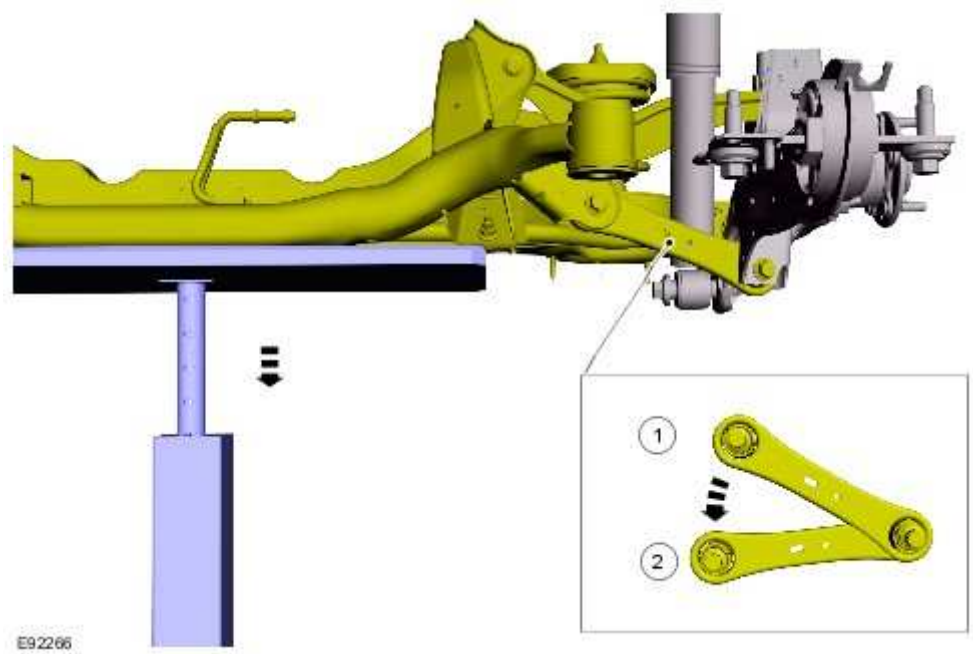




4. *General Equipment:* Transmission jack



5.



6.

7. *Install the Special Tool(s):* 204-598-01, 204-598

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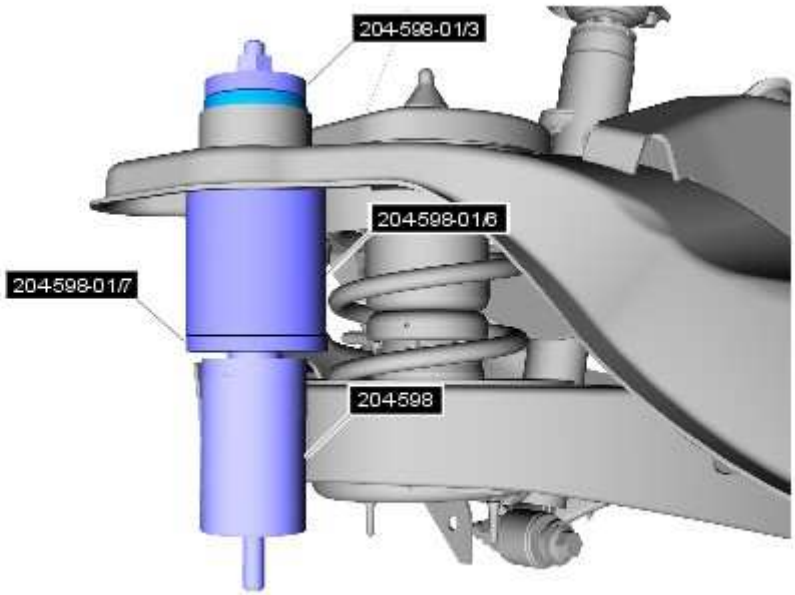
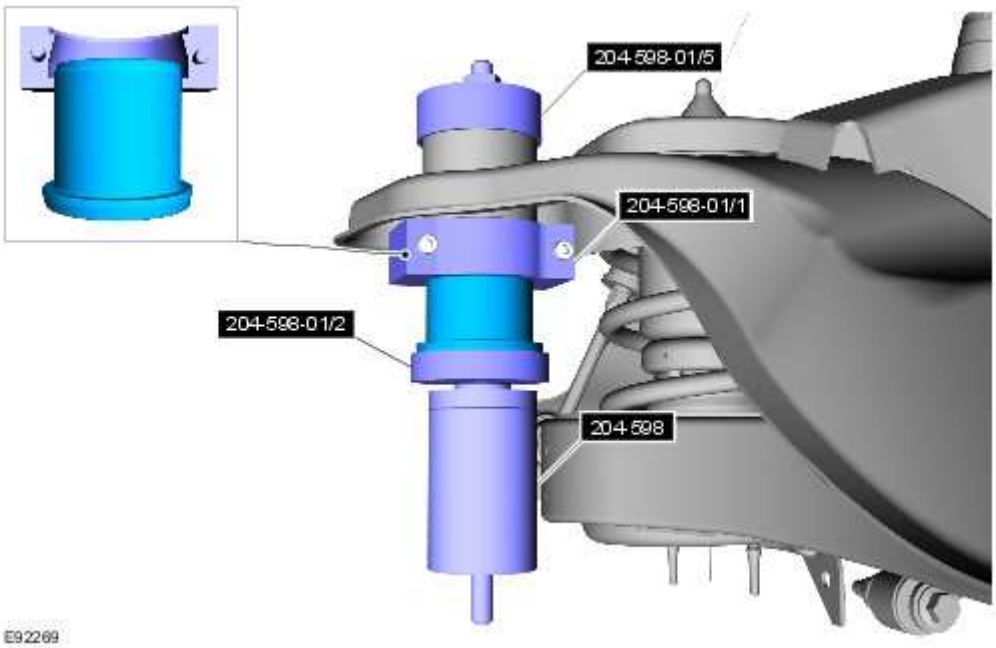


E92268

Installation



E92269

1. *Install the Special Tool(s):* 204-598, 204-598-01
2.

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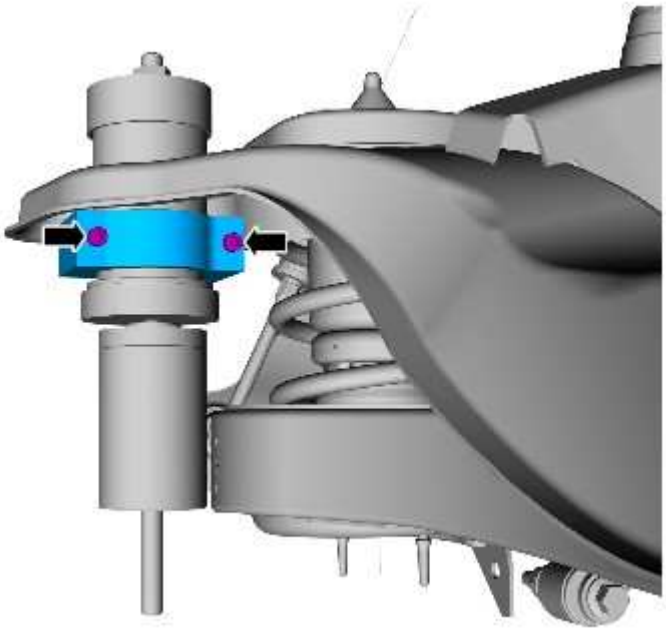
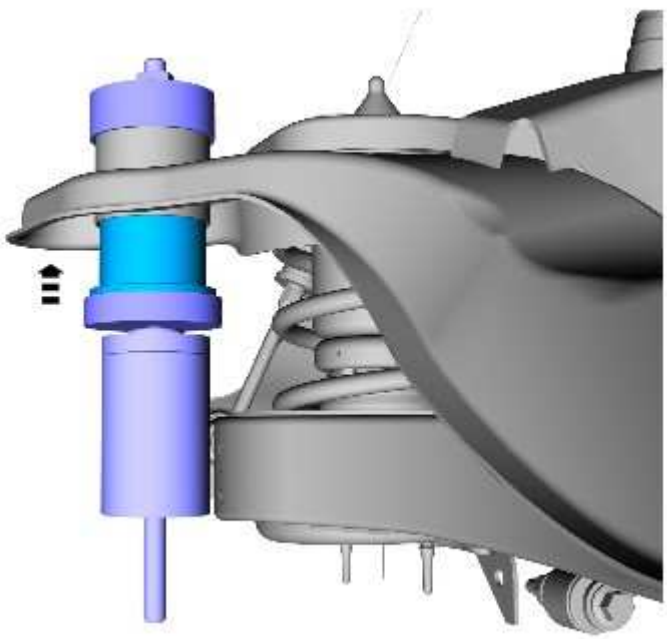


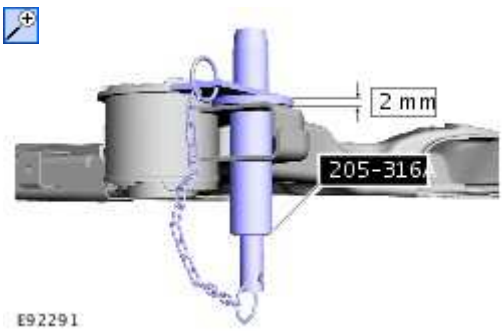
E92289

3.



E92290

4. *Install the Special Tool(s):* 205-316A



E92291

5. *General Equipment:* Transmission jack
   Torque: 110 Nm

6. *Remove the Special Tool(s):* 205-316A

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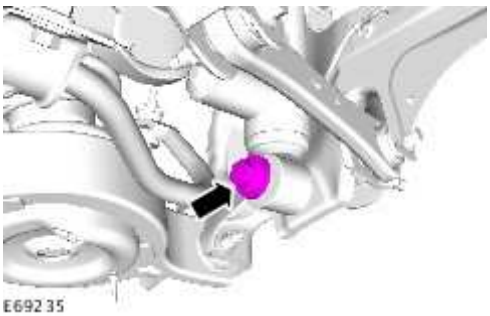
E92267


E69235

7. Remove the bolt, on both sides.

8. Install the spring, on both sides.

   Refer to: Spring (204-02 Rear Suspension, Removal and Installation).

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